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THE

DISPENSATORY

OF THE

UNITED STATES OF AMERICA.

BY

GEORGE B. WOOD, M.D.,

PRESIDENT OF THE AMERICAN PHILOSOPHICAL SOCIETY;
PRESIDENT OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA;
EMERITUS PROFESSOR OF THE THEORY AND PRACTICE OF MEDICINE IN THE UNIVERSITY OF PENNSYLVANIA, ETC. ETC.,

AND

FRANKLIN BACHE, M.D.,

LATE PROFESSOR OF CHEMISTRY IN JEFFERSON MEDICAL COLLEGE OF PHILADELPHIA,
LATE VICE-PRESIDENT OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA;
LATE PRESIDENT OF THE AMERICAN PHILOSOPHICAL SOCIETY, ETC. ETC.

COLLEGE OF PHYSICIANS

FOURTEENTH EDITION.

CAREFULLY REVISED BY DR. GEORGE B. WOOD, ASSISTED BY DR. H. C. WOOD

PHILADELPHIA:
J. B. LIPPINCOTT AND CO.
1879.

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PREFACE

TO

THE FIRST EDITION.

THE objects of a Dispensatory are to present an account of medicinal substances in the state in which they are brought into the shops, and to teach the modes in which they are prepared for use. The importance of these objects, and the general value and even necessity of a work of this nature, will not be disputed. It may, however, be a question, how far the wants of the medical and pharmaceutical community in this country are supplied by the Dispensatories already in circulation; and whether such a deficiency exists as to justify the offer of a new one to the public attention. The great merits of the works severally entitled "The Edinburgh New Dispensatory" and "The London Dispensatory," the former edited by the late Andrew Duncan, M.D., the latter by Anthony Todd Thomson, M.D., are well known wherever the English language is spoken. Founded, as they both are, upon the excellent basis laid by Lewis, they are nevertheless entitled, from the great addition of valuable materials, and the distinctive character exhibited in the arrangement of these materials, to be considered as original works; while the style in which they have been executed speaks strongly in favour of the skill and industry of their authors. But they were calculated especially for the sphere of Great Britain, and are too deficient in all that relates exclusively to this country, to admit of being received as standards here. In the history of our commerce in drugs, and of the nature, growth, and collection of our indigenous medical plants; in the chemical operations of our extensive laboratories; and in the modes of preparing, dispensing, and applying medicines, which have gradually grown into use among us; there is much that is peculiar, a knowledge of which is not to be gained from foreign books, and is yet necessary to the character of an accomplished American pharmaceutist. We have, moreover, a National Pharmacopœia, which requires an explanatory commentary, in order that its precepts may be fully appreciated, and advantageously put into practice. On these accounts it is desirable that there should be a Dispensatory of the United States, which, while it embraces whatever is useful

in European pharmacy, may accurately represent the art as it exists in this country, and give instruction adapted to our peculiar wants. It appears due to our national character that such a work should be in good faith an American work, newly prepared in all its parts, and not a mere edition of one of the European Dispensatories, with here and there additions and alterations, which, though they may be useful in themselves, cannot be made to harmonize with the other materials so as to give to the whole an appearance of unity, and certainly would not justify the assumption of a new national title for the book. Whether, in the Dispensatories which have been published in the United States, these requisites have been satisfactorily fulfilled, it rests with the public to determine. That valuable treatises on Materia Medica and Pharmacy have been issued in this country, no candid person, acquainted with our medical literature, will be disposed to deny. In offering a new work to the medical and pharmaceutical professions, the authors do not wish to be considered as undervaluing the labours of their predecessors. They simply conceive that the field has not been so fully occupied as to exclude all competition. The pharmacy of continental Europe is ground which has been almost untouched; and much information in relation to the natural history, commerce, and management of our own drugs, has lain ungathered in the possession of individuals, or scattered in separate treatises and periodicals not generally known and read. Since the publication of the last edition of our National Pharmacopœia, no general explanation of its processes has appeared, though required in justice both to that work and to the public. The hope of being able to supply these deficiencies may, perhaps, be considered a sufficient justification for the present undertaking.

The Pharmacopœia of the United States has been adopted as the basis of this Dispensatory. It is followed both in its general division of medicines, and in its alphabetical arrangement of them under each division. Precedence is, in every instance, given to the names which it recognises, while the explanations by which it fixes the signification of these names are inserted in immediate connection with the titles to which they severally belong. Every article which it designates is more or less fully described; and all its processes, after being literally copied, are commented on and explained wherever comment and explanation appeared necessary. Nothing, in fine, has been omitted, which, in the estimation of the authors, could serve to illustrate its meaning, or promote the ends which it was intended to subserve. This course of proceeding appeared to be due to the national character of the Pharmacopœia, and to the important object of establishing, as far as possible, throughout the United States, uniformity, both in the nomenclature and preparation of medicines. In one particular, convenience required that the plan of the Pharmacopœia should be departed from. The medicines belonging to the department of Materia Medica, instead of being arranged in two divisions corresponding with the *Primary* and *Secondary Catalogues* of that work, have been treated of indiscriminately

in alphabetical succession; and the place which they respectively hold in the Pharmacopœia is indicated by the employment of the term *Secondary*, in connection with the name of each of the medicines included in the latter catalogue.

But, though precedence has thus been given to the Pharmacopœia of the United States, those of Great Britain have not been neglected. The nomenclature adopted by the different British Colleges, and their formulas for the preparation of medicines, have been so extensively followed throughout the United States, that a work intended to represent the present state of pharmacy in this country would be imperfect without them; and the fact that the writings of British physicians and surgeons, in which their own officinal terms and preparations are exclusively employed and referred to, have an extensive circulation among us, renders some commentary necessary in order to prevent serious mistakes. The Pharmacopœias of London, Edinburgh, and Dublin have, therefore, been incorporated, in all their essential parts, into the present work. Their officinal titles are uniformly given, always in subordination to those of the United States Pharmacopœia, when they express the same object; but in chief, when, as often happens, no corresponding medicine or preparation is recognised by our national standard. In the latter case, if different names are applied by different British Colleges to the same object, that one is generally preferred which is most in accordance with our own system of nomenclature, and the others are given as synonymes. The medicines directed by the British Colleges are all described, and their processes either copied at length, or so far explained as to be intelligible in all essential particulars.

Besides the medicinal substances recognised as officinal by the Pharmacopœias alluded to, some others have been described, which, either from the lingering remains of former reputation, from recent reports in their favour, or from their important relation to medicines in general use, appear to have claims upon the attention of the physician and apothecary. Opportunity has, moreover, been taken to introduce incidentally brief accounts of substances used in other countries or in former times, and occasionally noticed in medical books; and, that the reader may be able to refer to them when desirous of information, their names have been placed with those of the standard remedies in the Index.

In the description of each medicine, if derived immediately from the animal, vegetable, or mineral kingdom, the attention of the authors has been directed to its natural history, the place of its growth or production, the method of collecting and preparing it for market, its commercial history, the state in which it reaches us, its sensible properties, its chemical composition and relations, the changes which it undergoes by time and exposure, its accidental or fraudulent adulterations, its medical properties and application, its economical uses, and the pharmaceutical treatment to which it is subjected. If a chemical preparation, the mode and principles of its manufacture are indicated in addition to the other particulars. If a

poison, and likely to be accidentally taken, or purposely employed as such, its peculiar toxicological effects, together with the mode of counteracting them, are indicated; and the best means of detecting its presence by reagents are explained.

The authors have followed the example of Dr. A. T. Thomson, in giving botanical descriptions of the plants from which the medicines treated of are derived. In relation to all indigenous medicinal plants, and those naturalized or cultivated in this country, the advantages of such descriptions are obvious. The physician may often be placed in situations, in which it may be highly important that he should be able to recognise the vegetable which yields a particular medicine; and the apothecary is constantly liable to imposition from the collectors of herbs, unless possessed of the means of distinguishing, by infallible marks, the various products presented to him. A knowledge of foreign medicinal plants, though of less importance, will be found useful in various ways, independently of the gratification afforded by the indulgence of a liberal curiosity in relation to objects so closely connected with our daily pursuits. The introduction of these botanical notices into a Dispensatory appears to be peculiarly appropriate; as they are to be considered rather as objects for occasional reference than for regular study or continuous perusal, and therefore coincide with the general design of the work, which is to collect into a convenient form for consultation all that is practically important in relation to medicines. The authors have endeavoured to preserve a due proportion between the minuteness of the descriptions, and their value as means of information to the student; and, in pursuance of this plan, have generally dwelt more at length upon our native plants than upon those of foreign growth; but, in all instances in which they have deemed a botanical description necessary, they have taken care to include in it the essential scientific character of the genus and species, with a reference to the position of the plant in the artificial and natural systems of classification; so that a person acquainted with the elements of botany may be able to recognise it when it comes under his observation.

In preparing the Dispensatory, the authors have consulted, in addition to many of the older works of authority, the greater number of the treatises and dissertations which have recently appeared upon the various subjects connected with Pharmacy, and especially those of the French writers, who stand at present at the head of this department of medical science. They have also endeavoured to collect such detached facts, scattered through the various scientific, medical, and pharmaceutical journals, as they conceive to be important in themselves, and applicable to the subjects under consideration; and have had frequent recourse to the reports of travellers in relation to the natural and commercial history of foreign drugs. The occasional references in the body of the work will indicate the sources from which they have most largely drawn, and the authorities upon which they have most relied. In relation to our own commerce in drugs, and to the opera-

tions of our chemical laboratories, they are indebted for information chiefly to the kindness of gentlemen engaged in these branches of business, who have always evinced, in answering their numerous inquiries, a promptitude and politeness which merit their warm thanks, and which they are pleased to have this opportunity of acknowledging.*

It has not been deemed necessary to follow the example of the British Dispensatories, by inserting into the work a treatise upon chemistry, under the name of Elements of Pharmacy. Such a treatise must necessarily be very meagre and imperfect; and, as systems of chemistry are in the hands of every physician and apothecary, would uselessly occupy the place of valuable matter of less easy access.

The authors may, perhaps, be permitted to observe, in relation to themselves, that they have expended much time and labour in the preparation of the work; have sought diligently for facts from every readily accessible source; have endeavoured, by a comparison of authorities, and a close scrutiny of evidence, to ascertain the truth whenever practicable; and have exerted themselves to the extent of their abilities to render the Dispensatory worthy of public approbation, both for the quality and quantity of its contents, and the general accuracy of its statements. They are conscious, nevertheless, that, in so great a multiplicity of details, numerous errors and deficiencies may exist, and that the faults of undue brevity in some cases, and prolixity in others, may not have been entirely avoided; but they venture to hope that a candid public will make all due allowances; and they take the liberty to invite, from all those who may feel interested in the diffusion of sound pharmaceutical knowledge, the communication of friendly suggestions or criticisms in relation to the objects and execution of the work.

Philadelphia, January, 1833.

* The authors deem it proper to state that they are peculiarly indebted for assistance to Mr. Daniel B. Smith, president of the Philadelphia College of Pharmacy, to whom, besides much important information in relation to the various branches of the apothecary's business, they owe the prefatory remarks on Pharmacy which are placed at the commencement of the second part of the work, and the several articles, in the Materia Medica, upon *Leeches, Carbonate of Magnesia,* and *Sulphate of Magnesia.*

PREFACE

TO THE

TWELFTH, THIRTEENTH, AND FOURTEENTH EDITIONS.

In the preface to the twelfth edition of the Dispensatory, the changes which had taken place after the first publication of the work, and its various existing relations, were so fully stated, and so little has since occurred to modify those relations, that it has been deemed advisable to retain that preface unaltered.

Preface to the Twelfth Edition.

In the foregoing preface to the first edition of this work, sufficient has been said of its objects, the plan upon which it was written, and the sources whence the materials composing it were originally derived. A modification of its arrangement was made in the second edition, by the introduction of an Appendix, containing an account of drugs not recognised by the American or British Pharmacopœias, yet possessing some interest from their former or existing relations to Medicine and Pharmacy. This Appendix was so much enlarged by the numerous additions made to it in successive editions, that the authors at length deemed it worthy of being considered as a third part of the Dispensatory; and, in the edition immediately preceding the present, this change was carried into effect, so that the work as then arranged, and as it now continues, consists of three divisions, the first treating exclusively of the medicines included in the Materia Medica catalogues of the Pharmacopœias, the second of the Preparations, and the third of substances not strictly officinal. An Appendix, however, is still retained, in which are introduced various tables and other subjects of interest or use to the apothecary and physician, for which a place could not conveniently be found in the body of the work. A precision has thus been given to the arrangement of the Dispensatory which was at first wanting.

In the several successive editions, it has been the aim of the authors to keep pace with the progress of Materia Medica and Pharmacy, making changes corresponding with those of the officinal codes acknowledged by them as authoritative, and introducing more or less in detail all the new facts, views, and processes, as they came to public notice. In the ninth edition, that, namely, of 1851, it was necessary to make a thorough revision of the whole work, and in a considerable degree to rearrange the materials, in consequence of the then recent appearance of new and greatly altered editions of our national Pharmacopœia, and of those of the London and Dublin Colleges. On this occasion, attention was called to a new division of weights adopted by the Dublin College, which, though the same in terms as those in general use, differed from them materially in value, and, therefore, required much caution, on the part of the authors, to guard against serious mistakes. Happily, these Dublin weights have been abandoned in the existing British Pharmacopœia, and one great source of inconvenience, if not of error, has been removed. The British Council, in the revision of the former London, Edinburgh, and Dublin Pharmacopœias, resulting in their consolidation into one work, which, under the name of the

British Pharmacopœia, is hereafter to serve as a standard for the whole empire, have retained the Imperial gallon and its subdivisions, differing more or less in value from the similar denominations of the wine measure used in the U. S. Pharmacopœia. They have, moreover, adopted the avoirdupois pound and ounce, abandoning entirely the Troy pound and its divisions, which are still retained in our national standard. To secure the practical pharmaceutist from misapprehension and mistakes in fulfilling the directions of the officinal formulas, arising from this want of uniformity in the meaning of the terms employed, it has been deemed necessary, in this work, to make a special reference to the value, in U. S. denominations, of the British measure or weight employed, in every formula in which entire accuracy is essential.

In regard to the present edition of the Dispensatory, it is thought desirable to enter into some detail. Few of our readers require to be informed of the decease of Dr. Bache, one of the authors of this work. This deplorable loss, by which long existing ties of friendship and joint labour have been broken, has thrown the whole responsibility of the revision upon the surviving author; and at a time, moreover, when circumstances called for an unusual exercise of judgment, and rendered necessary an extraordinary amount of labour in preparing a new edition.

In the first place, an unprecedented length of interval has occurred between the present and immediately preceding revisions of the work; the eleventh and latest edition having been published in February, 1858, more than seven years ago. It is true that, in this interval, it has been necessary to reprint the work twice to meet the public demand; but no material change could be made; and, with the exception of some errors corrected, the book remained the same as before. This delay of the revision was caused by the unfinished state of the Pharmacopœias, which were to constitute the basis of the new edition, as the old Pharmacopœias had done of the preceding. It was known that the U. S. Pharmacopœia was undergoing a thorough revision, with many and important changes; and it was equally notorious that the three British Pharmacopœias were in the course of consolidation into one, which, it was supposed, would retain few features of the former works, and almost none unaltered. Under these circumstances, it would have been folly to undertake a new revision of the Dispensatory, which, when completed, would in a short time have had its whole foundation undermined, and in all probability been left as useless lumber upon the hands of the publishers. This long period allowed materials to accumulate beyond all precedent, and thus increased in proportion the necessary labour of revision.

In the second place, the changes made both in our own and the British Pharmacopœias rendered indispensable similar changes in the Dispensatory. One not familiar with the subject can scarcely appreciate the constant vigilance, the unceasing attention to the minutest details running through every part of the work, which were necessary to obviate confusion and prevent embarrassing mistakes, in making the book conform to the present standards. Not only was it requisite to introduce all that was new, to alter positions in conformity with the changes in the standards, and to notice and discuss all modifications whether in substance or form; but there was a constantly recurring necessity to solve the various practical problems arising from the substitution of a single one for the three former British Pharmacopœias, which were referred to, at greater or less length, in almost every page.

Taking the above circumstances into consideration, and reflecting, in the third place, how greatly the field of labour has been extended for the surviving author by the decease of his colleague, the reader will understand that he has had a very heavy task upon his hands, and will not be disposed to censure him for a delay in the appearance of the present edition, which could have been shortened only at the expense of the usefulness and trustworthiness of the work itself. Independently of the attention given, ever since the publication of the preceding edition, to the collection of materials for the one to follow, he has, during the last six months, devoted his whole time and energy to the business of revision, at the sacrifice even of ordinary social enjoyments, in order that he might have nothing to regret in future from errors or deficiencies in a book in which accuracy is so important to the general good.

It is, however, with pleasure that he acknowledges his indebtedness, for material assistance in the prosecution of the revision, to his friends, Mr. William Procter, Jun., Professor of Pharmacy in the Philadelphia College of Pharmacy, and Dr. Robert Bridges, Professor of Chemistry in the same Institution. By the suggestion of new subjects for investigation and new points of inquiry, by a careful watchfulness to prevent or correct error, and by valuable information particularly connected with their special departments; though thereby rather increasing than diminishing the labours of the author, they have contributed no little to extend the usefulness, and secure the accuracy of the work. But with all these advantages it would be expecting too much from human fallibility to look for a faultless production. No one is more sensible than the author of possible errors and omissions; and he can only reiterate the invitation for friendly suggestion or criticism, given at the close of the original preface.

Some idea may be formed of the amount of new matter added to the Dispensatory in this revision, when it is understood that, notwithstanding the very considerable space gained by the consolidation of the three British Pharmacopœias into one, and the consequent substitution, in many instances, of a single process and its necessary commentary for three, and notwithstanding the effort made to compress everything to be said into the fewest possible words, and to leave no part of the space unoccupied, it has nevertheless been found necessary to extend the limits of the work by more than one hundred pages. Among the more important additions, independently of those made in conformity with the Pharmacopœias, in the first and second parts of the Dispensatory, and the various new or modified pharmaceutical processes in the preface to the second part, or scattered here and there throughout that division, may be particularized the articles in the third part upon *Anilin*, *Calabar Bean*, *Carbolic Acid*, *Coal Tar*, *Peroxide of Hydrogen*, *Petroleum*, *Propylamia*, *Sorghum*, *Thallium*, the *Upas*, &c., with numerous brief notices of plants, especially the indigenous, intended to call attention to them rather as objects worthy of inquiry by the physician, than from their known value. The reader who may be already in any degree familiar with the work will be struck with one change, for which he may probably not perceive, at first sight, sufficient necessity in all cases. Reference is here made to the transfer of various articles from one part of the Dispensatory to another, as for example the articles on coffee, gutta-percha, ignatia, leptandra, permanganate of potassa, &c., from the third into the first part, and origanum, sponge, tin, &c., from the first to the third. But all these and analogous changes have been made in accordance with the Pharmacopœias adopted as the basis of the work, and will be explained when necessary in connection with the several articles themselves. On the whole, it may be said truly of this revision, that there has been no one, since the Dispensatory was originally published, which has been attended with so much labour, or in which so many modifications and additions have been introduced.

Finally, it may be permitted to the surviving author to say that, considering his advanced age, it is hardly probable that he will live to see or at least participate in another revision, and, under these circumstances, to express his warm thanks to the members of the Medical and Pharmaceutical Professions, who have in so many ways evinced a kind regard for him personally, and a disposition to judge favourably if not partially of his works.

Philadelphia, March 14th, 1865.

Preface to the Thirteenth Edition.

In reference to the thirteenth edition it is only requisite to say that, in consequence of the rapid advance in pharmacological knowledge since the preceding revision, it has been necessary to add much new matter to the work, which, notwithstanding the enlarged leaf, has been increased by about one hundred pages. Some modifications were also rendered necessary by the publication of a second edition of the British Pharmacopœia, which differs in so many important particulars from the first edition, that, without corresponding changes in the Dispensatory, great injustice would have been done to the British authorities.

Preface to the Fourteenth Edition.

The last edition of the United States Dispensatory was published in 1870. Since that time not only has the growth of Pharmacological science been very great, but there has also been promulgated a new edition of the United States Pharmacopœia and a supplement to the British Standard. The additions and alterations which have thus been necessitated in the first and second portions of the present volume are numerous and important. To detail them would require more space than can be afforded, but some idea of their extent may be had from the following considerations.

In the United States Pharmacopœia, besides the alterations made in processes, there were added to the primary list twenty-four drugs, to the secondary list three, and to the preparations eighty-two. In the British supplement of 1874 are included thirty-four drugs and preparations. These medicines of course vary in importance, but not a few of them are highly valuable. As examples may be mentioned Carbolic Acid, Chloral, Nitrate of Ammonium, Digitalin, Iodoform, Bromide of Ammonium, Citrate of Lithium, Flexible Collodion, solution of Chloride of Arsenic, Glycerites, Fluid Extracts, &c.

The advance of our knowledge of extra-officinal drugs has been even more extensive, requiring the addition to the third part of the Dispensatory of accounts of no less than ninety-eight new substances; and, as in the cases of Propylamia, Nitrite of Amyl, &c., a complete re-writing of many of the old articles. The additions of course vary in importance, but many of them are believed to be of decided value. Among them may be mentioned Boldo, Bromal, Brominated Camphor, Bromides of Cadmium, Zinc, Lithium, Sodium, Cerium, and the Alkaloids, Caruba di Guida, Damiana, Eucalyptus Globulus, Goa Powder, Jaborandi, Koumys, Colored Inks, Extract of Malt, Salicylic Acid, Strychnos Potatorum, Methylic Ether.

No care or labour has been spared to render the present edition equal in *accuracy* and in *completeness* to its predecessors. Great pains have been taken to omit superfluous matter and to condense the text; but the additions have been so numerous that the work has been augmented by about seventy pages. This increase is of course to be deprecated; but without it one of the chief values of the book would have been impaired, and it has seemed better to have a few pages more of print than not to have a complete representation of the pharmacological science of the day.

In conclusion, the author has pleasure in acknowledging his great indebtedness to his assistant, Dr. H. C. Wood, Professor of Materia Medica and Pharmacy in the University of Pennsylvania, and to Dr. Robert Bridges, Professor of Chemistry in the Philadelphia College of Pharmacy; and he offers the work to the professions of medicine and pharmacy in the belief that the favourable judgment which has always been extended towards it will still continue, and with the assurance that an honest endeavour has been made to preserve unchanged its peculiar characteristics.

Philadelphia, April, 1877.

ABBREVIATIONS EMPLOYED IN THE WORK.

U. S.—"The Pharmacopœia of the United States of America. By authority of the National Convention for revising the Pharmacopœia, held at Washington, A. D. 1870."

U. S. 1850.—The same, by authority of the Convention of 1850.

Br.—The British Pharmacopœia, published under the direction of the General Council, A. D. 1867.

Lond.—London Pharmacopœia, A. D. 1851.

Ed.—Edinburgh Pharmacopœia, A. D. 1841.

Dub.—Dublin Pharmacopœia, A. D. 1850.

Off. Syn.—Officinal Synonymes, or the titles employed by the Pharmacopœias with the accompanying explanations, when these titles are not given in chief.

Sex. Syst.—The Sexual System, or the artificial system of Linnæus, founded on the sexual organization of plants.

Nat. Ord.—The Natural Order to which any particular genus of plants belongs. When not otherwise stated, it is to be understood that the natural orders referred to are those recognised by Professor Lindley, of the University of London, in his "Introduction to the Natural System of Botany."

Gen. Ch.—The Generic Character, or scientific description of any particular genus of plants under consideration.

Pharm. Uses.—Use of the substance referred to in the preparation of officinal medicines, without entering into the constitution of the medicines prepared.

Off. Prep.—Officinal Preparations; including all the preparations into which any particular medicine directed by the U. S. or British Pharmacopœia enters. When the same preparation is contained in both Pharmacopœias, neither is referred to; but when only in one, this is designated by its representative abbreviation at the end of the preparation named.

Sp. Gr.—Specific Gravity.

Equiv. or *Eq.*—Chemical Equivalent, or the number representing the smallest quantity in which bodies usually combine.

Linn., Linnæus. — *Juss.*, Jussieu. — *De Cand.*, De Candolle. — *Willd. Sp. Plant.*, Willdenow's edition of the Species Plantarum of Linnæus. — *Woodv. Med. Bot.*, Woodville's Medical Botany, 2d edition. — *B.*, Baumé's Hydrometer.

Fr., French. — *Germ.*, German. — *Ital.*, Italian. — *Span.*, Spanish. — *Arab.*, Arabic.

Journ. de Pharm.—Journal de Pharmacie et de Chimie.

Pharm. Journ.—London Pharmaceutical Journal and Transactions.

When, in referring to a journal in parenthesis, the word See is placed before the name of the journal, it is generally intended to intimate that the article referred to is not original.

THE

DISPENSATORY

OF

THE UNITED STATES.

PART I.

MATERIA MEDICA.

The Materia Medica, in its most comprehensive sense, embraces all those substances which are capable of making sanative impressions on the human system; but, as the term is employed in this work, it has a more restricted signification. The Pharmacopœia of the United States very appropriately arranges medicines in two distinct divisions; one including all those which are furnished immediately by nature, or thrown into commerce by the manufacturer; the other, those which are prepared by the apothecary, and are the objects of officinal directions. The former are enumerated under the title of "Materia Medica;" the latter under that of "Preparations." In Dispensatories, which may be considered as commentaries on the Pharmacopœias, the same arrangement is usually followed; and the authors of the present work adopt it the more willingly, as, independently of the weight of authority in its favour, it has the recommendation of being the most convenient. By this plan, all the directions which relate to the practical operations of the apothecary are collected in one place, and are thus more easily referred to than if mixed indiscriminately with other matters, as they must be by any mode of arrangement which makes no distinction between the original medicinal substances and their preparations. Under the head of Materia Medica, therefore, in this Dispensatory, we treat of medicines in the state only in which they are produced by nature, or come into the hands of the apothecary. Of these medicines, such as are recognised by our National Pharmacopœia are most minutely described; but we consider also all that are included in the British officinal catalogue.

Another point in which we accord with the Pharmacopœias is the alphabetical arrangement of the objects of the Materia Medica. As a Dispensatory is intended rather for reference than for regular perusal, it is important that its contents should be so disposed as to facilitate consultation. Medicines, in a work of this kind, are considered as independent objects, to be studied separately, and without any reference to community of source, or similarity of character. Their scientific classification belongs to works which treat of them rather in their relations than their essential properties; and different systems have been adopted, according to the set of relations towards which the mind of the author has been especially directed. Thus, the naturalist classifies them according to the affinities of the several objects in nature from which they are derived; the chemist, according to their composition; the practitioner of medicine, according to their effects upon the system in a state of

health and disease. But none of these classifications is without imperfections; and a simple alphabetical arrangement is decidedly preferable, in every case in which the medicines are considered solely in their individual capacity. Yet, as it comes within the scope of this work to treat of their physiological and therapeutical effects, and as the terms by which these effects are expressed are also the titles of classes to which the medicines belong, it will not be amiss to present the reader with the outlines of a system of classification, by consulting which he will be enabled to ascertain the precise meaning we attach to the terms employed to designate the peculiar action of different medicinal substances.

Remedies are divided into general and local; the former acting on the whole system, the latter on particular parts or organs.

I. GENERAL REMEDIES include 1. ARTERIAL STIMULANTS, sometimes called INCITANTS, which, while they raise the actions of the system above the standard of health, exhibit their influence chiefly upon the heart and arteries; 2. NARCOTICS, which especially affect the cerebral functions, and are either *stimulant* or *sedative* according as they increase or diminish action; 3. ANTI-SPASMODICS, or NERVOUS STIMULANTS, which, with a general stimulant power, exert a peculiar influence over the nervous system, exhibited in the relaxation of spasm, the calming of nervous irritation, &c., without any special and decided tendency to the brain; 4. TONICS, which moderately and permanently exalt the energies of all parts of the frame, without necessarily producing any apparent increase of the healthy actions; and 5. ASTRINGENTS, which have the property of producing contraction in the living tissues with which they may come in contact.

II. LOCAL REMEDIES may be divided into four sections: *a. Those affecting the function of a part*, namely 1. EMETICS, which act on the stomach, producing vomiting; 2. CATHARTICS, which act on the bowels, producing a purgative effect; 3. DIURETICS, which act on the kidneys, producing an increased flow of urine; 4. ANTILITHICS, which act on the same organs, preventing the formation of calculous matter; 5. DIAPHORETICS, which increase the cutaneous discharge; 6. EXPECTORANTS, which augment the secretion from the pulmonary mucous membrane, or promote the discharge of the secreted matter; 7. CHOLAGOGUES, which increase the flow of bile; 8. EMMENAGOGUES, which excite the menstrual secretion; 9. UTERINE MOTOR-STIMULANTS, or OXYTOCICS, which specially promote uterine contraction; 10. SIALAGOGUES, which increase the flow of saliva; and 11. ERRHINES, which increase the discharge from the mucous membrane of the nostrils: *b. Those affecting the organization of a part*, including 1. RUBEFACIENTS, which produce redness and inflammation of the skin; 2. EPISPASTICS or VESICATORIES, which produce a serous discharge beneath the cuticle, forming a blister; and 3. ESCHAROTICS or CAUSTICS, which destroy the life of the part upon which they act: *c. Those operating by a mechanical agency*, consisting of 1. DEMULCENTS, which lubricate the surface to which they are applied, and prevent the contact of irritating substances, or mingle with these and diminish their acrimony; 2. EMOLLIENTS, which serve as vehicles for the application of warmth and moisture; and 3. PROTECTIVES, which operate by excluding the air: *d. Those which act on extraneous matters contained within the organs*, including 1. ANTACIDS, which neutralize acid, whether existing in the alimentary canal, or circulating with the blood; 2. ABSORBENTS, which absorb, and thus in some degree counteract certain irritant or poisonous substances; 3. SOLVENTS, which promote the solution of indigestible matters in the stomach; 4. DISINFECTANTS, which destroy or prevent noxious and offensive effluvia, and counteract other injurious influences originating in animal or vegetable decomposition; 5. ANTHELMINTICS, which destroy worms, or expel them from the bowels; and 6. ANTIZYMOTICS, which destroy or render inert all microscopic organized beings, which are hostile to human health by promoting the fermenting processes.

It is believed that all substances employed as medicines, with the exception of a very few which are so peculiar in their action as scarcely to admit of classification, may be distributed without violence among the above classes. Some substances, however, in addition to the properties of the classes to which they are severally

attached, possess others in common, which give them practical value, and authorize their association in distinct groups, not recognised in the system of classification, but constantly referred to in medical language. Thus, we have REFRIGERANTS, which, when internally administered, diminish animal temperature; ALTERATIVES, which change, in some inexplicable and insensible manner, certain morbid actions or states of the system; and CARMINATIVES, which, by promoting contraction in the muscular coat of the stomach and bowels, cause the expulsion of flatus. It is customary, moreover, to attach distinct names to groups of remedies, with reference to certain effects which are incident to the properties that serve to arrange them in some more comprehensive class. Thus, NARCOTICS frequently promote sleep, relieve pain, and produce insensibility, and, in relation to these properties, are called SOPORIFICS, ANODYNES, and ANÆSTHETICS; and various medicines, which, by diversified modes of action, serve to remove chronic inflammation and enlargements of the glands or viscera, are called DEOBSTRUENTS. These terms are occasionally employed in the following pages, and are here explained, in order that the sense in which we use them may be accurately understood. W.

ABSINTHIUM. *U.S.*

Wormwood.

The tops and leaves of Artemisia Absinthium. *U.S.*

Absinthe, *Fr.;* Gemeiner Wermuth, *Germ.;* Assenzio, *Ital.;* Artemisio Axenjo, *Span.*

ARTEMISIA. *Sex. Syst.* Syngenesia Superflua.—*Nat. Ord.* Compositæ Senecionideæ. *De Cand.* Asteraceæ. *Lindley.*

Gen. Ch. Receptacle sub-villous, or nearly naked. *Seed-down* none. *Calyx* imbricate, with roundish converging scales. *Corollas of the ray* none. *Willd.*

Several species of Artemisia have enjoyed some reputation as medicines. The leaves of *A. Abrotanum*, or *southernwood*, have a fragrant odour, and a warm, bitter, nauseous taste; and were formerly employed as a tonic, deobstruent, and anthelmintic. Similar virtues have been ascribed to *A. Santonica*. *A. pontica* has been occasionally substituted for common wormwood, but is weaker. *A. vulgaris*, or *mugwort*, formerly enjoyed considerable reputation as an emmenagogue, and some years since came into notice, in consequence of the recommendation of its root in epilepsy by Dr. Burdach, of Germany. For this purpose it should be collected in autumn or early in the spring, and only the side roots dried for use. These should be powdered as they are wanted, the ligneous portion being rejected. The dose is about a drachm, to be administered in some warm vehicle in anticipation of the paroxysm, and to be repeated once or twice, at intervals of half an hour, till perspiration is produced, the patient being confined to bed. In the intervals, it may be given every second day. This is merely the revival of an old practice in Germany. Dr. Neumeister, of Arneburg, has used mugwort, in connection with assafetida, successfully in chorea. He adds a pound of the tops to a gallon of water, digests for three days, then strains, adds three ounces of assafetida, and gives a teacupful for a dose. The proportion of assafetida might be reduced to one-third, if well mixed. *A. vulgaris* of this country is thought by Nuttall to be a distinct species. *A. Ludoviciana*, a native of the S. Western regions of the U. States, is thought, when applied to the head in the state of infusion, to favour the growth of the hair. (Maisch, *Am. Journ. of Pharm.*, May, 1872, p. 106.) In China, *moxa* is said to be prepared from the leaves of *Artemisia Chinensis* and *A. Indica*. The medicine known in Europe by the name of wormseed, is the product of different species of Artemisia. The only species which requires particular description here is *A. Absinthium*.

Artemisia Absinthium. Willd. *Sp. Plant.* iii. 1844; Woodv. *Med. Bot.* p. 54, t. 22. Wormwood is a perennial plant, with branching, round, and striated or furrowed stems, which rise two or three feet in height, and are panicled at their summit. The lower portion of the stem lives several years, and annually sends up herbaceous shoots, which perish in the winter. The radical leaves are triply pinnatifid, with lanceolate, obtuse, dentate divisions; those of the stem, doubly or simply pinnatifid, with lanceolate, somewhat acute divisions; the floral leaves are lanceolate; all are hoary. The flowers are of a brownish-yellow colour, hemispherical, pedicelled, nodding, and in erect racemes. The florets of the disk are numerous, those of the ray few. The plant is a native of Europe, where it is also cultivated. It is among our garden herbs, and has been naturalized in the mountainous districts of New England. The leaves and flowering summits are employed; the larger parts of the stalk being rejected. They should be gathered in July or August, when the plant is in flower. They preserve their peculiar sensible properties long when dried.

Wormwood has a strong odour, and an intensely bitter, nauseous taste, which it imparts to water and alcohol. It yields by distillation a volatile oil (*oleum absinthii*), usually dark-green, sometimes yellow or brownish, having a strong odour of the plant, an acrid peculiar taste, and the sp. gr. 0·972. It is sometimes adulterated with alcohol, oil of turpentine, &c., which lessen its specific gravity. The dried herb yields much more than the fresh. (*Zeller.*) The other constituents, according to Braconnot, are a very bitter, and an almost insipid azotized matter, an excessively bitter resinous substance, chlorophyll, albumen, starch, saline matters, and lignin. The cold infusion becomes olive-green and turbid on the addition of sesquichloride of iron,

indicating the probable existence of a little tannic acid. (*Pereira.*) Among the salts, Braconnot found one consisting of potassa, and an acid which he supposed to be peculiar, and denominated *absinthic acid*, but which is said to be identical with the succinic. This acid may be recognized among the products of the dry distillation of wormwood. The substance formerly called *salt of wormwood* (*sal absinthii*) was impure carbonate of potassium, obtained by lixiviating the ashes of the plant. By precipitating an infusion of wormwood with acetate of lead, separating the excess of lead by sulphuretted hydrogen, evaporating the liquor to dryness, digesting the residue in a mixture of alcohol and ether, and submitting the resulting tincture to slow evaporation, Caventou obtained a very bitter, imperfectly crystalline substance, which he considered as the active principle, and which has been named *absinthin*. Dr. E. Luck has procured pure absinthin by a process which may be seen in the *Am. Journ. of Pharm.* (xxiii. 358).

Medical Properties and Uses. Wormwood was known to the ancients. It is highly tonic; and its active principles probably enter the circulation, as it is said to render the flesh and milk of animals fed with it bitter. It formerly enjoyed great reputation in numerous complaints, attended with a debilitated condition of the digestive organs, or of the system generally. Before the introduction of Peruvian bark, it was much used in the treatment of intermittents. It has also been supposed to possess anthelmintic virtues. At present, however, it is little used in regular practice on this side of the Atlantic. A narcotic property has been ascribed to it by some writers, in consequence of its tendency to occasion headache, and, when long continued, to produce disorder of the nervous system. This property is supposed to depend on the volatile oil, and, therefore, to be less obvious in the decoction than in the powder or infusion. A case is recorded in the *Lancet* (Dec. 6, 1862, p. 619), in which half an ounce of the oil, swallowed by a male adult, produced insensibility, convulsions, foaming at the mouth, and a tendency to vomit; though the patient recovered under the use of emetics, with stimulants and demulcents. In large doses, wormwood irritates the stomach, and excites the circulation. The herb is sometimes applied externally, by way of fomentation, as an antiseptic and discutient. The dose in substance is from one to two scruples; of the infusion, made by macerating an ounce in a pint of boiling water, from one to two fluidounces.* W.

* *Oil of Wormwood.* The possession of narcotic properties by this volatile oil, referred to in the text, has been confirmed by experiments on the lower animals. Among its effects, one of the most striking and characteristic are epileptiform convulsions, which seem to occur uniformly from a certain dose. Recovery after the convulsions often takes place; but large doses are capable of producing death. M. Marcé, in a communication to the Academy of Sciences, in Paris, A.D. 1864, states, as the result of experiments on dogs and rabbits, that two or three grammes (30 or 45 grs.) given by the stomach, produce trembling, stupor, hebetude, insensibility, and all the appearances of extreme terror; that from three to eight grammes induce epileptiform convulsions, with involuntary evacuations, foaming at the mouth, and stertorous breathing; but that these symptoms are transient, and do not cause death. (*Bulletin Gén. Thérap.*, Mai 15, 1864.) Similar experiments were afterwards made by M. Magnan, with similar results, except that in the case of guinea-pigs, death followed convulsions from a dose of two grammes of the oil with three grammes of alcohol. (*L'Union Méd.*, Août 4 et 9, 1864.) Dr. R. Amory, of Boston, subsequently repeated these experiments on guinea-pigs and rabbits with confirmatory results. Dr. Amory, on post-mortem examination, found no apparent lesion except slight cerebral congestion. (*Boston Med. and Surg. Journ.*, March 12, 1868, p. 83.)

Absinthe. Under this name, a *liqueur* is much used in France, consisting essentially of alcohol mixed with volatile oil of wormwood, and some other less active ingredients, especially oil of anise. It has for some time been noticed that the effects of this liqueur differ essentially from those of pure alcoholic drinks, constituting a series of symptoms, which have been designated by the name of *absinthism*. From a case recorded by M. Magnan, in which the patient, having habituated himself to the use of brandy, and afterwards substituted *absinthe*, gave an opportunity of comparing the effects of the two kinds of drink, it appears that the characteristic symptoms of the latter, taken in excess, are restlessness at night with disturbing dreams, nausea and vomiting in the morning, with great trembling of the hands and tongue, vertigo, and a tendency to epileptiform convulsions, in which the patient loses consciousness, falls, bites his tongue, foams at the mouth, makes facial grimaces, throws about his limbs, &c., but from which he usually recovers. Experiments made with alcohol and oil of wormwood, separately, on the lower animals, have demonstrated that these latter effects are ascribable to the wormwood; and the inference is that the abuse of absinthe is more dangerous than that of alcoholic drink in its purer forms. From the fatal effects produced by the oil of wormwood, recorded in the preceding paragraph and in the text, it is highly probable that absinthe is capable of producing immediately fatal convulsions, in quantities in which ordinary spirituous drinks, containing a similar amount of alcohol, might be taken with present impunity. (*Boston Med. and Surg. Journ.*, March 5, 1868, p. 69.) The injurious effects of

ACACIA. *U.S.*

Gum Arabic.

A gummy exudation from Acacia vera and other species of Acacia. *U.S.*

Off. Syn. ACACIÆ GUMMI. A gummy exudation from the stems of one or more undetermined species of Acacia. *Br.*

Gomme Arabique, *Fr.;* Arabisches Gummi, *Germ.;* Gomma Arabica, *Ital.;* Goma Arabiga, *Span.;* Samagh Arabee, *Arab.*

ACACIA. *Sex. Syst.* Polygamia Monœcia.—*Nat. Ord.* Leguminosæ. *Trib.* Mimoseæ.

This genus is one of those into which the old genus Mimosa of Linnæus was divided by Willdenow. The name *Acacia* was employed by the ancient Greeks to designate the gum-tree of Egypt, and has been appropriately applied to the new genus in which that plant is included.

Gen. Ch. HERMAPHRODITE. *Calyx* five-toothed. *Corolla* five-cleft, or formed of five petals. *Stamens* 4–100. *Pistil* one. *Legume* bivalve. MALE. *Calyx* five-toothed. *Corolla* five-cleft, or formed of five petals. *Stamens* 4–100. *Willd.*

Several species of Acacia contribute to furnish the gum arabic of the shops. Among the most important are *A. vera* and *A. Arabica*, confounded together by Linnæus under the title of *Mimosa Nilotica.*

Acacia vera. Willd. *Sp. Plant.* iv. 1805; Hayne, *Darstel. und Beschreib. &c.* x. 34. This is a tree of middling size, with numerous scattered branches, of which the younger are much bent, and covered with a reddish-brown bark. The leaves are alternate and bipinnate, with two pairs of pinnæ, of which the lower are usually furnished with ten pairs of leaflets, the upper with eight. The leaflets are very small, oblong-linear, smooth, and supported upon very short footstalks. On the common petiole is a gland between each pair of pinnæ. Both the common and partial petiole are smooth. Two sharp spines, from a quarter to half an inch long, of the color of the smaller branches, and joined together at their base, are found at the insertion of each leaf. The flowers are yellow, inodorous, small, and collected in globular heads, supported upon slender peduncles, which rise from the axils of the leaves, in number from two to five together. The fruit is a smooth, flat, two-valved legume, divided by contractions, occurring at regular intervals, into several roundish portions, each containing one seed. This species flourishes in Upper Egypt and Senegal, and is probably scattered over the whole intervening portions of Africa.

A. Arabica. Willd. *Sp. Plant.* iv. 1805; Hayne, *Darstel. und Beschreib.* x. 32; Carson, *Illust. of Med. Bot.* i. 31.—*Acacia Nilotica*, Delille, *Illust. Flor. de l'Egypte*, p. 79. This species, though often little more than a shrub, attains in favourable situations the size of a considerable tree, being sometimes forty feet high, with a trunk a foot or more in diameter. The leaves are alternate and doubly pinnate, having from four to six pairs of pinnæ, each of which is furnished with from ten to twenty pairs of minute, smooth, oblong-linear leaflets. The common petiole has a gland between the lowest pair of pinnæ, and often also between the uppermost pair. Both the common and partial petioles, as well as the young branches, are downy. The thorns are straight, and disposed as in the former species. The flowers are also arranged as in A. vera, and the fruit is of a similar shape. A. Arabica is perhaps the most widely diffused of the gum-bearing species. It grows in Upper and Lower Egypt, Senegal, and other parts of Africa, flourishes also in Arabia, and is abundant in Hindostan, where its gum is used for food. It has been introduced into Algeria. (*Am. Journ. of Pharm.*, Sept. 1865, p. 337.)

Besides the two species above described, the following afford considerable quantities of gum:—*A. Karroo* of the Cape of Good Hope, formerly considered by some as identical with A. vera; *A. Senegal*, a small tree, inhabiting the hottest regions of Africa, and said to form vast forests in Senegambia; *A. gummifera*, seen by Brous-

this drink have been so great, in France, that the sale of it has been legally forbidden except by apothecaries. (*Journ. de Pharm.*, Sept. 1872, p. 222.)—*Note to the thirteenth and fourteenth editions.*

sonet in Morocco near Mogador; *A. Ehrenbergiana*, a shrub six or eight feet high, named in honour of the German traveller Ehrenberg, who observed it in the deserts of Libya, Nubia, and Dongola; *A. Seyal*, growing in the same region, and also in Upper Egypt and Senegambia; *A. Adansonii*, of the *Flore de Sénégambie*, said to contribute a portion of the Senegal gum; and *A. tortilis*, which sometimes attains the height of sixty feet, and inhabits Arabia Felix, Nubia, Dongola, and the Libyan desert. It is highly probable that gum is obtained from other species not hitherto described, growing in the hot latitudes of Africa. *A. decurrens* and *A. floribunda* are said to yield it in New Holland. Trees, moreover, not belonging to the genus, afford a similar product, especially *Feronia elephantum* of Hindostan, the gum of which, according to Ainslie, is used for medical purposes in Lower India, and *Algarobia glandulosa* of New Mexico, supposed to be the source of the *mezquite gum*.

The gum-bearing Acacias are all thorny or prickly trees or shrubs, calculated by nature for a dry and sandy soil, and flourishing in deserts where few other trees will grow. We are told that camels, attached to the caravans, derive from them their chief sustenance in many parts of those desolate regions in which Africa abounds. In these situations, they have a stunted growth, and present a bare, withered, and uninviting aspect; but in favourable situations, as on the banks of rivers, they are often luxuriant and beautiful.

Their bark and unripe fruit contain tannic and gallic acids, and are sometimes used in tanning. An extract was formerly obtained from the immature pods of *A. Arabica* and *A. vera*, by expression and inspissation. It was known to the ancients by the name of *acaciæ veræ succus*, and was highly praised by some of the Greek medical writers, but is at present little used. It is a solid, heavy, shining, reddish-brown substance, of a sweetish, acidulous, styptic taste, and soluble in water. Its virtues are probably those of a mild astringent. On the continent of Europe, a preparation is said to be substituted for it called *acacia nostras*, obtained by expression and inspissation from the unripe fruit of *Prunus spinosa*, or the wild plum-tree.

The gum of the Acacias exudes spontaneously from the bark, and hardens on exposure; but incisions are sometimes made in order to facilitate the exudation. This is supposed to be favoured by disease; and it is stated by Jackson that, in Morocco, the greatest product is obtained in the driest and hottest weather, and from the most sickly trees. An elevated temperature appears to be essential; for in cooler climates, though the tree may flourish, it yields no gum. According to Ehrenberg, the varieties in the characters of the gum do not depend upon difference in the species of the plant. Thus, from the same tree, it will exude frothy or thick, and clear or dark-coloured, and will assume, upon hardening, different shapes and sizes; so that the pieces, when collected, require to be assorted before being delivered into commerce.

Commercial History and Varieties. The most common varieties of this drug are the *Turkey*, the *Barbary*, the *Senegal*, and the *India gum;* to which may be added the *Cape* and the *Australian gum.*

1. Turkey Gum. Gum arabic was formerly procured, chiefly if not exclusively, from Egypt and the neighbouring countries; and much is still obtained from the same sources. It is collected in Upper Egypt, Nubia, Kordofan, and Darfur, whence it is taken down the Nile to Alexandria. We obtain it in this country through Smyrna, Trieste, Marseilles, or some other entrepot of the Mediterranean commerce. Two varieties have long been noticed, one more or less coloured, the other white, which were formerly distinguished by the titles of *gum gedda* and *gum turic*, derived from the ports of the Red Sea, Jidda and Tor, from which the varieties were erroneously supposed to be respectively exported.* The gum from Egypt is commonly called *Turkey gum*, and is the kind with which apothecaries are usually supplied. Though interspersed with roundish pieces of various sizes, it consists chiefly of small, irregular fragments, commonly whitish, or slightly tinged with yellow or reddish-yellow. It is, on the whole, lighter coloured, more brittle, more readily soluble, and freer from impurities than the other commercial varieties, and contains much

* Bayard Taylor states that Turkey gum is obtained almost entirely from Kordofan, where 30,000 cwt. are annually gathered. (*Journey to Central Africa*, N. Y. 1854, p. 387.)

of that form of gum arabic which is characterized by innumerable minute fissures pervading its substance, and impairing its transparency.

2. Barbary Gum. Much gum arabic is obtained from Barbary; and Mogador, a port of Morocco, is the chief entrepot of the trade. It is probably derived, in part at least, from *Acacia gummifera*. According to Jackson, the natives call the tree which affords it *attaleh*. They gather it in July and August, when the weather is hot and very dry. Two kinds are brought to Mogador, one from the neighbouring provinces, the other by caravans from Timbuctoo. This may account for the fact, that Barbary gum in part resembles the Turkey, in part the Senegal. When first deposited in the warehouses, it has a faint smell, and makes a crackling noise, occasioned by the rupture of the small masses as they become more dry. Barbary gum is exported in casks, and reaches the United States through English commerce.

3. Senegal Gum. This variety was introduced into Europe by the Dutch. The French afterwards planted a colony on the western coast of Africa, and took possession of the trade; but, since the last great European war, it has been largely shared by the English. St. Louis, at the mouth of the Senegal, and Portendic, considerably further north, are the ports in which the commerce in gum chiefly centres. Immense forests of Acacia exist in the interior. These are composed chiefly of two trees, called by the natives *vereck* or *nereck*, and *nebuel* or *nebued;* the former yielding a white gum, the latter a red. These are probably distinct species; the vereck being, according to M. Rain, *A. vera*, and the nebuel, *A. Senegal.* According to Adanson, there are several other gum-bearing species in the neighbourhood. The juice begins to exude in November. The dry winds, which prevail after the rainy season, cause the bark to crack; the juice flows out, and hardens in masses, which are often as large as a pigeon's egg, and sometimes as that of the ostrich. At this period, the Moors and negroes proceed to the forests in caravans, collect the gum in leather sacks, and convey it to the coast. Senegal gum is imported into the United States chiefly from Bordeaux. It is usually in roundish or oval unbroken pieces, of various sizes, sometimes whitish, but generally yellowish, reddish, or brownish-red, larger than those of Turkey gum, less brittle and pulverizable, and breaking with a more conchoidal fracture.*

4. India Gum. Large quantities of gum have been imported from India, derived from *A. Arabica*, and probably other species of Acacia. Most of it is taken to Bombay in Arab vessels from Cape Gardafui and Berbera on the northeastern coast of Africa, where it is collected, or from the ports of the Red Sea. It is in pieces of various size, colour, and quality, some resembling the broken fragments of Turkey gum, though much less chinky; others large, roundish, and tenacious, like the Senegal. It is usually much contaminated, containing, besides genuine gum arabic, portions of a different product, having the characteristic properties of Bassora gum. This is distinguished by its insolubility in water, with which, however, it unites, swelling up, and forming a soft viscid mass. It owes its properties to the presence of *bassorin*. Besides this impurity in the India gum, there are often others more readily detected. Among these, we have observed a yellowish-white resinous substance, which has the sensible properties of the turpentines. If care be used in

* An interesting account is given by M. J. Leon Soubeiran of the varieties of gum sold under the name of Senegal. The following is an abstract from his paper, published in the *Journ. de Pharm. et de Chim.* (Juillet, 1856, p. 53).

Hard gum Galam (*gomme dure de Galam*) is the name given to the product of the two species mentioned in the text. That of *A. vereck* is white, wrinkled, and dull externally, of a vitreous fracture, sometimes vermicular or tortuous, but in general roundish or oval, two inches in diameter, of a sweetish slightly acidulous taste, and wholly soluble in water, with which it forms a mucilage much clearer and less consistent than that of Turkey gum, and reddening the tincture of litmus. The product of *A. nebued* differs only in being more frequently of a reddish colour, almost always in roundish lumps from six lines to an inch in diameter, transparent, of a slightly bitter taste, and yielding a mucilage thicker than that of Turkey gum, and but very slightly reddening the tincture of litmus.

Mixed with the Galam gum are two other varieties, named *Bondou gum* and *Gonakié gum;* the former closely resembling the Galam gum, but differing by its decidedly bitter taste, which renders it unfit for medical use; the latter derived from *A. Adansonii*, redder than the red Galam gum, drying readily and becoming vitreous like the better varieties, but unfortunately so bitter as much to lessen the value of the gum with which it may be mixed, and from which it is not easy to distinguish it.

assorting this commercial variety, it may be employed for all the purposes of good gum arabic. India gum is brought to this country, partly from Calcutta or Bombay, and partly by way of England. It usually comes in large cases. We have seen a parcel said to have come directly from the Red Sea, enclosed in large sacks made of a kind of matting, and bearing a close resemblance to the gum from Calcutta, except that it was more impure, and contained numerous large, irregular, very brittle masses, not much less than the fist in size.*

5. Cape Gum. Pereira mentions that gum is imported into Great Britain from the Cape of Good Hope, where it is collected probably from *Acacia Karroo*, which grows abundantly on the banks of the Gariep, and in other parts. Dr. Pappe, of Cape Town, refers it to *Acacia horrida* of Willdenow. (*Flor. Capens.* 8.) It is of a pale-yellow colour, in tears or fragments, and is considered an inferior variety. According to Mr. Simmons, the importation has nearly ceased; this gum having been superseded by the artificial product called British gum or dextrin. (See *Am. Journ. of Pharm.*, xxix. 75.)

6. Australian Gum. Considerable quantities of gum have been imported into England from South Australia. It is in pieces elongated or globular, rough and even wrinkled upon the surface, and of a violaceous tint, which distinguishes it from other varieties. It is not entirely soluble in water, to which it imparts less viscidity than ordinary gum arabic.†

Brittle gum, Salabreda, or *Sadra-beida,* is supposed to be obtained from *A. albida* of the Flora of Senegambia, which is much smaller than *A. vereck,* and characterized by its white bark. The gum is usually in small, irregular pieces, like coarse salt, probably the fragments of larger lumps, but sometimes in vermicular pieces about as thick as a goose-quill, and of variable length. It is dull and often wrinkled externally, of a vitreous fracture, and of different tints of colour, white, green, yellow, or orange. It is always somewhat bitter. Very easily soluble in its weight of water, it affords a mucilage of little consistence, which has but a slight effect on the tincture of litmus. When the solution is evaporated to the consistence of a paste, it absorbs moisture so as to become viscid; and this property detracts much from its value. It is much less esteemed than the Galam gum. (*Note to the eleventh edition.*)

For interesting details in relation to the growth of the gum-bearing trees, and the collection of their products in the interior desert regions, from which the commerce of Senegal is supplied, the reader is referred to a paper by Dr. Béranger Feraud, contained in the *Pharm. Journ. and Trans.* (Aug. 1873, p. 166), and derived originally from a Memoir on the natural products of this region, published in the *Moniteur Official de Senegal* (Sept. 3, 1872).—*Note to the fourteenth edition.*

* In the *Journ. de Pharm. et de Chim.* (Oct. 1867, p. 270), a variety of India gum, imported into France, by way of London, in boxes containing about 400 pounds, is described as follows. It is a mixture of tears of various tints with impurities. In assorting it for use, the lightest coloured tears are selected. These are less perfectly transparent than gum arabic, less fissured on the surface, which is brilliant and often mammillated, and are also much less friable. But the most important distinctive character of this gum consists in its relations to water. If agitated with twice or thrice its weight of cold water, instead of forming, like ordinary gum arabic, a homogeneous, slightly mucilaginous solution, it forms a thick, transparent, very tenacious magma, which cannot be diluted with a larger quantity of water, but may, after a long time, be coarsely divided, still, however, retaining its viscid, ropy aspect, which never entirely disappears, whatever may be the quantity of water added. It imparts to syrup a very thick and very viscid consistence. It is important that the apothecary should be able to distinguish it, as it is unfit for ordinary pharmaceutic use, being employed exclusively by manufacturers in the preparation of cloths. All that is necessary is to add a few pieces to twice their weight of cold water, and allow the mixture to stand. After some hours, the peculiar, very viscid mucilage above described is developed, betraying the character of the gum. (*Note to the thirteenth edition.*)

† *Constitution of Gum.* Much confusion has existed in the use of the word *gum,* which has been employed to express various concrete vegetable juices, and, at the same time, a peculiar proximate principle of plants. It is now proposed to restrict the term to the former of these applications, and to designate the principle alluded to by the name of arabin. The subject of the gums was investigated by M. Guérin, who repeated and corrected the experiments of former chemists, and threw new light upon the nature of these substances. Several of the facts mentioned in the text were derived from his memoir, published in the *Ann. de Chim. et de Phys.* (t. xlix. p. 248). M. Guérin considers as characteristic of gums, the property of affording mucic acid, when acted on by nitric acid. He recognises in the different gums three distinct proximate principles; namely, 1. *arabin,* or the pure gum of chemical writers, which is the essential constituent of gum arabic; 2. *bassorin,* which enters largely into the composition of Bassora gum and tragacanth; and 3. *cerasin,* which constitutes the portion of cherry gum insoluble in cold water. Of arabin sufficient is said in the text. Bassorin will be treated of under the head of Bassora gum. (See *Part Third.*) Of *cerasin* it may be proper to say a few words in this place.

Cerasin. The gums which exude from the cherry, apricot, peach, and plum trees, and which the French call *gomme du pays,* appear to be identical in composition, consisting of a portion soluble in cold water, which is arabin, and a portion insoluble, which was formerly thought to be bassorin, but has been proved by M. Guérin to be different, and is appropriately denominated *cerasin.* This

General Properties. Gum arabic is in roundish or amorphous pieces, or irregular fragments of various size, more or less transparent, hard, brittle, pulverizable, and breaking with a shining fracture. It is usually white, or yellowish-white; but frequently presents different shades of red, and is sometimes of a deep-orange or brownish colour. It is bleached by exposure to the sun. In powder it is always white. It is inodorous, has a feeble, slightly sweetish taste, and when pure dissolves wholly in the mouth. The sp. gr. varies from 1·31 to 1·48. Gum arabic consists essentially of a peculiar proximate principle usually called *gum*, but for which the name of *arabin* has been adopted. In describing its chemical relations, therefore, we describe those of the principle alluded to. Water, either cold or hot, dissolves it, and forms a viscid solution called mucilage, which, when evaporated, yields the gum unchanged. (See *Mucilago Acaciæ.*) It is insoluble in alcohol, ether, and the oils; and alcohol precipitates it from its aqueous solution. Diluted acids dissolve it, but not more freely than water. The concentrated acids decompose it. Triturated with sulphuric acid, at ordinary temperatures, it is converted into a product similar to the gummy substance resulting from the action of the same acid on linen rags and sawdust. Heated with concentrated sulphuric acid, it is decomposed with the evolution of carbon. The diluted acid, when boiled with it, gives rise to the formation of a saccharine substance. Strong nitric acid converts it into mucic acid, and at the same time produces oxalic and malic acids. It combines with several salifiable bases. With the alkalies and earths it forms soluble compounds. By the subacetate of lead it is precipitated from its solution, in the form of a white insoluble compound of gum and protoxide of lead; and a delicate test of its presence in any liquid is thus afforded. It enters into combination with several salts. A solution of borax coagulates it. When added to a solution of silicate of potassium, it precipitates a compound of gum, potassa, and silica; while a compound of gum and potassa remains dissolved. Its solution yields a precipitate with nitrate of mercury, and forms a brown, semi-transparent jelly with a strong solution of sesquichloride of iron. In solution it unites with sugar; and the liquid, when evaporated, yields a transparent, solid substance, insusceptible of crystallization.*

principle is colourless, semi-transparent, tasteless, inodorous, uncrystallizable, insoluble in alcohol, insoluble in cold water in which it softens and swells a little, and convertible by the action of boiling water into arabin, with which it appears to be isomeric. In this last property it differs from bassorin, which is not changed by boiling water. M. Guérin suggests that the heat of the climate, in tropical countries, produces the same effect upon the exuded gums as artificial heat in colder regions, and that consequently the acacia gum consists chiefly of arabin. (*Note to the third edition.*)

From the observations of Dr. Kützing, it would appear that the spontaneously exuded gum of the plum, cherry, &c., is sometimes at least the product of a diseased cell-action, and contains remains of the cells, probably analogous to the epithelial constituent of animal mucus. (See *Am. Journ. of Pharm.*, xxv. 39.)—*Note to the tenth edition.*

* *Arabin or Pure Gum. Gummic Acid. Arabic Acid.* At the time of the publication of the eleventh edition of this work, experiments by Löwenthal, reported by Neubauer, had led to the supposition that arabin or pure gum, instead of being a distinct proximate principle, was really complex, consisting of an insoluble acid united with a small proportion of lime or other base, forming a soluble compound. Since that period, the subject of the gums generally, and of gum arabic in particular, has received a new and interesting development through the researches of M. Frémy. The following are the conclusions to which these researches have led.

1. Pure gum or arabin consists of a substance soluble in water, having acid properties, and hence called *gummic acid* (*arabic acid*, Gmelin, Handbook, xv. 193), combined with about 3 per cent. of lime, forming a soluble salt. In other words, the arabin of Guérin is *gummate of calcium* (*gummate of lime*). Gummic acid may be obtained in a soluble state by decomposing gum arabic by means of oxalic acid, which separates the lime without modifying the condition of the acid.

2. Under the influence of concentrated sulphuric acid, applied in a peculiar manner, or of a heat of about 300° F. maintained for several hours, gummic acid undergoes a molecular change, by which it is converted into an isomeric substance, also feebly acid, which M. Frémy calls *metagummic acid*, and of which the distinctive property is that it swells up with water without dissolving, acting in this respect like cerasin and bassorin.

3. When this insoluble metagummic acid is exposed to the action of boiling water alone, it undergoes no change; but, if small quantities of a base, such as potassa, soda, ammonia, baryta, or lime are added, it is immediately dissolved, having been reconverted, under the influence of these bases, into gummic acid, which forms soluble salts with them; and the salt thus formed has all the characters of gum arabic.

4. Gum arabic itself, as ascertained by M. Gélis, undergoes the same change under the operation of a high temperature; being converted from a gummate into a metagummate of calcium, which swells up in cold water without dissolving, but by boiling water is rendered again soluble, being reconverted into gummate of calcium.

Gum arabic undergoes no change by time, when kept in a dry place. Its aqueous solution, if strong, remains for a considerable time unaltered, but ultimately becomes sour, from the production of acetic acid. The disposition to become sour is increased by employing hot water to dissolve it. The tendency of a weak solution to become mouldy is said to be obviated by adding a few drops of sulphuric acid, and decanting from the sulphate of calcium deposited. (*Am. Journ. of Pharm.*, Aug. 1872, p. 353.) Mixed with chalk and cheese, at ordinary temperatures, the solution undergoes a fermentation, resulting in the production of alcohol, without an antecedent formation of sugar. (*Journ. de Pharm. et de Chim.*, 3e sér., xxxii. 261.) Between 300° and 400°, the gum softens, and may be drawn into threads. At a red heat it is decomposed, yielding, among other substances, a minute proportion of ammonia. When burnt, it leaves about 3 per cent. of ashes, consisting, according to Guérin, of carbonates of potassium and calcium, a little phosphate of calcium, chloride of potassium, oxide of iron, alumina, magnesia, and silica. The lime is now supposed to exist in the gum combined with gummic or arabic acid, and this compound constitutes pure gum or arabin. In consequence of the presence of lime, oxalate of ammonium occasions a precipitate with the solution. Besides pure gum, gum arabic contains a very small proportion of an azotized body, which is thought to occasion a slight opalescence in its solution, several saline substances, and 16 to 17 per cent. of uncombined water. (*Guérin.*) Pure gum (or more properly gummic acid) may be obtained by treating the compound of gum and protoxide of lead with sulphuretted hydrogen. Its ultimate constituents are carbon, hydrogen, and oxygen; its generally admitted formula being $C_{12}H_{11}O_{11}$.

The properties above enumerated belong to gum arabic generally. There are, however, pharmaceutic varieties with differences which deserve notice. 1. *Gum that is transparent and readily soluble.* This constitutes by far the greater portion of the commercial varieties distinguished by the names of Turkey and Senegal gum. It is characterized by its transparency, ready solubility, and the comparatively slight degree of thickness and viscidity of its solution. Under this head may be included the *gomme blanche fendillée* of Guibourt. It is distinguished by the whiteness and deficient transparency of the pieces, attributable to the minute cracks or fissures with which they abound, and which render them very brittle and easily pulverizable. This peculiar structure is generally ascribed to the influence of solar heat and light; but is conjectured by Hayne to arise from the exudation of the juice in the frothy state noticed by Ehrenberg. Though the unbroken pieces are somewhat opaque, each minute fragment is perfectly transparent and homogeneous. This variety, in consequence of its prompt and entire solubility, is usually preferred for medical use, and for most purposes in pharmacy. 2. *Gum less transparent and less soluble.* Guibourt has proposed for portions of this gum the name of *gomme pelliculée*, from the circumstance that the masses are always apparently covered, on some part of their surface, by a yellowish opaque pellicle. Other portions of it have a mammillary appearance on the surface. It is less transparent than the former variety, is less freely and completely dissolved by water, and forms a more viscid solution. It melts with difficulty in the mouth, and adheres tenaciously to the teeth. It is found in all the commercial varieties of gum, but least in that from Egypt. Its peculiari-

5. According to M. Frémy, *cerasin* is nothing more than *metagummate of calcium*, being, as is well known, changed by boiling with water into arabin, in other words, gummate of calcium, or gum arabic.

6. Hence, M. Frémy supposes that, in plants, metagummic acid is first formed, which in the progress of vegetation is more or less completely changed into gummic acid, thus giving rise to different varieties of gum, distinguished by the greater or less proportion of the soluble to the insoluble ingredients.

7. Bassorin, however, when boiled with water and an alkali, though rendered soluble, is not, like cerasin, converted into gum arabic or arabin; the soluble gum which results being precipitated from its aqueous solution by neutral acetate of lead, which is not the case with gum arabic. (*Journ. de Pharm. et de Chim.*, Fev. 1860, p. 81.)—*Note to the twelfth edition.*

Dr. Græger has recently, in the *Neues Jahrbuch für Pharmacie* (xxxviii. p. 129), published investigations into the chemistry of gum arabic, which confirm while they modify the results of Frémy. He treats especially of the nature and mode of production of metagummic acid: and, according to the author cited, it is this acid and not the gummic which unites with lime, potassa, and magnesia to form gum arabic. The character of this work does not admit of extended statements of matters purely chemical, and we must content ourselves with referring to a translation of Dr. Græger's paper in the *Pharm. Journ. and Trans.*, Jan. 1873, p. 973. (*Note to the fourteenth edition.*)

ties have been ascribed to variable proportions of *bassorin* or *cerasin* associated with the soluble *arabin*. Between these two varieties of gum there are insensible gradations, so that it is not always easy to classify specimens.

Impurities and Adulterations. In parcels of gum arabic there are sometimes pieces of a dark colour, opaque, and incorporated with ligneous, earthy, or other impurities. The inferior are often mixed with or substituted for the better kinds, especially in powder; and portions of insoluble gum, bdellium, and other concrete juices of unknown origin, are found among the genuine. Flour or starch is sometimes fraudulently added to the powder, but is easily detected by the blue colour which it produces with tincture of iodine. In consequence of the impurities and difference in quality, gum arabic should generally be assorted for pharmaceutic use. A foreign substance sometimes adheres to its surface, giving it a bitter taste, from which it may be freed by washing in water.* *Dextrin*, broken into small fragments, has been mingled with parcels of gum. It may be known by yielding, in solution, a reddish-purple colour with solution of iodine. It does not, like gum, produce a yellowish or brownish jelly with solutions of the sesquisalts of iron. The confection sold as *gum-balls*, which should consist of gum and cane sugar, are said to be frequently a mixture of glucose and gelatin. In this state they are not wholly soluble in cold water; but leave, in the bottom of the vessel, a gelatinous mass, which preserves the spherical form. (*Journ. de Pharm.*, Nov. 1868, p. 362.)

Medical Properties and Uses. This gum is used in medicine chiefly as a demulcent. By the viscidity of its solution, it serves to cover and sheathe inflamed surfaces; and, by blending with and diluting irritating matters, blunts their acrimony. Hence, it is advantageously employed in catarrhal affections and irritation of the fauces, by being held in the mouth and allowed slowly to dissolve. Internally administered, it has been found useful in inflammations of the gastric and intestinal mucous membrane; and its employment has even been extended to similar affections of the lungs and urinary organs. Whether it is beneficial, in the latter cases, in any other manner than by the dilution resulting from its watery vehicle, is doubtful. By some it has been thought to possess a positively sedative influence over inflamed surfaces to which it may be applied in the state of solution. It is a good article of diet in cases of high febrile and inflammatory action, requiring a very rigid regimen. If not positively sedative, it is certainly not in the least irritating; while it is sufficiently nourishing to prevent the injurious action of the organs upon themselves. Its nutritive properties have been denied; but the fact of their existence rests on incontrovertible evidence. The Moors and negroes live on it almost exclusively during the period of its collection and conveyance to market; the Bushman Hottentots, in times of scarcity, support themselves upon it for days together; and we are told that the apes of South Africa are very fond of it. Six ounces a day are said to be sufficient to sustain life for a time in a healthy adult. In many cases of disease, its solution may constitute, for a short period, the exclusive drink and food of the patient. It is best prepared by dissolving an ounce of the gum in a pint of boiling water, and allowing the solution to cool. An excellent demulcent, called *gum-pectoral*, is made by dissolving equal parts of gum arabic and sugar in water, and evaporating by means of a water-bath. It is held in the mouth, and allowed slowly to dissolve.† In pharmacy, gum arabic is extensively used for the suspension of insoluble substances in water, and for the formation of pills and troches.

* *Bleaching of gum.* M. Picciotto proposes to purify coloured gum by dissolving it in six or eight parts of a strong and pure solution of sulphurous acid, heating the solution, treating it with carbonate of barium in excess, then filtering, and evaporating at a moderate heat. (*Pharm. Journ. and Trans.*, ix. 16.)—*Note to the ninth edition.*

M. Picciotto has since proposed a better method, consisting in dissolving the gum in 6 to 18 parts of water, passing the solution through linen, and then mixing it with gelatinous alumina freshly precipitated. A pap-like substance is formed; and the colouring matter is so fixed by the alumina, that, when the mixture is placed on a linen strainer, the mucilage escapes colourless; or, if not entirely so at first, becomes so on a repetition of the process. The alumina may be used a second time. To recover the alumina, it may be washed with hot water to separate the remaining gum, then treated with chlorine water, or hypochlorite of calcium, and finally washed with boiling water. (*Journ. de Pharm. et de Chim.*, Juillet, 1867, p. 55.)—*Note to the thirteenth edition.*

† *Jujube paste. Marsh-mallow paste. Iceland moss paste.* Under these names preparations are sold in the shops which are essentially the *gum pectoral* of the text, containing little or none of the

Off. Prep. Mistura Amygdalæ, *U. S.;* Mistura Cretæ; Mistura Glycyrrhizæ Composita, *U. S.;* Mistura Guaiaci, *Br.;* Mucilago Acaciæ; Pulvis Amygdalæ Comp., *Br.;* Pulvis Tragacanthæ Comp., *Br.;* Syrupus Acaciæ, *U. S.* W.

ACETUM. *U. S., Br.*

Vinegar.

Impure dilute acetic acid prepared by fermentation. *U. S.* An acid liquid, prepared from malt and unmalted grain by the acetous fermentation. *Br.*

Vinaigre, *Fr.;* Essig, *Germ.;* Aceto, *Ital.;* Vinagre, *Span.*

Vinegar is a sour liquid, the product of the acetous fermentation. Viewed chemically, it is a very dilute solution of acetic acid containing certain foreign matters.

The *acetous fermentation* may be induced in all liquors which have undergone or are susceptible of the vinous fermentation. Thus sugar and water, saccharine vegetable juices, infusion of malt, cider, and wine may be converted into vinegar, if subjected to the action of a ferment, and exposed, with access of air, to a temperature between 75° and 90°. During the acetous fermentation, a microscopic vegetable growth has been noticed, which Pasteur has shown to be a cryptogam of the genus *Mycoderma*, and which appears to be essential to the process. By the presence and influence of this plant, the germs of which exist in the atmosphere, alcohol sufficiently diluted with water is converted into acetic acid, as sugar in solution is, through the agency of an analogous growth, converted into alcohol.

Vinegar is generally made by the *German process*, by which the time consumed in its formation is greatly abridged. A mixture is prepared of one part of alcohol of 80 per cent., four or six parts of water, and one-thousandth of honey or extract of malt, to act as a ferment. This mixture is allowed to trickle through a mass of beech shavings, previously steeped in vinegar, and contained in a deep oaken tub, called a *vinegar generator*. The tub is furnished near the top, with a wooden diaphragm perforated with numerous small holes, which are loosely filled with packthread about six inches long, prevented from slipping through by a knot at one end. The alcoholic mixture, heated to between 75° and 83°, is placed on the diaphragm, and slowly percolates the beech shavings, whereby it becomes minutely divided. It is essential to the success of the process that a current of air should pass through the tub. In order to establish this current, eight equidistant holes are pierced near the bottom of the tub, forming a horizontal row, and four glass tubes are inserted vertically in the diaphragm, of sufficient length to project above and below it. The air enters by the holes below, and passes out by the tubes. The contact of the air with the minutely divided liquid rapidly promotes the acetification, which consists essentially, in the oxidation of the alcohol. During the process the temperature rises to 100° or 104°, and remains nearly stationary while the process is going on favourably. The liquid is drawn off by a discharge pipe near the bottom, and must be passed three or four times through the tub, before the acetification is completed, which generally occupies from twenty-four to thirty-six hours. According to Wimmer, pieces of charcoal, about the size of a walnut, may be substituted for the beech shavings in the process, with the effect of expediting the acetification. The charcoal must be deprived of saline matter by dilute muriatic acid, and afterwards washed with water. M. Pasteur denies that the more rapid acetification, produced by enlarging the surface of contact with the atmosphere, by means of packthread, beech shavings, &c., is owing to the direct influence of the air, and ascribes it to the presence of mycoderms upon the surface of these substances.

In England vinegar is made from the infusion of malt by the German process, which is said to have originated with Mr. Ham, of Bristol, England, as early as 1822.

substances which give them distinctive names. Prof. Procter has favoured us with the following formula, according to which they are made. Take of gum arabic 8℔s., of sugar 12℔s. avoirdupois, the whites of two dozen eggs, and 5 pints of water. Heat together the gum and water, by means of steam, to 220°, stir till dissolved, strain forcibly, stir in the sugar quickly, and, when it is dissolved, add the white of eggs previously well beaten, stirring constantly, and at the same time remove from the fire. If made in real accordance with the name, decoction of marsh-mallow or Iceland moss must be substituted for the water. (*Note to the twelfth edition.*)

The fermented wort is made to fall in a shower upon a mass of fagots of birch twigs, occupying the upper part of a large vat, and, after trickling down to the bottom, is pumped up repeatedly to the top, to be again allowed to fall, until the acetification is completed. This mode of oxidizing the alcohol in the fermented wort has the advantage of rendering insoluble certain glutinous and albuminous principles, which, if not removed, would cause a muddiness in the vinegar, and make it liable to spoil.

In the United States, vinegar is often prepared from cider. When it is made on a large scale, the cider is placed in barrels with their bung-holes open, which are exposed during the summer to the heat of the sun. The acetification is completed in the course of about two years. The progress of the fermentation, however, must be watched; and, as soon as perfect vinegar is formed, it should be racked off into clean barrels. Without this precaution, the acetous fermentation would run into the putrefactive, and the vinegar be spoiled. Cider vinegar contains no aldehyd. It contains malic acid, and therefore yields a precipitate with acetate of lead. The want of such a precipitate would indicate that the supposed cider vinegar is probably a manufactured substitute.

Vinegar may be clarified, without impairing its aroma, by throwing about a tumblerful of boiling milk into from fifty to sixty gallons of the liquid, and stirring the mixture. This operation has the effect at the same time of rendering red vinegar pale.

The series of changes which occur during the *acetous fermentation* is called *acetification*. During its progress, there is a disengagement of heat; the liquor absorbs oxygen and becomes turbid; and filaments form, which are observed to move in various directions, until, finally, upon the completion of the fermentation they are deposited in a mass of a pultaceous consistence. The liquor now becomes transparent, its alcohol has disappeared, and acetic acid has been formed in its place. How is this change of alcohol into acetic acid effected? Liebig supposes that it takes place in consequence of the formation of aldehyd, into which the alcohol is changed by the loss of a part of its hydrogen. The alcohol, consisting of four eqs. of carbon, six of hydrogen, and two of oxygen, loses two eqs. of hydrogen through the influence of the atmosphere, and becomes aldehyd, composed of four eqs. of carbon, four of hydrogen, and two of oxygen. This, by the absorption of two eqs. of oxygen becomes four eqs. of carbon, four of hydrogen, and four of oxygen; that is, hydrated acetic acid ($C_4H_3O_3$,HO). Thus the conversion of alcohol into acetic acid consists in, first, the removal of two eqs. of hydrogen, and afterwards the addition of two eqs. of oxygen. *Aldehyd* is a colourless, very inflammable, ethereal liquid, having a pungent taste and smell. Its density is 0·79. It absorbs oxygen with avidity, and is thus converted into acetic acid, as just stated. Its property of absorbing oxygen gives it a reducing power like that possessed by glucose. Hence, Trommer's test for glucose may be applied to the detection of aldehyd. A few drops of solution of sulphate of copper is added to the solution suspected to contain aldehyd, and then a solution of potassa in excess. The liquid is next heated nearly to the boiling point, which will cause the precipitation of red suboxide of copper, if aldehyd be present. The name, aldehyd, alludes to its relation to *al*cohol, *alcohol dehyd*rogenated. Its aqueous solution is decomposed by caustic potassa, with formation of *aldehyd resin*. This is a soft, light-brown mass, which, heated to 212°, gives off a nauseous soapy smell.*

* To the above account of acetous fermentation by Dr. Bache, the progress of science requires that some addition should be made. It has been shown that, as the alcoholic and most other fermentative processes, the acetous is necessarily connected with the presence of a microscopic plant, which is generally believed to be the real cause of the changes by which the alcohol is converted into acetic acid. The organism is, in this instance, the *Mycoderma aceti*, which is one of the simplest of vegetables, consisting of articulated structures, somewhat compressed at the middle, about $\frac{1}{5000}$ of a millimeter in diameter, and twice as long. Without the presence of this mycoderm, alcohol, so far as is known, never undergoes acetification, whatever quantity of albuminoid matter, formerly supposed to act as the ferment, may be present; and, with the mycoderm, the process will take place, even in the absence of albuminoid matter, provided there exist in the liquid a little alkaline and earthy phosphate. Hence it is inferred that the albuminoid substances, usually employed as ferment, act merely as nourishment for the mycoderm. The pultaceous mass referred to in the text formed during the fermentation, and commonly called *mother of vinegar*, because vulgarly supposed to be essential to its production, consists of this mycoderm, portions of which, spread over the beechwood shavings, in the German process for manufacturing vinegar, produce

Properties. Vinegar, when good, is of an agreeable penetrating odour, and pleasant acid taste. According to Magnes Lahens, wine vinegar always contains a little aldehyd. The better sorts of vinegar have a grateful aroma, which is probably due to the presence of an ethereal substance, perhaps acetic ether. The colour of vinegar varies from pale yellow to deep red. When long kept, especially if exposed to the air, it becomes muddy and ropy, acquires an unpleasant smell, putrefies, and loses its acidity.

The essential ingredients of vinegar are acetic acid and water; but, besides these, it contains various other substances, derived from the particular vinous liquor from which it may have been prepared. Among these may be mentioned, colouring matter, gum, starch, gluten, sugar, a little alcohol, and frequently malic and tartaric acids, with a minute proportion of alkaline and earthy salts. According to the U. S. Pharmacopœia, vinegar should be devoid of lead and copper and of free sulphuric acid, as shown by its not being discoloured by sulphuretted hydrogen, and yielding no precipitate, when boiled with a solution of chloride of calcium; and of such a strength that a fluidounce would require for saturation, not less than thirty-five grains of bicarbonate of potassium. After saturation it should be free from acrid taste, indicating the absence of acrid substances, the taste of which may have been concealed by that of the acetic acid.

In the late Edinburgh Pharmacopœia, two kinds of vinegar were officinal, malt vinegar and wine vinegar, under the names of *British vinegar* and *French vinegar*. The present British Pharmacopœia recognises only the former.

Malt vinegar (Acetum Britannicum) has a brown colour, and a sp. gr. from 1·006 to 1·019. The strongest kind, called *proof vinegar*, contains from 4·6 to 5 per cent. of acetic acid. That of British manufacture usually contains sulphuric acid, which the manufacturer is allowed by law to add in a proportion not exceeding one part in a thousand. This addition was at one time thought necessary to preserve the vinegar; but it is now admitted that, if the vinegar be properly made, it does not require to be thus protected.

As ordered by the British Pharmacopœia, "it has a sp. gr. of 1·017 to 1·019; one fluidounce of it (445·4 grains) requires at least 402 grain-measures of the *volumetric solution of soda* for neutralization, corresponding to 4·6 per cent. of anhydrous acetic acid. If ten minims of solution of chloride of barium be added to a fluidounce of the vinegar, and the precipitate, if any, be separated by filtration, a further addition of the test will give no precipitate. Sulphuretted hydrogen causes no change of colour." *Br.* The chloride of barium test admits the presence of 1 part in 1000 of sulphuric acid. The non-action of sulphuretted hydrogen indicates the absence of metals generally.

Wine vinegar (Acetum Gallicum) is nearly one-sixth stronger than pure malt vinegar. It is of two sorts, the white and the red, according as it is prepared from white or red wine. *White wine vinegar* is usually preferred, and that made at Orleans is the best. *Red wine vinegar* may be deprived of its colour, and rendered limpid,

acetification. The mycoderm probably acts by oxidizing the alcohol, deriving oxygen itself from the air; and hence it is necessary that it should be at the surface of the liquid; and the fermentation is suspended on its submersion. When the whole of the alcohol has been consumed in the process, the mycoderm, if it continues present, extends its oxidizing influence to the acetic acid, which is thus converted into water and carbonic acid. For the development of these facts in reference to the acetous fermentation, science is indebted to the researches of Pasteur. (See *Am. Journ. of Pharm.*, Sept. 1865, p. 343.)—*Note to the thirteenth edition.*

In a comparatively recent communication to the press, Liebig, while admitting the existence of the Mycoderma aceti, and its influence in the production of acetic acid, expresses his belief that this action is not physiological, but merely chemical, and that it consists in causing the combination of atmospheric oxygen with the alcohol, by which the latter is changed into acetic acid, as various other substances, having no vitality, cause a similar change in the presence of alcohol and oxygen. (See *Pharm. Journ. and Trans.*, Aug. 1870, p. 122.)—*Note to the fourteenth edition.*

It is well known that, in certain kinds of vinegar, little eel-like animals may be seen in great numbers. Their origin was unknown, until they were shown by M. Davaine to be developed in most fruits, as the apple, plum, peach, cherry, &c., in great numbers, and thus their presence in cider vinegar can easily be explained. These little animals need air for their support; and a curious contest may sometimes be noticed between them and the mycoderms upon the surface, which, as they tend to consume all the oxygen absorbed, the little eels combine their efforts to submerge, so as to expose the liquid freely to the air. (*Neues Repert. für Pharm.*, 1865, band xiv., no. 809, s. 427.)—*Note to the thirteenth edition.*

by being passed through animal charcoal. According to the late Edinburgh Pharmacopœia, wine vinegar may be distinguished from malt vinegar by the addition of ammonia in slight excess, which causes in the former "a purplish muddiness, and slowly a purplish precipitate," and in the latter, either no effect, or a dirty-brownish precipitate.

Adulterations. The principal foreign substances which vinegar is liable to contain, are sulphuric and sulphurous acids, certain acrid substances, and copper and lead, derived from improper vessels used in its manufacture. Tin has been found in it after standing a short time in tin vessels. Muriatic and nitric acids are but rarely present. Chloride of calcium will detect free sulphuric acid, when boiled with the vinegar, without causing the least precipitate with the minute quantity of sulphates, almost always present in the liquid. (*Boettger.*) Chloride of barium is not a suitable test here; as it will cause a precipitate with these sulphates, when no free sulphuric acid is present. Sulphurous acid may be detected and estimated by first precipitating the sulphates and free sulphuric acid by baryta-water, next acting on the vinegar with arsenic acid, which converts sulphurous into sulphuric acid, and finally precipitating the newly-formed sulphuric acid by chloride of barium. From the sulphuric acid in the last precipitate, its equivalent of sulphurous acid is easily calculated. (*Laroque.*) Muriatic acid may be discovered by adding to a distilled portion of the suspected vinegar a solution of nitrate of silver, which will throw down a curdy white precipitate, insoluble in nitric acid. If nitric acid be present, an improbable impurity, it may be detected by producing a yellow colour, when the suspected vinegar is boiled with indigo. The acrid substances usually introduced into vinegar are red pepper, long pepper, pellitory, grains of paradise, and mustard seed. These may be detected by evaporating the vinegar to an extract, which will have an acrid, biting taste, if any one of these substances be present. By far the most dangerous impurities in vinegar are copper and lead. The former may be detected by a brownish precipitate on the addition of ferrocyanide of potassium to the concentrated vinegar; the latter, by a blackish precipitate with sulphuretted hydrogen, and a yellow one with iodide of potassium. Pure vinegar is not discoloured by sulphuretted hydrogen. According to Chevallier, wine vinegar, which has been strengthened with acetic acid from wood, sometimes contains a minute proportion of arsenic. This is probably derived from arseniferous sulphuric acid, employed in preparing the acetic acid.

Medical Properties. Vinegar acts as a refrigerant and diuretic. With this view it is added to diluent drinks in inflammatory fevers. It is sometimes used as a clyster, diluted with twice or thrice its bulk of water. It has been supposed to be a powerful antidote to the narcotic poisons, but this is a mistake. In the case of opium, the best authorities unite in considering it worse than useless; as it gives activity to the poison rather than neutralizes it. Externally it is employed as a fomentation in bruises and sprains. Diluted with water, it forms the best means of clearing the eye from small particles of lime. Mixed with an equal measure of water, strong cider vinegar was successfully used by Dr. A. H. Hunt, of Wayne Co., Ohio, by injection into the bladder, for breaking up and removing clotted blood from the cavity of that viscus. (*Med. and Surg. Reporter*, Sept. 14, 1867, p. 222.) Its vapour is inhaled in certain states of sorethroat, and it is diffused through sick rooms under the impression that it destroys unwholesome effluvia, though, in fact, it has little other effect than to cover unpleasant smells. The dose is from one to four fluidrachms; as a clyster, the quantity used is one or two fluidounces.

Off. Prep. Acetum Destillatum, *U. S.;* Emplastrum Cerati Saponis, *Br.* B.

ACHILLEA. *U. S. Secondary.*

Yarrow.

The leaves and flowering tops of Achillea millefolium. *U. S.*

Millefeuille, *Fr.;* Schafgarbe, *Germ.;* Millefoglie, *Ital.;* Cientoenrama, Yerba de San Juan, *Span.*

ACHILLEA. *Sex. Syst.* Syngenesia Superflua.—*Nat. Ord.* Compositæ Senecionideæ. *De Cand.*

Gen. Ch. Receptacle chaffy. *Calyx* imbricate, ovate, unequal. *Pappus* none. *Florets of the ray* five to ten, roundish, dilated.

Achillea Millefolium. Willd. *Sp. Plant.* iii. 2208; Woodv. *Med. Bot.* p. 36, t. 15. Milfoil or yarrow is a perennial herb, common to the old and new continents, though supposed to have been introduced into this country from Europe. It abounds in old fields, along fences, and on the borders of woods and of cultivated grounds, throughout the United States. It is from a foot to eighteen inches high, and is specifically distinguished by its doubly pinnate, downy, minutely divided leaves, with linear, dentate, mucronate divisions, from which it derived the name of milfoil, by its furrowed stem and calyx, and by its dense corymb of whitish flowers, which appear throughout the summer, from June to September. The whole herb is medicinal.

Properties. Both the flowers and leaves have an agreeable, though feeble aromatic odour, which continues after drying, and a bitterish, astringent, pungent taste. The aromatic properties are strongest in the flowers, the astringency in the leaves. The plant owes its virtues to a volatile oil, a bitter extractive, and tannin. It contains also a peculiar acid, denominated *achilleic acid.* The oil, which may be obtained separate by distillation with water, has a beautiful azure-blue colour, and the peculiar flavour of milfoil. The active principles are extracted both by water and alcohol.

Medical Properties. The medical properties of the herb are those of a mild aromatic tonic and astringent. In former times it was much used as a vulnerary, and was given internally for the suppression of hemorrhages, and of profuse mucous discharges. It was employed also in intermittents, and as an antispasmodic in flatulent colic and nervous affections. It has recently been highly recommended by M. Richart, of Soissons, in low forms of exanthematous fevers with difficult eruption, in colic, painful menstruation, and infantile convulsions. He uses the infusion at once as a drink, an injection, and fomentation. (*Journ. de Pharm. et de Chim.*, xviii. 62.) Dr. B. H. Coates, of Philadelphia, has found it useful in hemorrhage (*Trans. of Philad. Col. of Phys.*, N. S., ii. 334); and D. R. Joly, of France, has used it very advantageously as an emmenagogue, and states that it is much employed popularly, in his neighbourhood, for the same purpose. (*Bullet. Gén. de Thérap.*, Mars, 1857.) He has also found it useful in the suppressed lochia. In some parts of Sweden it is said to be employed as a substitute for hops in the preparation of beer, which it is thought to render more intoxicating. It is most conveniently administered in the form of infusion, which may be made in the proportion of an ounce to the pint, and given in the dose of a wineglassful or more. The volatile oil has been given in the dose of twenty or thirty drops. W.

ACIDUM ACETICUM. *U. S., Br.*

Acetic Acid.

Acetic acid of the sp. gr. 1·047, and containing 36 per cent. of *monohydrated* acetic acid. *U. S.* An acid liquid prepared from wood by destructive distillation and subsequent purification; 100 parts by weight contain 33 parts of the acetic acid, $HO,C_4H_3O_3$, corresponding to 28 parts of anhydrous acetic acid, $C_4H_3O_3$. *Br.*

ACIDUM ACETICUM GLACIALE. *Br.*

Glacial Acetic Acid.

Concentrated Acetic Acid, corresponding to at least 84 per cent. of anhydrous acid, $C_4H_3O_3$. *Br.*

Exclusively of *Acidum Aceticum Dilutum*, which will be noticed in the second part of this work, two strengths of acetic acid are now officinal in the U. S. and British Pharmacopœias, assuming those acids to be identical which approach most nearly to equality in specific gravity. These are the *Acidum Aceticum Glaciale*, Br., of the sp. gr. 1·065 to 1·066, and the *Acidum Aceticum*, U. S., Br., of the sp. gr. 1·047 as directed by our officinal standard, and 1·044 by the British.

We shall consider these grades separately, in the order of their strength.

Acidum Aceticum Glaciale, sp. gr. 1·065 to 1·066. *Br.* A process for this preparation was given in the British Pharmacopœia of 1864, which consisted in first heating acetate of sodium so as to drive off all its water of crystallization, then, after cooling, distilling it with concentrated sulphuric acid, and, finally, if the resulting acetic acid, upon being tested with a mixture of solution of iodate of potassium and a little mucilage of starch, was found to contain sulphurous acid, agitating the distilled acid with perfectly dry black oxide of manganese, and again distilling. The object of the process was to furnish an acid of the maximum strength, containing one eq. of dry acid with one of water derived from the sulphuric acid. But, on trial, it was not found to be satisfactory, as the resulting acid was not truly glacial, and always contained sulphurous acid. (C. H. Wood, *Pharm. J. and Trans.*, July, 1867, p. 17.) The acetate of lead, which was employed for the same purpose by the Edinburgh and Dublin Colleges, is said to yield a purer product, though objectionable from the liability of being by accident contaminated with lead. In the Dublin method, well-dried acetate of lead was decomposed by dry muriatic acid gas, and the liberated acetic acid distilled over. It is said that acetate of calcium is preferable to either of the salts mentioned, because better able to bear without decomposition the heat necessary to dry it. (*Ibid.*)* It is affirmed, however, by Prof. Redwood, that the true monohydrated acetic acid cannot be produced by this process, nor by any other on a small scale, and that to obtain it recourse must be had to the manufacturer, who operates on large quantities of the material. (*Pharm. Journ. and Trans.*, March, 1864, p. 411.) It was, therefore, wise in the revisers of the British Pharmacopœia to abandon the process, and trust to the manufacturer, securing a proper purity and strength of the acid by giving precise directions on these points.

Acetic acid of maximum strength may be obtained by distilling binacetate of potassium at a heat between 390° and 570°. One eq. of monohydrated acetic acid distils over, and neutral acetate of potassium is left. The binacetate may be formed by evaporating a mixture of the neutral acetate with an excess of watery acetic acid. In this process, the same acetate of potassium serves repeatedly for conversion into binacetate, and subsequent decomposition. This process is said to be employed by manufacturers on a large scale in some parts of the continent of Europe. It origi nated with M. Melsens.

Acidum Aceticum, *U. S.*, *Br.* (sp. gr. 1·047, *U. S.*, 1·044, *Br.*). This is the acid resulting from the purification of the crude acetic acid obtained by the destructive distillation of wood. It is the acid most useful to the apothecary, and which gives the first heading to this article. As this grade of acid has its source in the impure acetic acid, obtained by the destructive distillation of wood, it will be proper to pre mise some account of the crude acid, called *crude pyroligneous acid.*

Wood, when charred, yields many volatile products, among which are an acid liquor, an empyreumatic oil, and tar containing creasote and some other proximate principles. When the carbonization is performed in close vessels, these products, which are lost in the ordinary process of charring, may be collected, and, at the same time, a large amount of charcoal is obtained.

The carbonization of wood in close vessels, with a view to collect the condensible products, was first put in practice by Molleret in France. The apparatus employed at Choisy, near Paris, is thus described by Thenard. It consists of 1st, a furnace with a movable top; 2d, a strong sheet-iron cylinder, standing upright, sufficiently

* The process of the late British Pharmacopœia is contained, in detail, in the 12th edition of the U. S. Dispensatory (*page* 17), that of the Dublin College in the 11th edition (*page* 17), and that of the Edinburgh College, in which acetate of lead was decomposed by sulphuric acid, in the same place. The process said to have been principally followed by the British manufacturer is the following. One cwt. of purified acetate of sodium, which had previously been deprived of water by fusion, and broken up after cooling, was digested with 60 lbs. of sulphuric acid, of sp. gr. 1·848, and then heated in a still till all the acetic acid was driven over. This was redistilled, in a chloride of calcium or oil bath, with peroxide of manganese, and afterwards again distilled from charcoal and peroxide of lead. The acid thus procured, being placed in ice, was in great measure solidified: and, the liquid portion being decanted, the solid residue, when melted, had the sp. gr. 1·067, and contained 98 per cent. of the monohydrated acid. (Heathfield, *Pharm. Journ. and Trans.*, 2d ser., vii 188.)—*Note to the thirteenth edition.*

capacious to contain a cord of wood, and furnished with a sheet-iron cover; 3d, a sheet-iron tube, proceeding horizontally from the upper and lateral part of the cylinder to the distance of about a foot; 4th, a copper tube connected with the last, which is bent in such a manner as to plunge successively to the bottom of two casks filled with water, and, after rising out of the second, is bent back, and made to terminate in the furnace. At the bottom of each cask, the tube dilates into a ball, from the under part of which another tube proceeds, which, passing water-tight through the cask, terminates above a vessel intended to receive the condensible products.

The sheet-iron cylinder, being filled with wood, in the state of billets, or, as some prefer, in that of sawdust, and closed by luting on its cover with fire clay, is let down into the furnace by the help of a crane. The fire is then applied; and, when the process is completed, the cylinder is removed by the same means, to be replaced by another. During the carbonization, the volatile products are received by the tube; and those which are condensible, being an acid liquor and tar, are condensed by the water in the casks, and collect in the lower bends of the tubes, from which they run into the several recipients; while the incondensible products, being inflammable gases, are discharged into the furnace, where, by their combustion, they assist in maintaining the heat. Eight hundred pounds of wood afford, on an average, thirty-five gallons of acid liquor, weighing about three hundred pounds.

This is the crude pyroligneous acid, sometimes called *pyroligneous vinegar*. It is a dark-brown liquid, having a strong smoky smell, and consists of acetic acid, diluted with more or less water, and holding in solution chiefly tar and empyreumatic oil, with pyroxylic spirit, and probably a small proportion of creasote. It is from this crude acid that the U. S. and British acetic acid, corresponding to the acetic acid of commerce, is obtained. The purification is effected as follows. The acid is saturated with cream of lime, whereby acetate of calcium is formed in solution, and a good deal of the tarry matter precipitated. The solution of acetate of calcium is then mixed with a concentrated solution of sulphate of sodium, and, by double decomposition, acetate of sodium is formed in solution, and sulphate of calcium precipitated. The solution of acetate of sodium is next subjected to evaporation, during which further impurities that separate on the surface are skimmed off. The solution, being duly concentrated, is set aside to crystallize; and the impure salt thus obtained, after having been partially purified by solution and recrystallization, is fused in an iron vessel, stirred until it dries, and, the heat being carefully raised, subjected to incipient carbonization, whereby remaining empyreumatic matters are carbonized, with little damage to the salt. The mass is then dissolved in water, and the solution being strained and recrystallized, furnishes pure acetate of sodium. (See *Sodii Acetas.*) Finally, this salt is distilled with from 34 to 35 per cent. of its weight of sulphuric acid, when it yields the acetic acid of commerce, the residue being sulphate of sodium, which is reserved for decomposing fresh portions of acetate of calcium. The acid has still an empyreumatic flavour, which is removed by filtering it through animal charcoal.

Sometimes the acetate of calcium is distilled with sulphuric acid directly, without having been previously converted into acetate of sodium, by which mode of proceeding a step in the process is saved. But this is attended with many inconveniences, and the acetic acid obtained is apt to contain sulphuric acid. The same step is saved, and without this risk, by distilling the acetate of calcium with hydrochloric acid, as recommended by Christl; and, if the acid be not in excess, the acetic acid obtained scarcely contains a trace of chlorine.*

The sp. gr. of the different acetic acids increases with their strength up to the density of 1·0735 (maximum), after which it decreases until it reaches 1·063, the density of the strongest acid (*glacial acid*). The following table, condensed from one given by Pereira on the authority of Mohr, exhibits the sp. gr. of acetic acid of different strengths, including the officinal Acidum Aceticum Dilutum. The officinal

* M. Richter prefers the acetate of barium to that of sodium, because the fusibility of the latter somewhat interferes with the operation; but adds to the baryta salt 2 per cent. of the acetate of sodium, in order in some measure to obviate its tendency to become pulverulent. (*Journ. de Pharm et de Chim.*, 4e sér., v. 159.)—*Note to the thirteenth edition.*

and commercial acids are noted opposite to their several densities, and the corresponding number in the column on the left gives the percentage of *monohydrated* acid in each.

Per cent. of Acid.	Specific Gravity.	Per cent. of Acid.	Specific Gravity.
100	1·063 Acetic acid (glacial), *Ed.**	36	1·047 Acetic acid, *U.S.*
99	1·065 Glacial acetic acid, *Br.*	33	1·044 Acetic acid of commerce, *Dub.*, *Br.*
97	1·068		
90	1·073	32	1·042 Scotch acid of commerce (strongest).
80	1·0735 Maximum density.		
70	1·070	31	1·041 Acetic acid, *U.S.*, 1850.
60	1·067	30	1.040
59	1·066 Strong acetic acid, *Dub.*	25	1·034 Pyroligneous acid, *Ed.*
54	1·063 Acid corresponding in sp. gr. to the strongest.	20	1·027
		10	1·015
52	1·062	6	1·008 Diluted acetic acid, *Lond.*
50	1·060	5	1·006 Diluted acetic acid, *U.S.*, *Br.*
40	1·051	4	1·0055
39	1·050 English acid of commerce.	3	1·004 Diluted acetic acid, *U.S.* 1850.

Up to the specific gravity 1·062, the density of acetic acid is a pretty accurate index of its strength; but above that specific gravity, two acids of different strengths may coincide in density. Thus, by the table, it is seen that an acid weighing 1·063 may be either the strongest possible liquid acid, or an acid containing only 54 per cent. of such acid. The ambiguity may be removed by diluting the acid with a portion of water, when, if the density be increased, the given specimen is the stronger acid of the two having the same density. Hence the test in the British Pharmacopœia, of adding 10 per cent. of water to their glacial acetic acid. The density of the English and Scotch acetic acids of commerce is given on the authority of Dr. Christison.

Properties of the Glacial Acid (Acidum Aceticum Glaciale, *Br.*). This acid, sometimes called *radical vinegar*, is a colourless, volatile, inflammable liquid, possessing a corrosive taste, and an acetous, pungent, and refreshing smell. It crystallizes when cooled to 34°, and remains crystalline until heated above 48° (*Br.*). Its sp. gr. is 1·063 (1·065 to 1·066, *Br.*), and is increased by adding 10 per cent. of water; an apparent anomaly, which has been already noticed. It possesses the property of dissolving a number of substances, such as volatile oils, camphor, resins, and gum resins, fibrin, albumen, &c. As it attracts humidity from the atmosphere, it should be preserved in well-stopped bottles. Its combinations with salifiable bases are called acetates. A drachm of it, "mixed with a fluidounce of distilled water, requires for neutralization at least 990 grain-measures of the *volumetric solution of soda*. If a fluidrachm of it, mixed with half a [fluid] ounce of distilled water and half a drachm of pure hydrochloric acid, be put into a small flask with a few pieces of granulated zinc, and while the effervescence continues a slip of bibulous paper wetted with solution of subacetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not become discoloured" (*Br.*); showing the absence of sulphurous acid. (See *Liquor Sodæ.*) It consists of one eq. of dry acid 51, and one of water 9 = 60. The dry acid has been isolated by C. Gerhardt, who finds it to be a limpid liquid, heavier than water, and having the constant boiling point of 279°. Its formula is $C_4H_3O_3$.

Properties of the Acid of Commerce (Acidum Aceticum, *U. S.*, *Br.*). This acid has similar properties to those of the glacial, but milder in degree. It is a colourless, volatile liquid, having a sharp taste and pungent smell. It unites in all proportions with water, and to a certain extent with alcohol. It is incompatible with the alkalies and alkaline earths, both pure and carbonated, with metallic oxides, and with most substances acted on by other acids. It is wholly volatilized by heat, and yields no precipitate with chloride of barium or nitrate of silver. Any fixed residue is impurity; and precipitates by the tests mentioned show the presence of sulphuric

* Varies to 1·065. The abbreviations used in this table, *Lond.*, *Ed.*, and *Dub.*, have reference to the Pharmacopœias of the several British Colleges, now no longer in use.

and muriatic acids. Sulphohydrate of ammonium does not discolour it. Sometimes the acid is contaminated with empyreumatic oil arising from its mode of preparation. Much of this impurity would betray itself to the senses of smell and taste. When too minute in proportion to be sensible, it may be detected, according to Mr. John Lightfoot, by neutralizing the acid with carbonate of potassium, and adding solution of permanganate of potassium, when, if the acid is pure, the latter retains its pinky colour, but if in the slightest degree empyreumatic, the permanganate is decolorized, and after standing a brown precipitate occurs. (*Chem. News*, Nov. 30, 1861, p. 290.) If sulphuretted hydrogen produces a milkiness, sulphurous acid is present. When saturated with ammonia, the acid gives no precipitate with iodide or ferrocyanide of potassium, which proves the absence of lead and copper. If silver be digested in it, and chlorohydric acid afterwards added, no precipitate will be produced. The negative indication of this test shows the absence of nitric acid. Of the U. S. acid (sp. gr. 1·047) "100 grains neutralize 60 grains of bicarbonate of potassium, and contain 36 grains of monohydrated acetic acid." This corresponds exactly with the percentage given in the foregoing table. Of the British acid (sp. gr. 1·044) the strength in anhydrous acetic acid is 28 per cent., in the monohydrated acid, according to the table, is 33 per cent. "By weight 182 grains require for neutralization 1000 grain-measures of the *volumetric solution of soda*." Br. It should respond in the same manner as the glacial acid to the test of hydrochloric acid and granulated zinc. The U. S. officinal acid is somewhat stronger than the British. Phosphate of calcium has been largely detected in acetic acid sold as pure, and was copiously precipitated by ammonia added in excess. (Bruckner, *Am. Journ. of Pharm.*, Sept. 1870, p. 389.)

It is difficult to ascertain the strength of acetic acid by saturating it with the carbonated alkalies, when the operator depends upon test-paper for ascertaining the point of neutralization. The difficulty is caused by the fact that the acetates of potassium and sodium, though neutral in composition, are alkaline to test-paper. Hence the liquid begins to be alkaline to test-paper, while some free acid yet remains, but insufficient to overcome the alkaline reaction of the salt formed. It follows, therefore, that, by the use of test-paper, the strength of the acetic acid will be underrated. The degree of inaccuracy, where test-paper is used, is much diminished by saturating the acid with a solution of saccharate of calcium, of a known strength, as proposed by Mr. C. G. Williams. (*Pharm. Journ. and Trans.*, May, 1854, p. 594.) A still better way is to add to the acid a weighed excess of carbonate of barium, and to calculate its strength by the amount of the carbonate decomposed, ascertained by deducting the undissolved from the total used. (*Redwood.*) Equally accurate results may be obtained by the use of carbonate of calcium in a similar manner. (E. C. Nicholson and D. S. Price, *Chem. Gaz.*, Jan. 15, 1856.)

Uses of Crude Pyroligneous Acid. This acid having been incidentally described as the source of the acetic acid of commerce, it may be proper in this place to notice its uses. It has been employed as an application to gangrene and ill-conditioned ulcers. It acts on the principle of an antiseptic and stimulant; the former property being probably chiefly due to the presence of creasote. Several cases in which it was successfully employed are reported in a paper by Dr. T. Y. Simons, of Charleston, S. C. (*Am. Journ. of Med. Sci.*, O. S., v. 310.)

The crude acid is advantageously applied to the preservation of animal food. Mr. William Ramsey made some interesting experiments with it for that purpose. Herrings and other fish, simply dipped in the acid and afterwards dried in the shade, were effectually preserved, and when eaten were found very agreeable to the taste. Herrings, slightly cured with salt by being sprinkled with it for six hours, then drained, next immersed in pyroligneous acid for a few seconds, and afterwards dried in the shade for two months, were found by Mr. Ramsey to be of fine quality and flavour. Fresh beef, dipped in the acid in summer for the space of a minute, was perfectly sweet in the following spring. Professor Silliman states that one quart of the acid, added to the common pickle for a barrel of hams, at the time they are laid down, will impart to them the smoked flavour as perfectly as if they had undergone the ordinary process of smoking.

Medical Properties of Acetic Acid of Commerce (Acidum Aceticum, *U. S.*, *Br.*). Acetic acid of about this strength acts as a stimulant. When diluted sufficiently, it is refrigerant, diaphoretic, and diuretic. Owing to its volatility and pungency, its vapour is frequently applied to the nostrils as an excitant in syncope, asphyxia, and headache. When employed in this manner, it is generally added to a small portion of sulphate of potassium, so as to moisten the salt, and the mixture is put into small glass bottles with ground stoppers.

Acetic acid, more or less diluted, has been proposed by Dr. Broadbent, of London, as a local remedy in cancer, being injected by means of a syringe into the diseased tissue. Some instances have been reported of good effects in cancroid tumours; but the general result has not been favourable, and the remedy will probably be abandoned ere long.

In large doses it is capable of producing poisonous effects; and a case is recorded in the *Lancet* (July 27, 1867, p. 98), in which an adult man, by swallowing two or three ounces of the undiluted acid, was brought into a condition of great danger, from which he was with difficulty rescued. The prominent symptoms were at first slight collapse, and asphyxia from closure of the glottis, from which he was recovered by tracheotomy, and, after reaction, great thirst, salivation, pain in the fauces, and inability to swallow, but without any evidence of serious gastric, pulmonary, or cardiac disturbance.

Medical Properties of the Glacial Acid. This acid is used only externally, and acts as a rubefacient, vesicant, or caustic, according to the length of time it is applied. Its application requires caution. It is sometimes employed as a substitute for cantharides, when a speedy blister is desired; as, for example, in croup, sorethroat, and other cases of internal inflammation. It may be applied by means of blotting paper or cambric moistened with the acid. It is a good corrosive for destroying warts and corns, and is also a valuable remedy in scaldhead.

Pharm. Uses of Acetic Acid. In the preparation of Digitalinum; Santoninum, *U. S.*

Off. Prep. of Acetic Acid. Acetum Cantharidis, *Br.;* Acidum Aceticum Dilutum; Extractum Colchici Aceticum; Extract. Ergotæ Fluidum, *U. S.;* Liniment. Terebinthinæ Aceticum, *Br.;* Liquor Ammoniæ Acetatis, *Br.;* Liquor Epispasticus, *Br.;* Morphiæ Acetas; Oxymel, *Br.;* Plumbi Acetas, *Br.;* Potassæ Acetas, *Br.;* Potassii Acetas, *U. S.;* Zinci Acetas.

Off. Prep. of Glacial Acetic Acid. Acetum Cantharidis, *Br.;* Mistura Creasoti, *Br.* B.

ACIDUM ARSENIOSUM. *U. S.*, *Br.*

Arsenious Acid.

Sublimed arsenious acid in masses. *U. S.* An anhydrous acid, obtained by roasting arsenical ores, and purified by sublimation. As_2O_3. *Br.*

Arsenicum album, *Ed.;* White arsenic; Acide arsenieux, Arsenic blanc, *Fr.;* Arsenichte Säure, Weisser Arsenik, *Germ.;* Arsenik, *Dan., Swed., Polish;* Acido arsenioso, Arsenico, *Ital.;* Arsenico blanco, *Span.*

Arsenious acid is prepared chiefly in Bohemia and Saxony, where it is procured on a large scale, as a collateral product, during the smelting of cobalt ores, which are almost invariably accompanied by arsenic. These ores are roasted in reverberatory furnaces, with long horizontal flues. The arsenic is converted by combustion into arsenious acid, which rises in vapour, and condenses on the sides of the flues. In this state it is impure, and requires a second sublimation, which is performed in cast-iron vessels, fitted with conical heads of the same material, having an opening at the summit. The vessels are placed over a furnace, and brought to a red heat, when a portion of the impure arsenious acid is thrown in through the opening, which is immediately stopped. This portion being sublimed, a second portion is introduced in a similar manner. Finally, the vessels are allowed to cool; and, upon removing the heads, the purified acid is found attached to them in vitreous layers, at first as transparent as glass, but gradually becoming, by contact with the air, opaque at their surface. These are broken into fragments of a convenient size, and

thrown into commerce. The arsenious acid which reaches this country is generally packed in casks, containing from two to five hundred pounds, and is shipped principally from the ports of Hamburg and Bremen.

Properties. Arsenious acid is entirely volatilized by heat. As it occurs in commerce, it is in masses, with a vitreous fracture, and of a milk-white colour exteriorly, but, internally, often perfectly transparent. As first sublimed, the whole mass is transparent; but it gradually becomes white and opaque, the change proceeding progressively from the surface inwards. This change has not been well explained; but probably depends upon the absorption of moisture, causing a gradual passage of the acid from the amorphous to the crystalline state. (*Pereira.*) Hence the masses "usually present a stratified appearance, caused by the existence of layers differing in degrees of opacity." *Br.* According to Guibourt, the sp. gr. of the transparent variety is 3·73, of the opaque 3·69. The experiments, however, of Dr. J. K. Mitchell and Mr. Durand make the density of the former variety from 3·208 to 3·333. As it occurs in the shops for medical use, it is often in the form of a white powder, almost as fine as flour. In this state it is sometimes adulterated with powdered lime or chalk, or sulphate or arsenite of calcium, a fraud which is easily detected by exposing the powder to a heat sufficient to evaporate the arsenious acid, when these impurities will be left behind. In consequence of the liability of the acid to contain impurities when in powder, it is directed in the U. S. Pharmacopœia to be kept in masses; so that the apothecary may powder it for himself as it is wanted. It has been erroneously stated to have an acrid taste. Dr. Christison asserts that it possesses hardly any taste; inasmuch as it produces merely a faint sweetish impression on the palate. In strong, hot solution, it has an austere taste, most nearly resembling that of sulphate of zinc. (*Mitchell* and *Durand.*) It has no smell, even in vapour; but, when thrown on ignited charcoal, it emits a garlicky odour, in consequence of its deoxidation, and the volatilization of the reduced metal. Its point of sublimation, according to Berzelius, is at an incipient red heat; but, according to Mitchell and Durand, it is lower than that of metallic arsenic, being only 425° F. In the Br. Pharmacopœia it is said to be entirely volatilized at a temperature not exceeding 400°. Dr. Taylor, in his work on Medical Jurisprudence, gives the subliming point at 370°; and Mr. Wm. A. Guy, who has made careful experiments on the volatility of various substances, states that arsenious acid rises in vapour at about 280°. (*Pharm. Journ. and Trans.*, Feb. 1868, p. 373.) When slowly sublimed, it condenses in regular octohedral crystals of a sparkling lustre. It may also be obtained crystallized in fine octohedrals by the slow cooling of a solution of the acid in boiling diluted muriatic acid. (*Journ. de Pharm.*, Sept. 1873, p. 246.) It consists of one eq. of arsenic 75, and three of oxygen 24 = 99. "Of this acid, 100 grains, boiled with dilute muriatic acid, and then treated with hydrosulphuric acid, yield a deposit of tersulphuret of arsenic, weighing 124 grains." *U. S.* "Four grains dissolved in boiling water with eight grains of bicarbonate of soda, discharge the colour of 808 grain-measures of *the volumetric solution of iodine.*" *Br.*

Arsenious acid is soluble in water. According to Bussy, at the temperature of 55° a pint of water dissolves 293 grains of the transparent variety, and only about 92 grains of the opaque. Thus the transparent acid, so far from being less, as previously supposed, is much more soluble than the opaque variety. The following particulars are given on the same authority. The transparent acid dissolves much more rapidly than the opaque. By prolonged ebullition with water, the opaque variety attains the same solubility as the transparent, and may be supposed to be converted into the latter. Thus, at the boiling temperature, a pint of water dissolves 807 grains of both varieties. The transparent variety, in cold saturated solution, gradually lessens in solubility, until it reaches the solubility of the opaque, no doubt in consequence of being changed into the latter. Pulverization lessens the solubility of the transparent variety, without affecting that of the opaque. The mixture of the two varieties of the acid in the same solution serves to explain the anomalies heretofore observed in its solubility. (*Journ. de Pharm.*, Nov. 1847.) In relation to some of these results, Bussy had been anticipated by Taylor. (See *Lond.*

and Ed. Philos. Mag., Nov. 1837.)* "The solution of arsenious acid yields a yellow precipitate on the addition of hydrosulphuric acid, a lemon yellow precipitate on the addition first of ammonia and then of nitrate of silver, and a green precipitate with potassa and sulphate of copper." *U. S.* Though arsenious acid combines with salifiable bases, yet, when it is heated with muriate of ammonium, instead of evolution of muriatic acid gas, which might have been anticipated, we have an escape of ammonia; the materials reacting so as to produce chloride of arsenic, water, and ammonia. (V. de Luynes, *Comptes Rendus*, Juin 29, 1857, p. 1354.)

Medical Properties. Internally, the action of the preparations of arsenic is alterative and febrifuge; externally, for the most part violently irritant. They have been considered as peculiarly applicable to the treatment of diseases of a periodical character. At the commencement of their exhibition, the dose should be small, and afterwards gradually increased, the operation being carefully watched. When the specific effects of the medicine are perceived, it must be immediately laid aside. These are, a general disposition to œdema, especially of the face and eyelids, a feeling of stiffness in these parts, itching of the skin, tenderness of the mouth, loss of appetite, and uneasiness and sickness of the stomach. The peculiar swelling produced is called *œdema arsenicalis.* In some instances, their internal use is productive of a rash not unlike that of measles, and, as in that affection, attended with catarrhal symptoms. (Tilbury Fox, *Med. T. & Gaz.*, March, 1868, p. 327.) Sometimes salivation is produced, and occasionally the hair and nails fall off. It is stated by M. Charot that he has seen, in two cases, decided anaphrodisiac effects from the prolonged use of arsenic, which disappeared several months after its discontinuance, and in one instance returned upon its resumption. (*Ann. de Thérap.*, 1865, p. 267.) The principal preparations now in use are the arsenious acid, the solution of arsenite of potassium or *Fowler's solution*, and the solution of iodide of arsenic and mercury, or *Donovan's solution.* The arseniates of potassium, sodium, and iron are occasionally employed; and the Br. Pharmacopœia has a preparation denominated hydrochloric solution of arsenic.

M. Tschudi has given some strange accounts of the habitual use, by the peasants of Styria and the Tyrol, of arsenious acid as an invigorating remedy, which they are unable to relinquish without suffering. The air in the neighbourhood of Swansea, in South Wales, is impregnated with arsenical vapour derived from the copper smelting works in that locality, and yet the workmen do not appear to suffer in health. (*Wood's Therapeutics*, ii. 308.) This negative statement is very different from that of M. Tschudi, who would lead us to believe that the habitual use of arsenic may be beneficial in ordinary health. Encouraged by the reports from Styria, M. Decaisne tried a course of arsenious acid in marsh cachexy, but with unfavourable results. Upon the whole it is not improbable that the accounts received of the habitual use of arsenic by the peasants of Styria, though having a basis of truth, are greatly exaggerated. It is said that horse dealers sometimes fatten horses by giving them small doses of arsenic. If this statement be admitted as reliable, it may perhaps be explained upon the ground that arsenic, as would seem to result from the experiments of Schmidt and Stürswage upon animals, lessens the amount of carbonic acid expired and urea excreted, showing a diminished oxidation in the system, and consequently a diminished destruction of its constituents. (*Philos. Mag.*, March, 1860.)

Arsenious acid has been exhibited in a great variety of diseases, the principal of which are scirrhus and cancer, especially cancer of the lip; anomalous ulcers; various cutaneous diseases; intermittent fever; chorea; chronic rheumatism, particularly those forms of it attended with pains in the bones; rheumatic gout; diseases of the bones, especially nodes, and firm swellings with deformity of the small joints of the hands, chronic syphilitic affections; frontal neuralgia; different painful affections of the head, known under the names of hemicrania and periodical headache; and intermittent

* Experiments of M. L. A. Buchner on the solubility of arsenious acid in its various forms gave the following results. A litre of water saturated at 15° C. with crystallized arsenious acid contains gr. 2·821; with the amorphous and vitreous acid, gr. 9·306; while the same solutions, made by boiling and then allowed to cool for 24 hours, down to 15° C., contain of the crystallized acid gr. 27·839 per litre, and of the amorphous and vitreous, gr. 34·056 per litre. These results serve to confirm those of M. Bussy referred to in the text. (*Journ. de Pharm.*, Oct. 1873, p. 247.)—*Note to the fourteenth edition.*

neuralgic pains of the stomach and bowels. In intermittent fever it is inferior only to Peruvian bark and its alkaloids; and probably no remedy surpasses, or even equals it, in that most obstinate affection of the joints frequently called rheumatic gout. It is asserted by M. Blain that, associated with tannin, arsenious acid has been attended with a success in intermittents greater than could be obtained from sulphate of quinia, or arsenious acid alone. (*Ann. de Thérap.*, 1865, p. 270.) Mr. Henry Hunt, of Dartmouth, England, found it useful in mitigating the pain of ulcerated cancer of the uterus and in menorrhagia; also in irritable uterus, attended with pain and bearing down in the erect posture. He gave it in pill, in the dose of the twentieth of a grain three times a day. In this dose the remedy seldom produces unpleasant feelings, and may be continued for three or four months, for which period it must sometimes be employed, in order to produce the desired effect on the uterus. In cutaneous affections, especially those of a scaly character, as lepra and psoriasis, it is an invaluable remedy. Dr. Pereira says that he has seen it used in a large number of cases of this kind without a single failure. It is thought highly of by some in the treatment of lupus, and of ill-looking sores of the face, lips, and tongue, and sometimes effects a cure. Dr. Piquot, of Honfleur, employs it in apoplectic congestion, in the belief that there is in that affection a great excess of red corpuscles, and that arsenic has the effect of diminishing this constituent of the blood in a very decided manner. (*Ranking's Abstract*, xxxi. 53, Am. ed.) It is asserted also to have proved beneficial in piles and passive hemorrhages, and to be a useful remedy in habitual constipation. Inhalation of the vapour of arsenious acid is said to have proved very beneficial in asthma, the arsenious acid being smoked in a cigarette, in the dose of one quarter of a grain; but this application of the remedy would require great caution. (*Ibid.*, xxxv. 87.) Arsenic has also been found useful in intermittent mania where quinia had proved useless. (*Ibid.*, xxv. 50.) M. Cahen was very successful with it in cholera; 20 cases having been recovered under it out of 24 in which it was used. (*Ann. de Thérap.*, 1867, p. 140.) Dr. L. S. Blackwell has experienced much advantage from it in prolapsus uteri from congestion of the cervix. (*M. & S. Reporter*, Sept. 4, 1869, p. 193.) Dr. Devergie has in many instances succeeded in getting rid of sugar in the urine by means of arsenic, without change of diet. (*New Remedies*, iii. 498.)

Five cases of snake-bite, occurring in men, are said to have been successfully treated by Mr. Ireland, in the Island of St. Lucia, by grain doses of arsenious acid, in the form of Fowler's solution, given every half hour, until the patient began to revive. The quantity of the solution to form this dose is two fluidrachms. The number of doses taken varied from six to eight, which always produced abundant vomiting and purging, results important to the success of the treatment. (*Braithwaite*, xxviii. 423.)

The external application of arsenic has been principally restricted to cancer, and anomalous and malignant ulcers, especially of the kind denominated *noli me tangere*. Dupuytren used with advantage a powder composed of one part of arsenious acid and 24 parts of calomel, as a topical application to herpes exedens, and to the foul ulcers occurring after repeated courses of mercury.

Arsenic is the chief ingredient in nearly all the empirical remedies for the cure of cancer by external application. *Plunket's caustic*, a remedy of this kind, of great celebrity, consisted of the Ranunculus acris and Ranunculus Flammula, each an ounce, bruised and mixed with a drachm of arsenious acid, and five scruples of sulphur. The whole was beaten into a paste, formed into balls, and dried in the sun. When used, these balls were rubbed up with yolk of egg, and spread on pig's bladder. The use of the vegetable matter is to destroy the cuticle; for, unless this is done, the arsenic will not act. Mr. Samuel Cooper thinks that this caustic was never of any permanent benefit in genuine cancer, but has effected cures in some examples of lupus, and malignant ulcers of the lips and roots of the nails. In onychia maligna, Mr. Luke, of London, regards an ointment composed of two grains of arsenious acid and an ounce of spermaceti ointment as almost a specific. (Pereira, *Mat. Med.*)

At Paris, an *arsenical paste* of the following composition has been used as an application to malignant ulcers:—Red sulphuret of mercury 70 parts; dragon's blood 22 parts; arsenious acid 8 parts. It is applied, made up into a paste with saliva. The pain produced by this composition is very severe, and its application dangerous.

The *arsenical paste of Frère Côme* has been applied advantageously by M. Biett to the ulcerated surfaces in yaws. The precaution was used of not applying it, at one time, over a surface larger than that of half a dollar. This paste is made by mixing water with a powder consisting of ten grains of arsenious acid, two scruples of red sulphuret of mercury, and ten grains of powdered animal charcoal. The practice of sprinkling unmixed arsenious acid on ulcers is fraught with the greatest danger. Mr. S. Cooper characterizes it as a murderous practice. The acid may, however, be used either in solution, or reduced by some mild ointment. A lotion may be formed of eight grains of arsenious acid and the same quantity of carbonate of potassium, dissolved in four fluidounces of distilled water; and a cerate, of half a drachm of arsenious acid and six drachms of simple cerate. The cerate is sometimes formed of half this strength. The lotion is in effect a solution of arsenite of potassium.

Febure's remedy for cancer consisted of ten grains of arsenious acid, dissolved in a pint of distilled water, to which were added an ounce of extract of conium, three fluidounces of solution of subacetate of lead, and a fluidrachm of tincture of opium. With this the cancer was washed every morning. Febure's formula for internal exhibition was, arsenious acid two grains, rhubarb half an ounce, syrup of chicory q. s., distilled water a pint. Of this mixture, a tablespoonful, containing about the sixteenth of a grain of the acid, was given every night and morning, with half a fluidrachm of the syrup of poppies. The dose was gradually increased to six tablespoonfuls.

Mr. Lloyd, of London, praises the effects of arsenical injections in cancer of the vagina and uterus. They act favourably by preventing rather than destroying the fetor, and by diminishing the sloughing and discharge. The strength of the solution employed was from two to eight grains of arsenious acid to the pint of water. (See *Am. Journ. of Med. Sci.*, Oct. 1854, p. 541.)

The average dose of arsenious acid is the tenth of a grain, three times a day, given in the form of pill. It is usually combined with opium, which enables the stomach to bear the medicine better. A convenient formula is to mix one grain of the acid with ten grains of sugar, and to beat the mixture thoroughly with crumb of bread, so as to form a pilular mass, to be divided into ten pills. The *Asiatic pills*, so called, consist of arsenious acid and black pepper, in the proportion of 1 part of the former to 80 of the latter. A preparation much used on the continent of Europe is *Boudin's solution*, which is simply an aqueous solution of arsenious acid with the addition of wine, and is made by boiling one gramme (15·4 grains) of the acid with one litre (2·1 pints) of distilled water till entirely dissolved, then cooling, filtering, adding enough distilled water to supply the loss, and finally mixing with one litre of white wine. Of this solution a fluidounce contains about one-quarter of a grain of arsenious acid.

Properties of Arsenious Acid as a Poison. Arsenious acid, in an overdose, whether internally or externally, acts with very great energy, and generally destroys life in a short time; but, in some rare instances, no well-marked symptoms are developed until eight or nine hours after the ingestion of the poison. Dr. Edward Hartshorne relates a case of recovery, in which at least a drachm of arsenious acid had been swallowed, and where the symptoms of poisoning were delayed for sixteen hours. (*Med. Examiner*, Dec. 1855, p. 707.) The symptoms produced by the poison are an austere taste; fetid state of the mouth; frequent ptyalism; continual hawking; constriction of the pharynx and œsophagus; the sensation of the teeth being on edge; hiccough; nausea; anxiety; frequent sinkings; burning pain at the præcordia; inflammation of the lips, tongue, palate, throat, bronchi, and œsophagus; irritable stomach, so as not to be able to support the blandest drinks; vomiting of matters, sometimes brown, at other times bloody; black, horribly fetid stools; small frequent, concentrated, and irregular pulse, but occasionally slow and unequal; palpitations; syncope; insatiable thirst; burning heat over the whole body, or a sensation of icy coldness; difficult respiration; cold sweats; suppression of urine; scanty, red, bloody, and sometimes albuminous urine; change in the countenance; a livid circle round the eyelids; swelling and itching of the body; livid spots over the surface, and occasionally a miliary eruption; prostration of strength; loss of feeling, especially in the feet and hands;

delirium; convulsions, often accompanied with insupportable priapism; falling off of the hair, detachment of the cuticle, &c. In some cases there is inflammation with burning pain in the urino-genital organs. It is very rare to observe all these symptoms in the same individual. Sometimes, indeed, they are nearly all wanting, death taking place without any pain or prominent symptom. Occasionally the symptoms have a perfect resemblance to those of Asiatic cholera, in the stage of collapse. After death, the morbid appearances are various. In some instances, no vestige of lesion can be discovered. The appearances, however, in the generality of cases, are the following. The mouth, stomach, and intestines are inflamed; the stomach and duodenum exhibit spots resembling eschars, and perforations of all their coats; and the villous coat of the former is in a manner destroyed, and reduced to the consistence of a reddish-brown pulp. In cases of recovery, it has been a question how long it takes for the poison to be eliminated from the system. In an instance, reported by Dr. D. Maclagan, in which about two drachms of the poison had been swallowed, and in which magnesia was used successfully as an antidote, arsenic was detected in the urine by Marsh's test as late as the twentieth day.

A milder grade of arsenical poisoning, yet sometimes serious in its consequences, has resulted in many instances from the inhalation of the air of apartments lined with green wall-paper, which owes its colour to arsenite of copper, and from which a fine poisonous dust sometimes escapes when the paper has not been well prepared. (See *Chem. News*, March 24, 1860.) The burning of green tapers is sometimes attended with an arsenical odour; and chemical examination has shown that, though in relatively rare instances, they do contain arsenious acid in quantities sufficient to prove injurious. (*Lancet*, Nov. 15, 1873, p. 715.) Death has also resulted, in more than one instance, from working in the manufacture of artificial leaves, which owe their green colour to the same poison. (*Chem. News*, Nov. 30, 1861.) Ulceration of the anus has resulted from the habitual use of green paper, and has disappeared on the disuse of that material.

In view of the numerous accidents and crimes caused by the use of arsenious acid. its sale should be regulated by law in all the States of the Union. In 1851, an act for this purpose was passed by the British Parliament.

Dr. Christison divides the poisonous effects of arsenious acid into three orders of cases, according to the character and violence of the symptoms. In the first order, the poison produces symptoms of irritation and inflammation along the course of the alimentary canal, and commonly kills in from one to three days. In the second, the signs of inflammation are moderate, or even altogether wanting, and death occurs in five or six hours, at a period too early for inflammation to be always fully developed. In the third order of cases, two stages occur; the first stage being characterized by inflammatory symptoms, as in the first order; the second, by symptoms referable to nervous irritation, such as imperfect palsy of the arms or legs, epilepsy, tetanus, hysterical affections, mania, and coma. It is a general character of this poison to induce inflammation of the stomach in almost all instances, provided death does not take place immediately, whatever be the part to which it is applied. Thus the poison, when applied to a fresh wound, will give rise to the same morbid appearances in the stomach and intestines, as when it is swallowed. In some cases, observed by Drs. Mall and Bailie, the rectum was much inflamed, while the colon and small intestines escaped.

The precise rank which should be assigned, in the scale of poisons, to arsenious acid when applied externally, is still undetermined. One set of observers contend that its external application is not attended with great danger; while another party conceives that it acts as a virulent poison. Hunter, Sir Everard Home, Jœger, Brodie, Dr. Campbell of Edinburgh, Smith, and Orfila have all adduced experiments on the inferior animals, which prove that arsenious acid, inserted into a recent wound, causes death after a longer or shorter period. Indeed, some observations go to prove that its poisonous effects are developed by a smaller amount, applied in this way, than when taken into the stomach. Nor are there wanting many well-authenticated facts of its deleterious effects, externally applied, on the human constitution. Roux has put on record the case of a young woman under his care, whose death was caused,

after agonizing sufferings, by the application of an arsenical paste to a cancerous breast. Death has occurred from the application of an arsenical paste to a soft tumour of the temple; the poisonous effects on the system at large being the cause of the fatal result. Sir Astley Cooper bears testimony to the dangerous effects of arsenic, externally applied. On the other hand, some writers assert the safety of the external application of this poison. Mr. Blackadder applied it in large quantities to sores, and never witnessed a single instance in which it acted constitutionally. The late Dr. Randolph, of this city, stated that Dr. Physick frequently and successfully employed arsenic by external application, without the injurious consequences which have been attributed to it. (*North Am. Med. and Surg. Journ.*, v. 257.) In weighing testimony so conflicting, we are constrained to believe that the circumstances of the different experiments and observations must have been different; and we think that the observations of Blackadder and Harles show in what this difference consists. It seems to depend entirely on the circumstances of the application, as being favourable or otherwise to absorption. Blackadder attributes his success to the large quantity of arsenic which he employs, and which, he contends, kills the part without being absorbed; and this is probably the fact. Harles's observations may be explained on the same principle. He contended that the outward application of arsenic is comparatively safe to ulcers, either common or malignant; but is dangerous to parts recently wounded and pouring out blood. Here the difference would seem to consist in the greater liability to absorption in the latter than in the former case. The very dilution caused by the blood may be an efficient promoter of absorption; for the experiments of Dr. Campbell show that arsenic acts with more energy when dissolved in water than when in the solid state. The case in which Dr. Randolph employed arsenious acid, by the advice of Dr. Physick, was one of ulcerated scrotum, in which it acted by producing the death of the diseased part, a state evidently unfavourable to absorption. The formula employed was one part of the acid to five of sublimed sulphur. Arsenious acid proves escharotic, according to some, by acting on the vital properties of the part so as to cause its death; according to others, by producing a chemical decomposition of the structure.

Upon the whole, new facts are wanting to clear up this difficult subject. Judging from the lights we possess, the external application of arsenious acid, in case it is absorbed, is attended with very great danger; and the conditions of a part, and of the system at large, favourable or otherwise to absorption, are too little understood to make it warrantable to use this poison externally without the greatest caution.

Treatment of Poisoning by Arsenious Acid. Before the antidote, to be mentioned presently, can be obtained, the poison should be dislodged as far as possible by free vomiting, induced by the finger, the feather part of a quill, and the administration of an emetic of sulphate of copper or sulphate of zinc. The same object is promoted by the use of the stomach-pump. Demulcent drinks should be freely given, such as milk, white of eggs and water, or flour and water, which serve to encourage the vomiting and envelope the poison.

The antidote above referred to is the hydrated sesquioxide (peroxide) of iron, in the *moist* or *pulpy* state. As soon as it is ready, it must be given in doses of a tablespoonful to an adult, of a dessertspoonful to children, every five or ten minutes, until the urgent symptoms are relieved. It is calculated that the quantity taken should be at least twelve times the supposed amount of the poison swallowed; but, as the antidote is perfectly innocent, it is prudent to give it in larger quantities. According to the experiments of E. Riegel, one part of arsenious acid in solution is so fully precipitated by ten of the dry oxide, that, after its action, not a trace of the poison can be detected, even by Marsh's test. Its efficacy is of course greater, the sooner it is administered after the ingestion of the poison; but, even after delay, its use will prove advantageous, so long as any portion of the poison still remains in the stomach. The antidote acts by producing with the poison, by a transfer of oxygen from the oxide to the acid, an insoluble, and therefore inert, subarseniate of protoxide of iron ($2Fe_2O_3$ and $AsO_3 = 4FeO,AsO_5$).* The manner of preparing the antidote will be

* If the statements made by British writers as to the efficiency of the arseniate of protoxide of iron as a remedy, and the minuteness of the dose necessary, be admitted as correct, it will be neces-

given elsewhere. (See *Ferri Oxidum Hydratum.*) It should be kept by all apothecaries ready for use.

This antidote for arsenious acid was discovered by Drs. Bunsen and Berthold, of Göttingen, in 1834; and its efficacy has been abundantly confirmed by experiments on inferior animals, and by its successful application to numerous cases of poisoning in the human subject. Among others, the reader is referred to the following.—1. The case of M. Blondel, in which two drachms of arsenic had been swallowed. 2. Two cases treated by Dr. Buzorini. 3. A case reported by Mr. John Robson, in which more than a drachm and a half of the poison had been swallowed, and the antidote was not administered until two hours after the poison had been taken. In the last-mentioned case, about an hour after the ingestion of the poison, the stomach-pump was used, but unsuccessfully, on account of the instrument becoming choked with the remains of food. 4. A case related by Dr. Thomas, of Baltimore, in which twenty grains of the poison had been swallowed. 5. Case of Dr. MacDonald in the *N. Y. Journ. of Med. and Surg.* (ii. 205.) 6. Case reported by Dr. Gerhard. (*Med. Exam.*, iii. 250.) 7. Cases related by Drs. Smiley and Wallace, of this city. Eight persons in one family were poisoned, of whom six recovered and two died. In the fatal cases, the patients could not retain the antidote. (*Ibid.*, iii. 679.)

Several valuable observations have been made in relation to the antidotal powers of the different oxides of iron, and the circumstances which influence their efficacy. The forms of oxide experimented with are the anhydrous sesquioxide (colcothar), the dry hydrated sesquioxide (rust of iron, and the subcarbonate of iron of the U. S. Pharmacopœia, which are both essentially hydrated oxides), the hydrated oxide in the state of pulp or magma, and the same oxide kept under a stratum of water. Orfila has shown that *colcothar* is without effect, because it does not combine with the arsenious acid. Dr. Von Specz, of Vienna, has proved that *rust of iron* acts as an antidote to arsenious acid; but, as it is much less powerful than the pulpy hydrate, it should be used only in the absence of the latter, and until it can be procured. Orfila agrees with Von Specz as to the degree of efficacy of the rust, and attributes its inferior power to its inability *completely* to neutralize the arsenious acid. According to the French toxicologist, it forms with the acid a subsalt which is poisonous, though much less so than the free arsenious acid. All the best authorities unite in considering the *hydrated oxide*, in the state of *pulp* or *magma*, to be the best form of the antidote; but opinions have been divided as to the necessity of its being *freshly* prepared as well as moist, and as to the relative advantage of much or little water to maintain it in the moist state. An able paper of Prof. William Procter, jun., of this city, appears to have settled these points. (*Amer. Journ. of Pharmacy*, xiv. 29, April, 1842.) He has proved that the moist oxide gradually decreases in its power of neutralizing arsenious acid, the longer it is kept; and that this decrease in power is more rapid in the oxide, when mixed with much water, than when in the form of a thick magma. The cause of this diminution of neutralizing power on the part of the moist oxide, by being kept, is explained by the experiments of G. C. Wittstein. This chemist finds that the hydrated oxide of iron, recently precipitated, dissolves readily in acetic and other vegetable acids in the cold, but becomes nearly insoluble when kept for some time under water. This change in solubility is attributed by Wittstein to two causes; the gradual change of the oxide from the amorphous to the crystalline state, and its partial dehydration; for, when kept a long time, the oxide loses half its water. From these considerations, Wittstein prefers the more recent oxide as an antidote for arsenic, and recommends that the preparation should be re-made every six months or year,

sary to seek some other explanation of the antidotal powers of the hydrated sesquioxide of iron than the one above given by the late Dr. Bache. The probability is that the new compound is the *sesquiarseniate of sesquioxide of iron* ($2F_2O_3 3AsO_5$); and the following may be the rationale. Six eqs. of sesquioxide (F_2O_3) may surrender each one eq. of oxygen to 3 eqs. of arsenious acid (AsO_3), converting them into 3 eqs. of arsenic acid (AsO_5), which then combines with 2 eqs. of undecomposed sesquioxide, producing the sesquiarseniate of sesquioxide of iron ($2F_2O_3,3AsO_5$); twelve eqs. of protoxide resulting from the loss of one eq. of oxygen, each by the six eqs. of sesquioxide first mentioned. If this be the true explanation, it may be determined by a simple calculation, based on the combining numbers, that each grain of arsenious acid will require for saturation 2·64 grains of hydrated sesquioxide of iron; but, in fact, according to the experiments of the Messrs. T. & H. Smith, of Edinburgh, 8 grains are practically necessary. (*Note to the thirteenth edition.*)

by dissolving the old oxide in muriatic acid, and re-precipitating with ammonia. (*Buchner's Repert.*, xliii. 366.) In the latter remarks, Wittstein has only confirmed what had been previously observed by Procter.

It follows from the above facts and observations, that the forms of sesquioxide of iron are efficacious as antidotes to arsenic in the following order, beginning with the one having the least power:—1, dry hydrated oxide; 2, hydrated oxide, long kept and mixed with much water; 3, the same, long kept, and in the form of a thick magma; 4, the same just precipitated and still pulpy. The form of antidote which can be obtained first must be used first, although not the best, and may be replaced by a better as soon as it can be procured. The apothecary should, therefore, always keep the oxide in the form of thick magma, and be prepared, at a moment's warning, to make the antidote. When applied to for it, he must furnish the magma, or, if unprovided with this, the rust or subcarbonate, and immediately proceed to prepare the antidote, which may be done in ten or fifteen minutes, if the proper solutions are always kept on hand. (See *Ferri Oxidum Hydratum.*)

The antidote having been faithfully applied, the subsequent treatment consists in the administration of mucilaginous drinks. Should the patient survive long enough for inflammatory symptoms to arise, these must be combated on general principles. Accordingly, venesection and leeches may become necessary; and, in the course of the treatment, emollient enemata, antispasmodics, and narcotics will often prove useful in mitigating pain and allaying nervous irritation. Convalescence is generally long and distressing; and hence it is of the greatest importance to attend to the diet, which should consist exclusively of milk, gruel, cream, rice, and similar bland articles.

Dr. Köhler, of Halle, proposes the saccharine oxide of iron in solution, as preferable to all other preparations in poisoning by arsenious acid. This forms, like the hydrated powder, an insoluble compound with the acid. He bases his evidence upon experiments with the lower animals, and gives the details of a case in which it proved successful in the human subject, after the swallowing of more than half a drachm of the acid in powder. He gave a large teaspoonful of the saccharine oxide with a drachm of water immediately afterwards, which was repeated every 15 minutes for two hours, followed by an emetic dose of ipecacuanha, and then repeated every half hour. The patient recovered. (*Br. and F. Medico-chir. Rev.*, April, 1870, p. 538.)

Bussy has proposed light magnesia, or the kind which has not been too strongly calcined, as well as recently precipitated gelatinous magnesia, as an antidote for arsenious acid; and a case is given by him in which it appeared to prove efficacious. (*Journ. de Pharm.*, x. 81.) The dense kind has very little efficacy. Dr. Christison saw a case in which this antidote seemed very serviceable. A successful case is also reported by Cadet-de-Gassicourt (*Journ. de Pharm.*, Mars, 1848), and another by Dr. E. Bissel, of Norwalk, Conn. (*Am. Journ. of Med. Sci.*, July, 1848.) For the full precipitation of arsenious acid, eighteen times its weight of anhydrous magnesia are required. (*E. Riegel.*) Like the sesquioxide of iron, the magnesian antidote is conveniently kept, in a pulpy state, under water in stopped bottles. M. Schroff has made some experiments on rabbits, to determine the comparative efficacy, as antidotes, of the sesquioxide and magnesia, and gives the preference to the latter. The hydrated magnesia is best prepared extemporaneously by quickly forming a solution of sulphate of magnesium, and precipitating by water of ammonia, which is preferable to potassa, as any portion of the latter, remaining in the preparation, might act injuriously by favouring the solubility of the arsenious acid. Notwithstanding these statements, however, it is asserted by T. & H. Smith of Edinburgh, on the basis of experiment, that magnesia is incapable of neutralizing arsenious acid, and is utterly useless as an antidote. (*Pharm. Journ.*, Oct. 1865, p. 144.) Under these circumstances, it would be unwarrantable to rely on it when the ferruginous antidote is attainable. Some experiments have been made to show that sugar mixed with magnesia may serve as an antidote to poisoning by arsenious acid. (*Lancet*, Aug. 2, 1873, p. 31.)

For the salts of the acids of arsenic, the subacetate of the sesquioxide of iron has been suggested as an antidote by Duflos. In poisoning by these salts, the sesquioxide is said to be without effect.

A mechanical method of counteracting the effects of arsenic is said to have been employed with complete success in several instances. It consists, after thoroughly washing out the stomach, in administering large quantities, a pound or more, of a mixture of chalk and castor oil, of the consistence of thick cream, which so envelopes the particles of the poison adhering to the mucous membrane as to render them harmless, while carried through the bowels and evacuated. (W. T. Fewtrell, *Chem. News*, Jan. 14, 1860, p. 71.)

Reagents for detecting Arsenious Acid. As arsenic is so frequently employed for criminal purposes, it becomes important to detect its presence in medico-legal investigations. The tests for it may be divided into those which indicate indirectly its presence, and those which demonstrate its presence incontestably, by bringing it to the metallic state. The former embrace all the liquid reagents, so called; the latter, the processes for metallization. It is necessary, however, to be aware of the fact, that many of the substances employed as tests for arsenic are themselves often contaminated with arsenic, and unless great care be exercised to select reagents perfectly free from this impurity, there will be danger that the results may be fallacious.

The most characteristic reagents are *sulphuretted hydrogen, ammoniacal nitrate of silver, and ammoniacal sulphate of copper.* In the opinion of Dr. Christison, the concurrent indications of these three tests are all-sufficient for detecting arsenious acid; but we think that, in questions involving life, the metallization of the poison should never be omitted.

In using sulphuretted hydrogen, the solution must be neutral. An excess of alkali may be neutralized with acetic acid, and an excess of nitric or sulphuric acid by potassa. A slight excess of acetic acid is not hurtful, but rather favours the subsidence of the precipitate, which is the tersulphuret of arsenic. According to Dr. Christison, this test is so exceedingly delicate, that it detects the poison when dissolved in one hundred thousand parts of water. The colour it produces is lemon or sulphur-yellow; but the presence of vegetable or animal matter commonly gives it a whitish or brownish tint. Some medical jurists recommend the use of sulphuretted hydrogen water; but the gas is far preferable. It can be applied with much convenience by using one of Dr. Hare's self-regulating gas generators.

The ammoniacal nitrate of silver gives a yellow precipitate of arsenite of silver.

The ammoniacal sulphate of copper is a test of very great delicacy. The precipitate occasioned by it is the arsenite of copper, of an apple-green or grass-green colour. Its operation is prevented by muriatic, nitric, sulphuric, acetic, citric, and tartaric acids in excess; as also by ammonia.

Of the three tests mentioned, perhaps sulphuretted hydrogen is the most delicate; and it has the advantage of yielding a precipitate eligible for subsequent reduction. But they are all liable to the objection of being obscured in their indications, where the amount of poison is small, by the presence of organic principles; a complication constituting the most difficult problem for the medical jurist. As this case includes all others of more easy solution, we shall suppose it to occur, and shall indicate the steps to be pursued.

Having obtained general indications of the presence of arsenic, the first step will be to separate the organic matters; the second, to throw down the arsenic by means of sulphuretted hydrogen; and the third, to reduce the precipitate obtained to the metallic state. It is proper to state here that, in a communication to the Paris Academy, Dr. Blondlot, of Nancy, asserts, as the result of numerous experiments, that the smallest quantity of oily or fatty matter has the effect of diminishing, even to one-twentieth, the solubility of arsenious acid, and consequently of very much increasing the difficulty of detecting it. (See *Am. Journ. of Pharm.*, May, 1860, p. 220.)

The following are the directions given by Dr. Christison for separating the organic principles. Boil the suspected matter with distilled water for half an hour, and filter, first through gauze to separate the coarser particles, and afterwards through paper. To the transparent solution thus obtained add acetic acid, which will coagulate some animal principles. To ascertain whether the solution has been sufficiently freed from animal matter by this measure, neutralize with ammonia, and test a small portion of it with the ammoniacal nitrate of silver. If this give a characteristic precipitate, the

solution is sufficiently deprived of animal matter; if not, another measure must be adopted to separate it. This consists in first rendering the solution neutral or slightly alkaline, next faintly acidulating with muriatic acid, and then adding an excess of nitrate of silver. This salt precipitates the animal matter in combination with oxide of silver. After this step, the excess of silver is thrown down by a slight excess of chloride of sodium, and the solution filtered.

The solution having in this manner been disembarrassed of organic matter, the free nitric acid is neutralized by potassa in slight excess, and the solution acidulated with acetic acid. A stream of sulphuretted hydrogen is then passed through it, which will throw down the arsenic as the tersulphuret. If the proportion of arsenic be very small, a yellowishness only will be produced, owing to the precipitate being soluble in an excess of the precipitant. In this case it is necessary to boil, to drive off the excess of sulphuretted hydrogen. The precipitate is then collected and dried. If it be very minute, it must be allowed to subside; and, the clear liquid having been withdrawn, the remainder is to be poured upon a filter. After filtration, the precipitate is washed down to the bottom of the filter, by means of the *pipette*, an instrument employed for washing scanty precipitates. The filter is then gently pressed between folds of bibulous paper, and the precipitate removed with the point of a knife before it dries, and then dried in little masses on a watch-glass. In this manner, Dr. Christison states that it is easy to collect a portion of the tersulphuret so small as the twenty-fifth part of a grain. When the precipitate is small and not easily separated. Devergie recommends to dissolve it in a small quantity of ammonia, filter the solution, and evaporate it in a watch-glass, when the tersulphuret will be left. The precipitate is then to be reduced by means of a flux, which this author recommends to consist of two parts of ignited carbonate of sodium and one of charcoal, as preferable to black flux. The best flux for arsenious acid is freshly ignited charcoal.

In order to facilitate the detection of arsenic in the solid tissues, as the liver, spleen, stomach, &c., it is customary first to destroy the animal matter, and then to dissolve out the poison. Various agencies have been resorted to for this purpose, but heating with somewhat less than one-half the weight of concentrated sulphuric acid is perhaps the most convenient and effectual. The animal matter is thus carbonized, and will now yield a part at least of the arsenic which it may contain to boiling water, in a state proper for the application of tests. But M. Blondlot has ascertained by experiment that all the arsenic is not thus extracted; a considerable portion being left behind in the state of insoluble sulphuret, resulting from a partial decomposition of the sulphuric acid. To remedy this disadvantage, M. Blondlot recommends, after the carbonized tissue has been exhausted as far as possible with water, to treat it with solution of ammonia, which dissolves the sulphuret, and yields it on evaporation. The sulphuret is now to be converted into arsenic acid by boiling with nitric acid; and, having been evaporated to dryness, is to be treated with water. The solution thus obtained is to be added to the first, and the two will yield all the arsenic originally present in the tissue. (*Journ. de Pharm.*, Août, 1857, p. 117.)

Another method of separating arsenic in solution from organic matters is by the process of dialysis, invented by Prof. Graham, of London, of which a particular account will be given in the pharmaceutical preface to the second part of this work. By means of an instrument called the dialyser, watery solutions of saline and other crystallizable substances may be separated from those not crystallizable, such as gelatinous, albuminous, mucilaginous, and amylaceous liquids, the latter refusing to pass through a diaphragm of some porous substance, which is readily permeable by the former. Thus, a circular piece of parchment paper, folded in the form of a common filter, is placed in a vessel containing distilled water; the suspected liquid having been heated so as to effect a more complete solution of the arsenic, is poured into the filter, and the vessel set aside for twenty-four hours. At the end of this time, the crystallizable matter, including the arsenic, will have, to a great extent, passed through into the distilled water, leaving the organic matters behind, and a solution will have been obtained in a condition fit for the application of the different tests.

Following up a suggestion of Dr. Clarke, of Aberdeen, that arsenic might be separated by taking advantage of the volatility of its chloride, Dr. Andrew Fyfe, of the

same place, applied the principle to the detection of the metal when mixed with organic matter. For this purpose, he heated the arsenical liquid with sulphuric acid, free from arsenious acid, in a flask to which a bent tube and cooled receiver were adapted. When the mixture was brought to the boiling point, a little dried sea-salt was added, the receiver was connected, and the distillation continued for some time. Hydrochloric acid was evolved, which, by reacting with the arsenious acid, produced terchloride of arsenic, which distilled over free from organic matter. The terchloride of arsenic was then precipitated by a stream of sulphuretted hydrogen to obtain the yellow tersulphuret of arsenic, or subjected to the action of Marsh's test. (*Philos. Mag.*, 4th series, ii. 487.) The distillate of terchloride, as thus obtained, is liable to contain sulphurous acid, from the action of organic matter on the sulphuric acid, with the effect of obscuring the indications of Marsh's test when subsequently applied, by giving rise to a yellow ring instead of a black stain. To prevent the formation of sulphurous acid, L. A. Buchner recommends that the chloride of sodium should be added to the arsenical liquid before the sulphuric acid, having been previously mixed with a little chlorate of potassium, the chlorine from which has the effect of promoting the formation of the arsenical terchloride, and of rendering the decomposition of the organic matter more complete. (*Pharm. Journ. and Trans.*, July, 1855, p. 38.) Dr. Penny and Mr. W. Wallace bear testimony to the value of the plan of converting the arsenic into terchloride, as a means of separating the metal from organic matter, but think it will be found in practice more convenient to produce the terchloride by the direct agency of hydrochloric acid, than by sulphuric acid and chloride of sodium, as recommended by Dr. Fyfe.

The general formula for reduction is as follows. The operation is performed in a small glass tube. If the matter to be operated on is small, it is introduced to the bottom of the tube, and then a little of the flux is added to cover it, care being taken that the materials are conducted to the place they are to occupy, by means of a small glass funnel with a slender stem, without soiling the empty part of the tube. The heat is applied by means of a spirit-lamp, the upper part of the material being first heated with a small flame, and afterwards the lower part with a larger flame. A little water, disengaged at first, should be removed by a roll of filtering paper, before sufficient heat has been applied to sublime the metal. When the dark crust begins to form, the tube should be held quite steady, and in the same part of the flame. This crust is the metallic arsenic, having the surface next to the tube resplendent and polished, and the interior surface crystalline. Its characters are quite distinct, even when it does not amount to more than the three-hundredth part of a grain. If any doubt should be felt as to the nature of the crust, it may be driven up and down the tube, so as to convert it into sparkling octohedral crystals of arsenious acid, the triangular facets of which may be seen with a magnifying glass. Finally, the crystals may be dissolved in a drop or two of distilled water, and the solution will react characteristically with the liquid tests.

Another method of testing for arsenic has been proposed by Mr. Marsh. It consists in taking advantage of the power, which nascent hydrogen possesses, of decomposing the acids of arsenic, with the result of forming water and arseniuretted hydrogen. The liquid from the stomach, or obtained from its contents by boiling water, is added to the materials for generating hydrogen (pure dilute sulphuric acid and zinc), contained in a self-regulating generator of hydrogen. If the liquid from the stomach contain arsenic, the nascent hydrogen will combine with the metal, and the nature of the compound gas formed may be ascertained by burning a jet of it from a fine jet-pipe connected with the generator. The flame will have a characteristic blue colour; and, by holding a porcelain plate against it, a thin film of metallic arsenic, forming a black stain, will be deposited. Liebig and Mohr bear testimony to the delicacy of this test; but, to remove every source of fallacy, it is necessary to be sure of the purity of the materials for generating the hydrogen by a preliminary trial of the gas, before the suspected liquid is added; as zinc and sulphuric acid are both liable to contain a minute proportion of arsenic. This trial is made by holding a plate against the burning hydrogen, which, if pure, will produce no stain. The pieces of zinc employed should be changed after every experiment. Magnesium might be advantageously

substituted for zinc, as it contains no arsenic. A modification of Marsh's apparatus, which is praised by Berzelius for the certainty and distinctness of its results, is figured in the *Chemical Gazette* (iii. 46).

It has been objected to Marsh's test, that antimony forms a compound with hydrogen, very similar to arseniuretted hydrogen, both in the colour of its flame, and in the metallic spot which it deposits during combustion on cold surfaces. Still, the two metals may be discriminated by acting on the metallic spot with a drop or two of fuming nitric acid, with the aid of heat. Arsenic will thus be converted into soluble arsenic acid, precipitable brick-red by nitrate of silver; antimony, on the other hand, into insoluble antimonic acid. Another way of distinguishing them is to apply to the stain a solution of hypochlorite of sodium, which instantly dissolves the arsenical spot, without affecting that of antimony. Another method, dependent on the difference of temperature at which the two metals are sublimed, has been proposed by Dr. D. Maclagan, of Edinburgh. It consists in subjecting the metallic spot to about the temperature of 500°, by means of a bath of olive oil; when it will be totally volatilized if arsenic, but remain unchanged if antimony. (*Ed. Month. Journ.*, Nov. 1848.) Prof. E. Davy recommends a platinum spatula, instead of porcelain, to receive the metallic spot. A platinum surface affords facilities for testing the spot, which, if arsenic, may be removed by the flame of a candle, giving rise to a garlicky odour; but, if antimony, cannot be so removed. (See *Am. Journ. of Pharm.*, March, 1857, p. 172.) Hydrosulphate of ammonium dissolves the arsenical spot with difficulty, leaving on evaporation a yellow stain; it readily dissolves the antimonial, and yields an orange-red.

Professor Reinsch has proposed a method for detecting arsenic in organic liquids, which is extremely delicate, and at the same time has the merits of facility and celerity. It consists in acidulating the suspected liquid with muriatic acid, which converts the arsenious acid into the terchloride, and boiling in it, for ten minutes, a slip of copper foil, on which the arsenic is deposited as a white alloy of arsenic and copper; and then separating it in the state of arsenious acid, by subjecting the copper, cut into small chips, to a low-red heat in the bottom of a small glass tube. The peculiar crystalline appearance of arsenious acid, mentioned in the last page, is conclusive of its presence; and, besides, if collected and dissolved in water, it will answer to the ordinary tests for the poison. The form of copper, preferred by Dr. Maclagan, is that of copper wire, No. 24, made bright by being rubbed with sand-paper, and rolled into a loose spiral, about an inch long, by being twisted round a small pencil. In this form, the copper affords an extensive surface for the deposition of the arsenic. The merit of Reinsch's procedure is not so much that it gives a characteristic deposit on the copper; for bismuth, tin, zinc, and antimony also give deposits; as that the copper collects all the arsenic from the organic liquid, and presents it in a convenient form for applying the liquid and subliming tests. Yet the gray metallic appearance of the arsenical deposit can hardly be confounded with that of any other metal, except perhaps of antimony, which can be distinguished by the tests already mentioned. But Reinsch's method is not without its fallacies. Thus, it has been ascertained that the presence of a nitrate or chlorate in the suspected material, prevents the characteristic action of the arsenic on the copper, until the whole of these substances have been consumed by reaction with the metal. Besides, both muriatic acid and copper, even such as have been sold in the shops as the purest, are liable to contain arsenic, and therefore to afford fallacious results. This, however, is less true of the muriatic acid prepared in this country than the European, as the sulphuric acid employed in its preparation is obtained generally from native sulphur, instead of from pyrites as abroad. Nevertheless, no conclusion from Reinsch's test can be certainly relied on, unless the muriatic acid has been ascertained to be free from arsenic. With the copper there is less risk, as the arsenic in it can act only by solution of the copper itself, and this is known by the green colour imparted to the liquid; so that, if the arsenical deposit is produced without discoloration of the liquid, the indication of the presence of the poison may be considered as satisfactory. (*Olding* and *Taylor.*)

If the process of Reinsch be applied to the sulphuret (sulphide) of arsenic, it will be necessary to bring this into the liquid form. For this purpose Prof. J. C. Draper, of New York, makes use of ammonia, which dissolves the sulphuret, and is also capa-

ble of attacking copper. The substance supposed to contain the sulphuret having been covered, in a suitable vessel, with water of ammonia, is set aside in a warm place, and permitted to stand for a few hours. The solution of the sulphuret is then separated by filtration, strips of clean, bright copper are introduced into it, and the whole gently heated. The copper gradually becomes coated with a deposit like that which is formed in Reinsch's process. (*N. Y. Med. Journ.*, April, 1865, p. 13.)

A modification of the methods of Marsh and Reinsch has been proposed by Dr. Alfred S. Taylor, which he has found effectual in detecting arsenic whether in liquids or solids, and whether associated with organic or inorganic substances, for an account of which, however, we must be content, from want of space, to refer the reader to the paper of that eminent toxicologist in the *Pharmaceutical Journal and Transactions* (Feb. 1861, p. 411).

Still another method of detecting arsenic is the *electrolytic*, consisting in exposing the suspected liquid, in connection with diluted sulphuric acid, to a voltaic current, through the influence of which, if arsenic be present, even though associated with large quantities of organic matter, arseniuretted hydrogen (*terhydride of arsenic*) is evolved. It is, however, only the arsenious acid that will respond to this test, arsenic acid not being affected; and the presence of mercury interferes materially with the process. For an account of the process, and of the method of rendering arsenic acid sensible to the test, and of counteracting the influence of the mercury, see papers by Mr. C. L. Bloxam in the *Pharm. Journ. and Trans.* (Jan. 1860, p. 376, and April, 1861, p. 528).

It has been shown by MM. Malaguti and Sarzeau that, for the detection of minute quantities of arsenic in exhumed bodies, the best method of proceeding is to distil the viscera with aqua regia, made by mixing one part of nitric with three of hydrochloric acid. The animal matter (the liver for example), cut into small pieces, is dried by a gentle heat, and mixed with a quantity of the aqua regia equal to the weight of the matter before it was dried. The mixture is distilled, and the arsenic, if present, comes over in the form of the volatile terchloride, which may be converted into the tersulphuret in the usual manner.

Arsenic may be detected in exhumed bodies long after death. M. Blondlot found it in the brain of a body that had been buried twenty years. In this case, it was ascertained that no arsenic existed in the earth of the cemetery. (See *Brit. and For. Medico-chir. Rev.*, Jan. 1855, p. 222.) It is necessary also to be guarded against the possible presence, about the body, of metals which may contain arsenic; as, for example, brass and copper. L. A. Buchner has found, in the intestines of persons who had been poisoned with arsenious acid, examined some months after death, the poison in the state of yellow sulphuret of arsenic, into which it had been converted by the sulphuretted hydrogen developed by the putrefactive process that had taken place in the bowels, showing that even in poisonous doses arsenic has not always the property of preserving the body from corruption. (*Neues Repertorium*, xvii. 21.)

Off. Prep. Liquor Arsenicalis, *Br.;* Liquor Arsenici Chloridi, *U. S.;* Liquor Arsenici Hydrochloricus, *Br.;* Liquor Potassii Arsenitis, *U. S.;* Sodæ Arsenias, *Br.;* Sodii Arsenias, *U. S.* B.

ACIDUM CARBOLICUM. *U. S., Br.*

Carbolic Acid.

A solid substance obtained from the products of the distillation of coal-tar between the temperatures of 300° and 400°. *U. S.*

An acid obtained from coal-tar oil by fractional distillation and subsequent purification. *Br.*

Syn. Phenic Acid. Phenylic Acid. Phenol. Hydrated Oxide of Phenyl. Phenylic Alcohol. Acide Phénique, *Fr.*

This important medicine is a new officinal of the British Pharmacopœia, and was recognised by our own at the last revision. It was discovered, in 1834, in the tar of coal, by Runge, who gave it the name of carbolic acid. In 1841, it was thoroughly investigated by Laurent, by whom it was considered as the hydrated oxide of a peculiar compound radical called *phenyl* (from φαινω, I show), and therefore described by the

name of *hydrated oxide of phenyl.* Its acid properties, however, having been subsequently recognised, it received the name of *phenic acid;* but, out of consideration for the original discoverer, chemical writers generally adhere to the title he gave it of carbolic acid. When on the subject of its composition, we shall have occasion to show that it is more closely related chemically with the alcohols, than the acids, and that consequently its proper designation would be *phenylic alcohol.*

Preparation. Carbolic acid exists, in some unknown mode of combination, in that portion of coal-tar which distils over between 300° and 400° F. This, when mixed with a hot concentrated solution of hydrate of potassa, is resolved, on the addition of water, into a light oil and a heavier alkaline liquid. If the latter be separated, and neutralized with muriatic acid, carbolic acid will be disengaged in an impure state, and will float on the surface in the form of a light oil. By distilling this from dried chloride of calcium to separate water, and exposing the distillate to a low temperature, carbolic acid congeals in the form of a colourless crystalline mass, disposed to deliquescence, which is to be separated from the accompanying liquid by pressure in bibulous paper. This remains solid at a higher temperature than that required to congeal it; but at 95° it melts, and constitutes the acid in its liquid form.

But it is much more difficult to obtain the acid in its pure crystalline condition than might be inferred from this simple method of preparation. There are two difficulties especially in the way; one consisting of the presence in coal-tar oil of another principle, closely analogous to carbolic acid, denominated *cresylic acid*, which is apt to accompany the former in all the steps of its preparation, and, through its much lower congealing point, interferes with its crystallization; the second, of the existence in the original oil of a principle which, on exposure to the air, becomes of a brown colour, and, if not thoroughly separated in the process, imparts the same property to the carbolic acid. Now cresylic acid has remedial and hygienic influences, equal, and, as some think, even superior in certain respects to the carbolic; so that, unless the object be to obtain the carbolic acid in the crystalline state, which is for some purposes highly desirable, no great harm can result from their admixture. The colouring impurity, however, is only injurious, and should be got rid of if possible.

The following observations of M. Muller, condensed from the *Zeitschrift für Chemie* (New ser., vol. i. p. 270), may be useful to the manufacturer. Carbolic acid (phenic acid or phenylic alcohol) is habitually accompanied by its congeners, denominated by M. Muller, from his view of the nature of these bodies, *xylic* and *cresylic alcohols*, which adhere to it tenaciously, and cause it to become brown on contact with the air. The author procures it pure in the following method. Coal-tar yields to soda a mixture of the substances mentioned with naphthalin, which is soluble in a concentrated solution of the alkaline carbolates. Water is added until it ceases to produce a precipitate; and the liquid is exposed to the air in broad shallow vessels, so as to facilitate the formation and deposition of brown substances. The liquid is then filtered, and the quantity of organic matter held in solution approximatively determined. As the matter consists mainly of carbolic acid and its congeners, combined with the alkali used, it is easily separated by acids. But the carbolic acid is the last to separate; so that it is easy to get rid of the congeners, as well as the brown and resinified products, by adding only so much acid, the quantity being ascertained by calculation, as may be required to precipitate at once the foreign substances. By a few additions cautiously made, the operator will soon reach a point at which the carbolic acid will remain nearly pure. After rectification, the product soon crystallizes. As water, even in minute proportion, hinders this crystallization, a current of dry air is made to pass over the carbolic acid nearly boiling hot, so as to complete the desiccation. The crystallization is promoted by a sudden reduction of temperature, or the introduction of a fragment of the acid already crystallized. M. Muller attaches much importance to the long exposure to the air of the original alkaline solution, so as to favour the resinification and deposition of the brown matters; as the carbolic acid is always impure when coloured. It often also contains a fetid substance, which is probably a sulphuretted compound of phenyl or cresyl. This can be separated by distillation from a little oxide of lead. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 408.)

Commercial forms. In one of his latest publications in reference to carbolic acid,

Dr. F. Crace Calvert, to whom probably, more than any other person, is owing the introduction of this substance into use in Great Britain and the United States, informs us that the carbolic acid obtained by Laurent, melting at 34° C. (93° F.), and boiling at 186° C. (367° F.), was not quite pure. By successive steps of improvement in the process employed by the manufacturing house at Manchester with which he is connected, they had at length succeeded in preparing the pure crystallized acid, without colour or sulphurous odour; but, unfortunately, this statement is not accompanied with an account of the means by which the end had been attained. But, as the products of this factory are those now generally used, a brief notice, derived from the same source, of the forms of the drug prepared by them, and now circulating in the market, is desirable. 1. A pure acid is prepared, crystallizing in white prismatic crystals, but, as usually sold, in a white, hard, fused mass, which differs from Laurent's in being soluble in 20 parts of water instead of 33 parts, fusible at 106° instead of 93°, and boiling at 359° instead of 367°. This should be preferred for internal use. 2. The second form is less pure. Like Laurent's, it is white, solid, and fusible at 93°, and may be employed for external purposes, whether in medicine or surgery; but it is objectionable for internal use on account of its tar-like taste. 3. A third quality is manufactured, in white detached crystals, which melt at 81°. This, when dissolved in from 50 to 100 parts of water, forms a perfectly colourless solution, which can be used for antiseptic and disinfecting purposes. 4. The fourth and last form is that of a nearly colourless liquid, which is a mixture of carbolic and cresylic acids. Diluted with 100 parts of water or more, it may be used for the coarser antiseptic and disinfecting purposes out of doors, as in cess-pools, sewers, &c., and has been extensively employed to prevent the spread of the late very fatal disease among cattle, the famous *rinderpest.* (*Lancet*, Dec. 14, 1867, p. 734.) Besides these forms of carbolic acid, which issue from the manufacturing establishment of the Messrs. Calvert, there are others from different sources, generally in the liquid state, which are usually of a brownish colour, and consist of mixtures of carbolic acid with the cresylic acid, colouring mattter, &c., and of which the first often constitutes but a small proportion. These are often imported from Germany. They should not be used internally; but, for disinfectant and antiseptic purposes, they are probably equal to solutions of the pure acid, as the cresylic acid is said to be quite as powerfully disinfectant as the carbolic, if not more so.

These impure liquors are sold sometimes under the improper name of *coal-tar creasote.* They are recognized in the U. S. Pharmacopœia, under the name of "Acidum Carbolicum Impurum." (See the next article.) They are of various shades of colour from a light brown to nearly black. Their value depends on the proportion of carbolic and cresylic acids contained in them. Sometimes they consist of these acids almost exclusively, sometimes contain little comparatively, the residue consisting of nearly valueless coal oils, and occasionally in part of sulphuretted compounds of the two acids. In certain cases, an alkali is added to increase the solubility of the acids. They ought to contain from 70 to 90 parts of the acids (*Squibb*), and should yield this percentage of their bulk to warm water when agitated with it in great excess.*

Properties. Carbolic acid, in its pure state, is a solid at ordinary temperatures, crystallizing in minute plates or long rhomboidal needles, white or colourless, of a peculiar odour recalling that of creasote, and an acrid burning taste. Its sp. gr. is 1·065. (*Lemaire.*) If coloured pinkish or brown, under the influence of light and air,

* Mr. William Crooks gives the following methods of testing these liquids, with sufficient accuracy for practical use. Commercial carbolic acid fit for disinfecting purposes is soluble in from 20 to 70 parts of water, and in twice its bulk of solution of caustic soda, while the oily impurities are nearly insoluble. 1. Put one fluidrachm of the liquid to be examined in a bottle, add half a pint of warm water, and shake occasionally for half an hour. The amount of oily residue will indicate the measure of adulteration. 2. Mix one part of caustic soda with ten parts of the adulterated liquid, and shake them well together. The residue undissolved is impurity. 3. The presence of the "sulpho-carbolic and sulpho-cresylic acids," as well as the sophistication which consists in dissolving carbolic acid in water by means of an alkali, may be determined through the greater solubility of the adulterated than the unadulterated liquid. Put a wineglassful of the suspected liquid in a bottle, and add half a pint of warm water. If the greater portion dissolves, it is adulterated. If the liquid change litmus decidedly red, the impurity will be shown to consist of the acids mentioned; while, if the alkaline adulteration has been used, the litmus previously reddened will have its blue colour restored. (See *Am. Journ. of Pharm.*, May, 1867, p. 232.)

it is impure. It deliquesces on exposure, and ultimately becomes liquid; and the presence of water in the smallest proportion causes it to liquefy. When quite pure, it melts at 106°, forming an oily-looking, colourless liquid, and boils at 359° F. (*Calvert*); but, as often met with, its point of fusion is lower, and that of volatilization higher than those named. The U. S. Pharmacopœia gives the former at from 93° to 106°, the latter from 359° to 367°; the British, the former at 95°, the latter at 370°; both, therefore, admitting considerable impurity. Carbolic acid is inflammable, burning with a reddish flame. The plane of polarization of a ray of polarized light is not affected by it. It is soluble in 20 parts of water (*Lemaire*); in from 20 to 33 parts (*U. S.*); the purest being most soluble. Its solution is, if pure, colourless, and remains so; but, if impure, is coloured brownish by exposure. It is very soluble in alcohol, ether, acetic acid, glycerin, and the volatile and fixed oils. (*Lemaire.*) Though neutral to test-paper, it combines feebly with salifiable bases; its salts being decomposed by carbonic acid, and those with the alkalies having an alkaline reaction. The carbolate of potassium is said to be decomposed even by water. Heated with ammonia, it yields aniline and water; though this is denied on the authority of experiments by Berthelot. (Dr. J. H. Bill. *Am. J. of Med. Sci.*, July, 1872, p. 19.) Nitric acid converts it into picric acid, in the manufacture of which it is largely used. It reduces many metallic salts, especially those of silver and copper, and coagulates collodion. Bromine water, added in excess to a weak solution, produces a yellowish-white precipitate. This is said to be a delicate test. (*Am. J. of Pharm.*, Sept. 1872, p. 418.) All the soluble carbolates communicate to pine wood, impregnated with their solution, the property of assuming a deep-blue colour half an hour or an hour after having been steeped in muriatic acid. (*Lemaire.*) Carbolic acid in solution coagulates albumen, arrests fermentation, instantly destroys the lower forms of vegetable and animal life, and in very small proportion prevents mouldiness in vegetable juices, and protects animal substances against putrefaction.

The substances with which carbolic acid is most likely to be confounded are cresylic acid and creasote, the former, like it, extracted from coal-tar, the latter from wood-tar exclusively. As cresylic acid is incapable of crystallizing at ordinary temperatures, the two cannot be confounded in the solid state, and, as before observed, its presence in the liquid state is of little consequence; as its virtues are of the same kind, and at least equal. Its boiling point, however, is considerably higher than that of carbolic acid, being about 400°; and it may, therefore, be supposed to be present in any suspected liquid which will not crystallize at any common temperature, nor boil under 395° to 400°. Creasote is distinguished by its less density, its liquid form, and higher boiling point; by not coagulating collodion; and by the different effects on it of strong nitric acid, which with carbolic acid produces pure picric or trinitrophenic acid, and with creasote, oxalic acid, resinous matter, and but a small proportion of picric acid. (Calvert, *Lancet*, Oct. 31, 1863, p. 523.) Carbolic acid differs also in having no effect on polarized light. The change of colour in pine wood under the successive action of carbolic and muriatic acids has been mentioned above.

Composition. The view generally taken of the composition of carbolic acid is, that it is the hydrated oxide of a peculiar compound radical denominated by Laurent *phenyl* ($C_{12}H_5$), and therefore, being analogous to the alcohols, should be called *phenylic alcohol.* It may be represented by the formula $C_{12}H_5,O+HO$, or empirically $C_{12}H_6O_2$. Indeed, its claims to be considered as an acid are very feeble; as, though it combines with salifiable bases, it is incapable of neutralizing the alkalies, does not affect the colour of litmus, and may be separated from its combinations with great facility, sometimes it is asserted even by water. Shaken in the liquid form with one-fourth of water, and cooled to 40° F., it crystallizes in the form of a hydrate, $C_{12}H_5O+2HO$. (C. H. Wood, *Pharm. Journ. and Trans.*, July, 1867, p. 19.)

Medical Properties and Uses. Carbolic acid, in the liquid form, is locally powerfully irritant, and, applied undiluted to the skin, causes a sharp pain lasting for about an hour, and accompanied with a whiteness of the surface, which has been ascribed to the coagulation of albumen, and is followed by severe inflammation and separation of the epidermis. In contact with mucous surfaces it acts in the same way, and if continued long enough may produce a superficial caustic effect. Taken internally in

large quantities, and in a concentrated state, it operates as an irritant or corrosive poison; and a case is recorded of instant death in a man, who, half intoxicated, had swallowed a bottle of it in mistake for rum. (*Med. Times and Gaz.*, Aug. 1866, p. 173.) A subsequent case is recorded in the same Journal (Oct. 1870, p. 474), in which death resulted from the administration of a tablespoonful of the strong liquid acid, by mistake for the medicine prescribed, in a young man of 19, affected with enteric fever. Great prostration soon came on, and in two days the patient died, with a livid, mottled skin, blackish or brownish stools, and blackish urine. Many instances, besides, have been known of death or serious injury from its incautious use, even when externally applied. A case, however, is recorded by Dr. Outerbridge in the *Medical Record* (Oct. 15, 1873, p. 517), in which a man took half an ounce of the acid, without other disagreeable effect than a severe burning pain in his throat, which lasted a few days, though the patient was under the effects of laudanum at the time, and took freely of olive oil when he discovered what had happened. Its effects when taken internally in moderate doses do not seem to have been very accurately studied. They are probably similar to those of creasote. Upon the alimentary mucous membrane the medicine operates as a gentle irritant, and, being absorbed into the circulation, probably escapes through the kidneys, and by exhalation from the bronchial mucous membrane, thus acting as a diuretic and expectorant, and at the same time as an alterative to the urinary and respiratory passages. It is said, when applied freely to raw or ulcerated surfaces, to cause a dark discoloration of the urine, and, even when taken internally in very large doses, to produce a less degree of the same effect. (*Lancet*, Aug. 23, 1873, p. 262.) It is also somewhat stimulant to the circulation; and, though it produces no very observable influence on the brain in the ordinary medicinal doses, it seems to act powerfully on that organ when very largely taken. In experiments made by Dr. W. Kempster, of Utica, New York, on certain small animals, as the cricket, the mouse, and the rat, by confining them in large glass vessels, with a little liquid carbolic acid, either spread over the sides of the vessel, or suspended within it upon a piece of sponge, the animals, at first greatly excited, soon began to show signs of intoxication by their staggering movements, which were followed by a state of anæsthesia, and death preceded by violent convulsions. The brain and its membranes were found, on dissection, greatly congested; while the spinal cord below the cervical vertebra was bloodless, the lungs were collapsed, and the heart tense, though filled with coagulated blood. (*Am. Journ. of Med. Sci.*, July, 1868.) In a communication to the same Journal (Oct. 1870, p. 573), it is stated by Dr. J. H. Bill, U. S. A., that a strong solution applied to the skin is decidedly and even strongly anæsthetic. To obviate the poisonous effects of carbolic acid, M. Huseman has decided, as the result of numerous experiments, that the alkaline earths, given in solution, in great excess, are the best antidotes; and the most suitable of these is lime combined with sugar, in the form of saccharate of lime. This may be prepared for the purpose, by dissolving 16 parts of sugar in 40 of distilled water, adding 5 parts of caustic lime, digesting it three days with occasional agitation, then filtering and evaporating to dryness. The resulting saccharate should be given in solution. (*Journ. de Pharm.*, Sept. 1873, p. 222.)

But by far the most important property of carbolic acid, both as a therapeutic and preventive agent, is its destructive influence over the lower grades of organic life, whether vegetable or animal. In a solution containing only one part of the acid in 500 of water, it instantly destroys vegetable mould, both plant and spores, and operates with equal destructiveness upon minute or microscopic animalcules. Hoppe Seyler gives, as the result of his observation, that all inferior organisms perish in a liquid containing 1 per cent. of the acid. (*Arch. Gén.*, Mai, 1873, p. 633.) Rosenbach injected dogs and rabbits with unhealthy pus with and without admixture of carbolic acid; and found that death generally followed in the former case; while with the addition of 5 per cent. of carbolic acid, no permanent injury resulted. (*Med. Record*, Sept. 1, 1873, p. 427.) Through this power, it checks the different proper fermentations, including the putrefactive, and thus acts powerfully as an antiseptic or disinfecting agent. It operates with wonderful efficiency in correcting or preventing putrefaction in animal substances, produces the same effect in the living human sub-

ject, and, through the same influence, corrects or suppresses those fermentative processes in the body which often lead to the most serious results, as purulent infection, poisoned dissecting wounds, carbunculous disease, and hospital gangrene. Of these applications, as well as of its use in the prevention of infectious diseases, we shall treat more in detail directly. Experiments have determined that, mixed with vaccine matter in the proportion of 2 per cent., it entirely destroys its efficacy; while, in a much smaller proportion, it has no effect. (*Arch. Gén.*, Mai, 1873, p. 632.)

Carbolic acid has been used internally with advantage in vomiting and diarrhœa, and in cases of dyspepsia accompanied with pain after eating, in all of which it may be supposed to act usefully by its stimulant or alterative influence on the mucous membrane. But there are also gastric and intestinal affections in which its antizymotic powers may sometimes give it great efficiency, as in yeasty vomiting; excessive flatulence, with or without pain, dependent on fermentation in the incompletely digested food; and in the cases of obstinate diarrhœa associated with the action of putrescent miasms on the system. Dr. Kempster speaks of it as being successfully used in the State Lunatic Asylum at Utica, in sluggishness of the bowels with offensive breath; and, in all instances of fetid eructation, or extremely offensive flatulent discharges per anum, it would be very apt to afford relief. In cases of foul breath, connected with morbid states of the blood, it is clearly indicated; as also in chronic bronchial inflammation, and disease of the urinary passages attended with offensive purulent discharge; in all which cases it may come by absorption into positive contact with the morbid cause. From its poisonous action on the lower animals, its use in the different verminose diseases of the bowels has been suggested; and it is peculiarly applicable to ascarides in the rectum administered by injection. But, as poisonous results have followed its use by injection, caution should be observed not to give overdoses in this way. In various so-called zymotic diseases, as scarlatina, diphtheria, &c., independently of its usefulness as a local application, it has been given in the hope that it may interrupt the fermentative process supposed to be going on in the system, as it interrupts similar processes out of the body. With similar views it has been administered in various miasmatic fevers, and advantageous effects have been claimed for it even in intermittent fever; but the weight of testimony can hardly be admitted as favourable in these affections. Dr. Lailler of the St. Louis Hospital, Paris, recommends it internally as a preventive of hydrophobia. (*Med. Record*, Aug. 2, 1873.)

But it is more as a topical than as an internal and systemic remedy that carbolic acid has been used; and its employment in this way has reference in general to its antiseptic and antizymotic property. As regards the mere correction of offensive odour, by decomposition or neutralization of the effluvia on which the odour depends, there are other medicines much more energetic than carbolic acid, as chlorine, bromine, and especially permanganate of potassium. Indeed, it has been doubted whether carbolic acid acts, in any degree, upon the offensive effluvia; but this, I think, is going too far; and the probability is that, even as regards the odorous matter, it exercises some deodorizing influence beyond that of merely disguising the smell of the offensive exhalations by its own, in other words, that it really acts chemically on them; though much less energetically than several other deodorizers. Its real action, however, is much more upon the cause of the exhalations than upon themselves. Most of these offensive odours depend upon a species of fermentation, the putrefactive for example, and the fermentations themselves are at present generally ascribed to the influence of microscopic organisms. Now carbolic acid, even in very dilute solution, is powerfully destructive of all such organisms, and consequently of the fermentative processes they support. Thus, carbolic acid acts much more by preventing putrefactive exhalations, than by destroying them. A piece of offensive animal matter is less speedily deodorized by carbolic acid than by permanganate of potassium; but the former in a short time entirely suppresses the putrefaction, and the matter consequently ceases to smell because it ceases to putrefy; whereas, under the mere chemical agent, it is only by its constant presence that the odour is prevented, and the putrefaction goes on unchecked.

Through its parasiticidal influence, carbolic acid is highly useful, as a local appli-

cation, in all the diseases which are connected with or dependent on the presence of microscopic plants or animals. Hence its use in scabies, in which it destroys the itch insect, in the different forms of porrigo and trichosis, in pityriasis versicolor, in the thrush of infants, and in all cases of minute vermin affecting the human body. In these cases, it is applied to the parts affected in weak solution, or in the form of ointment, or, where the affection is widely diffused, in that of bath. Offensive diphtheric exudations, putrid ulcers wherever they can be reached, and suppuration with a similar offensive odour, whether on the outer surface, or from the mucous passages, as of the nose, bronchial tubes, external meatus, urinary outlets, the rectum, and the vagina in females, afford similar indications for its use. Hence, it has been recommended in diphtheria, scarlatina anginosa, malignant or putrid sorethroat, ozæna, chronic bronchitis with copious expectoration of bad-smelling pus, in purulent otitis, in chronic cystirrhœa, hemorrhoids, rectal fistulas, abscesses into which the air has found entrance, and in leucorrhœa, and offensive lochial discharges. In the bronchial affection, the solution has been employed successfully by Dr. Kempster in the form of spray, by means of the atomizer. (*Am. Journ. of Med. Sci.*, July, 1868.) It may be used advantageously also in burns, anthrax, malignant erysipelas, hospital gangrene, and in fistulous ulcers, often affecting the bones, into which it may be injected. On the same principle, it has recently been much used as a dressing in compound fractures, and after extensive surgical operations, in which it was introduced by Dr. Jos. Lister, Prof. of Surgery in the University of Glasgow. (*Lancet*, Sept. 21, 1867, p. 353.) In bad cases of this kind, copious suppuration is apt to occur, with offensive discharges from the putrefaction of pus, blood, or other substances in the wound, by which the system often becomes seriously affected, and even purulent infection may take place. By dressing the wounds with carbolic acid in various degrees of strength, these sinister effects are often obviated, the suppurative process itself controlled, and healing greatly promoted. This is easily understood, if it be admitted that the changes originate in the presence of living organisms, giving rise to putrefactive or other hurtful fermentations. Exactly on the same grounds, good may be anticipated in puerperal cases attended with offensive discharges, and in the systemic disturbances from dissecting and other poisoned wounds. It has been highly recommended as a dentifrice in carious teeth with offensive breath, and to keep the teeth and gums clean from tartar or other morbid deposit, consequent upon, or at least connected with, the presence of minute parasitic organisms in these parts. Introduced on cotton, in a concentrated liquid state, into the cavity of a carious tooth, it quickly relieves pain; but care must be taken to prevent it from touching the lips, or internal surface of the mouth. In cases, too, of morbidly offensive secretion in the axilla and groin, between the toes, &c., it may be used in the form of solution or ointment with hope of benefit.

Independently of its disinfectant properties, it may be employed locally, in weak solution, as a gentle irritant or alterative, or concentrated, as a mild escharotic, in chronic indolent or flabby ulcers, or in those of a specific character, as the syphilitic, in cutaneous eruptions independent of cryptogamic cause, and in non-suppurative chronic or even acute inflammation of the mucous membranes, as in common angina. In scalds and burns it is said to have proved very useful. Dr. E. R. Squibb has published a statement of extraordinary success from it in two cases, one a scald and the other a burn, in which its application in the early stage produced a prompt relief of the pain, and favoured a speedy cure. (*N. Y. Med. Gaz.*, April 18, 1868, p. 236.) In consequence of its coagulating albumen, it may sometimes be beneficially employed to arrest hemorrhage.

The dose of carbolic acid is one or two grains, or of the acid in its concentrated liquid form one or two drops, which may be given in half a fluidounce or a fluidounce of sweetened water. An excellent menstruum is glycerin, which dissolves it in all proportions; and a preparation is officinal in both the U.S. and Br. Pharmacopœias, consisting of an ounce of carbolic acid dissolved in four fluidounces of glycerin, of which about four minims represent a grain of the acid. From this solution formulas may be readily prepared, either for internal or external use, by diluting it with water. An emulsion also may be made by mixing one part of the acid with

eight parts of water and one or two parts of sugar. (See *Glyceritum Acidi Carbolici*, in Part II.) The injurious effects of overdoses are best obviated by demulcents, as almond emulsion, &c.; and after poisonous quantities, this should be accompanied with emetic doses of ipecacuanha. (*Pharm. Journ. and Trans.*, Jan. 1869, p. 391.)

For external use the strength varies greatly according to the object desired. When applied with a view to its superficial escharotic action, as in gangrenous or specific ulcers, it may be used in the solid state properly comminuted, or in the strongest liquid form. In this state it may be readily obtained by placing the bottle containing it in hot water. For the skin affections one part of the acid may be dissolved in one hundred or two hundred parts of water; or the impure liquid acid may be used, diluted in the same proportion. M. Bazin uses a solution of one part in forty parts of acetic acid of 8° B., and 100 of water, in tetter and psora, and states that a single application will destroy the itch insect. A solution containing a grain to the fluidounce of water may be used for application, in the form of *spray*, to the fauces, larynx, and bronchia, by means of the *atomizer;* and the strength may be increased, if thought desirable, up to four or five grains or more to the fluidounce.

Prof. Lister, in his use of the acid in compound fractures, first introduces the liquid acid of its full strength into all accessible parts of the wound, in order completely to destroy all the septic germs which may have entered the wound with the air at the occurrence of the accident; and, for this purpose, a few drops of water added to the crystallized acid are sufficient to render it liquid. The next step is to cover the surface of the wound and a part of the sound skin with lint dipped into the liquid acid, in order to prevent the introduction of the septic agent from the atmosphere, along the stream of blood, &c. oozing from the wounded surfaces, and making its escape. The lint he protects by a tin covering, which is raised daily to admit of a fresh application of the acid. If the wound, however, is extensive, he substitutes for the saturated lint a sort of paste, made by rubbing up common whiting with a solution of one part of carbolic acid in four parts of boiled linseed oil, so as to form a firm putty, which is to be applied of the thickness of one-fourth of an inch, between two pieces of muslin. This does not excoriate the skin. So long as there is any discharge, the paste is renewed daily. The whole is covered with rags dipped in the oleaginous solution of the acid applied directly to the skin and kept there. When the discharge ceases, the paste is removed; but the original dressing is left till the wound heals. This plan, introduced into hospital practice, has not only acted most favourably on individual cases, but has had an excellent effect in preserving the healthfulness of the wards; the prevalence of pyæmia, hospital gangrene, erysipelas, &c., having been effectually prevented. A plaster made with shellac has been found to work better than the paste above referred to. Taking 3 parts of shellac and 1 of the crystallized acid, mix the former with about one-third of the latter, with a gentle heat; then remove from the fire, and, adding the remainder of the acid, stir briskly till they are thoroughly mixed.

For a gargle in diphtheria, the sorethroat of scarlatina, &c., 20 minims of the liquid acid may be mixed with half a drachm of acetic acid (*Br.*), two fluidrachms of tincture of myrrh, and six fluidounces of water. It is asserted that with this early applied there will be few failures in diphtheria. (*M. and S. Reporter*, Aug. 3, 1867, p. 101; from *Med. T. and Gaz.*) For burns and scalds a liniment may be made by rubbing together one part of carbolic acid and 6 parts of olive oil, applied on lint. For the dressing of cancerous and other foul ulcers, a cerate may be used composed of five grains of the acid rubbed with an ounce of simple cerate. There is an officinal ointment.

A carbolic acid paper, used in packing fresh meats, in order to preserve them, may be made by melting 5 parts of stearin with a gentle heat, stirring in thoroughly 2 parts of carbolic acid, then adding 5 parts of melted paraffin, stirring the mixture till it cools, and finally melting, and applying in the usual manner to the paper in quires. (*Chemist and Druggist*, Dec. 1871.)

The impure liquid acid sold in the shops usually contains from 70 to 90 per cent. of carbolic and cresylic acids jointly (*Squibb*), and, as the latter acid is quite equal to the former in disinfecting power, yields, if dissolved in water in the proportion of one to 80 parts, a solution equivalent on the average to that produced by dissolving one part of the pure acid in 100 parts of water.

M. Bobœuf prefers the salts of carbolic acid to the acid itself. He has found the carbolate of potassium or sodium, in a solution of from 5° to 10° B., applied by means of compresses, to bleeding wounds, to suppress hemorrhage instantly. (*Ann. de Thérap.*, 1862, p. 62.)

The *hygienic application* of carbolic acid is among its most important uses, if not absolutely the most important. By the free use of it in the wards of hospitals, and in the private chambers of the sick, sprinkling it over the contents and through the air of the infected apartments, introducing it into the close stools, and washing with it, to a greater or less extent, the persons of the sick when requiring it, much may no doubt be done towards the prevention of infectious and probably even contagious diseases; and there is reason to believe that the spread of certain fatal epidemics, as cholera, yellow-fever, and various malignant typhoid affections, though probably not arrested, may be much limited by bringing this agent to bear upon the morbific causes, and especially by correcting, through its influence, the numerous exhalations from accumulations of filth, which contribute to the support and propagation of these causes. It is believed that the use of carbolic acid proved to a certain extent effectual in limiting the prevalence of the epidemic cattle disease, lately so destructive in Europe. For these purposes, as before stated, the impure liquid acid is at least equally effectual; and Dr. Squibb recommends that, for disinfecting purposes, a solution should be kept on hand, made, on the large scale, by dissolving two pints of the impure acid in a barrel or forty gallons of water; this being of about the same strength as the acid usually sold for such purposes. (*N. Y. Med. Gaz.*, April 18, 1868, p. 235.)

Off. Prep. Glycerinum Acidi Carbolici, *Br.;* Glyceritum Acidi Carbolici, *U. S.;* Unguentum Acidi Carbolici, *U. S.* W.

ACIDUM CARBOLICUM IMPURUM. *U. S.*

Impure Carbolic Acid.

With great propriety, we think, the revisers of the U. S. Pharmacopœia have given a distinct heading to this form of carbolic acid, and directed it to be used only externally; for, while its impurity, and more or less uncertain composition and strength, unfit it for internal employment, it is equally efficacious with the purer acid as a local remedy, and may be very advantageously used for disinfectant purposes. In addition to what has been said of it in the preceding article, the following description of it in the Pharmacopœia is all that is required on the subject.

"A liquid obtained from coal-tar oil, by treating it first with an alkali, and then with an acid, and finally distilling. Impure Carbolic Acid is either colourless, or has a brown shade; but, if originally colourless, it becomes reddish-brown on exposure. It has the odour and taste of the pure acid, but sometimes modified by an empyreumatic odour of tar. It consists of carbolic and cresylic acids, in variable proportions, with impurities derived from coal-tar, which vary from 10 to 30 per cent. As the two acids are soluble in water, and the impurities not so, its degree of strength may be measured by agitating it with a large proportion of pure water, say about 100 measures for one of the liquid. The residue undissolved will indicate the proportion of impurity, which should not exceed 30 per cent. by measure. It should not give an alkaline reaction with test-paper, and should not be soluble in less than 20 per cent. of water, thus indicating that it is not an alkaline solution of carbolic acid. The coagulation of collodion, and the change of colour in pine wood, as mentioned under the pure acid, are tests applicable also to the impure."

"Impure Carbolic Acid is to be used only as an external remedy, or for disinfecting purposes." *U. S.*

ACIDUM CHROMICUM. *U. S.*

Chromic Acid.

This is readily obtained by mixing 100 measures of a cold saturated solution of bichromate of potassium with 150 measures of sulphuric acid, and allowing the mixture to cool. The sulphuric acid unites with the potassa, and sets free the chromic acid,

which is deposited in crystals. The mother-liquor having been poured off, these are placed upon a tile to drain, covered with a glass bell-jar. For another method of preparing the acid, by M. Duviller, in which chromate of barium is treated by nitric acid, and the chromic acid crystallized out of the mother-liquor, see the *American Journal of Pharmacy*, Jan. 1873, p. 23.

Properties. Chromic acid is in the form of anhydrous, acicular crystals, of a brilliant crimson-red colour and an acid metallic taste, deliquescent, and very soluble in water, forming an orange-yellow solution. "At a heat between 356° and 374°, they melt into a reddish-brown liquid, which, on cooling, becomes a red, opaque, and brittle mass." *U. S.* Chromic acid is a teroxide of the metal chromium, having the formula CrO_3. At a heat above the melting point, it gives off half its oxygen, and is converted into the green sesquioxide Cr_2O_3. It is a powerful oxidizing and bleaching material, and gives up its oxygen with great facility to organic matter, which is at the same time dissolved. "If a few drops of alcohol are allowed to fall on a small portion of it, a vigorous action takes place, attended with an increase of bulk, and the liquid formed becomes yellowish-brown." *U. S.*

Medical Properties and Uses. At first considered only as an escharotic, in which capacity it has extraordinary powers, chromic acid has since been shown to be antiseptic and disinfectant, with the property of destroying germ-growth. In these latter powers, it is asserted by Dr. John Dougal (*Lancet*, Dec. 16, 1871), who founds his conclusions on experiment, to be second to none, and, in some respects, to surpass even carbolic acid. A piece of fresh beef immersed in a solution of chromic acid, containing only 1 part in 2000 of water, became in two days quite black, in six as hard as wood, and, at the end of three months, remained perfectly free from mould or taint. It appears to owe its antiseptic action to its power of coagulating albumen and all protean compounds, in which it has been found to exceed all the acids and metallic salts that were tried, being 10 times stronger than carbolic acid, 15 times stronger than nitric acid, and 20 times than bichloride of mercury. It is, therefore, one of the best tests of the presence of albumen in a fluid; two grains dissolved in an ounce of water, readily detecting its presence in a solution containing one part of a saturated solution of beef-juice in 20 of water. Besides coagulating albuminous substances, it oxidizes decaying organic matter, combines with and neutralizes the escaping ammonia, and decomposes sulphuretted hydrogen, reducing it to water and free sulphur. Added to putrefying animal matters, it destroys their offensive odour, and keeps them fresh indefinitely. It is one of the most powerfully destructive agents to inferior organic life, greatly exceeding carbolic acid in this respect, and therefore one of the most energetic disinfecting agents known, according to the view of those who consider the process of fermentation as the basis of many febrile diseases, and fermentation itself as the result of organized agents. Chromic acid has been used medically only as an escharotic, in which capacity it acts by rapidly oxidizing and thus decomposing the tissues, while by the loss of one-half its oxygen, it is itself converted into the inert sesquioxide. It was first employed as a caustic by Prof. Sigmund, of Vienna, on the recommendation of Dr. Heller. Used in substance, made into a paste with water, its action is exceedingly slow and gradual, but deeply penetrating. In saturated solution its action is less penetrating and less gradual. By using a solution more or less dilute, the action may be graduated according to the degree of effect desired. Prof. Sigmund tried the concentrated solution, with advantage, for the destruction of condylomata, occurring in his syphilitic wards. But caution is necessary in its use; as it may give rise to a deep slough if too largely applied; and, according to M. Gubler, patients have been poisoned, through absorption, by a too extensive application of the acid to the surface. (*Ed. Med. Journ.*, Sept. 1871, p. 281.) The acid has been used with very good results by Mr. Marshall, of University College Hospital, London, for removing warts and other morbid growths from the genital organs. The solution employed was of the strength of 100 grains of the acid to a fluidounce of distilled water. It is most conveniently applied by means of a pointed glass rod. Dissolved in an equal weight of distilled water, it has been employed very advantageously by M. Hairion in destroying excrescences in the female generative organs, and in certain obstinate forms of granular conjunctivitis, in which

nodules form on the conjunctiva, threatening a destruction of the neighbouring tissues, especially of the cornea. He applies it by means of a pencil, and finds it neither very painful, nor followed by much reaction. Nevertheless, great caution is required not to allow the destruction of parts to extend too far; and in ordinary granular disease of the membrane he considers it too hazardous for use. (*Archives Générales*, Mars, 1859, p. 352.) Chromic acid is well suited to the destruction of morbid growths, and gives less pain than other caustics. It acts as a rapid solvent of organic matter. "Smaller animals (mice, birds, &c.) were so completely dissolved by the acid within fifteen or twenty minutes, that no trace of their bones, skin, hair, claws, or teeth could be discovered." (*Dublin Quarterly Journ.*, xiii. 250, from the *Wiener Medicinische Wochenschrift.*) Besides these applications, it has been recommended, from its combined escharotic and disinfecting properties, in hospital gangrene, phagædenic ulcers, bites of rabid animals, poisoned wounds, &c.; as a wash to arrest fetid discharges; as a gargle in diphtheria; as an injection in ozæna, leucorrhœa, and gonorrhœa; to prevent suppuration and putrefaction in wounds, &c.; and for the disinfection of cholera and fever stools, as well as for correcting fetid odours from all sources. (Dougal, *Lancet*, Dec. 30, 1871, p. 913.) Where a positive escharotic effect is not required, the solution should not contain more than half a grain in the fluidounce. M. Isambert has employed the acid with advantage in scorbutic diseases of the gums, ulceration of the mucous membrane of the mouth and pharynx, and in similar affections of the larynx, with the aid of the laryngoscope. He has found it also very efficient in œdema of the glottis, so as in several instances to have obviated the necessity of tracheotomy. (*Ann. de Thérap.*, 1873, p. 232.) Dr. D. Wooster, of San Francisco, Cal., has obtained great success from the injection of its solution into the womb, in cases of uterine hemorrhage and leucorrhœa. (*Am. J. of Med. Sci.*, Oct. 1869, p. 369.)

There can be little doubt that advantage might be derived from its internal use, in cases where the ordinary disinfectants have proved beneficial. The proper dose does not appear to have been satisfactorily ascertained; but, until otherwise decided by experience, it should not exceed one-quarter of a grain to begin with. B.

ACIDUM CITRICUM. *U.S., Br.*

Citric Acid.

Acidum limonis, *Lat.;* Acide citrique, *Fr.;* Citronensäure, *Germ.;* Acido citrico, *Ital., Span.*

Citric acid is the peculiar acid to which limes and lemons owe their sourness. It is present also in the juice of other fruits; such as the cranberry, the red whortleberry, the berry of the bittersweet, the red gooseberry, the currant, the strawberry, the raspberry, the tamarind, and the red elderberry (fruit of Sambucus racemosa rubra). The latter berry contains citric acid so abundantly that it has been proposed as a source of the acid by M. Thibierge, of Versailles. It is contained also largely in the fruit of Cyphomandra botacea, a solanaceous plant, indigenous in Mexico, Peru, and other parts of S. America, where it is called *tomato de la paz.* (*Journ. de Pharm.*, Oct. 1869, p. 305.)

The acid is extracted from lemon or lime juice by a very simple process, for which we are indebted to Scheele. The boiling juice is first completely saturated with carbonate of calcium (chalk or whiting) in fine powder, and the citrate of calcium formed is allowed to subside. This is then washed repeatedly with water, and decomposed by dilute sulphuric acid. An insoluble sulphate of calcium is immediately formed, and the disengaged citric acid remains in the supernatant liquor. This is carefully concentrated in leaden boilers until a pellicle begins to form, when it is transferred to other vessels in order to cool and crystallize.

In the *U.S. Pharmacopœia* citric acid is properly placed in the Materia Medica list as an article purchased from the manufacturing chemist. The *British Pharmacopœia* gives the following process for preparing it.

"Take of Lemon Juice *four pints* [Imperial measure]; Prepared Chalk *four ounces and a half* [avoirdupois]; Sulphuric Acid *two fluidounces and a half;* Distilled Water *a sufficiency.* Heat the Lemon Juice to its boiling point, and add the

Chalk by degrees till there is no more effervescence. Collect the deposit on a calico filter, and wash it with hot water till the filtered liquor passes from it colourless. Mix the deposit with a pint [Imp. meas.] of Distilled Water, and gradually add the Sulphuric Acid previously diluted with a pint and a half [Imp. meas.] of Distilled Water. Boil gently for half an hour, keeping the mixture constantly stirred. Separate the acid solution by filtration, wash the insoluble matter with a little Distilled Water, and add the washings to the solution. Concentrate the solution to the density of 1·21, then allow it to cool, and after twenty-four hours decant the liquor from the crystals of sulphate of lime which have formed; further concentrate the liquor until a film forms on its surface, and set it aside to cool and crystallize. Purify the crystals if necessary by a recrystallization." *Br.*

A preliminary fermentation, which was directed in the former British Pharmacopœia, has been abandoned in the present; and properly, as the viscidity which it was intended to remove, is sufficiently got rid of by heating the juice to the boiling point. The Br. Pharmacopœia states, as an evidence of the purity of the crystals, that "70 grains dissolved in distilled water are neutralized by 1000 grain-measures of the *volumetric solution of soda.*"

Preparation on the Large Scale. The juice is placed in a large vat, closed at top, and is saturated with whiting (carbonate of calcium). Carbonic acid gas is evolved, which passes out by an exit-pipe, and may be used in the manufacture of bicarbonate of sodium; and citrate of calcium precipitates. The supernatant liquor, containing much extractive matter, is drawn off; and the citrate of calcium is decomposed by dilute sulphuric acid, liberating the citric acid, and precipitating the lime as a sulphate. The mixture of citric acid and sulphate of calcium is run off into a wooden filter back, lined with lead, furnished with a perforated false bottom, and lined throughout with stout twilled flannel. The solution of citric acid passes off through a pipe, leading from the bottom of the back to suitable reservoirs. The sulphate is washed until it becomes tasteless, and the washings are run off into the same reservoirs. The filtered acid solution is then concentrated by evaporation in wooden vessels lined with lead, through which steam is made to pass by means of coiled lead pipes. As citric acid is liable to decomposition, if subjected to too high a temperature, the use of the vacuum pan is highly advantageous in concentrating the solution. When the liquor is sufficiently concentrated, it is transferred to cylindrical sheet-lead vessels, placed in a warm situation, to crystallize. The crystals, at first obtained, are coloured. In order to purify them, they are redissolved in a small quantity of water, with the assistance of heat, and the solution is digested with purified animal charcoal, filtered, and recrystallized. The crystals, after having been washed and drained, are dried on wooden trays lined with sheet-lead, in a room heated by steam. More recently, Dr. Price and Mr. Pontifex, both of England, have made improvements in the manufacture of citric acid, for the details of which the reader is referred to the *Pharmaceutical Journal and Transactions* (xiii. 313, and xvi. 430).*

*Some suggestions have recently appeared in the journals, in relation to the preparation of citric acid on the large scale, which may be of use to the manufacturer. In the *Chemical News* (Jan. 20, 1866, p. 40) is a short paper by Mr. Frederick Row, in which it is stated that the lemon or lime juice imported, from which most of the acid is prepared, contains so much colouring matter, mucilage, and other impurities, as very much to impede the process, and to make repeated crystallization and saturation necessary, to render the crystals fit for the market. It seems that the acid imported has undergone concentration, for the obvious purposes of enabling it to keep better, and to lessen the cost of carriage. Mr. Row states that he has found that much of the difficulty may be obviated by diluting the concentrated liquor, so that it shall have the strength of the fresh juice, by which operation much of the mucilage and other impurities will be made to separate in a flocculent form, and the citrate of calcium, and consequently the citric acid, will be obtained in a state of comparative purity.

Another important point is that the sulphuric acid, in slight excess at first, accumulates largely in proportion with the repeated evaporation and crystallization of the citric acid out of the solutions, and thus exercises a most destructive action on that remaining in the mother-liquors. The most effectual way of removing this difficulty is to pass the mother-liquors, as soon as the sulphuric acid becomes in injurious excess, through a fresh portion of citrate of calcium, which not only removes the sulphuric acid, but causes also at the same time the deposition of flocculent matters before held in solution by means of the acid, consisting mainly of sulphate of calcium.

Preparation of citric acid with the aid of magnesia. M. Perret proposes to manufacture citric acid by preparing from the juice, in the situations where lemons and limes are produced, first an insoluble tribasic citrate of magnesium, and then from this a soluble bibasic citrate of magnesium, which

The citrate of calcium of the above process should be decomposed without delay; for, if kept, it will undergo fermentation, with the effect of destroying the citric acid. According to Personne, the products of this fermentation are acetic and butyric acids; carbonic acid and hydrogen being evolved. It is desirable to have a slight excess of sulphuric acid, as this rather favours than otherwise the crystallization of the citric acid. It is found necessary, also, to add occasionally a small proportion of sulphuric acid to the citric acid liquor, during the progress of its concentration.

According to the late Mr. Parkes, a gallon of good juice, if the process be well conducted, will yield eight ounces of white crystals. But the product depends on the proportion of citric acid in the juice, which is very variable. The more recent the juice the better the quality. That which is stale will sometimes be quite sour, without containing any citric acid, in consequence of having undergone the acetous fermentation.

Properties. Citric acid is a white, crystallized solid, often in large crystals, having the form of rhomboidal prisms with dihedral summits. It is permanent in a dry air, but becomes moist in a damp one. Its sp. gr. is 1·6. Its taste is strongly acid, and almost caustic. When heated, it dissolves in its water of crystallization, and, at a higher temperature, undergoes decomposition, becoming yellow or brown, and forming a very sour syrupy liquid, which is uncrystallizable. By destructive distillation it gives rise to water, empyreumatic oil, acetic and carbonic acids, carburetted hydrogen, and a number of pyrogenous acids, among which is the *aconitic*. A voluminous coal is left.

Citric acid dissolves in three-fourths of its weight of cold, and half its weight of boiling water. It is soluble also in alcohol, but is insoluble in pure ether. A weak solution of it has an agreeable taste, but cannot be kept, as it undergoes spontaneous decomposition. It is incompatible with alkaline solutions, whether pure or carbonated, converting them into citrates; also with the earthy and metallic carbonates, most acetates, the alkaline sulphurets, and soaps. It is characterized by its taste, by the shape of its crystals, and by forming an insoluble salt with lime-water when heated, and a deliquescent one with potassa. If sulphuric acid be present, the precipitate by acetate of lead will not be entirely soluble in nitric acid; the insoluble portion being sulphate of lead. Sometimes crystals of tartaric acid are substituted for or mixed with the citric, or the two acids may be mixed in powder, a fraud which is readily detected by adding a solution of carbonate of potassium to one of the suspected acids; when, if tartaric acid be present, a crystalline precipitate of bitartrate of potassium (cream of tartar) will be formed. A still more delicate method of detecting tartaric acid is to digest the suspected acid with hydrated sesquioxide of iron in a test tube, afterwards to raise the heat slowly to the boiling point, and, having allowed the excess of oxide to subside, to decant the clear liquid, and evaporate it to a syrupy consistence. If the acid is pure the liquid remains limpid, and of a fine red colour; if contaminated with the tartaric acid, even to the extent of only one per cent., it becomes cloudy, and deposits tartrate of the sesquioxide. (*Journ. de Pharm.*, Août, 1862, p. 169.) Another test is permanganate of potassium, of which an alkaline solution is without action on citric acid; while, under the action of tartaric acid, the peroxide of manganese is deposited. (*Ibid.*, Sept. 1867, p. 239.) "The aqueous solution of citric acid is not darkened by sulphuretted hydrogen, gives no precipitate when added in excess to solution of acetate of potassa, or of chloride of barium, and, if sparingly added to cold lime-water, does not render it turbid," *Br.*; showing the absence of metals, and of oxalic, tartaric, and sulphuric acids. Lime or other fixed impurity is detected by incinerating the acid, alone or with red oxide of mercury, when the fixed matter will be left. "Its aqueous solution, neutralized with ammonia,

may be delivered to the manufacturing chemist for the extraction of the citric acid. The advantage of this method is that a material is brought to the manufacturer not liable to the injurious changes to which lemon-juice and mere citrate of calcium are liable on exposure. The tribasic citrate is made from the defecated juice by adding an excess of magnesia; and the bibasic from it, by treating it with an additional quantity of juice equal to that first employed. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 48; also *Chem. News*, March 2, 1866, p. 100.)—*Note to the thirteenth edition.*

produces with chloride of calcium a precipitate, which is soluble in cold, but insoluble in boiling water. One hundred grains of citric acid saturate 150 grains of bicarbonate of potassium." *U. S.*

Composition. The formula of this acid, considered dry, as it exists in the citrate of silver, is $C_{12}H_5O_{11}$. When crystallized from its solution by cooling, it contains four eqs. of water, three of which are basic. The British Pharmacopœia gives the formula of the crystallized acid $3HO,C_{12}H_5O_{11}+2HO$, thus giving it two eqs. of water of crystallization.

Medical Properties, &c. Citric acid, when given in concentrated solution to the inferior animals, acts as a poison, producing effects similar to those of oxalic acid. When largely diluted with water, it forms a cooling refreshing drink. Accordingly, it is much used for making a substitute for lemonade. It is also employed in the composition of effervescing draughts, and for preparing the neutral mixture. (See *Liquor Potassæ Citratis.*) When added in the quantity of nine drachms and a half to a pint of distilled water, it forms a solution of the average strength of lemon-juice. Of this solution, or of lemon-juice, a scruple of bicarbonate of potassium saturates three fluidrachms and a half; a scruple of carbonate of potassium, four fluidrachms; and a scruple of carbonate of ammonium, six fluidrachms. Half a fluidounce of lemon-juice, or of an equivalent solution of citric acid, when saturated, is considered a dose. An agreeable substitute for lemonade may be made by dissolving from two to four parts of the acid, mixed with sugar and a little oil of lemons, in nine hundred parts of water; or a scruple of the acid may be dissolved in a pint of water, and sweetened with sugar which has been rubbed on fresh lemon peel. The dose of the acid may be stated at from five to thirty grains.

The physiological action of a weak solution of citric acid is that of a refrigerant, increasing the fluidity of the blood, and rendering it less coagulable. Hence its utility in inflammations and fevers. Dr. C. W. Oleson, of Bloomingdale, Ill., has found it peculiarly useful in a case of metritis, giving a teaspoonful of a solution, containing about four grains of the acid, every two hours. (*Am. Journ. of Med. Sci.*, July, 1867, p. 277.) It is also useful in scurvy, liver disease, and dropsy. In recent times citric acid, in the form of lemon-juice, has come into vogue as a remedy for gout and rheumatism; but the trials made with it in these diseases have not shown that it possesses any peculiar efficacy. Dr. H. Bence Jones has made some interesting observations on citric acid and lemon-juice, and concludes that their action is identical. Experimental trials showed that they always increase the acidity of the urine. In view of this fact, Dr. Jones cautions the practitioner against the use of the juice for three or four weeks continuously in chronic gout or rheumatism, for fear that red gravel, or uric acid calculus should be produced. (See *Am. Journ. of the Med. Sci.*, Jan. 1855, p. 204.) The dose of lemon-juice in inflammatory rheumatism is two fluidounces, repeated from four to six times a day. Citric acid has recently been employed with much supposed advantage, as a local remedy, in diphtheric exudation, and in cancerous ulcers, being applied in the form of lemon-juice, or dissolved in water in the proportion of a drachm to eight fluidounces.

Pharm. Uses. In preparing Ferri Pyrophosphas, *U. S.*

Off. Prep. Ferri et Ammoniæ Citras, *Br.;* Ferri et Quiniæ Citras, *Br.;* Liquor Ammoniæ Citratis, *Br.;* Liquor Bismuthi et Ammoniæ Citratis, *Br.;* Liquor Ferri Citratis, *U. S.;* Liquor Magnesii Citratis, *U. S.;* Liquor Potassii Citratis, *U. S.;* Lithiæ Citras, *Br.;* Lithii Citras, *U. S.;* Potassæ Citras, *Br.;* Potassii Citras, *U. S.;* Sodæ Citro-tartras Effervescens, *Br.;* Syrupus Acidi Citrici, *U. S.* B.

ACIDUM LACTICUM. *U. S.*

Lactic Acid.

Lactic acid was discovered by Scheele. It exists in sour milk, and has been found in a number of the secretions, including the healthy gastric juice, in which its presence has been incontestably proved by Bernard and Barreswil. Liebig has shown that it exists abundantly in the juice of flesh. It has been detected by Prof. Wittstein in

the vegetable kingdom, especially in the peduncles of Solanum Dulcamara, and the liquid which oozes from freshly cut vine branches. It is a product of the viscous or lactic fermentation of rice-water, and of the juices of the beet, turnip, and carrot. Indeed, it is formed whenever sugar in solution, of whatever kind, is placed in contact with an alkaline or earthy carbonate, in presence of a special ferment, as, for example, the casein of milk, or cheese which contains it. Pasteur has demonstrated that the lactic acid fermentation, like the vinous, is accompanied with the growth of a peculiar microscopic plant or mycoderm, which he is disposed to consider as the real agent of the changes produced. This fermentation is attended with the production not only of lactic acid, but of other substances also, and among them, a peculiar *gum-like substance* in abundance, which, first noticed by Kirchof, has been isolated in a pure state by Brüning. Though similar to arabin and dextrin, with the formula $C_{12}H_{10}O_{10}$, it is not identical with either, and yields no mucic acid when treated with the nitric. (See *Chem. Gaz.*, May 15, 1858, p. 197.)

Preparation. Lactic acid may be obtained by the following process, which was recommended by M. Louradour as the first step in preparing lactate of iron. Ferment whey by keeping it at a temperature between 70° and 80°, whereby it becomes charged with a considerable quantity of lactic acid. Evaporate the liquor to one-third of its bulk, decant and filter, and then saturate with milk of lime. This converts the lactic acid into lactate of calcium, which remains in solution, and throws down a precipitate, consisting principally of phosphate of calcium. The liquor is filtrated again, and precipitated by oxalic acid, which throws down the lime as oxalate of calcium, and sets free the lactic acid. By a new filtration a solution of lactic acid is obtained, containing lactin (sugar of milk) and certain salts. From these it may be purified by concentrating it to a syrupy consistence, and treating it with alcohol, which dissolves the acid, and precipitates the lactin and foreign salts. The solution is filtered, and the lactic acid is obtained pure by distilling off the alcohol. Wackenroder's method is to mix 10 parts of skimmed milk, 2·5 of sugar of milk, 2 of chalk, and 20 of water, to digest at about 75° for six weeks, or till the chalk is dissolved, then to express, clarify, and evaporate so as to crystallize the *lactate of calcium*, and having recrystallized this salt, to decompose it with sulphuric or oxalic acid in exact saturating proportions.

Lautemann proposes a modification of this plan, consisting in substituting oxide of zinc for chalk. The fermentation is completed in eight or ten days. After boiling, the mixture is filtered, and the liquor, having been evaporated and again filtered, is allowed to stand. Lactate of zinc now separates, from which the acid may be obtained by dissolving the salt in boiling water, throwing down the zinc by sulphuretted hydrogen, filtering, and concentrating. The solution now contains mannite and lactic acid, both the result of the fermentation. By agitating with ether the acid is dissolved, and the mannite left; and by evaporating the ethereal solution the lactic acid is obtained. (See *Philos. Mag.*, May, 1860, p. 385.)

Properties. Lactic acid is a limpid, syrupy liquid, colourless or of a pale-wine colour, of a slight not unpleasant odour, and a very sour taste. Its sp. gr. is 1·212, and its formula $C_6H_6O_6$, or, if considered as hydrated, $C_6H_5O_5 + HO$. Some consider it a bi-basic acid, and give as its formula $C_{12}H_{12}O_{12}$, or $C_{12}H_{10}O_{10} + 2HO$. It unites in all proportions with water, alcohol, and ether. Exposed to a heat of 480°, it is for the most part converted into a new body called concrete lactic acid or *lactide*. It coagulates albumen, and dissolves a large quantity of freshly precipitated phosphate of calcium; a property which, doubtless, renders it important in the animal economy.

In the U.S. Pharmacopœia it is stated to produce no precipitate with acetate of lead, oxalate of ammonium, or, after saturation by ammonia, with sulphuretted hydrogen; proving the absence of sulphuric acid, lime, and metallic salts. Ninety grains of it are neutralized by not less than 75 grains of bicarbonate of potassium. When gently heated it should yield no smell of acetic or butyric acid. Its colour is not materially changed by an excess of caustic potassa.

Lactic acid, of the kind found in muscle, is said to exist copiously in the urine, both of men and animals, when labouring under the poisonous effects of phosphorus. (Schultzen, *Zeitschrift für Chem.*, 1867, p. 138.) This variety of lactic acid, though

corresponding in composition with that obtained by fermentation, differs somewhat in properties, and has received the distinctive name of sarkolactic acid from M. Strecker, who states that it has a formula double that of the ordinary acid. M. Wislicenus, however, has determined that the lactic acid of muscle is a mixture of at least two isomeric acids, of which the more abundant has the rotatory power to the right, and furnishes readily crystallizable salts, while the second gives salts that are crystallizable with difficulty. (See *Journ. de Pharm.*, Déc. 1873, p. 504.)

Medical Properties and Uses. Lactic acid was proposed by Magendie, on theoretical grounds, as a remedy in certain forms of dyspepsia, and for the removal of phosphatic deposits in the urine. It has subsequently been employed with good effects in dyspepsia by Dr. Handfield Jones and Dr. O'Connor, both of London. The remedy should be taken at the time of meals. It is most conveniently given in solution sweetened with sugar, prepared like lemonade. From one to three drachms may be taken in the course of the day. Professor Cantani, of Naples, was induced by theoretical considerations to employ lactic acid in diabetes, in connection with an exclusively meat diet, and has been remarkably successful; the cure, in recent cases, being speedy and almost certain. (*Ed. Med. Journ.*, Dec. 1871, p. 533.) In solution the acid has been found very efficacious, locally applied, in dissolving false membrane, and has consequently been employed, with much apparent advantage, in diphtheric affections and croup; the solution employed containing one part of the acid to five parts of the menstruum. (*Ann. de Thérap.*, A.D. 1869, p. 220.)

Lactic acid is a useful addition to medicinal pepsin, increasing the solvent power of that agent upon the food, when taken into the stomach. Some importance has also been attached to it from the supposition that it might be the materies morbi in rheumatism, as uric acid has been supposed to be in gout; but in either case the acid is probably rather the effect than the cause of the disease.

Off. Prep. Ferri Lactas, *U.S.* B.

ACIDUM MURIATICUM. *U.S.*

Muriatic Acid.

An aqueous solution of hydrochloric acid gas, of the sp. gr. 1·160. *U.S.*

Off. Syn. ACIDUM HYDROCHLORICUM. Hydrochloric acid gas, HCl, dissolved in water, and forming 31·8 per cent. by weight of the solution. *Br.*

Spirit of sea-salt, Marine acid, Hydrochloric acid, Chlorohydric acid; Acide hydrochlorique, *Fr.*; Salzsäure, Kochsalzsäure, *Germ.*; Acido muriatico, *Ital., Span.*

The muriatic acid of pharmacy and the arts is a solution of muriatic acid *gas* in water. It is sometimes called *liquid* muriatic acid, but more properly *aqueous* muriatic acid. The acid is placed in the Materia Medica Catalogue of the U.S. Pharmacopœia; but among the Preparations in the *British*, which gives the following process for preparing it.

"Take of Chloride of Sodium, dried, *forty-eight ounces* [avoirdupois]; Sulphuric Acid *forty-four fluidounces;* Water *thirty-six fluidounces;* Distilled Water *fifty fluidounces.* Pour the Sulphuric Acid slowly into thirty-two [fluid]ounces of the Water, and when the mixture has cooled, add it to the Chloride of Sodium previously introduced into a flask having the capacity of at least one gallon [Imp. meas.]. Connect the flask by corks and a bent glass tube with a three-necked wash-bottle, furnished with a safety tube, and containing the remaining four [fluid]ounces of the Water; then, applying heat to the flask, conduct the disengaged gas through the wash-bottle, into a second bottle containing the Distilled Water, by means of a bent tube dipping about half an inch below the surface; and let the process be continued until the product measures sixty-six [fluid]ounces, or the liquid has acquired a sp. gr. of 1·16. The bottle containing the distilled water must be kept cool during the whole operation." *Br.*

Preparation. Muriatic acid is obtained by the action of sulphuric acid on chloride of sodium or common salt. The commercial acid is procured, on a large scale, by distilling the salt with an equal weight of sulphuric acid, somewhat diluted with water, from iron stills, furnished with earthen heads into earthenware receivers con-

taining water. When thus obtained, it is contaminated with iron and other impurities, and is not fit for medicinal purposes.

Commercial muriatic acid is now procured in large quantities in England, during the decomposition of common salt for the purpose of making sulphate of sodium, from which soda-ash and carbonate of sodium are afterwards manufactured in immense quantities. When the object is to obtain sulphate of sodium, the decomposition of the sea-salt is performed in semi-cylindrical vessels, the curved part, next the fire, being made of iron, and the upper or flat surface, of stone. If the acid is to be saved, it is conveyed by a pipe to a double-necked stoneware receiver, half filled with water, and connected with a row of similar receivers, likewise containing water.

The acid, when required to be pure, is generally prepared by saturating distilled water with the gas in a Woulfe's apparatus. A quantity of pure fused common salt is introduced into a retort or matrass, placed on a sand-bath. The vessel is then furnished with an S tube, and connected with a series of bottles, each two-thirds full of water. A quantity of sulphuric acid is then gradually added, equal in weight to the common salt employed, and diluted with one-third of its weight of water. The materials ought not to occupy more than half the body of the retort. When the extrication of the gas slackens, heat is applied, and gradually increased until the water in the bottles refuses to absorb any more, or until no more gas is found to come over. As soon as the process is completed, boiling water should be added to the contents of the retort or matrass, in order to facilitate the removal of the residue. During the progress of the saturation, the water in the several bottles increases in temperature, which lessens its power of absorption. It is, therefore, expedient, in order to obtain a strong acid, to keep the bottles cool by means of water or ice. The connecting tubes need not plunge deeply into the acid.

The process of the British Pharmacopœia is substantially the same as the one here described, with the exception of the proportion of the acid and salt employed. In the process for muriatic acid, theory calls for a little less than 82 parts of liquid sulphuric acid to 100 of common salt. A moderate excess of the former may be useful to ensure the complete decomposition of the salt; but the quantity of acid, directed in the British process, is sufficient to decompose twice the quantity of common salt taken. The intention obviously is to use enough of the acid to form the bisulphate instead of sulphate of sodium; and it is thought that the process is thus facilitated.

The rationale of the process for obtaining this acid is very simple. Common salt is a compound of chlorine and sodium; muriatic acid, of chlorine and hydrogen; and liquid sulphuric acid, of dry sulphuric acid and water. The water is decomposed; its oxygen, combining with the sodium of the common salt, generates soda, which unites with the sulphuric acid to form sulphate of sodium; while the hydrogen and chlorine, being both in the nascent state, combine, and escape as muriatic acid gas. The residue of the process is consequently sulphate of sodium or Glauber's salt.

As muriatic acid, prepared in the ordinary mode, often contains arsenic, so as to obscure its indications when employed in testing for that poison, it is of interest to the practical toxicologist to know that it may be obtained free from that impurity by distilling chloride of sodium or potassium with oxalic acid in equivalent proportions. (*Chem. News*, Jan. 18, 1862, p. 41.)

The following method of freeing muriatic acid from arsenious acid is recommended by M. Engel as easy and entirely efficacious. It is founded on the fact, that arsenious acid is held in solution by hypophosphorous acid. Into a litre (about 2 pints) of arsenical muriatic acid introduce 4 to 5 grammes (about 60 or 70 grains) of hypophosphite of potassium, dissolved in a little water. At the end of an hour or two, the liquid becomes yellow and then brown; and a precipitate soon forms, more or less copious according to the amount of impurity. After the liquid becomes clear, which usually happens in 45 minutes, decant the muriatic acid and distil it. The acid thus obtained is entirely free from arsenic. This process should be conducted in a place where the direct rays of the sun may fall on the vessels; or, where this is im-

possible, the vessels should be subjected, by means of a water-bath, from 4 to 6 hours, to a heat little short of the boiling point of the acid. (*Journ. de Pharm.*, Juillet, 1873, p. 10.)

Properties of the Pure Acid. Muriatic acid, when pure, is a transparent colourless liquid, of a suffocating odour and corrosive taste. Exposed to the air it emits white fumes, owing to the escape of the acid gas, and its union with the moisture of the atmosphere. When concentrated, it blackens organic substances like sulphuric acid. Its sp. gr. varies with its strength. When as highly concentrated as possible, its density is 1·21. The *U. S. medicinal acid*, as well as that of the present *British* Pharmacopœia, has the sp. gr. 1·16; and "114·8 grains by weight, mixed with half a [fluid]ounce of distilled water, require for neutralization 1000 grain-measures of *the volumetric solution of soda.*" *Br.* When of the sp. gr. 1·16 it contains rather more than 33·9 per cent. of muriatic acid gas. (*Phillips.*) It freezes at 60° below zero. When exposed to heat, it continues to give off muriatic acid gas, with the appearance of ebullition, until its sp. gr. falls to 1·094, when it properly boils, and distils over unchanged.

Muriatic acid is characterized by forming, on the addition of nitrate of silver, a white precipitate (chloride of silver), which is insoluble in nitric acid, but readily soluble in ammonia. It is incompatible with alkalies and most earths, with oxides and their carbonates, and with sulphuret of potassium, tartrate of potassium, tartar emetic, tartrate of iron and potassium, nitrate of silver, and solution of subacetate of lead.

As it is desirable to know, on many occasions, in chemical and pharmaceutical operations, the quantity of strong aqueous acid, of acid gas, and of chlorine, contained in samples of acid of different densities, we subjoin a table by Dr. Ure, containing this information.

Table of the quantity of Aqueous Muriatic Acid of sp. gr. 1·2, *of Muriatic Acid Gas, and of Chlorine in* 100 *parts of Aqueous Acid of different densities.*

Sp. Gr.	Aqueous Acid of sp. gr. 1·2.	Acid Gas.	Chlorine.	Sp. Gr.	Aqueous Acid of sp. gr. 1·2.	Acid Gas.	Chlorine.
1·2000	100	40·777	39·675	1·1102	55	21·822	22·426
1·1910	95	38·738	37·692	1·1000	50	20·388	19·837
1·1822	90	36·700	35·707	1·0899	45	18·348	17·854
1·1721	85	34·660	33·724	1·0798	40	16·310	15·870
1·1701	84	34·252	33·328	1·0697	35	14·271	13·887
1·1620	80	32·621	31·746	1·0597	30	12·233	11·903
1·1599	79	32·213	31·343	1·0497	25	10·194	9·919
1·1515	75	30·582	29·757	1·0397	20	8·155	7·935
1·1410	70	28·544	27·772	1·0298	15	6·116	5·951
1·1308	65	26·504	25·789	1·0200	10	4·078	3·968
1·1206	60	24·466	23·805	1·0100	5	2·039	1·984

Impurities. This acid, when pure, will evaporate without residue in a platinum spoon. If sulphuric acid be present, a solution of chloride of barium will cause a precipitate of sulphate of barium in the acid, previously diluted with distilled water. Iron may be detected by saturating the diluted acid with carbonate of sodium, and then adding ferrocyanide of potassium, which will strike a blue colour if that metal be present. The absence of arsenic may be inferred if it do not tarnish bright copper foil when boiled with it, and of this as well as other metallic impregnation, excepting that of iron, by its giving no precipitate with sulphuretted hydrogen. Ammonia in excess shows the absence of iron, if it produces no precipitate. Free chlorine or nitric acid may be discovered by its having the power to dissolve gold-leaf. Any minute portion of the leaf which may be dissolved is detected by adding a solution of protochloride of tin, which will give rise to a purplish tint. The free chlorine is derived from the reaction of nitric or hyponitric acid on a small portion of the muriatic acid, which is thus deprived of its hydrogen. Hence it is that, when free chlorine is present, hyponitric acid or some other oxide of nitrogen is also present

as an impurity. The nitric and hyponitric acids are derived from nitrates in the common salt, and from hyponitric acid in the commercial sulphuric acid employed in the preparation of the muriatic acid.

Muriatic Acid of Commerce. This acid has the general properties of the pure aqueous acid. It has a yellowish colour, owing to the presence of sesquichloride of iron, or of a minute proportion of organic matter, such as cork, wood, &c. It usually contains sulphuric acid, and sometimes free chlorine and nitrous acid. But the most injurious impurity, to those who consume it in the arts, is sulphurous acid. Mr. T. H. Savory analyzed three samples of commercial muriatic acid, each having a sp. gr. of between 1·16 and 1·17, and found them to contain from 7 to nearly 11 per cent. of sulphurous acid. To detect this acid, M. Girardin has proposed a very delicate test, namely, the protochloride of tin. The mode of using the test is to take about half an ounce of the acid to be tested, and to add to it two or three drachms of the protochloride. The mixture having been stirred two or three times, as much distilled water as of the protochloride is to be added. If sulphurous acid is present, the muriatic acid becomes turbid and yellow immediately upon the addition of the protochloride; and, upon the subsequent addition of the water, a slight evolution of sulphuretted hydrogen takes place, perceptible to the smell, and the liquid assumes a brown hue, depositing a powder of the same colour. The manner in which the test acts is as follows. By a transfer of chlorine, the test is converted into bichloride and metallic tin, the latter of which, by reacting with the sulphurous acid, gives rise to a precipitate of the deutoxide and protosulphuret of tin. In case the sulphurous acid forms but one-half of one per cent. of the commercial acid, the precipitate may not be perceptible. Under these circumstances, a solution of sulphate of copper must be added to the liquid previously warmed, when a brown precipitate of sulphuret of copper will be immediately formed. (*Heintz.*) M. Lembert has proposed the following, which he considers as a more delicate test of sulphurous acid. Saturate the suspected muriatic acid with carbonate of potassium, and add successively a little weak solution of starch, one or two drops of solution of iodate of potassium, and sulphuric acid, drop by drop. Sulphurous acid, if present, will be set free with iodic acid, and these, by reacting on each other, will develope iodine, which will cause a blue colour with the starch.

Another impurity occasionally present in the commercial acid, as shown by Dupasquier, is arsenic. The immediate source of this impurity is the sulphuric acid used to prepare the muriatic acid. The sulphuric acid derives the arsenic from the sulphur used in its manufacture, and this last from pyrites containing a little of the poisonous metal. The arsenic, when present, is in the form of a terchloride, and from its volatility in this state of combination, is transferred to the muriatic acid, distilled from the commercial acid. This impurity is separated by diluting the acid with an equal volume of water, and passing through it sulphuretted hydrogen, which throws down the arsenic as a tersulphuret. According to Wittstein muriatic acid is freed from arsenic by mercury, according to Reinsch by copper, and in either case it may be deprived of metallic impregnation by distillation. (See *Am. Journ. of Pharm.*, Sept. 1851, p. 408.) M. Auguste Houzeau asserts that it is sufficient to deprive commercial arseniferous muriatic acid of arsenic simply to boil it, in a flat-bottomed vessel, to two-thirds of its original volume; all the arsenic escaping in the form of the terchloride. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 97.) Bettendorff separates arsenious and arsenic acids from muriatic acid, sufficiently concentrated, by precipitating with protochloride of tin, and then distilling the acid, which, thus treated, is perfectly free from arsenic. (*Am. Journ. of Pharm.*, May, 1870, p. 219.) When leaden vessels are used in preparing muriatic acid, it is apt to contain chloride of lead, which falls as a white precipitate on neutralizing the acid. The nature of the precipitate is verified by dissolving it in nitric acid and adding iodide of potassium, when the yellow iodide of lead will fall. (*Hainault.*) This impurity, being fixed, may be got rid of by distilling the acid. A small proportion of thallium has been detected in commercial muriatic acid by Mr. Wm. Crookes, being derived from sulphuric acid, in the manufacture of which pyrites were employed. (*Chem. News*, April 25, 1863, p. 194.)

Properties of Muriatic Acid Gas. Muriatic acid gas is a colourless elastic fluid, possessing a pungent odour, and the property of irritating the organs of respiration. It destroys life and extinguishes flame. It reddens litmus powerfully, and has the other properties of a strong acid. Its sp. gr. is 1·269. Subjected to a pressure of 40 atmospheres, at the temperature of 50°, it is condensed into a transparent liquid, to which alone the name of *liquid muriatic acid* properly belongs. It is absorbed by water with the greatest avidity, and, according to the temperature and pressure, unites with a greater or less quantity of that liquid. Water, at the temperature of 69°, takes up 464 times its volume of the gas, increasing one-third in bulk, and about three-fourths in weight. Water thus saturated constitutes the strong aqueous acid already described.

Composition. Muriatic acid gas consists of one eq. of chlorine 35·5, and one of hydrogen 1 = 36·5; or of one volume of chlorine and one of hydrogen, united without condensation.

Medical Properties. Muriatic acid is tonic, refrigerant, and antiseptic. It is exhibited, largely diluted with water, in low fevers, phthisis, chronic dyspepsia, some forms of syphilis, and to counteract phosphatic deposits in the urine. Dr. Paris has given it with success in malignant cases of typhus and scarlatina, administered in a strong infusion of quassia. It may also be added with advantage to infusions of columbo, gentian, and cinchona. It proves a good adjunct to gargles in ulcerated sorethroat and scarlatina maligna. The dose for internal exhibition is from ten to twenty minims, in a sufficient quantity of some bland fluid, as barley-water or gruel. In the composition of gargles, it may be used in the proportion of from half a fluidrachm to two fluidrachms, mixed with six fluidounces of the vehicle. (See *Acidum Muriaticum Dilutum.*) It has been found useful as a topical application, in various affections of the skin, particularly in follicular acne. It may be used diluted with glycerin, or concentrated. If applied in an undiluted form, it should be removed in less than thirty seconds by washing with pure water and afterwards with soap.

Toxicological Properties. Muriatic acid, when swallowed, is highly irritating and corrosive, but less so than sulphuric or nitric acid. It produces blackness of the lips, fiery redness of the tongue, hiccough, violent efforts to vomit, and agonizing pain in the stomach. There is much thirst, with great restlessness, a dry and burning skin, and a small, concentrated pulse. If the acid has been recently swallowed, white vapours of a pungent smell are emitted from the mouth. The best antidote is magnesia, which acts by saturating the acid. Soap is also useful for the same reason. In the course of the treatment, bland and mucilaginous drinks must be freely given. When inflammation supervenes, it must be treated on general principles.

Pharm. Uses. In the preparation of Acidum Hydrocyanicum Dilutum, *U. S.;* Antimonii Oxidum, *U. S.;* Calcis Phosphas, *Br.;* Calcii Phosphas Præcipitata, *U. S.;* Carbo Animalis Purificatus; Liquor Sodæ Chloratæ, *Br.;* Potassæ Bicarbonas, *Br.;* Quiniæ Sulphas; Sodæ Bicarbonas, *Br.;* Strychnia, *U. S.;* Sulphur Præcipitatum; Veratria, *Br.*

Off. Prep. of Muriatic Acid. Acidum Hydrochloricum Dilutum, *Br.;* Acidum Muriaticum Dilutum, *U. S.;* Acidum Nitrohydrochloricum Dilutum, *Br.;* Acidum Nitromuriaticum, *U. S.;* Acidum Nitromuriaticum Dilutum, *U. S.;* Aqua Chlorinii, *U. S.;* Barii Chloridum, *U. S.;* Calcii Chloridum, *Br.;* Ferri Chloridum, *U. S.;* Liquor Antimonii Chloridi, *Br.;* Liquor Arsenici Chloridi, *U. S.;* Liquor Arsenici Hydrochloricus, *Br.;* Liquor Calcii Chloridi, *U.S.;* Liquor Chlori, *Br.;* Liquor Ferri Chloridi, *U. S.;* Liquor Ferri Perchloridi Fortior, *Br.;* Liquor Zinci Chloridi; Morphiæ Murias, *U. S.;* Podophylli Resina, *Br.;* Resina Podophylli, *U. S.;* Zinci Chloridum, *Br.*

B.

ACIDUM NITRICUM. *U.S., Br.*

Nitric Acid.

Nitric acid, of the specific gravity 1·420. *U.S.* An acid containing 70 per cent. by weight of the nitric acid HO,NO_5, corresponding to 60 per cent. of anhydrous nitric acid NO_5. *Br.*

Spirit of nitre; Aqua Fortis; Acide nitrique, Acide azotique, *Fr.;* Saltpetersäure, *Germ.;* Zaltpeterzuur, Sterkwater, *Dutch;* Shedwater, *Swed.;* Acido nitrico, *Ital., Span.*

Nitric acid is one of the five compounds formed between nitrogen and oxygen. These are nitrous oxide (exhilarating gas), NO; nitric oxide, NO_2; nitrous acid (formerly hyponitrous acid), NO_3; hyponitric acid (formerly nitrous acid), NO_4; and nitric acid, NO_5.

Nitric acid is now officinal in two forms; the pure acid of the sp. gr. 1·42, and the diluted. The strong acid, of the sp. gr. 1·5, which was recognised in the former Br. Pharmacopœia, has been abandoned in the present. The two stronger will be noticed here, and the diluted under the preparations. (See *Acidum Nitricum Dilutum.*)

The usual practice, adopted in the laboratory for obtaining nitric acid, is to add to nitrate of potassium in coarse powder, contained in a retort, an equal weight of strong sulphuric acid, poured in by means of a tube or funnel, so as not to soil the neck. The materials should not occupy more than two-thirds of the capacity of the retort. A receiver being adapted, heat is applied by means of a spirit-lamp, the naked fire, or a sand-bath, moderately at first, but afterwards more strongly when the materials begin to thicken, in order to bring the whole into a state of perfect fusion. Red vapours will at first arise, and afterwards disappear in the course of the distillation. Towards its close they will be reproduced, and their reappearance will indicate that the process is completed.

The proportion of equal weights, as above given, corresponding nearly to one eq. of nitrate of potassium and two of monohydrated sulphuric acid, is the best for operations on a small scale in the laboratory. This proportion is preferred by Thenard. In operations on a large scale, where an iron vessel is used, a strong heat applied, and water placed in the receivers to condense the acid, less sulphuric acid may be advantageously employed.

Monohydrated Nitric Acid. Nitrate of Water. This is the strongest liquid nitric acid that can be procured, and may be supposed to be obtained by distilling one eq. of pure and dry nitre with two eqs. of monohydrated sulphuric acid. One eq. of monohydrated nitric acid distils over, and one eq. of monohydrated bisulphate of potassium remains behind, KO,NO_5 and $2(HO,SO_3)=HO,NO_5$ and $KO,2SO_3+HO$. Acid of this strength is very difficult to get, and requires for its preparation the most elaborate attention to separate the superabundant water. According to Mr. Arthur Smith, of London, acid, dehydrated as far as possible, is perfectly colourless, boils at 184°, has the sp. gr. 1·517 at 60°, and nearly approaches, in composition, to a monohydrate. Acid of this strength, even at the boiling temperature, has not the slightest action on tin or iron. (*Phil. Mag.*, Dec. 1847.) According to Millon, the true monohydrate has a sp. gr. as high as 1·521.

The acid of the late Br. Pharmacopœia, having the sp. gr. 1·5, is of a yellowish colour, and strongly corrosive. It is considered to be a sesquihydrate, consisting of one eq. of dry acid 54, and one and a half eqs. of water 13·5 = 67·5. Strictly speaking, it is a nitrate of water, diluted with half an eq. of water ($HO,NO_5+\frac{1}{2}HO$). An acid of this strength is inconveniently strong, is constantly undergoing decomposition under the influence of light, and has consequently been replaced by a pure acid of the density 1·42. This substitution was made in the U. S. Pharmacopœia of 1850, and in the British of 1867.

Nitric Acid (sp. gr. 1·42). *Quadrihydrated Nitric Acid.* This is the acid now officinal in both the U. S. and Br. Pharmacopœias. Acid of the density 1·5 was not found in any of the shops, and much pains were required to get it of that strength. Besides, acid of this density was not necessary for any process of the Pharmacopœia. Considerations of this kind induced the revisers of our national standard of 1850

to lower the strength of officinal nitric acid to 1·42, its purity in other respects remaining the same. To satisfy the tests given in the U. S. Pharmacopœia, it must be colourless, and entirely volatilizable by heat; must dissolve copper with the disengagement of red vapours; and, when diluted with at least six times its bulk of distilled water, must not be precipitated by hydrosulphuric acid, nitrate of silver, or chloride of barium. Acid of the density 1·42 is the most stable of the hydrated compounds of nitric acid, and boils at 250°. When either stronger or weaker than this, it distils over at a lower temperature; and, by losing more acid than water in the first case, and more water than acid in the second, constantly approaches to the sp. gr. 1·42, when its boiling point becomes stationary. These facts in relation to quadrihydrated nitric acid were first observed by Dalton, and have since been confirmed by Mr. Arthur Smith, of London. This acid consists of one eq. of dry acid and four of water ($4HO,NO_5$); but as only one of the eqs. of water is *basic*, the other three being *constitutional*, the true formula is $HO,NO_5 + 3HO$. "Ninety grains by weight of it, mixed with half an ounce of distilled water, require, for neutralization, 1000 grain-measures of the *volumetric solution of soda*." *Br.*

Nitric Acid of the Arts. Two strengths of this acid occur in the arts; *double aqua fortis* (sp. gr. 1·36), which is of half the strength of concentrated nitric acid, and *single aqua fortis* (sp. gr. 1·22), which is half as strong as the double. Aqua fortis is sometimes obtained by distilling a mixture of nitre and calcined sulphate of iron. By an interchange of ingredients, sulphate of potassium and nitrate of iron are formed, the latter of which, at the distilling heat, readily abandons its nitric acid. The sulphate of potassium is washed out of the residue, and the sesquioxide of iron which is left is sold, under the name of *colcothar*, to the polishers of metals. The distillation is performed in large cast-iron retorts, lined on the inside with a thick layer of red oxide of iron, to protect them from the action of the acid. The acid is received in large glass vessels containing water. A considerable portion of the acid is decomposed by the heat into reddish vapours, which subsequently dissolve in the water, and absorb the oxygen which had been disengaged. The acid thus obtained is red and tolerably strong, but is diluted with water before being thrown into commerce.

The reddish acid, called *nitrous acid of the shops*, is nitric acid containing more or less hyponitric acid (NO_4). The same acid may be formed by impregnating, to a limited extent, colourless nitric acid with nitric oxide (NO_2). If the saturation be complete, every two eqs. of nitric acid become three eqs. of hyponitric acid, by the aid of one eq. of nitric oxide ($2NO_5$ and $NO_2 = 3NO_4$). The nitrous acid of the shops may be converted into colourless nitric acid by exposing it to a gentle heat. As hyponitric acid (NO_4) forms, in contact with bases, a nitrate and nitrite, there being no hyponitrates, some chemists consider it as a compound of nitric and nitrous acids ($2NO_4 = NO_5 + NO_3$).

In France, nitric acid is manufactured on the large scale from nitre and sulphuric acid in cast-iron cylinders. The cylinders are disposed horizontally across a furnace, and are strewed internally throughout their length with nitre. Two circular cast-iron plates, each pierced with a hole, serve to close the ends. At one end the sulphuric acid is poured in, and, by means of a stoneware tube connected with the other end, the nitric acid is conducted to receivers. The sulphate of potassium is removed after each operation. The iron cylinders are acted upon by the acid; but this disadvantage is counterbalanced by a great saving of expense, when the process is conducted in such vessels.

In England, nitric acid is generally procured, for the purposes of the arts, by distilling the materials in earthenware retorts, or cast-iron pots with earthen heads, connected with a series of glass or stoneware receivers containing water. The proportion of sulphuric acid, employed by the manufacturer, is between one and two equivalents to one of the salt; and hence the product has an orange-red colour, which is removed by heating the acid.

In the United States, nitric acid is made, on the large scale, in a distillatory apparatus having the same general arrangement as in France and England. Sometimes a cast-iron cylinder is used, as in France, and sometimes a thick cast-iron pot with

an earthenware head. The pot is set in brick-work over a fire-place, and, the materials having been placed in it, the head is luted on with a fat lute, and made to communicate with two receivers, either of stoneware or glass, connected together by means of a tube. Large demijohns of glass answer the purpose of receivers very well. The incondensible products are made to pass, by means of a tube, into a portion of water. The quantity of sulphuric acid, employed in different establishments, varies from one-half to two-thirds of the weight of the nitre. Nitrate of sodium (cubic nitre), imported into the United States from Peru, is used by some manufacturing chemists to obtain nitric acid. One objection to this salt is that it often contains much common salt. If pure, it yields 10 per cent. more acid for a given weight than nitrate of potassium; but the residuum, sulphate of sodium, is less valuable than sulphate of potassium. The latter salt, under the name of *sal enixum*, is sold to the alum makers.

M. Mallet, of Paris, has proposed to obtain nitric acid from nitrate of sodium, by distilling it with dried boracic acid. In this case, biborate of sodium or borax is the residue. Another method, employed by Kuhlmann, is to expose a mixture of nitrate of sodium and chloride of manganese to a heat of about 450° F., and to pass the mixed gases which escape through water. Hyponitric acid and oxygen are disengaged, which become nitric acid when they enter the water. (See *Pharm. Journ. and Trans.*, Oct. 1862, p. 155.)

General Properties of Nitric Acid. Nitric acid, so called from nitre, is a liquid, extremely sour and corrosive. It was discovered by Raymond Lully, in the 13th century, and its constituents by Cavendish, in 1784. When perfectly pure it is colourless; but, as usually obtained, it has a straw colour, owing to the presence of hyponitric acid. The concentrated acid, when exposed to the air, emits white fumes, possessing a disagreeable odour. By the action of light it undergoes a slight decomposition, and becomes yellow. It acts powerfully on animal matter, causing its decomposition. On the living fibre it operates as a strong caustic. It stains the skin and most animal substances of an indelible yellow colour. On vegetable fibre it acts peculiarly, abstracting hydrogen or water, and combining with its remaining elements. When diluted, nitric acid converts most animal and vegetable substances into oxalic, malic, and carbonic acids. The general character of its action is to impart oxygen to other bodies, which it is enabled to do in consequence of the large quantity of this element which it contains in a state of loose combination. It acidifies sulphur and phosphorus, and oxidizes all the metals, except chromium, tungsten, columbium, cerium, titanium, osmium, rhodium, gold, platinum, and iridium. In the liquid state it always contains water, which is essential to its existence in that state. It combines with salifiable bases and forms nitrates. When mixed with muriatic acid, mutual decomposition takes place, and a liquid is formed, capable of dissolving gold, called nitromuriatic acid or aqua regia.

A trace of nitric acid has been detected in atmospheric air. It is said to be always present in the air in summer. (*Kletsinsky.*)

Tests. Nitric acid, when uncombined, is recognised by its dissolving copper with the production of red vapours, and by its forming nitre when saturated with potassa. When in the form of a nitrate, it is detected by its action on gold-leaf, after the addition of muriatic acid, in consequence of the evolution of chlorine, or it may be discovered, according to Dr. O'Shaughnessy, by heating the supposed nitrate in a test tube with a drop of sulphuric acid, and then adding a crystal of morphia. If nitric acid be present, it will be set free by the sulphuric acid, and reddened by the morphia. The same effect is produced by brucia, by commercial strychnia, on account of its containing brucia, and still more strongly, according to M. Braun, by sulphate of aniline, which is an exceedingly delicate test. (*Journ. de Pharm. et de Chim.*, Août, 1867, p. 157.) To prevent all ambiguity, arising from the accidental presence of nitric acid in the sulphuric acid employed, the operator should satisfy himself, by a separate experiment, that the latter acid has no power to produce the characteristic colour with morphia. Another test for nitric acid is to add *pure* sulphuric acid to the concentrated liquid, suspected to contain it, together with a little concentrated solution of the sulphate of protoxide of iron. The smallest trace of nitric acid affords,

when the mixture is warmed, a pink-red colour; and if it be present in considerable amount, the liquid becomes almost black.

The most common impurities in nitric acid are sulphuric acid and chlorine; the former derived from the acid used in the process for obtaining it, the latter from common salt, which is not an unfrequent impurity in nitre. They may be detected by adding a few drops of the solution of chloride of barium and of nitrate of silver to separate portions of the nitric acid, diluted with three or four parts of distilled water. If these reagents should produce a precipitate, the chloride will indicate sulphuric acid, and the nitrate, chlorine. These impurities may be separated by adding nitrate of silver in slight excess, which will precipitate them as sulphate and chloride of silver, and then distilling nearly to dryness in very clean vessels. The sulphuric acid may also be got rid of by distilling from a fresh portion of nitre. The chlorine may be separated without the use of nitrate of silver, by distilling the commercial acid, and rejecting the first eighth or fourth which comes over, according to the quality of the acid, and reserving that which passes subsequently, which is absolutely pure. (*Ch. Barreswil.*) According to M. Lembert, the nitric acid of commerce sometimes contains iodine, probably derived from the native nitrate of sodium, in which he found that element. It may be detected by saturating the suspected acid with a carbonated alkali, pouring in a little clear solution of starch, and then adding a few drops of sulphuric acid. If iodine be present, the sulphuric acid will set it free, and the starch solution will become blue. Another test, proposed by Mr. Stein, is to introduce a stick of tin into the suspected acid, and, after red vapours have begun to escape, to withdraw the metal, add a few drops of sulphuret of carbon, and agitate. If iodine be present, drops of the sulphuret will soon separate, coloured more or less deeply red according to the amount of impurity. These impurities, however, do not affect the medical properties of the acid.

As a nitric acid below the standard strength is necessarily employed in many chemical and pharmaceutical operations, it often becomes important to know the proportion of dry acid, and of acid of the strength of 1·5, contained in an acid of any given specific gravity. The following table, drawn up from experiments by Dr. Ure, gives information on these points.

Table showing the Quantity of Hydrated Nitric Acid (sp. gr. 1·5), *and of Dry Nitric Acid, contained in* 100 *parts of the Acid at different Densities.*

Sp. Gr.	Hyd. Acid in 100.	Dry Acid in 100.	Sp. Gr.	Hyd. Acid in 100.	Dry Acid in 100.	Sp. Gr.	Hyd. Acid in 100.	Dry Acid in 100.	Sp. Gr.	Hyd. Acid in 100.	Dry Acid in 100.
1·500	100	79·700	1·4189	75	59·775	1·2947	50	39·850	1·1403	25	19·925
1·498	99	78·903	1·4147	74	58·978	1·2887	49	39·053	1·1345	24	19·128
1·4960	98	78·106	1·4107	73	58·181	1·2826	48	38·256	1·1286	23	18·331
1·4940	97	77·309	1·4065	72	57·384	1·2765	47	37·459	1·1227	22	17·534
1·4910	96	76·512	1·4023	71	56·586	1·2705	46	36·662	1·1168	21	16·737
1·4880	95	75·715	1·3978	70	55·790	1·2644	45	35·865	1·1109	20	15·940
1·4850	94	74·918	1·3945	69	54·993	1·2583	44	35·068	1·1051	19	15·143
1·4820	93	74·121	1·3882	68	54·196	1·2523	43	34·271	1·0993	18	14·346
1·4790	92	73·324	1·3833	67	53·399	1·2462	42	33·474	1·0935	17	13·549
1·4760	91	72·527	1·3783	66	52·602	1·2402	41	32·677	1·0878	16	12·752
1·4730	90	71·730	1.3732	65	51·805	1·2341	40	31·880	1·0821	15	11·955
1·4700	89	70·933	1·3681	64	51·068	1·2277	39	31·083	1·0764	14	11·158
1·4670	88	70·136	1·3630	63	50·211	1·2212	38	30·286	1·0708	13	10·361
1·4640	87	69·339	1.3579	62	49·414	1·2148	37	29·489	1·0651	12	9·564
1·4600	86	68·542	1·3529	61	48·617	1·2084	36	28·692	1·0595	11	8·767
1·4570	85	67·745	1·3477	60	47·820	1·2019	35	27·895	1·0540	10	7·970
1·4530	84	66·948	1·3427	59	47·023	1·1958	34	27·098	1·0485	9	7·173
1·4500	83	66·155	1·3377	58	46·226	1·1895	33	26·301	1·0430	8	6·376
1·4460	82	65·354	1·3323	57	45·429	1·1833	32	25·504	1·0375	7	5·579
1·4424	81	64·557	1·3270	56	44·632	1·1770	31	24·707	1·0320	6	4·782
1·4385	80	63·760	1·3216	55	43·835	1·1709	30	23·910	1·0267	5	3·985
1·4346	79	62·963	1·3163	54	43·038	1·1648	29	23·113	1·0212	4	3·188
1·4306	78	62·166	1·3110	53	42·241	1·1587	28	22·316	1·0159	3	2·391
1·4269	77	61·369	1·3056	52	41·444	1·1526	27	21·519	1·0106	2	1·594
1·4228	76	60·572	1·3001	51	40·647	1·1465	26	20·722	1·0053	1	0·797

Composition.—The composition of the officinal acid of the density 1·42 has already been given. It contains about 75 per cent. of nitric acid, of the sp. gr. 1·5. Anhydrous nitric acid consists of one eq. of nitrogen 14, and five eqs. of oxygen 40 = 54; or, in volumes, of one volume of nitrogen and two and a half volumes of oxygen, supposed to be condensed to form nitric acid vapour, into one volume. In 1849, the interesting discovery was made by M. Deville, of Besançon, of the means of isolating *anhydrous nitric acid.* The method pursued was to pass perfectly dry chlorine over nitrate of silver. The anhydrous acid is in the form of colourless, brilliant, limpid crystals, which melt at 85° and boil at 113°. In contact with water, they form a colourless solution with evolution of heat, without the disengagement of gas. (*Journ. de Pharm.*, Mars, 1849, p. 207.)

Medical Properties. Nitric acid is tonic and antiseptic. Largely diluted with water, it forms a good acid drink in low forms of fever. It is praised as an antiperiodic in intermittent fever by Dr. Geo. Mendenhall and Dr. E. T. Bailey, of Indiana, given in doses of from five to eight drops once in six hours, without regard to intermissions or exacerbations. (See *Am. Journ. of the Med. Sci.*, Oct. 1854, p. 581.) According to Dr. Arnoldi, of Montreal, nitric acid added to water so as to give it the acidity of lemon-juice, and sweetened, is an efficacious remedy in hooping-cough; and his report of its value was confirmed by Dr. Geo. D. Gibb, in his treatise on hooping-cough, published in London in 1854. The dose for a child one year old is a dessertspoonful every hour; for an adult a tumblerful during the day. To save the teeth, the mouth should be washed after each dose. In syphilis, and in the chronic hepatitis of India, this acid was highly extolled by Dr. Scott, formerly of Bombay. It has occasionally excited ptyalism. It cannot be depended upon as a remedy in syphilis, but, in worn-out constitutions, is often an excellent adjuvant, either to prepare the system for the use of mercury, or to lessen the effects of that metal on the economy. As nitric acid dissolves both uric acid and the phosphates, it was supposed to be applicable to cases of gravel in which the uric acid and the phosphates are mixed; but experience has not confirmed the opinion. Nevertheless, when the sabulous deposit depends upon certain states of disordered digestion, this acid may prove serviceable by restoring the tone of the stomach. The dose is from five to twenty minims in three fluidounces or more of water, given three or four times a day. The diluted acid is more convenient for prescribing.

Externally, nitric acid has been used with advantage as a lotion to ulcers, in the strength of about twelve minims to the pint of water. This practice originated with Sir Everard Home, and is particularly applicable to those ulcers which are superficial and not disposed to cicatrize. It is also useful in ulceration of the mouth and gums as a gargle, made by adding about sixty drops of the acid to a pint of water. In sloughing phagedæna, *strong* nitric acid is one of the best remedies, applied by means of a piece of lint tied round a small stick, or by the use of a glass brush. Sometimes a piece of lint is soaked with the strong acid, and pressed into the sore, being allowed to remain for several hours. In cancrum oris concentrated nitric acid, freely applied, is one of the best local remedies that can be employed for arresting the phagedenic ulceration, and disposing the sore to heal. The *strong* acid has also been found very useful as an escharotic, in the local treatment of hemorrhoids and of prolapsus ani, by Dr. W. Cooke, of London, and others. For information as to the mode of applying the acid, the instruments employed, and the precautions to be observed, the reader is referred to *Ranking's Abstract* (Am. ed., xx. 143, and xxiii. 158).

Nitric acid, in the state of vapour, is considered useful for destroying contagion, and hence has been employed for purifying jails, hospitals, ships, and other infected places. It is prepared for use by the extemporaneous decomposition of nitre by sulphuric acid. Half an ounce of powdered nitre is put into a saucer, which is placed in an earthen dish containing heated sand. On the nitre two drachms of sulphuric acid are then poured, and the nitric acid fumes are immediately disengaged. The quantities just indicated are considered sufficient for disinfecting a cubic space of ten feet. Fumigation in this manner was first introduced by an English physician, Dr. Carmichael Smyth, who received from the British Parlia

ment, for its discovery, a reward of five thousand pounds. But nitric acid, as a disinfectant, is not comparable to chlorine; and, since the introduction of chlorinated lime and the solution of chlorinated soda as disinfecting agents, this gas has been brought into so manageable a form, that its use has entirely superseded that of nitric acid vapour.

Properties as a Poison. Nitric acid, in its concentrated state, is one of the mineral poisons most frequently taken for the purpose of self-destruction. Immediately after swallowing it, there are produced burning heat in the mouth, œsophagus, and stomach, acute pain, disengagement of gas, abundant eructations, nausea, and hiccough. These effects are soon followed by repeated and excessive vomiting of matter having a peculiar odour and taste, tumefaction of the abdomen with exquisite tenderness, a feeling of coldness on the surface, horripilations, icy coldness of the extremities, small depressed pulse, horrible anxieties, continual tossings and contortions, and extreme thirst. The breath becomes extremely fetid, and the countenance exhibits a complete picture of suffering. The cases are almost always fatal. The best remedies are repeated doses of magnesia as an antidote, mucilaginous drinks in large quantities, olive or almond oil in very large doses, emollient fomentations, and clysters. Until magnesia can be obtained, an immediate resort to a solution of soap in large amount will be proper.

Pharm. Uses. In the preparation of Acidum Phosphoricum Dilutum; Antimonii Oxidum, *U.S.;* Bismuthi Subcarbonas; Cadmii Sulphas, *U.S.;* Ferri Chloridum, *U.S.;* Hydrargyri Oxidum Rubrum; Liquor Ferri Chloridi, *U.S.;* Liquor Ferri Perchloridi Fortior, *Br.;* Liquor Ferri Subsulphatis, *U.S.;* Liquor Ferri Persulphatis, *Br.;* Liquor Ferri Tersulphatis, *U.S.;* Liquor Zinci Chloridi, *U.S.;* Pyroxylon, *U.S.*

Off. Prep. Acidum Nitricum Dilutum; Acidum Nitro-hydrochloricum Dilutum, *Br.;* Acidum Nitromuriaticum, *U.S.;* Acidum Nitromuriaticum Dilutum, *U.S.;* Argenti Nitras; Bismuthi Subnitras; Liquor Ferri Nitratis, *U.S.;* Liquor Ferri Pernitratis, *Br.;* Liquor Hydrargyri Nitratis, *U.S.;* Liquor Hydrargyri Nitratis Acidus, *Br.;* Spiritus Ætheris Nitrosi; Unguentum Hydrargyri Nitratis. B.

ACIDUM OXALICUM. *U.S.*

Oxalic Acid.

"In small, colourless, prismatic crystals, having a strongly acid taste, fusible, and decomposible by heat without residue." *U.S.*

Oxalate of iron having, at the late revision of the Pharmacopœia, been adopted as an officinal preparation, it became necessary to introduce oxalic acid, which is used in preparing it, into the Materia Medica catalogue; and, in accordance with the plan of the U.S. Dispensatory, to transfer it from Part III. of this work to the present.

This acid is found both in animals and vegetables. It is generated occasionally in consequence of a diseased action in the kidneys, and deposited in the bladder as oxalate of calcium, forming a peculiar concretion, called the *mulberry calculus.* In vegetables, it occurs in a free state in the bristles of the chick-pea (*Cicer arietinum*), combined with potassa as a supersalt in *Rumex acetosa* or common sorrel, and *Oxalis Acetosella* or wood-sorrel, and united with lime in several species of lichen, and in the roots of rhubarb, valerian, and several other plants.

Preparation. The usual process for obtaining oxalic acid consists in decomposing sugar by nitric acid. Four parts of sugar are acted upon by 24 of nitric acid of the sp. gr. 1·24, and the mixture is heated so long as any nitric oxide is disengaged. A part of the carbon of the sugar is converted into carbonic acid by oxygen derived from the nitric acid, which thereby becomes partly nitric oxide. The undecomposed nitric acid, reacting with the remaining elements of the sugar, generates oxalic and saccharic (oxalhydric) acids, the former of which crystallizes as the materials cool, while the latter remains in solution. The crystals being removed, a fresh crop may be obtained by further evaporation. The thick mother-water which now remains is a mixture of saccharic, nitric, and oxalic acids; and, by treating it with six times

its weight of nitric acid, the greater part of the saccharic will be converted into oxalic acid. The new crop of crystals, however, will have a yellow colour, and contain a portion of nitric acid, the greater part of which may be got rid of by allowing them to effloresce in a warm place. It is probable that, in the reaction occurring between nitric acid and sugar, half the carbon of the latter is converted into carbonic acid, and the other half into oxalic acid.

The manufacturing chemists are said to obtain oxalic acid on a large scale by heating a mixture of 112 lbs. of sugar, 560 lbs. of nitrate of potassium, and 280 lbs. of sulphuric acid. The products are 135 lbs. of oxalic acid, and 490 lbs. of super-sulphate of potassium, or *sal enixum.* (*L. Thompson.*)

Many substances, besides sugar, yield oxalic acid by the action of nitric acid; as molasses, rice, potato starch, gum, wool, hair, silk, and many vegetable acids. In every case in which it is thus generated, the proportional excess of oxygen which it contains, compared with every other organic compound, is furnished by the nitric acid. When the acid is obtained from potato starch, this is first converted into starch sugar by the action of sulphuric acid. The following is an outline of the process, as conducted on a large scale. The pulp of potatoes, obtained by rasping or other suitable means, is washed two or three times by stirring it well with water, allowing it to subside, and running off the water. It is then boiled for some hours with water in wooden boilers, lined with lead and heated by steam; a quantity of sulphuric acid being stirred in the mixture, equal to 2 per cent. of the weight of the potatoes employed. By this treatment the starch of the potatoes is converted into starch sugar; and the change is known to be completed when a drop of tincture of iodine, added to a little of the boiling liquor, placed on a piece of glass, ceases to produce a purple colour. The product is then filtered through a horse-hair cloth, and the liquid which passes is carefully evaporated until a gallon of it weighs about fourteen pounds. This liquid consists of a concentrated solution of starch sugar, and is now ready for conversion into oxalic acid. For this purpose it is placed in wooden boilers, lined with lead, eight feet square and three deep, and, having been mixed with the requisite proportion of nitric acid, is heated to a temperature of about 125° by means of steam, passed through a coil of lead pipe, until the decomposition is effected. The liquor is then drawn off by a syphon or cock into shallow lead-lined wooden coolers to crystallize. The crystals having formed, the mother-waters are drawn off for use in a subsequent operation. When the manufacture of the acid is conducted in vessels of the size just indicated, the density of the nitric acid should not be less than 1·20 nor higher than 1·27. If the nitric acid is used of undue strength, a part of the oxalic acid first formed becomes converted into carbonic acid, to the no small diminution of the desired product. (*Chem. Gaz.*, March 15, 1852, p. 112.) The product of oxalic acid from a given quantity of saccharine material has been much understated. If properly treated with nitric acid, 100 lbs. of good sugar will yield from 125 to 130 lbs. of oxalic acid, and the same weight of molasses, from 105 to 110 lbs.

Certain organic substances yield oxalic acid when heated with potassa. Thus shavings of wood, if mixed with a solution of caustic potassa, and exposed to a heat considerably higher than 212°, will be partially decomposed, and converted into oxalic acid, which then combines with the alkali. At present much of the oxalic acid of commerce is obtained by heating saw-dust with a mixture of caustic soda and potassa. Soda alone will not generate the acid, and potassa is too costly to be used by itself for the purpose; but Mr. Dale ascertained that, by mixing the two in the proportion of two eqs. of soda to one of potassa, the same result was obtained as from the latter alone. For an outline of Mr. Dale's process, the reader is referred to the 13th ed. of the U. S. Dispensatory, p. 1664. We have not space for it here.

As the oxalic acid of commerce often contains more or less of foreign matter, it requires for certain purposes to be purified. M. E. J. Maumené gives the following process for the purpose, which he says answers better than the method generally recommended. The acid is dissolved in sufficient hot water to give on cooling only from 10 to 20 for 100 of the crystals, according to the degree of impurity. The first crystals are put aside. The mother-water is then concentrated;. and, if the

resulting crystals be submitted to two or three successive crystallizations, the acid will be obtained quite free from all alkaline oxalate. (*Journ. de Pharm.*, Fev. 1864, p. 154.) Stolba prefers the method of purification by sublimation, especially for analytic purposes. His precise mode of proceeding will be found in Buchner's *Neues Repertorium* (1869, xviii. 182).

Properties. Oxalic acid is a colourless crystallized solid, possessing considerable volatility, and a strong, sour taste. Its crystals have the shape of slender, flattened four or six-sided prisms, with two-sided summits; and, when exposed to a very dry atmosphere, undergo a slight efflorescence. It sublimes at 180° F., and does not melt till heated to 280° F. (*Guy.*) It dissolves in about nine times its weight of cold, and in its own weight of boiling water. The solution of the crystals takes place with slight crepitation. It dissolves also, but not to the same extent, in alcohol. The presence of nitric acid renders it more soluble in water. It combines with salifiable bases, and forms salts called oxalates. The most interesting of these are the three *oxalates of potassium*, severally called *oxalate*, *binoxalate*, and *quadroxalate*, and the oxalate of calcium. The binoxalate and quadroxalate, both popularly called *essential salt of lemons*, are employed for removing iron moulds from linen, and act by their excess of acid, which forms a soluble salt with the sesquioxide of iron constituting the stain. Oxalic acid is used for removing ink stains and iron moulds, for cleaning the leather of boot-tops, and for discharging colours in calico-printing.

This acid has a very strong affinity for lime, and forms with it an insoluble precipitate consisting of oxalate of calcium, whenever the acid and earth are brought into contact in solution. It is even capable of decomposing fluoride of calcium, evolving hydrofluoric acid. (*J. W. Slater.*) Oxalic acid and its soluble combinations are the best tests for lime; and, conversely, a soluble salt of lime for oxalic acid. In weak solution the acid is said to absorb oxygen and to be converted into carbonic acid; but a strong solution is permanent. (*Am. Journ. of Pharm.*, July, 1870, p. 317.) When lime is searched for, oxalate of ammonium is the most convenient test. So strong is the mutual attraction between this acid and lime, that the former takes the latter even from sulphuric acid. Hence the addition of a soluble oxalate disturbs the transparency of a solution of sulphate of calcium.

Oxalic acid is distinguished from all other acids by the form of its crystals, and by its solution yielding a precipitate with lime-water, insoluble in an excess of the acid or of acetic acid.

Composition. Oxalic acid consists of two eqs. of carbon 12, and three of oxygen 24 = 36. Some chemists consider it a bibasic acid, and double these numbers. When crystallized, three eqs. of water 27 must be added, making the eq. of the crystals 63. Two eqs. of this water may be driven off by a regulated heat, by which the acid is made to effloresce, but the third cannot be expelled without destroying the acid itself. Accordingly, anhydrous oxalic acid is not known to exist. From the constitution of oxalic acid thus given, it is plain that this acid corresponds in composition with carbonic acid and carbonic oxide taken together. Notwithstanding that it contains less oxygen than carbonic acid, it is incomparably stronger as an acid. The composition of the acid not only corresponds with the united constituents of carbonic acid and oxide, but there is reason to believe that these two compounds are actually its proximate constituents; for, if treated with strong sulphuric acid, the whole of the water will be abstracted, and the elements of the dry oxalic acid are instantly resolved into equal volumes of carbonic acid and carbonic oxide. Oxalic acid, in combining with salifiable bases, sometimes drops its essential equivalent of water, at other times retains it. Thus the oxalate of lead is a compound of the dry acid and protoxide of lead; while the oxalate of calcium retains one equivalent of water.

Medical and Toxical Properties. Oxalic acid, in *small* doses, largely diluted with water and sweetened to the taste, forms an agreeable, cooling beverage, which may be used in febrile diseases as a substitute for lemonade. M. Nardo recommends it as an antiphlogistic and anodyne remedy in inflammation of the mucous membranes, given in the dose of a grain and a half dissolved in eight fluidounces of liquid. It has been given in phthisis, with the asserted effect of lessening the night-sweats and

expectoration, in the dose of half a grain, three or four times a day, increased to a grain. Combined with binoxalate of potassium, it has been used with extraordinary success in scurvy. Notwithstanding the safety of its employment in medicinal doses, it is a virulent poison in larger quantities, producing death with great rapidity and certainty. Instances are on record of death in ten minutes, and few survive a poisonous dose beyond an hour. A case is recorded in the *Chemical News* (April 24, 1868), in which death occurred in a young woman about ten minutes after she had taken three-quarters of an avoirdupois ounce of the poison. As this acid is generally kept in the shops, and not a few instances are on record of its fatal effects when taken by design, or by mistake, for Epsom salt, it is necessary to be somewhat full on its toxical relations.

Oxalic acid was first noticed as a poison by Mr. Royston in 1814; since which time it has been investigated in this relation principally by the late Dr. A. T. Thomson, of London, Dr. Percy, of Lausanne, Dr. Coindet, of Geneva, and Dr. Christison, of Edinburgh. Since its properties of certainty and rapidity as a poison have been more generally known, its employment for committing suicide has become more frequent.

From the general resemblance which the crystallized oxalic acid bears to Epsom salt, many fatal mistakes have occurred in consequence of its being sold for that saline purgative. Nothing, however, can be easier than to distinguish them by tasting a minute portion of the suspected substance, which, if oxalic acid, will be found strongly sour, whereas the salt in question is bitter. Unfortunately, however, in the instances of these fatal mistakes, no suspicions being awakened, the solution is swallowed with haste, and the mischief is done before the victim is aware of his danger.

Oxalic acid acts on the economy in two principal ways, according as its solution is concentrated or dilute. When concentrated it causes exquisite pain, followed by violent efforts to vomit, then sudden dulness, languor, and great debility, and finally death without a struggle. When dissolved in twenty times its weight of water, it possesses no corrosive and hardly any irritating power, and is yet a fatal poison, causing death by acting on the brain, spinal marrow, and heart. This statement, however, does not accord with the observations of Dr. Letheby, who asserts that the acid, whether in strong or weak solution, always exercises a corroding or softening power on the animal tissues.

The morbid appearances caused by oxalic acid are various. In a dissection reported by Dr. Christison, the mucous coat of the throat and gullet had an appearance as if scalded, and that of the gullet could be easily scraped off. The inner coat of the stomach was pultaceous, in many points black, in others red, and that of the intestines, similarly but less violently affected. In another case, the whole villous coat of the stomach was either softened or removed, as well as the inner membrane of the œsophagus; so that the muscular coat was exposed, and this coat exhibited a dark gangrenous appearance, being much thickened and highly injected. The stomach usually contains a dark fluid, resembling coffee-grounds, consisting chiefly of altered blood. Dr. Herbert Barker reports a fatal case of poisoning by this acid, in a boy aged sixteen years, in which about a drachm of the acid had been taken in the solid state. During life the tongue and lips were unusually pale, but not excoriated. The tongue, after death, was found dotted with white spots. (*B. and F. Medico-chir. Rev.*, Am. ed., April, 1856, p. 402.) Dr. Snow, of London, has seen a case, in which, after death, the tongue and lips were very white, while the stomach was black. In a few cases no morbid appearances have been discovered.

In the treatment of poisoning by oxalic acid, the remedial measures must be employed with great promptitude. If the antidotes are not at hand, and vomiting is not free, emetics will be proper. The stomach pump would be useful, but no delay in the application of other remedies is admissible. Dr. Christison objects to the use of warm water to facilitate vomiting, from a fear that it would increase the danger by favouring the absorption of the poison; but it may be a question whether this evil, considering the incidental benefit of the water in promoting vomiting, is not less than that of the corrosion of the stomach, which copious dilution has a tendency to prevent. The proper antidote is chalk or magnesia, mixed with water; and as

soon as either can be procured, it must be administered in large and repeated doses. These substances act by neutralizing the poison, forming with it an insoluble oxalate of calcium or of magnesium, both of which are inert. The soluble salts of oxalic acid, as oxalate of ammonium, and oxalate of potassium, are likewise poisonous, and the antidotes for them are the same as for the acid.

The best tests for the detection of oxalic acid in the contents of the stomach, or in the vomited matter, in cases of suspected poisoning by this acid, are chloride of calcium, sulphate of copper, and nitrate of silver. The first causes a white precipitate of oxalate of calcium, known by its being soluble in nitric acid; the second, a bluish-white precipitate of oxalate of copper; and the third, a dense white precipitate of oxalate of silver, which, when dried and heated, becomes brown and detonates faintly. When the antidotes have been freely used during life, the poison will be in the state of oxalate either of calcium or magnesium. In this case, the oxalate found is to be boiled with a solution of carbonate of potassium, whereby an oxalate of potassium will be generated; and this must then be examined with the reagents above indicated.

Off. Prep. Ferri Oxalas, *U. S.* B.

ACIDUM PHOSPHORICUM GLACIALE. *U. S.*

Glacial Phosphoric Acid.

Phosphoric acid, in the anhydrous state, consists of one eq. of phosphorus and five eqs. of oxygen, PO_5, and can be obtained only by the direct union of its constituents, which takes place when phosphorus is burned in perfectly dry oxygen gas. Thus procured, it is in the form of a white amorphous powder, extremely deliquescent, volatilizable at a red heat, and assuming, when it cools after fusion, a vitreous appearance. It has been shown by Prof. Graham that this acid is capable of assuming three isomeric conditions, each characterized by peculiar properties, and essentially distinguished by their relations to bases, water being considered as acting the part of a base. These are most conveniently designated as *monobasic*, *bibasic*, and *tribasic phosphoric acids*, the first uniting with one eq. of base, the second with two eqs., and the third with three. Obtained in any other way than as above stated, they are always combined with water, the *monobasic* consisting of one eq. of acid and one of water, HO,PO_5, the *bibasic* of one of the former and two of the latter, $2HO,PO_5$, the *tribasic* of one to three, $3HO,PO_5$. When uniting with other bases than water, the same relation of equivalents is observed, the monobasic combining with only one eq., giving up its eq. of water, the bibasic with one or two eqs. according as it retains one or gives up both its eqs. of water, the tribasic with one, two, or three eqs., according to the number of eqs. of water it abandons; in other words, the eqs. of water being replaced by as many eqs. of base; so that the acid always has its characteristic complement of basic eqs., water being counted among them. Other names had been given to these acids before their peculiar character was developed; the common and best known form of the acid being called simply *phosphoric acid*, which is the tribasic; another, from heat being used in its production, *pyrophosphoric*, which is the bibasic; and the third *metaphosphoric acid*, which is *monobasic*. An aqueous solution of either of the three acids, heated so long as water escapes, yields the monobasic or metaphosphoric acid; and as, upon cooling, it becomes a transparent ice-like solid, it has received in this state the name of glacial phosphoric acid. Conversely, this monobasic acid is slowly transformed, in aqueous solution, and more rapidly if the solution is heated, into the bibasic and tribasic forms. Mr. Maisch has ascertained that nitric acid, added to the solution of the monobasic acid, with the aid of heat, causes the change from the monobasic to the tribasic form, or that of common phosphoric acid, without undergoing any observable change itself, and without the intermediate production of the bibasic.

The three forms of acid are distinguishable by peculiar reactions. Thus, the *monobasic* is characterized by coagulating albumen, and giving white gelatinous uncrystallizable precipitates with the soluble salts of baryta, lime, and silver; the *bibasic* does not coagulate albumen, and, though it causes a *white* precipitate with

nitrate of silver, must first be neutralized; the tribasic does not coagulate albumen, and until neutralized does not precipitate nitrate of silver; but after neutralization throws down a *yellow* precipitate of phosphate of silver. The two latter forms of the acid will be considered in the second part of this work under appropriate heads. Our attention will at present be confined to the monobasic acid, which is the glacial acid of the U. S. Pharmacopœia.

Glacial Phosphoric Acid. *U. S. Metaphosphoric Acid. Monobasic Phosphoric Acid. Monohydrated Phosphoric Acid. Phosphate of Water.* This is most advantageously obtained from calcined bones, by first treating them with sulphuric acid, which produces an insoluble sulphate and soluble superphosphate of calcium; then dissolving out the latter salt, and saturating it with carbonate of ammonium, which generates phosphate of ammonium in solution; and, finally, obtaining the phosphate of ammonium by evaporation to dryness, and then igniting it in a platinum crucible. The ammonia and all the water except one eq. for each eq. of the acid are driven off, and the glacial acid remains. In France, a fossil phosphate of lime found in the Departement du Lot is sometimes substituted for bones, in the manufacture of phosphoric acid. (*Journ. de Pharm.*, Sept. 1872, p. 188.)

Properties. Thus procured, glacial phosphoric acid is in the form of a white, transparent, fusible solid, inodorous and sour to the taste, slowly deliquescent, slowly soluble in water, and soluble also in alcohol. Its formula is HO,PO_5, and it contains 11·2 per cent. of water. As already stated, it is characterized by producing white gelatinous precipitates with albumen, and with the soluble salts of lime, baryta, and silver; and the precipitate produced with the chloride of barium is readily redissolved by an excess of the acid. This is the form of the acid which results when the anhydrous acid, produced by burning phosphorus in dry oxygen gas, is introduced into water.

Impurities. Glacial phosphoric acid is seldom prepared in this country. That found in our shops is almost all imported, and chiefly from Germany. It is often more or less impure, containing most frequently, as shown by the experiments of Mr. Maisch, silica, and the phosphates of calcium and magnesium, which are precipitated from a neutralized solution of the acid by ammonia. In one instance 8 per cent. of these impurities was found; but in some others little or none. Mr. Maisch never found nitric or muriatic acid, and sulphuric acid rarely; and, though the presence of ammonia might be suspected from the source whence the acid is obtained, he did not detect it. (*Am. Journ. of Pharm.*, May, 1860, p. 194.) In consequence of its deliquescence upon exposure to the air, a portion of the monobasic acid passes into the state of the tribasic. This is detected, if in considerable quantity, by giving a yellowish colour to the precipitate with nitrate of silver. The U. S. Pharmacopœia directs that the acid, in aqueous solution, should yield no precipitate with sulphuretted hydrogen, showing the absence of metals; should cause a white precipitate with chloride of barium soluble in an excess of acid; with an excess of ammonia, should cause only a slight turbidness, proving the almost total absence of earthy salts; and should yield no ammonia when treated with potassa in excess. Should the presence of arsenic be ascertained by the tests for that metal, it may be separated by boiling with muriatic acid, so as to convert the arsenic into its very volatile chloride, which would escape with the vapours of the muriatic acid.

Medical Uses. Glacial phosphoric acid is seldom if ever used medicinally in reference to its influence on the system, though probably capable of producing all the effects for which the officinal diluted acid is employed. It was introduced into the Materia Medica of our Pharmacopœia as affording a convenient method of preparing the medicinal acid. It may also be used in prescriptions with the insoluble phosphates to render them soluble in the liquors of the stomach, and thereby favour their entrance into the circulation. Thirty-eight and a half grains, dissolved in a fluidounce of water, form a solution about equal in strength to the officinal U. S. diluted acid.

Off. Prep. Acidum Phosphoricum Dilutum, *U. S.* B.

ACIDUM SULPHURICUM. *U.S., Br.*

Sulphuric Acid.

Sulphuric acid, of the specific gravity 1·843. *U.S.* It contains 96·8 per cent. by weight of the Sulphuric Acid, HO,SO_3, and corresponds to 79 per cent. of anhydrous sulphuric acid, SO_3. *Br.*

Oil of vitriol, Vitriolic acid; Acide sulfurique, *Fr.;* Vitriolöl, Schwefelsäure, *Germ.;* Acido solforico, *Ital.;* Acido sulfurico, *Span.*

Sulphuric acid is placed in the Materia Medica list of the U. S. Pharmacopœia, as an article to be obtained from the wholesale manufacturer; and the same is now the case with the British Pharmacopœia. Provision, however, is made that it shall be free from all odorous substances, and all metallic and other non-volatile impurities.

Preparation. Sulphuric acid is obtained by burning sulphur, mixed with one-eighth of its weight of nitre, over a stratum of water contained in a chamber lined with sheet-lead. If the sulphur were burned by itself, the product would be sulphurous acid, which contains only two-thirds as much oxygen as sulphuric acid. The object of the nitre is to furnish, by its decomposition, the requisite additional quantity of oxygen. To understand the process, it is necessary to bear in mind that nitric acid contains five, sulphuric acid three, sulphurous acid two, nitric oxide two, nitrous acid three, and hyponitric acid four equivalents of oxygen, combined with one eq. of their several radicals. One eq. of sulphur decomposes one eq. of nitric acid of the nitre, and becomes one eq. of sulphuric acid, which combines with the potassa of the nitre to form sulphate of potassium. In the mean time, the nitric acid, by furnishing three eqs. of oxygen to form the sulphuric acid, is converted into one eq. of nitric oxide, which is evolved. This gas, by combining with two eqs. of the oxygen of the air, immediately becomes hyponitric acid vapour, which diffuses itself throughout the leaden chamber. While these changes are taking place, the remainder of the sulphur is undergoing combustion, and filling the chamber with sulphurous acid gas. One eq. of hyponitric acid vapour, and one eq. of sulphurous acid gas, being thus intermingled in the chamber, react on each other, with the aid of moisture, so as to form a crystalline compound, consisting of one eq. of sulphuric acid and one eq. of nitrous acid, united with a portion of water. This compound falls into the water of the chamber, and is instantly decomposed. The sulphuric acid dissolves in the water, and the nitrous acid, resolved, at the moment of its extrication, into hyponitric acid and nitric oxide, escapes with effervescence. The hyponitric acid thus set free, and that reproduced by the nitric oxide uniting with the oxygen of the air, again react with sulphurous acid and humidity, and give rise to a second portion of the crystalline compound, which undergoes the same changes as the first. Thus, the nitric oxide performs the part of a carrier of oxygen from the air of the chamber to the sulphurous acid, converting the latter into sulphuric acid. The residue of the combustion of the sulphur and nitre, consisting of sulphate of potassium, is sold to the alum makers.

Preparation on the Large Scale. The leaden chambers vary in size, but are generally from thirty to thirty-two feet square, and from sixteen to twenty high. The floor is slightly inclined to facilitate the drawing off of the acid, and covered to the depth of several inches with water. There are several modes of burning the mixture of sulphur and nitre, and otherwise conducting the process. That pursued in France is as follows. Near one of the sides of the chamber, and about a foot from its bottom, a cast-iron tray is placed over a furnace, resting on the ground, its mouth opening externally, and its chimney having no communication with the chamber. On this tray the mixture is placed, being introduced by a square opening, which may be shut by means of a sliding door, and the lower side of which is level with the surface of the tray. The door being shut, the fire is gradually raised in the furnace, whereby the sulphur is inflamed, and the products already spoken of are generated. When the combustion is over, the door is opened, and the sulphate of potassium removed. A fresh portion of the mixture is then placed on the tray,

and the air of the chamber is renewed by opening a door and valve situated at its opposite side. Next, the several openings are closed, and the fire is renewed. These operations are repeated, with fresh portions of the mixture, every three or four hours, until the water at the bottom of the chamber has the sp. gr. of about 1·5. It is then drawn off and transferred to leaden boilers, where it is boiled down to the sp. gr. 1·7. At this density it begins to act on lead, and its further concentration must be conducted in large glass or platinum retorts, where it is evaporated as long as water distils over. This water is slightly acid, and is thrown back into the chamber. When the acid is fully concentrated, grayish-white vapours arise, which indicate the completion of the process. The acid is allowed to cool, and is then transferred to demijohns of green glass, called carboys, which, for greater security, are surrounded with straw or wicker-work, and packed in square boxes, enclosing all the carboy except the neck.

As, in the manufacture of sulphuric acid, nitre is the most expensive material, many plans have been resorted to for obtaining the necessary hyponitric acid at a cheaper rate. One plan is to procure it by treating molasses or starch with common nitric acid. In this case, the manufacturer obtains oxalic acid as a collateral product, which serves to diminish the expense. Sometimes nitrate of sodium is substituted for nitre. The advantages of the former salt are its greater cheapness, and its larger proportional amount of nitric acid. Another method, sometimes practised, consists in filling the leaden chamber with sulphurous acid by the combustion of sulphur, and afterwards admitting into it hyponitric acid and steam. The acid is generated from a mixture of sulphuric acid with nitre or nitrate of sodium, placed in an iron pan over the burning sulphur in the sulphur furnace, where the draught conducts the hyponitric acid fumes into the chamber. As, under these circumstances, sulphurous and hyponitric acids and aqueous vapour are mingled in the chamber, all the conditions necessary for generating the crystalline compound, already alluded to, are present. Mr. Thomas Bell, of England, obtained a patent, in Dec. 1852, for the use of ozonized air, produced either by electricity, or by the slow combustion of phosphorus, in order to cause the union of sulphurous acid with the requisite oxygen, in the leaden chamber, without the use of nitre. (*Pharm. Journ. and Trans.*, March, 1853.)*

The process for making sulphuric acid by the combustion of sulphur with nitre was first mentioned by Lemery, and afterwards put in practice by an English physician, of the name of Ward. As practised by him, the combustion was conducted in very large glass vessels. About the year 1746, the great improvement of leaden chambers was introduced by Dr. Roebuck, of Birmingham, where the first apparatus of this kind was erected. In consequence of this improvement, the acid immediately fell to one-fourth of its former price.

The only way to obtain pure sulphuric acid is by distillation. Owing to the high boiling point of this acid, the operation is rather precarious, in consequence of the danger of the fracture of the retort from the sudden concussions to which the boiling acid gives rise. Dr. Ure recommends that a retort of the capacity of from two to four quarts be used in distilling a pint of acid. This is connected by means of a wide glass tube three or four feet long, with a receiver surrounded with cold water. All the vessels must be perfectly clean, and no luting employed. The retort is then gradually heated by a small furnace of charcoal, or, what is better, by means of a sand-bath, the retort being buried in the sand up to the neck. It is useful to put into the retort a few sharp-pointed pieces of glass, or slips of platinum foil, with the view of diminishing the shocks produced by the acid vapour. The distilled product ought not to be collected until a dense grayish white vapour is generated, the appearance of which is a sign that the pure concentrated acid is coming over. If this

* We are told by R. Weber that, in the presence of much water, sulphurous acid reduces binoxide of nitrogen (nitric oxide) to the protoxide (nitrous oxide); and thus considerable loss of nitric acid may be incurred in the manufacture. But sulphuric acid of a certain strength prevents this reaction, which should therefore diminish with the increase of sulphuric acid, and perhaps cease when the acid on the floor of the chamber becomes sufficiently concentrated. The inference is that the sulphuric acid in the chamber should always be kept of the necessary strength, which in the beginning of the process can be accomplished by the addition of a certain quantity of the acid. (*Chem. News*, July 5, 1867, p. 12; from *Pogg. Ann.*, cxxx. 277.)—*Note to the thirteenth edition.*

vapour should not immediately appear, it shows that the acid subjected to distillation is not of full strength; and the distilled product, until this point is attained, will be an acid water. In the distillation of sulphuric acid, M. Lembert uses fragments of the mineral called quartzite, instead of pieces of glass or platinum foil. After a time the fragments get worn, and must be changed.

What is said above relates to the mode of preparing common sulphuric acid; but there is another kind, known on the continent of Europe by the name of the *fuming sulphuric acid of Nordhausen*, so called from its properties, and a place in Saxony where it is largely manufactured. This acid is obtained by distilling dried sulphate of iron in large stoneware retorts, heated to redness, and connected with receivers of glass or stoneware. The fuming acid distils over, and sesquioxide of iron is left in the form of *colcothar* or *polishing rouge*, a material used for polishing metals, particularly gold and silver. According to A. Vogel, jun., a better polishing rouge for fine work is made by calcining oxalate of protoxide of iron. (*Chem. Gaz.*, Nov. 1, 1854, p. 410.)

Properties. Sulphuric acid (*sulphate of water*), commonly called *oil of vitriol*, is a dense, colourless, inodorous liquid, of an oily appearance, and strongly corrosive. On living tissues it acts as a powerful caustic. In the liquid form, it contains water, which is essential to its existence in that form. It unites with water in all proportions, and much heat is evolved on the mixture of the two fluids. When pure, and as highly concentrated as possible, as manufactured in leaden chambers, its sp. gr. is 1·845 (1·8485, Ure), a fluidounce weighing a small fraction over 14 drachms. When of this sp. gr., it contains about 18 per cent. of water. If its density exceed this, the presence of sulphate of lead or other impurity may be inferred. The commercial acid is seldom of full strength. According to Mr. Phillips, it has generally the sp. gr. 1·8433, and contains 22 per cent. of water; and this is about the strength of the Br. acid, of which the sp. gr. is stated to be 1·843. The strong acid boils at 620°, and freezes at 15° below zero. When diluted, its boiling point is lowered. When of the sp. gr. 1·78, it deposits crystals of the bihydrated acid at about 28°, and hence it is hazardous for manufacturers to keep an acid of that strength in glass vessels in cold weather, as they are liable to burst. With salifiable bases it forms a numerous class of salts, called sulphates. It acts powerfully on organic bodies, whether vegetable or animal, depriving them of the elements of water, developing charcoal, and turning them black. A small piece of cork or wood, dropped into the acid, will on this principle render it of a dark colour. It absorbs water with avidity, and is used as a desiccating agent. It has been ascertained by Professors W. B. and R. E. Rogers to be capable of absorbing 94 per cent. of carbonic acid gas, a fact having an important bearing on analytic operations. When diluted with distilled water, it ought to remain limpid; and, when heated sufficiently in a platinum spoon, the fixed residue should not exceed one part in 400 of the acid employed. When present in small quantity in solution, it is detected unerringly by chloride of barium, which causes a precipitate of sulphate of barium. The most usual impurities in it are the sulphates of potassium and lead; the former derived from the residue of the process, the latter from the leaden boilers in which the acid is concentrated. Sulphate of sodium or of magnesium is said to have been added to increase its specific gravity. Occasionally nitre is added to render dark samples of acid colourless. This addition gives rise to the impurity of sulphate of potassium. These impurities often amount to 3 or 4 per cent. The commercial acid cannot be expected to be absolutely pure; but, when properly manufactured, it should not contain more than one-fourth of 1 per cent. of impurity. The fixed impurities are discoverable by evaporating a portion of the acid, when they will remain. If sulphate of lead be present, the acid will become turbid on dilution with an equal bulk of water. This impurity is not detected by sulphuretted hydrogen, unless the sulphuric acid be saturated with an alkali. If only a scanty muddiness arises, the acid is of good commercial quality.

Other impurities occur in the commercial sulphuric acid. Hyponitric acid is always present in greater or less amount. It may be detected by gently pouring a solution of green vitriol over the commercial acid in a tube, when the solution, at the line of contact, will acquire a deep-red colour, due to the liberation of deutoxide of nitrogen.

Another method is to pass into tincture of guaiac the gases proceeding from the suspected acid heated with iron filings. If hyponitric acid is present the tincture becomes blue. The commercial acid, however, is not to be rejected, unless the test shows the presence of hyponitric acid in unusual quantity. Hyponitric acid is an injurious impurity when the sulphuric acid is employed in the manufacture of muriatic acid, which is decomposed by the hyponitric acid with evolution of chlorine. To remove this impurity it was recommended by Wackenroder, before distilling it, to heat the acid with a little sugar. This and the hyponitric acid mutually decompose each other, and the products are dissipated by heat. For the removal of the nitrogen acids generally, Dr. J. Löwe recommends the addition, to the heated sulphuric acid, of small portions of dry oxalic acid, so long as it exhibits a yellow tinge. The oxalic acid is decomposed into carbonic acid and oxide, the latter of which, in becoming carbonic acid, deoxidizes and destroys the nitrogen acids. A slight excess of oxalic acid produces no harm; as it is immediately decomposed. Perhaps a better method of getting rid of these acids is to distil with a little sulphate of ammonium. When sulphate of potassium is fraudulently introduced into the acid to increase its density, it may be detected by saturating the acid with ammonia, and heating to redness in a crucible; when sulphate of ammonium will be expelled, and the sulphate of potassium left.

Arsenic is sometimes present in sulphuric acid. In consequence of the high price of Sicilian sulphur, some English manufacturers have employed iron pyrites for the purpose of furnishing the necessary sulphurous acid in the manufacture of oil of vitriol. As the pyrites usually contains arsenic, it happens that the sulphurous acid fumes are accompanied by this metal, and thus the sulphuric acid becomes contaminated. From 22 to 35 grains of arsenious acid have been found in 20 fluidounces of oil of vitriol, of English manufacture, by Dr. G. O. Rees and Mr. Watson, and a still larger proportion by Mr. J. Cameron, of South Wales. To detect this impurity, the acid, previously diluted with five or six measures of distilled water, must be examined by Marsh's test. (See *Acidum Arseniosum.*) But a more easy method, said to be nearly as delicate, is that of Bettendorf. A little protochloride of iron is treated, in a shallow dish, with pure muriatic acid (sp. gr. 1·12) until dissolved. The suspected sulphuric acid is then added, drop by drop, to the solution, the vessel being shaken on each addition. Considerable heat will be produced, and the liquid, if no arsenic be present, will remain clear; but, if the acid be in the slightest degree contaminated with the poison, first a yellow, then a brown, and finally a dark grayish-brown colour will appear, and the liquid become turbid. (*New Remedies*, April, 1873, p. 367.) To separate the arsenious acid, Dr. J. Löwe recommends that the concentrated sulphuric acid should be gently heated in a flat dish, in a place where the fumes may be carried off, and then treated with small quantities of finely powdered chloride of sodium, constantly stirred in with a glass rod. By the reaction between the arsenious acid and disengaged muriatic acid, terchloride of arsenic is formed, which, being volatile, is separated by the heat. The heat is afterwards continued, to expel the excess of muriatic acid. This mode of purification introduces into the oil of vitriol a little sulphate of sodium. Buchner proposes a similar process; instead of chloride of sodium, employing muriatic acid, or a stream of the acid gas. This plan does not introduce sulphate of sodium into the acid; but is less convenient than that of Löwe, and, when the aqueous muriatic acid is used, tends to weaken the oil of vitriol by introducing water. Experience, however, has shown that neither plan can be entirely relied on. An excess of sulphuric acid is said to prevent the formation of the chloride of arsenic. (See *Am. Journ. of Pharm.*, Jan. 1860, p. 85.) The sulphuric acid manufactured in the U. States, being usually made from Sicilian sulphur, seldom contains arsenic. Dupasquier states that tin is sometimes present in commercial sulphuric acid, derived from the solderings of the leaden chambers; but this could scarcely happen now, as care is taken to avoid soldering, and to effect the union of the metal by fusion by means of the blow-pipe. It may be discovered by sulphuretted hydrogen, which precipitates sulphuret of tin, convertible by nitric acid into the white insoluble deutoxide of tin. Should the precipitate be the mixed sulphurets of arsenic and tin, the former would be converted by nitric acid into arsenic acid, and dissolved, and the latter into insoluble deutoxide and left. Another

impurity occasionally existing in French sulphuric acid is selenium, supposed to be derived from copper pyrites sometimes substituted for sulphur in the manufacture of the acid. For the mode of detecting and separating this impurity, see the *Journal de Pharmacie* (Juillet, 1872, p. 42). As ordered by the Br. Pharmacopœia, "50·6 grains by weight, mixed with distilled water, require for neutralization 1000 grain-measures of *the volumetric solution of soda.*" *Br.* For a very delicate method of detecting sulphurous acid and the oxides of nitrogen in sulphuric acid, see a communication by Mr. Robert Warrington in the *Chemical News* (Feb. 14, 1868, p. 75).

As sulphuric acid is often under the standard strength, it becomes important to know how much hydrated sulphuric acid of the standard specific gravity and of dry acid is contained in an acid of any given density. The following table, drawn up by Dr. Ure, gives this information.

Table of the Quantity of Hydrated Sulphuric Acid of Sp. Gr. 1·8485, *and of Dry Acid, in* 100 *parts of Dilute Acid at Different Densities.*

Sp. Gr.	Hyd. Acid in 100.	Dry Acid in 100.	Sp. Gr.	Hyd. Acid in 100.	Dry Acid in 100.	Sp. Gr.	Hyd. Acid in 100.	Dry Acid in 100.	Sp. Gr.	Hyd. Acid in 100.	Dry Acid in 100.
1·8485	100	81·54	1·6520	75	61·15	1·3884	50	40·77	1·1792	25	20·38
1·8475	99	80·72	1·6415	74	60·34	1·3788	49	39·95	1·1706	24	19·57
1·8460	98	79·90	1·6321	73	59·52	1·3697	48	39·14	1·1626	23	18·75
1·8439	97	79·09	1·6204	72	58·71	1·3612	47	38·32	1·1549	22	17·94
1·8410	96	78·28	1·6090	71	57·89	1·3530	46	37·51	1·1480	21	17·12
1·8376	95	77·46	1·5975	70	57·08	1·3440	45	36·69	1·1410	20	16·31
1·8336	94	76·65	1·5868	69	56·26	1·3345	44	35·88	1·1330	19	15·49
1·8290	93	75·83	1·5760	68	55·45	1·3255	43	35·06	1·1246	18	14·68
1·8233	92	75·02	1·5648	67	54·63	1·3165	42	34·25	1·1165	17	13·86
1·8179	91	74·20	1·5503	66	53·82	1·3080	41	33·43	1·1090	16	13·05
1·8115	90	73·39	1·5390	65	53·00	1·2999	40	32·61	1·1019	15	12·23
1·8043	89	72·57	1·5280	64	52·18	1·2913	39	31·80	1·0953	14	11·41
1·7962	88	71·75	1·5170	63	51·37	1·2826	38	30·98	1·0887	13	10·60
1·7870	87	70·94	1·5066	62	50·55	1·2740	37	30·17	1·0809	12	9·78
1·7774	86	70·12	1·4960	61	49·74	1·2654	36	29·35	1·0743	11	8·97
1·7673	85	69·31	1·4860	60	48·92	1·2572	35	28·54	1·0682	10	8·15
1·7570	84	68·49	1·4760	59	48·11	1·2490	34	27·72	1·0614	9	7·34
1·7465	83	67·68	1·4660	58	47·29	1·2409	33	26·91	1·0544	8	6·52
1·7360	82	66·86	1·4560	57	46·48	1·2334	32	26·09	1·0477	7	5·71
1·7245	81	66·05	1·4460	56	45·66	1·2260	31	25·28	1·0405	6	4·89
1·7120	80	65·23	1·4360	55	44·85	1·2184	30	24·46	1·0336	5	4·08
1·6993	79	64·42	1·4265	54	44·03	1·2108	29	23·65	1·0268	4	3·26
1·6870	78	63·60	1·4170	53	43·22	1·2032	28	22·83	1·0206	3	2·446
1·6750	77	62·78	1·4073	52	42·40	1·1956	27	22·01	1·0140	2	1·63
1·6630	76	61·97	1·3977	51	41·58	1·1876	26	21·20	1·0074	1	0·8154

Composition. The hydrated acid of the sp. gr. 1·845 ((1·8485, Ure) consists of one eq. of dry acid 40, and one eq. of water 9=49. As the water acts the part of a base, the proper name of it is sulphate of water, its formula being HO,SO_3. The dry acid consists of one eq. of sulphur 16, and three eqs. of oxygen 24=40. The ordinary commercial acid (sp. gr. 1·8433) consists, according to Phillips, of one eq. of dry acid, and one and a quarter eqs. of water. The hydrated acid of Nordhauser has a density as high as 1·89 or 1·9, and consists of two eqs. of dry acid, and one eq. of water ($HO,2SO_3$). This acid is particularly adapted to the purpose of dissolving indigo for dyeing the Saxon blue. When heated gently in a retort, connected with a dry and refrigerated receiver, dry or anhydrous sulphuric acid distils over, and the common monohydrated acid remains behind. In performing this operation, much difficulty from concussion is avoided, and the product of dry acid increased, by introducing a coil of platinum wire into the retort. The dry acid may also be obtained by the action of dry phosphoric acid on concentrated sulphuric acid, according to the method of Ch. Barreswil. The mixture must be made in a refrigerated retort, and afterwards distilled by a gentle heat into a refrigerated receiver. *Anhydrous sulphuric* acid under 64° is in small colourless crystals, resembling asbestos. It is tenacious, difficult to cut, and may be moulded in the fingers like wax, without acting

on them. Exposed to the air, it emits a thick opaque vapour of an acid smell. Above 64° it is a liquid, very nearly of the density 2.

Medical Properties. Sulphuric acid is tonic, antiseptic, and refrigerant. Internally it is always administered in a dilute state. For its medical properties in this state, the reader is referred to the title *Acidum Sulphuricum Dilutum.* Externally it is sometimes employed as a caustic; but, from its liquid form, it is very inconvenient for that purpose. A plan, however, has been proposed by Prof. Simpson by which it becomes very manageable. This consists in mixing it with dried and powdered sulphate of zinc sufficient to give it a pasty consistence. When mixed with saffron to the consistence of a ductile paste, Velpeau found it a convenient caustic, not liable to spread or be absorbed, and producing an eschar which is promptly detached. It is used also as an ointment, mixed with lard, in the proportion of a drachm to an ounce, in swellings of the knee-joint and other affections. Charpie, corroded by it, is a good application to gangrene.

Toxicological Properties. The symptoms of poisoning by this acid are the following:—Burning heat in the throat and stomach, extreme fetidness of the breath, nausea and excessive vomitings of black or reddish matter, excruciating pains in the bowels, difficulty of breathing, extreme anguish, a feeling of cold on the skin, great prostration, constant tossing, convulsions, and death. Sometimes there is no pain whatever in the stomach; sensibility being apparently destroyed by the violence of the caustic action. The intellectual faculties remain unimpaired. Frequently the uvula, palate, tonsils, and other parts of the fauces are covered with black or white sloughs. The treatment consists in the administration of large quantities of magnesia, or, if this be not at hand, of solution of soap. The safety of the patient depends upon the greatest promptitude in the application of the antidotes. After the poison has been neutralized, mucilaginous and other bland drinks must be taken freely. According to Dr. Geoghegan, the acid may be detected, after death, in the blood and the parenchymatous viscera, especially the liver. It is found, not as a sulphate, but combined severally with the colouring matter and tissues.

The holes burnt in linen by sulphuric acid, so long as the texture is undisturbed, are distinguished from those produced by red-hot coals, by the paste-like characters of the edges of the former. (*Masclika*, of Prague.)

Uses in the Arts. Sulphuric acid is more used in the arts than any other acid. It is employed to obtain many of the other acids; to extract soda from common salt; to make alum and sulphate of iron, when these salts command a good price, and the acid is cheap; to dissolve indigo; to prepare skins for tanning; to prepare phosphorus, chlorinated lime, sulphate of magnesium, &c. The arts of bleaching and dyeing cause its principal consumption.

Pharm. Uses. In preparing Acidum Citricum, *Br.;* Acidum Hydrochloricum, *Br.;* Acidum Hydrocyanicum Dilutum; Acidum Tartaricum, *Br.;* Æther; Argenti Cyanidum, *U. S.;* Chloroformum, *Br.;* Chloroformum Purificatum, *U. S.;* Ferrum Redactum, *Br.;* Hydrargyri Chloridum Corrosivum, *U. S.;* Hydrargyri Chloridum Mite, *U. S.;* Hydrargyri Cyanidum, *U. S.;* Pyroxylon, *U. S.;* Sodæ Phosphas, *Br.;* Sodii Phosphas, *U.S.;* Sodæ Valerianas, *Br.;* Spiritus Ætheris Nitrosi; Veratria, *U. S.*

Off. Prep. Acidum Sulphuricum Aromaticum; Acidum Sulphuricum Dilutum; Acidum Sulphurosum; Aluminii Sulphas, *U. S.;* Atropiæ Sulphas, *U. S.;* Beberiæ Sulphas, *Br.;* Cadmii Sulphas, *U. S.;* Cupri Sulphas, *Br.;* Ferri Sulphas; Ferri Sulphas Granulata, *Br.;* Hydrargyri Sulphas, *Br.;* Hydrargyri Sulphas Flava, *U. S.;* Liquor Ferri Persulphatis, *Br.;* Liquor Ferri Subsulphatis, *U. S.;* Liquor Ferri Tersulphatis, *U. S.;* Oleum Æthereum, *U. S.;* Quiniæ Sulphas, *U. S.;* Zinci Sulphas, *Br.* B.

ACIDUM TARTARICUM. *U. S., Br.*

Tartaric Acid.

"An Acid, $2HO,C_8H_4O_{10}$; a crystalline acid prepared from the Acid Tartrate of Potash." *Br.*

Acide tartrique, *Fr.;* Weinsteinsäure, *Germ.;* Acido tartarico, *Ital., Span.*

Tartaric acid is placed, in the U.S. Pharmacopœia, in the Materia Medica list, as an article to be purchased from the manufacturing chemist. In the Br. Pharmacopœia a process is given for its preparation. It is extracted from *tartar*, a peculiar substance which concretes on the inside of wine casks, being deposited there during the fermentation of the wine. Tartar, when purified and reduced to powder, is the cream of tartar of the shops, and consists of two eqs. of tartaric acid united to one of potassa. (See *Potassæ Bitartras.*) The following is the British process.

"Take of Acid Tartrate of Potash *forty-five ounces* [avoirdupois]; Distilled Water *a sufficiency;* Prepared Chalk *twelve ounces and a half* [avoird.]; Chloride of Calcium *thirteen ounces and a half* [avoird.]; Sulphuric Acid *thirteen fluidounces.* Boil the Acid Tartrate of Potash with two gallons [Imperial measure] of the Water, and add gradually the Chalk, constantly stirring. When the effervescence has ceased, add the Chloride of Calcium dissolved in two pints [Imp. meas.] of the Water. When the tartrate of lime has subsided pour off the liquid, and wash the tartrate with Distilled Water until it is rendered tasteless. Pour the Sulphuric Acid, first diluted with three pints [Imp. meas.] of the Water, on the tartrate of lime, mix thoroughly, boil for half an hour with repeated stirring, and filter through calico. Evaporate the filtrate at a gentle heat until it acquires the sp. gr. of 1·21, allow it to cool, and then separate and reject the crystals of sulphate of lime which have formed. Again evaporate the clear liquor till a film forms on its surface, and allow it to cool and crystallize. Lastly purify the crystals by solution, filtration (if necessary), and recrystallization." *Br.*

Tartaric acid was first obtained in a separate state by Scheele in 1770. The process consists in saturating the excess of acid in bitartrate of potassium or cream of tartar with carbonate of calcium, and decomposing the resulting insoluble tartrate of calcium by sulphuric acid, which precipitates in combination with the lime, and liberates the tartaric acid. The equivalent quantities are one eq. of bitartrate, and one of carbonate of calcium. The process, when thus conducted, furnishes the second equivalent, or excess of acid only of the bitartrate. The other equivalent may be procured, as in the British process, by decomposing the neutral tartrate of potassium, remaining in the solution after the precipitation of the tartrate of calcium, by chloride of calcium in excess. By double decomposition, chloride of potassium will be formed in solution, and a second portion of tartrate of calcium will precipitate, which may be decomposed by sulphuric acid together with the first portion. The process, when thus conducted, will, of course, furnish twice as much tartaric acid as when the excess of acid only is saturated and set free.

Preparation on the Large Scale. The process pursued on the large scale is different from that above given. The decompositions are effected in a wooden vessel, closed at the top, called a generator, of the capacity of about 2000 gallons, and furnished with an exit-pipe for carbonic acid, and with pipes, entering the sides of the generator, for the admission of steam and of cold water respectively. Into the generator, about one-fourth filled with water, 1500 pounds of washed chalk (carbonate of calcium) are introduced, and the whole is heated by a jet of steam, and thoroughly mixed by an agitator, until a uniform mass is obtained. About two tons of tartar are now introduced by degrees, and thoroughly mixed. The carbonate of calcium is decomposed, the carbonic acid escapes by the exit-pipe, and the lime unites with the excess of tartaric acid to form tartrate of calcium, which precipitates; while the neutral tartrate of potassium remains in solution. The next step is to decompose the tartrate of potassium, so as to convert its tartaric acid into tartrate of calcium. This is effected by the addition of sulphate of calcium in the state of paste, which, by double decomposition, forms a fresh portion of tartrate of calcium, while sulphate of potassium remains in solution. The solution of sulphate of potassium, when clear, is drawn off into suitable reservoirs, and the remaining tartrate of calcium is washed with several charges of cold water, the washings being preserved. The tartrate of calcium, mixed with sufficient water, is now decomposed by the requisite quantity of sulphuric acid, with the effect of forming sulphate of calcium, and liberating the tartaric acid, which remains in solution. The whole is now run off into a wooden back, lined with lead, furnished with a perforated false bottom, and covered

throughout with stout twilled flannel. Through this the solution of tartaric acid filters, and the filtered liquor passes through a pipe, leading from the bottom of the back, to suitable reservoirs. The sulphate of calcium is then washed until it is tasteless, and the whole acid liquor is evaporated, in order to crystallize. The evaporation is effected in wooden vessels, lined with lead, by means of steam circulating in coils of lead-pipe, care being taken that the heat does not exceed 165°. The vacuum-pan is used with advantage in evaporating the acid solution; as it furnishes the means of concentration at a lower temperature. When the acid liquor has attained the sp. gr. of about 1·5, it is drawn off into sheet-lead, cylindrical, crystallizing vessels, capable of holding 500 pounds of the solution. These crystallizers are placed in a warm situation, and, in the course of three or four days, a crop of crystals is produced in each, averaging 200 pounds. These crystals being somewhat coloured, are purified by redissolving them in hot water. The solution is then digested with purified animal charcoal, filtered, again concentrated, and crystallized. The crystals, having been washed and drained, are finally dried on wooden trays, lined with thin sheet-lead, placed in a room heated by steam. The mother-liquors of the first crystallization are again concentrated, and the crystals obtained, purified by animal charcoal as before. When the residuary liquors are no longer crystallizable, they are saturated with chalk, and converted into tartrate of calcium, to be added to the product of a new operation. In order to obtain fine crystals of tartaric acid, it is necessary to use a slight excess of sulphuric acid in decomposing the tartrate of calcium. (*Pharm. Journ. and Trans.*, Feb. 1851.) The merit of this process consists in the greater economy of sulphate of calcium over chloride of calcium for decomposing the tartrate of potassium.

Dr. Price, of England, has made some improvements in the above process, which are described, in detail, in the London *Pharmaceutical Journal and Transactions* (Jan. 1854, p. 315). The main point in his improvements is to convert the crude tartar into tartrate of potassium and ammonium by means of ammoniacal liquor, which gives a soluble double salt, comparatively free from organic colouring matter and other impurities, and, therefore, favourable for conversion into tartrate of calcium by the usual methods. Mr. Pontifex, of England, has obtained a patent for an improvement in manufacturing tartaric acid, which consists in evaporating in vacuo. (*Ibid.*, Feb. 1857, p. 430.)

Liebig has succeeded in preparing tartaric acid artificially by the oxidation of sugar of milk, and other substances, by nitric acid; and the resulting product has been found to be identical in all respects, even in its influence on polarized light, with the acid derived from grapes.

Properties. Tartaric acid is a white crystallized solid, in the form of irregular six-sided prisms. Sometimes two opposite sides of the prism become very much enlarged, so as to cause the crystals to present the appearance of tables. The Br. Pharmacopœia states that the primary form is the oblique rhombic prism. As found in the shops, it is in the form of a fine white powder, prepared by pulverizing the crystals. It is unalterable in the air, and possesses a strong acid taste, which becomes agreeable when the acid is sufficiently diluted with water. It is soluble in a little less than its weight of cold water, and in half its weight of boiling water. It is also soluble in alcohol. A weak solution undergoes spontaneous decomposition by keeping, becoming covered with a mouldy pellicle; but, if boiled and filtered, it is said to lose this tendency. (W. H. Wood, *Chem. News*, Nov. 24, 1871, p. 246.) In the form of crystals it always contains combined water, from which it cannot be separated without the substitution of a base. In uniting with bases, it has a remarkable tendency to form double salts, several of which constitute important medicines. It combines with several of the vegetable organic alkalies, so as to form salts. It is distinguished from all other acids by forming a crystalline precipitate, consisting of bitartrate of potassium, when added to a neutral salt of that alkali. When associated with an excess of boracic acid, it is detected with difficulty; potassa not precipitating it, even with the addition of acetic or muriatic acid. Its separation, however, may be effected, according to Barfoed, by means of fluoride of potassium, which detaches the boracic acid, to form the fluoborate of potassium, and

renders free the tartaric acid, which then responds to the ordinary test. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 70.) Its most usual impurity is sulphuric acid, which may be detected by the solution affording, with acetate of lead, a precipitate only partially soluble in nitric acid. When incinerated with red oxide of mercury, it leaves no residuum, or a mere trace. The British Pharmacopœia directs that it should give no precipitate with solution of sulphate of calcium, showing the absence of racemic and oxalic acids, or with solution of oxalate of ammonium, which would detect lime, sometimes present in minute proportion. Its solution should not be affected by sulphuretted hydrogen. "One hundred grains saturate 133·5 grains of bicarbonate of potassium." *U. S.* "Seventy-five grains dissolved in water require for neutralization 1000 grain-measures of *the volumetric solution of soda*." *Br.*

Tartaric acid is incompatible with salifiable bases and their carbonates; with salts of potassa, with which it produces a crystalline precipitate of bitartrate; and with the salts of lime and lead, with which it also forms precipitates. It consists, when dry, of four eqs. of carbon 24, two of hydrogen 2, and five of oxygen 40 = 66; and, when crystallized, of one eq. of dry acid 66, and one of water 9 = 75. But, if we agree with the chemists who regard it as bibasic, these numbers must be doubled, and its formula given, as in the British Pharmacopœia, $C_8H_4O_{10}$, or, in its crystallized state, $2HO,C_8H_4O_{10}$. In this view, its ordinary salts, whether with one or two bases, consist of one eq. of acid and two of base; and in the acid or bitartrates, one eq. of base is replaced by one of water, as in the bitartrate of potassium or cream of tartar, the constitution of which would be expressed by the formula $KO,HO + C_8H_4O_{10}$.

Racemic acid, otherwise called *paratartaric* or *uvic acid*, is isomeric with tartaric acid. It exists, naturally, in small proportion, in the juice of grapes, growing in particular localities, and was obtained artificially, in 1853, by M. Pasteur. By combination with certain organic alkalies, M. Pasteur has resolved racemic acid into two acids which form distinct salts with the alkali. The acids in these salts have the power of turning the plane of polarization of polarized light in contrary directions, one to the right, the other to the left, which has caused them to be distinguished as *dextro-* and *lævo-tartaric acids*. Ordinary tartaric acid is dextro-tartaric acid, which may be converted into racemic acid, by exposing it, in the form of tartrate of cinchonia, to a heat of 338° for several hours. At the same time, a portion of tartaric acid is formed, which has no action on polarized light, and which is, therefore, called *inactive tartaric acid*. This acid, like racemic acid, is resolvable into dextro- and lævo-tartaric acids. Accordingly, we have four isomeric tartaric acids — dextro-tartaric (ordinary tartaric acid); lævo-tartaric; racemic, consisting of dextro- and lævo-tartaric acids; and inactive tartaric acid. Racemic acid differs from ordinary tartaric acid in being much less soluble in water, in precipitating the neutral salts of lime, and in want of action on polarized light. When crystallized it contains one eq. more of water than tartaric acid. The *racemates* differ from the tartrates in their crystalline form, and in their less solubility in water.

Medical Properties. Tartaric acid, being cheaper than citric acid, forms, when dissolved in water and sweetened, a good substitute for lemonade. It is much used in medicine to form acid refrigerant drinks and effervescing draughts. It is also employed in making *soda powders* and *Seidlitz powders*, preparations now officinal in the U. S. Pharmacopœia. (See *Pulveres Effervescentes* and *Pulveres Effervescentes Aperientes*, Part II.) Tartaric acid, dried by a gentle heat, and then mixed with bicarbonate of sodium, in the proportion of thirty-five grains of the acid to forty of the bicarbonate, forms a good effervescing powder, the dose of which is a teaspoonful, stirred in a tumbler of water. The powder is generally directed to be kept in well-stopped vials; but Prof. Otto has shown that this direction tends to spoil rather than to preserve it, by preventing the evaporation of some water of crystallization which is set free by a commencing chemical reaction. A better plan is to keep the powder in ordinary boxes. On this subject see remarks by Mr. J. M. Maisch, published in the *Proceedings of the American Pharmaceutical Association* (A. D. 1856, p. 52). The neutralizing power of tartaric acid is about the same as that of citric acid. Tartaric acid, in an overdose, acts as a poison. After death, it may be de-

tected in the blood and liver, from which it should be extracted by absolute alcohol, to avoid the error of mistaking the tartrates for it.*

Off. Prep. Ferri et Ammonii Tartras, *U. S.;* Pulveres Effervescentes, *U. S.;* Pulveres Effervescentes Aperientes, *U. S.;* Sodæ Citrotartras Effervescens, *Br.* B.

ACIDUM VALERIANICUM. *U. S.*

Valerianic Acid.

"Valerianic acid is a colourless liquid, of an oily consistence, a penetrating, disagreeable odour, and caustic taste; and of the sp. gr. 0·935." *U. S.*

Acide valerianique, *Fr.;* Valeriansäure, *Germ.;* Acido valerianico, *Ital., Span.*

This acid was, at the late revision of the U. S. Pharmacopœia, transferred from the Preparations to the Materia Medica, and with great propriety; as valerianic acid is almost always obtained from the manufacturing chemist. The following is the mode of preparing it as directed in the Pharmacopœia of 1860.

"Take of Valerianate of Soda, in coarse powder, *eight troyounces;* Sulphuric Acid, Water, each, *a sufficient quantity.* To the Valerianate of Soda add, first, three fluidounces of Water, and then three troyounces and a half of Sulphuric Acid. Mix them thoroughly, and from the mixture, after standing, separate the oily acid liquid which rises to the surface. Agitate this repeatedly with small portions of Sulphuric Acid until its specific gravity is reduced below 0·950. Then introduce it into a retort, and distil nearly to dryness, rejecting the distillate so long as it has a specific gravity above 0·940, and keeping the remainder for use. The rejected portion of the distillate, after agitation with Sulphuric Acid, may be returned to the retort during the progress of the distillation." *U. S.*

The object of this process is merely to procure valerianic acid in a state adapted for the preparation of valerianate of ammonium. The sulphuric acid, uniting with the soda of the valerianate of sodium, separates the valerianic acid, which rises to the surface with the appearance of an oil. In this state it is combined with more than one eq. of water, and as it is the monohydrated acid that is wanted, the direction is given to agitate it with sulphuric acid which deprives it of the excess of water. It is now distilled in order to separate any sulphuric acid and water that may be mixed with it. The process is that of Mr. B. J. Crew, published in the *Am. Journ. of Pharm.* for March, 1860 (p. 109). Mr. F. C. Musgiller, of Brooklyn, N. Y., states that the acid cannot be obtained by the U. S. process of a sp. gr. so low as 0·933 with ordinary sulphuric acid, and suggests that 0·935 be adopted as the officinal standard; as acid of this strength is equally well adapted for the preparation

* *Solution of Tartrate of Magnesium as a Purgative.* From the relatively high price of citric acid, attempts have been made to substitute for that acid, in the solution of citrate of magnesium, a cheaper acid, which might yield with magnesia an equally acceptable solution. M. E. Leger thinks he has accomplished this object by means of tartaric acid. The ordinary tartaric acid, however, will not answer; as the solution of the magnesian tartrate made with it, though at first limpid, soon becomes turbid, and most of the salt is deposited. But, by employing a metastatic acid into which the ordinary acid is converted at the heat of 170° C., he believes that he has accomplished his object, and prepared a solution having all the desired properties. He prepares the metatartaric acid in the following manner.

Heating over a gentle fire, in a porcelain or preferably silver capsule, a little tartaric acid until it melts, stirring carefully from time to time, he adds successively small portions of fresh acid, taking care not to use so much as to cause the liquid to cool and solidify, and continuing to add until the vessel is two-thirds full. The heat is maintained until the mass, at first pasty and puffed up, becomes completely liquid. When bubbles are formed on the surface, the acid assumes a slight amber hue, and the desired modification has been effected. The vessel is now removed from the fire, and the contents allowed to cool until the acid can be handled without adhering to the fingers, when it is pressed into cakes, quickly cooled, and put into stopped bottles.

In the preparation of the magnesian solution, three-fourths of the water to be used is poured, cold, on a mixture of the acid and carbonate of magnesium (two parts of the former and one of the latter); a very brisk reaction takes place, and in less than ten minutes the solution is complete. Heat must be avoided; as otherwise the acid returns to the former state, and the salt is precipitated. When the acid has been completely modified, the solution will keep unchanged for several weeks. The cathartic action of the tartrate of magnesium is, according to M. Leger, much more certain than that of the citrate, and nearly equal to that of the sulphate. The solution is without unpleasant taste. (*Pharm. Journ.*, July 12, 1873, p. 29; from *Répertoire de Pharm.*, Juin 25, 1873.)—*Note to the fourteenth edition.*

of the valerianates, for which it is used. This suggestion, as to the sp. gr., was adopted at the late revision of the U. S. Pharmacopœia. Mr. Musgiller proposes some modifications of the U. S. process which appear to be judicious. (See *Am. Journ. of Pharm.*, Jan. 1869, p. 83; also *Proceed. of Am. Pharm. Assoc.*, 1868.)

For modes of preparing valerianic acid from the oil and roots of valerian, the reader is referred to the article on Valerian in this work. It is prepared also from fusel oil (amylic alcohol) by reaction with a mixture of bichromate of potassium and sulphuric acid, as the first step in the preparation of valerianate of sodium. (See *Sodæ Valerianas*, Br., Part II.)

Valerianic acid received its name from having been found in the oil distilled from the root of Valeriana officinalis. It is sometimes called also *valeric acid*. It was first obtained in 1817 by Chevreul from the oil of the dolphin, and received the name of *delphinic acid*, which, however, upon the discovery of its identity with the acid afterwards obtained by Pentz from valerian, was superseded by its present title. It has been obtained also from the bark and fruit of Viburnum opulus, the sap-wood of the European elder (Sambucus nigra), the root of Angelica Archangelica, and from various organic products whether of the vegetable or animal kingdom.

Properties. Valerianic acid is a colourless liquid, of an oily consistence, a repulsive odour, recalling, however, that of valerian, and a pungent, sour, acrid, disagreeable taste. Its sp. gr. is variously given from 0·930 at 55° to 0·944 at 50°. (*Gmelin.*) As stated in the U. S. Pharmacopœia, it is 0·935. It remains liquid at 8° below zero, and boils at 270° F. (*Trommsdorff.*) It is soluble in 30 parts of cold water, and when agitated with water takes up about 20 per cent., without losing its oily consistence, and rises to the surface of the liquid. Alcohol and ether mix with it in all proportions. It is very soluble in strong acetic acid, and dissolves camphor and some resins. (*Trommsdorff.*) It forms salts with the alkalies, and reddens litmus paper strongly, but the blue colour gradually returns in a warm place. Its composition is represented by $C_{10}H_{10}O_4$; but it is supposed to bear to fusel oil a similar relation with that between acetic acid and alcohol. Thus, the compound radical *amyl* ($C_{10}H_{11}$) uniting with one eq. of oxygen and one of water forms *fusel oil* ($C_{10}H_{11}O+HO$), which, by the loss of two eqs. of hydrogen and the gain of two of oxygen, becomes monohydrated valerianic acid ($C_{10}H_9O_3+HO$). In this state the acid is capable of uniting with two additional eqs. of water, forming the terhydrated acid ($C_{10}H_9O_3+3HO$), or, if the eq. of water in the dry acid be considered as constitutional, the bihydrated acid ($C_{10}H_{10}O_4+2HO$). This has a much milder taste than the dry or monohydrated acid, and at the same time somewhat saccharine. According to Chiozza, the anhydrous acid ($C_{10}H_9O_3$) may be prepared by treating valerianate of potassium with oxychloride of phosphorus. (*Gmelin's Handbook*, xi. 37.) The U. S. Pharmacopœia gives the following tests of the officinal acid. "A solution of Valerianic Acid in 50 parts of hot water, saturated with hydrated carbonate of zinc, yields a liquid, which, when filtered and evaporated to 10 parts and cooled, affords white pearly crystals of valerianate of zinc. The mother-water, drained from these crystals, should not yield, by further evaporation and cooling, a salt crystallizing in six-sided tables, and very soluble in water. When the Acid is added to a concentrated solution of acetate of copper, the transparency of the solution is not disturbed." The former of the last two tests indicates the absence of acetic, the latter of butyric acid.

Medical Properties and Uses. In the state in which it is obtained by this process, valerianic acid has not been used as a medicine. The acid distilled from the oil or root of valerian has been employed in nervous affections, and possesses properties similar to those of valerian. According to Landerer, the acid artificially produced does not operate therapeutically so satisfactorily as the native product. The dose would probably be about the same as that of the oil of valerian. It may be given in sweetened water.

Off. Prep. Ammonii Valerianas, *U. S.;* Quiniæ Valerianas, *U. S.* W.

ACONITI FOLIA. *U.S., Br.*

Aconite Leaves.

Aconiti Folium, *Pharm.* 1860. *U.S.*

The leaves of Aconitum Napellus. *U.S.* The fresh leaves and flowering tops of Aconitum Napellus, gathered when about one-third of the flowers are expanded. *Br.*

ACONITI RADIX. *U.S., Br.*

Aconite Root.

The root of Aconitum Napellus. *U.S.* The dried root; collected in the winter or early spring before the leaves have appeared. *Br.*

Aconit, *Fr.;* Eisenhut, Mönchskappe, *Germ.;* Aconito Napello, *Ital.;* Aconito, *Span.*

ACONITUM. *Sex. Syst.* Polyandria Trigynia.—*Nat. Ord.* Ranunculaceæ.

Gen. Ch. Calyx none. *Petals* five, the highest arched. *Nectaries* two, peduncled, recurved. *Pods* three or five. *Willd.*

The plants belonging to this genus are herbaceous, with divided leaves, and violet, yellow, or white flowers, in spikes, racemes, or panicles. In the Paris Codex three species were recognised as officinal, *A. Anthora*, *A. Cammarum*, and *A. Napellus;* but the French authorities unite at present with our own and the British in acknowledging only A. Napellus. There has been much difference of opinion as to the plant originally employed by Störck. Formerly thought to be *A. Napellus*, it was afterwards generally believed to be *A. neomontanum* of Willdenow, and by De Candolle was determined to be a variety of his *A. paniculatum*, designated as *Störckianum.* But, according to Geiger, *A. neomontanum* is possessed of little acrimony; and Dr. Christison states that *A. paniculatum*, raised at Edinburgh from seeds sent by De Candolle himself, was quite destitute of that property. Neither of these, therefore, could have been Störck's plant, which is represented as extraordinarily acrid. It is, however, of little consequence which was used by Störck; as many of the species possess similar virtues, and one is frequently substituted for another in the shops. Those are probably the best which are most acrid. Among these certainly is *A. Lycoctonum.** Dr. Christison found *A. Napellus*, *A. Sinense*, *A. Tauricum*, *A. uncinatum*, and *A. ferox* to have intense acrimony; and Geiger states that he has found none equal, in this respect, to A. Napellus. This species is said to yield aconitia most largely. (*Répert. de Pharm.*, Nov. 1859.) *A. uncinatum* and *A. reclinatum* (Gray) are our only indigenous species. Most of the others are natives of the Alpine regions of Europe and Siberia. Those used in medicine appear to be indiscriminately called by English writers *wolfsbane* or *monkshood.* The root of *A. heterophyllum* is said to be used as an antiperiodic in Upper India (*Pharm. Journ. and Trans.*, xvi. 312), and that of *A. Japonicum* as a local anæsthetic in China, as also for poisoning arrows (*Ibid.*, Nov. 1861, p. 263).

Aconitum Napellus. Linn., *Flor. Suec.*, ed. 1755, p. 168.—*A. neubergense.* De Candolle, *Prodrom.* i. 62.—*A. variabile neubergense.* Hayne, *Darstel. und Beschreib.* &c., xii. 14. This is a perennial herbaceous plant, with a spindle-shaped, tapering root, seldom exceeding at top the thickness of the finger, three or four inches or

*M. Hubschmann is said to have extracted two alkaloids from A. Lycoctonum; one in the form of a white powder, insoluble in ether, but soluble in water and alcohol, which he names *acolytin;* the other crystallizable, very soluble in alcohol, and but slightly so in ether or water, and named by him *lycoctonin.* (*Am. Journ. of Pharm.*, July, 1866, p. 376.)—*Note to the thirteenth edition.*

According to Prof. Flückiger, *lycoctonin* is in white acicular crystals, melting like aconitin in boiling water, though at a somewhat higher heat. On cooling it crystallizes only when moistened with water, when the amorphous mass is converted into tufted crystals. It leaves no water upon melting, and combines with none on crystallizing. It readily dissolves in chloroform, and upon evaporation is left as an amorphous varnish, which, on the addition of a little water, becomes strikingly crystalline. It is largely dissolved by sulphide of carbon, ether, alcohol, the fixed and volatile oils, amylic alcohol, and petroleum spirit; but requires 600 parts of boiling water for solution. The solution is bitter and has an alkaline reaction, and with bromine water produces fine yellow crystals; and this effect results, though the solution contain only one part of the alkaloid in 30,000. Lycoctonin is an alkaloid quite distinct from aconitia and pseudaconitia; and is much less poisonous than either. (Flückiger, *Pharm. Journ.*, Aug. 1870, p. 122.)—*Note to the fourteenth edition.*

more in length, brownish externally, whitish and fleshy within, and sending forth numerous long, thick, fleshy fibres. When the plant is in full growth, there are usually two roots joined together, of which the older is dark-brown and supports the stem, while the younger is of a light yellowish-brown, and is destined to furnish the stem of the following year, the old root decaying. The stem is erect, round, smooth, leafy, usually simple, and from two to six or even eight feet high. The leaves are alternate, petiolate, divided almost to the base, from two to four inches in diameter, deep-green upon their upper surface, light-green beneath, somewhat rigid, and more or less smooth and shining on both sides. Those on the lower part of the stem have long footstalks and five or seven divisions; the upper, short footstalks and three or five divisions. The divisions are wedge-form, with two or three lobes, which extend nearly or quite to the middle. The lobes are cleft or toothed, and the laciniæ or teeth are linear or linear-lanceolate and pointed. The flowers are of a dark violet-blue colour, large and beautiful, and are borne at the summit of the stem upon a thick, simple, straight, erect, spike-like raceme, beneath which, in the cultivated plant, several smaller racemes arise from the axils of the upper leaves. Though without calyx, they have two small calycinal stipules, situated on the peduncle within a few lines of the flower. The petals are five, the upper helmet-shaped and beaked, nearly hemispherical, open or closed, the two lateral roundish and internally hairy, the two lower oblong-oval. They enclose two pediceled nectaries, of which the spur is capitate, and the lip bifid and revolute. The fruit consists of three, four, or five pod-like capsules.

The plant is abundant in the mountain forests of France, Switzerland, and Germany. It is also cultivated in the gardens of Europe, and has been introduced into this country as an ornamental flower. Much of the commercial aconite is brought from India, where it appears to be gathered indiscriminately from a number of the indigenous species, of which *A. Napellus*, *A. ferox*, *A. luridum*, and *A. palmatum*, are indicated by Dr. Hooker (*Flora Indica*) as growing in different parts of the Himalayas. The Indian name "*bish*" is given to the aconite from this source. Dr. Hooker states that he has been unable to find any difference in the dried roots of commerce; nor does he think that there is any such difference. (*Pharm. Journ.*, Jan. 1873, p. 563.) All parts of the plant are acrid and poisonous. The leaves and root are used. The leaves should be collected when the flowers begin to appear, or shortly before. After the fruit has formed, they are less efficacious. The root is much more active than the leaves; and an extract from the latter is said to have only one-twentieth of the strength of one made from the former. It should be gathered in autumn or winter after the leaves have fallen, and is not perfect until the second year. It has been mistakenly substituted for horseradish root, as a condiment, with fatal effect; but the possibility of such an event has only to be known to be avoided. The seeds also are acrid. The wild plant is said to be more active than the cultivated. (*Schroff.*) Prof. Wm. Procter has found the roots of the plant cultivated in this country richer in the active alkaline principle than the imported roots; having obtained as much as 0·85 per cent. from the former. (*Proceed. of the Am. Pharm. Association*, A. D. 1860.)

The aconite root is brought into market in packages or bales, originally, in general, either from the continent of Europe or from India. It is of variable quality; some parcels being unobjectionable; while others contain a considerable proportion of inert or defective roots. Dr. E. R. Squibb states, as the result of his observation, that the quality of the parcels has improved of late, and that the proportion of admissible roots has increased from 6 out of 10, to 8. It should never be bought by the apothecary in powder. The best test is the taste; and roots should be rejected which have not in a fair degree the characteristic properties in this respect described below, especially the sensation of numbness and tingling on the tongue, lips, and fauces. According to Dr. Squibb, many parcels of the root, within the last few years, have been entirely or partially tasteless, owing, as he supposes, to having been exhausted before being dried and sent into the market. (*Proceedings of the Am. Pharm. Assoc.*, A. D. 1872.)

Properties. The *fresh leaves* have a faint narcotic odour, most sensible when they

are rubbed. Their taste is at first bitterish and herbaceous, afterwards burning and acrid, with a feeling of numbness and tingling on the inside of the lips, tongue, and fauces, which is very durable, lasting sometimes many hours. When long chewed, they inflame the tongue. The *dried leaves* have a similar taste, but the acrid impression commences later. Their sensible properties and medicinal activity are impaired by long keeping. They should be of a green colour, and free from mustiness. The *root* has a feeble, earthy smell. Though sweetish at first, it has afterwards the same effect as the leaves upon the mouth and fauces. It shrinks much in drying, and becomes darker, but does not lose its acrimony. Those parcels, whether of leaves or roots, should always be rejected, which are destitute of this property. The analysis of aconite, though attempted by several chemists, has not been satisfactorily accomplished. Bucholz obtained from the fresh herb of A. neomontanum, resin, wax, gum, albumen, extractive, lignin, malate and citrate of calcium and other saline matters, besides 83·33 per cent. of water. During the bruising of the herb, he experienced headache, vertigo, &c., though water distilled from it produced no poisonous effect. It was rendered probable by Geiger and Hesse, that there are two active principles in aconite; one easily destructible, upon which the acrimony depends, the other less acrid, alkaline, and capable of exerting a powerful narcotic influence. For the latter the name of *aconitin* or *aconitia* has been proposed. Mr. Thos. B. Groves was unable to obtain any peculiar acrid principle from either the leaves or root by distillation with water; and though, when lime was added, an alkaline distillate was obtained, he found this to owe its alkalinity to ammonia. Mr. Groves, therefore, concluded that aconite contains no peculiar volatile acrid substance, and is disposed to ascribe any loss of acrimony which may take place on drying to the easy destructibility of aconitia; and that any greater acrimony that the root may possess over aconitia is ascribable to an acrid resin with which the root may be said to abound. (*Pharm. Journ. and Trans.*, Sept. 1866, p. 118.) Hesse obtained aconitia from the dried leaves by a process similar to that employed in procuring atropia. (See *Atropia*, Part II.) The U. S. and Br. Pharmacopœias give a process for its preparation. (See *Aconitia*, Part II.) Hubschmann has found in impure commercial aconitia a small proportion of another alkaloid which he names *napellina*.* Messrs. T. and H. Smith, of Edinburgh, have announced the discovery of a new alkaloid in the root, which they propose to name *aconella*, and which bears so close a resemblance to narcotina as to suggest the identity of the two.† Peschier discovered a peculiar acid in aconite, which he called *aconitic acid*. The root contains also mannite and a fatty matter soluble in alcohol.

* *Napellina. Acraconitine* (Ludwig). *Pseudaconitine* (Hubschmann). To obtain this principle, Hubschmann treats the impure aconitia with the least quantity of ether necessary to dissolve the pure alkaloid, dissolves the residue in alcohol, filters the solution, adds acetate of lead so long as it produces a precipitate, again filters, and, having separated the lead by sulphuretted hydrogen and subsequent filtration, evaporates the alcohol, adds an excess of carbonate of potassium, evaporates to dryness, treats the residue with alcohol, passes the solution through animal charcoal, and again evaporates to dryness. The resulting napellina is in the form of a white powder, of a bitter and afterwards burning taste, of decided alkaline properties, but slightly soluble in ether, and not, like aconitia, precipitated from its aqueous solution by ammonia. It contains nitrogen. (See *Am. Journ. of Pharm.*, xxx. 399.)—*Note to the twelfth edition.*

Since the publication of the thirteenth edition, Hubschmann has pushed his investigation into this alkaloid, and satisfactorily shown that there are two distinct alkaloids in aconite roots, which have been more or less confounded in commerce; and very unfortunately; as one is more acrid and poisonous than the other, and could not be safely given in doses which might be innocent in the other. The common *aconitin* or *aconitia*, that which is officinally thus designated, and the one ordinarily kept in the shops, is described as follows by Prof. Flückiger. "It dissolves in 2 parts of ether, 2·6 of chloroform, and 4·2 of alcohol; but does not distinctly crystallize upon evaporation. It produces an intense violet colour with hot, concentrated phosphoric acid, lasting several days. It has an extremely bitter, and but slightly acrid taste. *Pseudaconitine*, as the other has come to be generally named, is but sparingly soluble in ether, chloroform, and even alcohol; but readily crystallizes, especially from its solution in hot alcohol. It has a burning, but not bitter taste, and produces no coloured reaction with concentrated sulphuric, nitric, or phosphoric acid, cold or hot, alone or combined. (*Pharm. Journ.*, Aug. 30, 1870, p. 121.) From these statements it is obvious that the two alkaloids, if existing together, may be easily distinguished and separated.—*Note to the fourteenth edition.*

† *Aconella.* The Messrs. Smith obtained this alkaloid in the following manner. The juice of the fresh root is evaporated to a soft extract, which is exhausted by officinal alcohol. The alcoholic liquid is treated with lime in the proportion of 0·5 per cent. of the root employed. To the liquid,

Medical Properties and Uses. Aconite was well known to the ancients as a powerful poison, but was first employed as a medicine by Baron Störck, of Vienna, whose experiments with it were published in the year 1762. In moderate doses, it has been said to excite the circulation, and to increase the perspiratory and urinary discharges; but these effects are doubtful, and certainly not constant. Schroff, however, states that it generally increases the secretion of urine. According to Dr. Fleming, it is a powerful sedative to the nervous system, reducing also the force of the circulation. In moderate doses, it produces warmth in the stomach and sometimes nausea, general warmth of the body, numbness and tingling in the lips and fingers, muscular weakness, diminished force and frequency of the pulse, and diminished frequency of respiration. From larger doses all these effects are experienced in an increased degree. The stomach is more nauseated; the numbness and tingling extend over the body; headache, vertigo, and dimness of vision occur; the patient complains occasionally of severe neuralgic pains; the pulse, respiration, and muscular strength are greatly reduced; and a state of general prostration may be induced, from which the patient may not quite recover in less than two or three days. The effects of remedial doses begin to be felt in twenty or thirty minutes, are at their height in an hour or two, and continue with little abatement from three to five hours.

In poisonous doses, besides the characteristic tingling in the mouth and elsewhere, aconite occasions burning heat of the œsophagus and stomach, thirst, violent nausea, vomiting, purging, severe gastric and intestinal spasms, headache, dimness of vision with contracted or expanded pupils, numbness or paralysis of the limbs, diminished sensibility in general, stiffness or spasm of the muscles, great prostration, pallid countenance, cold extremities, an extremely feeble pulse, and death in a few hours, sometimes preceded by delirium, stupor, or convulsions. All these effects are not experienced in every case; but there is no one of them which has not been recorded as having occurred in one or more instances. Dissection reveals inflammation of the stomach and bowels, and engorgement of the brain and lungs. Pereira states that, when dogs are opened immediately after death from aconite, no pulsations of the heart are visible. Life may usually be saved by a timely and thorough evacuation of the stomach, and the use of stimulant remedies internally and externally; and it is wonderful how rapidly the patient passes from a state of imminent danger to perfect health. Experiments upon inferior animals appear to have demonstrated a physiological antagonism between aconite and nux vomica, or of their two alkaloids respectively, of which advantage may be taken in treating the poisonous effects of these substances. In a case of extreme poisoning from tincture of aconite in a child, the tincture of nux vomica was administered with the apparent effect of saving

previously filtered, sulphuric acid is gradually added till a precipitate ceases to be produced. After filtration, the alcohol is distilled off, and the watery residue, after separation of a copious dark-green fatty matter, is again filtered. The liquid is now very acid; and it is through this acidity that it retains the aconella; so that all that is required to separate the alkaloid is to neutralize the acid. For this purpose carbonate of sodium is added, at first freely while there is brisk effervescence, but at last gradually, with constant stirring, till the liquid is nearly, but not quite neutralized, when it is to be set aside for a time. The aconitia, which has hitherto accompanied the aconella, remains in the solution provided it be not alkaline, while the latter alkaloid is deposited partially crystallized. After a day or two, it is to be removed, and may be purified by repeated solution in hot alcohol, with the addition of animal charcoal. It is deposited from the alcoholic solution on cooling.

Aconella is thus obtained in snow-white tufts of acicular crystals, which are without taste, though bitter in solution, nearly insoluble in pure water, but very soluble in water acidulated by any acid, soluble in 300 parts of cold and 11·4 parts of boiling alcohol of 0·840, moderately soluble in ether, much more so in acetic ether, and remarkably so in chloroform. It is distinguished by an extraordinary facility of crystallization. It forms salts with the acids, of which only the muriate is crystallizable. It is precipitated from its acidulated solution by tincture of iodine. Tannic acid precipitates its oxalate but not its muriate. Its solution in acids, even in contact with an excess of the base, reddens litmus, though the alkaloid itself restores the blue of litmus paper feebly reddened by acids. It is not poisonous; the Messrs. Smith gave 15 grains to a cat without apparent inconvenience. In all these points it resembles *narcotina*, and its combining number was found virtually to be the same. Hence the Messrs. Smith, as stated in the text, are disposed to consider it identical with that alkaloid.

An important practical consideration is that aconella probably often constitutes an unintentional impurity of aconitia, being precipitated along with it in its preparation. Hence in some degree may be accounted for the frequent relative weakness of the aconitia of the shops. (*Pharm. Journ. and Trans.*, Jan. 1864, p. 317.)—*Note to the twelfth edition.*

life. (Hanson, *Boston Med. and Surg. Journ.*, Sept. 26, 1861.) But reliance should not be placed on this antidote to the exclusion of emetic and stimulant measures. Applied to the skin, aconite occasions heat and prickling or tingling, followed by numbness, and, if in contact with a wound, produces its peculiar constitutional effects. Applied to the eye, it causes contraction of the pupil. In relation to its mode of action, it appears to be locally irritant, and, at the same time, entering the system, to operate powerfully on the brain, spinal marrow, and nerves, directly diminishing their power, and thus producing, to a greater or less extent, paralysis both of sensation and motion. The heart also feels this paralyzing influence, and hence proceeds the great depression of the pulse under the full action of the medicine.

Aconite has been employed in rheumatism, neuralgia, gout, anginose and catarrhal affections, scrofula, phthisis, metastatic abscess and other cases of purulent infection, secondary syphilis, carcinoma, certain cutaneous diseases, hooping-cough, amaurosis, deafness, paralysis, epilepsy, intermittent fever, dropsies, and hypertrophy of the heart. It has long enjoyed, in Germany, a high reputation as a remedy in rheumatism; and has recently come into great vogue elsewhere in the treatment of that disease, especially in its chronic and neuralgic forms. By some practitioners it is considered as one of the most effectual remedies in neuralgia, in which it is used both internally and as a local application. Dr. Fleming considers it highly useful as an antiphlogistic remedy, and especially applicable to cases of active cerebral congestion or inflammation; while it is contraindicated in the headache of anæmia, and in all cases attended with a torpid or paralytic condition of the muscular system. Cazenave has found it very useful in cutaneous eruptions with extreme sensibility of the skin; and it is said sometimes to check excessive sweating. It may be administered in powder, extract, or tincture. The dose of the powdered leaves is one or two grains, of the extract from half a grain to a grain, of the tincture of the leaves twenty or thirty drops, to be repeated twice or three times a day, and gradually increased till the effects of the medicine are experienced. The preparation now most employed is probably the strong tincture of the root, *Tinctura Aconiti Radicis, U. S.* Of this, from five to ten drops may be given three times a day, and gradually increased till its effects become obvious. It is very important to distinguish between the tincture of the leaves and the strong tincture of the root just referred to. Few patients will bear at first more than ten minims of the latter. Very properly, we think, the tincture of the leaves was abandoned at the last revision of the U. S. Pharmacopœia. Aconite may be used externally in the form of the saturated tincture of the root, of extract mixed with lard, of a plaster or liniment, or of *aconitia*. The tincture may be applied by means of a soft piece of sponge, fastened to the end of a stick.

Off. Prep. of the Leaves. Extractum Aconiti.

Off. Prep. of the Root. Aconitia; Emplastrum Aconiti, *U. S.;* Linimentum Aconiti; Tinctura Aconiti, *Br.;* Tinctura Aconiti Radicis, *U. S.* W.

ADEPS. *U. S.*

Lard.

The prepared fat of Sus Scrofa. Lard should be free from saline matter. Below the temperature of 90°, it is a soft solid. *U. S.*

Off. Syn. ADEPS PRÆPARATUS. The purified fat of the hog, Sus scrofa. *Br.* Axungia, *Lat.;* Axonge, Graisse, Saindoux, *Fr.;* Schweineschmalz, *Germ.;* Grasso di porco, Lardo, *Ital.;* Manteca de puerco, Lardo, *Span.*

Lard is the prepared fat of the hog. The Br. Pharmacopœia gives a process for its preparation; but in this country it is generally purchased by the druggists already prepared. The adipose matter of the omentum and mesentery, and that around the kidneys, are usually employed; though the subcutaneous fat is said to afford lard of a firmer consistence. In the crude state it contains membranes and vessels, and is more or less contaminated with blood, from all which it must be freed before it can be fit for use. For this purpose, the fat, having been deprived as far as possible by the hand of membranous matter, is cut into pieces, washed with water till the liquor ceases to be coloured, and then melted, usually with a small portion of water, in a

copper or iron vessel, over a slow fire.* The heat is continued till all the moisture is evaporated, which may be known by the transparency of the melted fat, and the absence of crepitation when a small portion of it is thrown into the fire. Care should be taken that the heat is not too great; as otherwise the lard might be partially decomposed, acquire a yellow colour, and become acrid. This may be guarded against by using a water-bath in melting the lard. The process is completed by straining the liquid through linen, and pouring it into suitable vessels, in which it concretes upon cooling. To render it, however, perfectly free from particles of membrane and tissue, which are often the cause of rancidity, and unfit lard for its finer and more permanent uses, Mr. Ed. Smith, of Torquay, insists on the necessity of filtering the lard through paper, after freeing it from its coarser impurities by straining through linen. By this author it is recommended that the process of purification should be completed by remelting the lard, by means of a water-bath, and then carefully filtering it through paper in a warm closet. (*Pharm. Journ.*, Sept. 1869, p. 131.) Lard may be rendered quite inodorous by melting it, when fresh, by means of a salt-water bath, adding a little alum or common salt, continuing the heat till a scum rises which is to be skimmed off, and, after the lard has concreted, separating the saline matter by washing it thoroughly with water. For a particular account of the process, see the *Am. Journ. of Pharm.* (xxviii. 176).

The following is the process of the British Pharmacopœia for preparing lard. "Take of the internal fat of the abdomen of the hog, perfectly fresh, *fourteen pounds*. Remove as much of the membranes as possible, cut the fat into small pieces, put it into a suitable vessel with about four gallons of cold water, and, while a current of water is running through the vessel, break up the masses of fat with the hands, exposing every part to the water, so that whatever is soluble may thus be dissolved and carried away. Afterwards collect the washed fat on a sieve or in a cloth, drain away as much as possible of the water, liquefy the fat at a heat not exceeding 212°, and strain through flannel, pressing the residue while hot; then put it into a pan heated by steam, and keep it at a temperature a little but not much above 212°, stirring it continually, until it becomes clear and entirely free from water; finally strain it through flannel." *Br.*

Lard, as offered for sale, often contains common salt, which renders it unfit for pharmaceutic purposes. This may be detected, when the quantity is insufficient to be sensible to the taste, by means of nitrate of silver, which will produce a precipitate of chloride of silver with water in which the salted lard has been boiled, after cooling and filtration. To free it from this impurity, it may be melted with twice its weight of boiling water, the mixture well agitated and set aside to cool, and the fat then separated. American lard is said to be adulterated, in England, with water, starch, and a small proportion of alum and quicklime, which render it whiter, but unfit for medical use. The Br. Pharmacopœia provides against the admixture of starch by directing that distilled water, in which it has been boiled, should not be rendered blue by the addition of solution of iodine. Considerable quantities of lard have been imported into France from the United States, adulterated with 25 per cent. of a jelly-like substance, supposed to be extracted from Irish moss. This was separated by treating the lard with boiling water. (*Journ. de Pharm.*, 1855, p. 455.)

Properties. Lard is white, inodorous, with little taste, of a soft consistence at ordinary temperatures, fusible at about 100° F., insoluble in water, partially soluble in alcohol, entirely so in ether and the volatile oils, dissolved and decomposed by the stronger acids, and converted into soap by reaction with the alkalies. When melted, it readily unites with wax and resins. According to Braconnot, it contains, in 100 parts, 62 of *olëin* or the liquid principle of oils, and 38 of *stearin* or the concrete principle. But M. Le Canu ascertained that the stearin of Braconnot consisted of two distinct substances, differing in fusibility and solubility. For the least fusible of these he

* Prof. Procter recommends the following method of operating. After careful removal of the membranes and adhering flesh, the crude lard is to be cut into small pieces, malaxated with successive portions of cold water until this remains clear, and then heated moderately, in a tinned vessel, until the melted fat becomes perfectly clear and anhydrous. Lastly, it is to be strained into earthen pots, being occasionally stirred as it cools; and the pots should be securely covered with waxed or varnished paper, and kept in a cool, dry cellar. (*Am. Journ. of Pharm.*, xxxv. 114.)—*Note to the twelfth edition.*

retained the name of stearin, and to the other applied that of *margarin*, from its resemblance to the principle of the same name in vegetable oils. Most fats and oils of animal origin are composed of these ingredients, upon the relative proportion of which their consistence respectively depends. The liquid and concrete principles may be obtained separate by the action of boiling alcohol, which deposits the latter on cooling, and yields the former upon evaporation. Another method is to compress fat, or oil congealed by cold, between the folds of bibulous paper. The olein is absorbed by the paper, and may be separated by compression under water; the stearin and margarin remain.

Olein, stearin, and margarin are now generally considered as compounds respectively of oleic, stearic, and margaric acids with glycerin. For an account of these principles, see *Olea Fixa.* Very good candles are made out of the concrete constituents of lard; and the liquid principle or olein is extensively employed for burning in lamps, and other purposes in the arts. Vast quantities of it are prepared in Cincinnati, Ohio, and much is exported. In France it is said to be largely used for adulterating olive oil.

Exposed to the air, lard absorbs oxygen and becomes rancid. It should, therefore, be kept in well-closed vessels, or procured fresh when wanted for use. In the rancid state, it irritates the skin, and sometimes exercises an injurious reaction on substances mixed with it. Thus, the ointment of iodide of potassium, which is white, when prepared with fresh lard, is said to be more or less yellow when the lard employed is rancid. Rancidity in lard and other fats is prevented by digesting them with benzoin, or poplar buds. (See *Unguenta.*)

Medical Properties and Uses. Lard is emollient, and is occasionally employed by itself in frictions, or in connection with poultices to preserve their soft consistence; but its chief use is in pharmacy as an ingredient of ointments and cerates. It is frequently added to laxative enemata.

Off. Prep. Adeps Benzoatus, *Br.;* Ceratum, *U. S.;* Ceratum Cantharidis, *U. S.;* Ceratum Extracti Cantharidis, *U. S.;* Ceratum Resinæ, *U. S.;* Unguentum, *U. S.;* Ung. Acidi Tannici, *U. S.;* Ung. Antimonii, *U. S.;* Ung. Belladonnæ, *U. S.;* Ung. Benzoini, *U. S.;* Ung. Creasoti, *U. S.;* Ung. Gallæ, *U. S.;* Ung. Hydrargyri, *U. S.;* Ung. Hydrargyri Nitratis, *U. S.;* Ung. Iodinii, *U. S.;* Ung. Iodinii Comp., *U. S.;* Ung. Mezerii, *U. S.;* Ung. Potassii Iodidi, *U. S.;* Ung. Stramonii, *U. S.;* Ung. Sulphuris, *U. S.;* Ung. Sulphuris Iodidi, *U. S.;* Ung. Tabaci, *U. S.;* Ung. Veratriæ, *U. S.;* Ung. Simplex, *Br.* W.

ALCOHOL. *U. S.*

Alcohol.

Spirit of the specific gravity 0·835. *U. S.*

Off. Syn. SPIRITUS RECTIFICATUS. *Rectified Spirit.* Alcohol, $C_4H_6O_2$, with 16 per cent. of water, of the sp. gr. 0·838. *Br.*

Rectified spirit, Spirit of wine; Alcohol, Esprit de vin, *Fr.;* Rectificirter Weingeist, *Germ.:* Alcoole, Acquavite rectificata, *Ital.;* Alcohol, Espiritu rectificado de vino, *Span.*

ALCOHOL DILUTUM. *U. S.*

Diluted Alcohol.

Alcohol mixed with an equal measure of Distilled Water. The specific gravity is 0·941. *U. S.*

Off. Syn. SPIRITUS TENUIOR. *Proof Spirit.* Made by mixing five pints of Rectified Spirit with three pints of Distilled Water. Sp. gr. 0·920. *Br.*

ALCOHOL FORTIUS. *U. S.*

Stronger Alcohol.

Spirit of the specific gravity 0·817. *U. S.*

From the titles and definitions above given, which include all the forms of alcohol recognised by the U. S. and Br. Pharmacopœias, it will be perceived that there are

three officinal strengths of Alcohol, those being considered the same which approach nearly in specific gravity, and are employed for similar purposes. Of these, two are common to both Pharmacopœias; Alcohol, U.S. (sp.gr. 0·835), corresponding with Spiritus Rectificatus, Br. (sp.gr. 0·838); and Diluted Alcohol, U.S. (sp.gr. 0·941), corresponding with Spiritus Tenuior or Proof Spirit, Br. (sp.gr. 0·920). The third, Alcohol Fortius or Stronger Alcohol (sp.gr. 0·817), is peculiar to our own officinal standard. As they are all placed in the Materia Medica Catalogue of the U. S. Pharmacopœia, they will all be considered here.

Alcohol, in the chemical sense, is a peculiar liquid, generated for the most part in vegetable juices and infusions by a *fermentation*, called the *vinous* or *alcoholic*. The liquids which have undergone it are called vinous liquors, and are of various kinds. Thus, the fermented juice of the grape is called wine; of the apple, cider; and the fermented infusion of malt, beer.

With regard to the nature of the liquids susceptible of the vinous fermentation, however various they may be in other respects, one general character prevails; that, namely, of containing sugar in some form or other. It is found, further, that, after they have undergone the vinous fermentation, the sugar they contain has either wholly or in part disappeared; and it was long believed that the only new products are alcohol which remains in the liquid, and carbonic acid which escapes during the process; and that these, when taken together, are equal in weight to the sugar lost. It was hence inferred that sugar is the subject-matter of the changes that occur during the vinous fermentation, and that it is resolved into alcohol and carbonic acid. More recently, however, it has been shown by M. Pasteur that, along with alcohol and carbonic acid, glycerin and succinic acid are also generated, and that the process is not so simple as at first supposed. Indeed, a peculiar alkaloid is said to have been detected as a result of vinous fermentation. (Oser, *J. de Pharm.*, Juillet, 1868, p. 80.)

Sugar will not undergo the vinous fermentation by itself; but requires to be dissolved in water, subjected to the influence of a ferment, and kept at a certain temperature. Accordingly, sugar, water, the presence of a ferment, and the maintenance of an adequate temperature may be deemed the prerequisites of the vinous fermentation. The water acts by giving fluidity, and the ferment and temperature by commencing and maintaining the chemical changes. The precise manner in which the ferment operates has not been positively determined; but the fermentative change seems to be intimately connected with the multiplication of a microscopic vegetable, in the form of diaphanous globules, contained in the ferment, and called *torula cerevisiæ*. Pasteur has rendered it highly probable that the yeast plant lives and grows at the expense of the sugar, which is converted partly into the tissue of the plant, partly into alcohol and those other products which have been proved to result from vinous fermentation. The proper temperature for conducting the vinous fermentation ranges from 60° to 90°.

Certain vegetable infusions, as those of potatoes and rice, though consisting almost entirely of starch, are, nevertheless, capable of undergoing the vinous fermentation, and form seeming exceptions to the rule, that sugar is the only substance susceptible of this fermentation. The apparent exception is explained by the circumstance, that starch is susceptible of a spontaneous change which converts it into sugar. How this change takes place is not well known, but it is designated by some authors as the *saccharine fermentation*. Thus, Kirchoff proved that, if a mixture of gluten from flour, and starch from potatoes be put into hot water, the starch will be converted into sugar. When, therefore, starch is apparently converted into alcohol by fermentation, it is supposed that it passes through the intermediate state of sugar. According to Berthelot, mannite, glycerin, and similar substances may be made to ferment by contact, for several weeks, with chalk and cheese at 104°; and the change takes place without the production of sugar, provided chalk is present. M. Arnoult has succeeded in obtaining alcohol by fermenting sugar (glucose), formed by the action of sulphuric acid on poplar wood sawdust, which yielded from 70 to 80 per cent. of this kind of sugar.

Alcohol, being the product of the vinous fermentation, necessarily exists in all vinous liquors, and may be obtained from them by distillation. Formerly it was

supposed that these liquors did not contain alcohol, but were merely capable of furnishing it, in consequence of a new arrangement of their ultimate constituents, the result of the heat applied. Brande, however, disproved this idea, by showing that alcohol may be obtained from all vinous liquors without the application of heat, and therefore must pre-exist in them. His method of separating it consists in precipitating the acid and colouring matter from each vinous liquor by subacetate of lead, and removing the water by carbonate of potassium. According to Gay-Lussac, litharge, in fine powder, is the best agent for precipitating the colouring matter.

In vinous liquors, the alcohol is largely diluted with water, and associated with colouring matter, volatile oil, extractive, etherial substances, and various acids and salts. In purifying it, we take advantage of its volatility, which enables us to separate it by distillation, combined with some of the principles of the vinous liquor employed, and more or less water. The distilled product of vinous liquors forms the different *ardent spirits of commerce.* When obtained from wine, it is called brandy; from fermented molasses, rum; from cider, malted barley, or rye, whisky; from malted barley and rye-meal with hops, and rectified from juniper berries, Holland gin; from malted barley, rye, or potatoes, and rectified from turpentine, common gin; and from fermented rice, arrack. These spirits are of different strengths, that is, contain different proportions of alcohol, and have various peculiarities by which they are distinguished by the taste. Their strength is accurately judged of by the specific gravity, which is always less in proportion as their concentration is greater. When they have the sp. gr. 0·920 (0·91984, *Drinkwater*), they are designated in commerce by the term *proof spirit.* If lighter than this, they are said to be above proof; if heavier, below proof; and the percentage of water, or of spirit of 0·825, necessary to be added to any sample of spirit to bring it to the standard of proof spirit, indicates the number of degrees the given sample is above or below proof. Thus, if 100 volumes of a spirit require 10 volumes of water to reduce it to proof spirit, it is said to be "10 over proof." On the other hand, if 100 volumes of a spirit require 10 volumes of spirit, of 0·825, to raise it to proof, it is said to be "10 under proof."

Proof spirit is still very far from being pure; being a dilute alcohol, containing about half its weight of water, together with a peculiar oil and other foreign matters. It may be further purified and strengthened by redistillation, or *rectification* as it is called. Whisky is the spirit usually employed for this purpose; and from every hundred gallons, between fifty-seven and fifty-eight may be obtained, of the average strength of rectified spirit (sp. gr. 0·835), corresponding with the *Alcohol* of the U. S. Pharmacopœia, and very nearly with the *Spiritus Rectificatus* of the British. When this is once more cautiously distilled, it will be further purified from water, and the sp. gr. attained will be about 0·825, which is the lightest spirit that can be obtained by ordinary distillation, and is the pure spirit of the British system of excise. It still, however, contains 11 per cent. of water. In the mean while, the spirit, by these repeated distillations, becomes more and more freed from the contaminating oil, called *grain oil* or *fusel oil.* (See *Alcohol Amylicum.*) We shall first consider the general properties of alcohol, and afterwards the different officinal forms.

Properties. Alcohol, using this term in a generic sense, is a colourless, transparent, volatile liquid, of a penetrating, agreeable odour, and burning taste. It should be free from foreign odour, which, when present, is owing to fusel oil. When free from water, it is called *anhydrous* or *absolute alcohol.* It is inflammable, and burns without smoke or residue, forming water and carbonic acid. Its flame is bluish when strong, but yellowish when weak. It combines in all proportions with water and ether; and, when diluted with distilled water, preserves its transparency. Its density varies with the proportion of water it contains. When of the sp. gr. 0·820, its boiling point is at 176°. Its value depends upon the quantity of absolute alcohol contained in it; and, as this is greater in proportion as the sp. gr. is less, it is found convenient to take the density of a sample in estimating its strength. This is done by instruments called hydrometers, which, when allowed to float in the spirit, sink deeper into it in proportion as it is lighter. Each hydrometer strength has a corresponding specific gravity; and, by referring to tables constructed for the pur-

pose, the percentage of absolute alcohol is at once shown. Dr. W. H. Pile, maker of hydrometers, of this city, graduates instruments showing specific gravity at once, which are exceedingly convenient.

Alcohol is capable of dissolving a great number of substances; as, for example, sulphur and phosphorus in small quantity, iodine and ammonia freely, and potassa, soda, and lithia in the caustic state, but not as carbonates. Among organic substances, it is a solvent of the organic vegetable alkalies, urea, tannic, citric, and tartaric acids, sugar, mannite, camphor, resins, balsams, volatile oils, and soap. It dissolves the fixed oils sparingly, except castor oil, which is abundantly soluble. It acts on most acids, forming ethers with some, and effecting the solution of others. All deliquescent salts are soluble in alcohol, except carbonate of potassium; while the efflorescent salts, and those either insoluble or sparingly soluble in water are mostly insoluble in it. It dissolves muriate of ammonium, and most of the chlorides readily soluble in water; also some nitrates, but none of the metallic sulphates.

A method of detecting alcohol in small proportions has been proposed by M. Carstanjin. The liquid supposed to contain it, having been mixed with platinum black in a small flask, is heated to 124° F., well shaken, and filtered. To the filtrate a few drops of solution of potassa is added, and the liquor evaporated to dryness on a water-bath. The residue is then heated with a little arsenious acid; when, if alcohol is present, a garlic odour will be perceived, owing to the production of cacodyl. According to M. Nickles, however, propylic alcohol would produce the same result. (*Am. J. of Pharm.*, Sept. 1865, p. 334.)

The table below, constructed by Lowitz and improved by Thomson, gives the sp. gr. of different mixtures by weight of absolute alcohol and water. H. von Baumhauer has inferred from his experiments that the results in the table are not entirely correct. The inaccuracies, however, admitting the results of Baumhauer, are not so great as to be of much importance in a pharmaceutic point of view. (See *Am. Journ. of Pharm.*, July, 1860, p. 1.)

Table of the Specific Gravity of different Mixtures by Weight of Absolute Alcohol and Distilled Water, at the Temperature of 60°.

100 parts.		Sp. Gr. at 60°.	100 parts.		Sp. Gr. at 60°.	100 parts.		Sp. Gr. at 60°.	100 parts.		Sp. Gr. at 60°.
Alc.	Wat.		Alc.	Wat.		Alc.	Wat.		Alc.	Wat.	
100	0	·796*	76	24	·857	52	48	·912	28	72	·962
99	1	·798	75	25	·860	51	49	·915	27	73	·963
98	2	·801	74	26	·863	50	50	·917	26	74	·965
97	3	·804	73	27	·865	49	51	·920¶	25	75	·967
96	4	·807	72	28	·867	48	52	·922	24	76	·968
95	5	·809	71	29	·870	47	53	·924	23	77	·970
94	6	·812	70	30	·871	46	54	·926	22	78	·972
93	7	·815	69	31	·874	45	55	·928	21	79	·973
92	8	·817†	68	32	·875	44	56	·930	20	80	·974
91	9	·820	67	33	·879	43	57	·933	19	81	·975
90	10	·822	66	34	·880	42	58	·935	18	82	·977
89	11	·825‡	65	35	·883	41	59	·937	17	83	·978
88	12	·827	64	36	·886	40	60	·939	16	84	·979
87	13	·830	63	37	·889	39	61	·941**	15	85	·981
86	14	·832	62	38	·891	38	62	·943	14	86	·982
85	15	·835ℨ	61	39	·893	37	63	·945	13	87	·984
84	16	·838‖	60	40	·896	36	64	·947	12	88	·986
83	17	·840	59	41	·898	35	65	·949	11	89	·987
82	18	·843	58	42	·900	34	66	·951	10	90	·988
81	19	·846	57	43	·903	33	67	·953	9	91	·989
80	20	·848	56	44	·904	32	68	·955	8	92	·990
79	21	·851	55	45	·906	31	69	·957	7	93	·991
78	22	·853	54	46	·908	30	70	·958	6	94	·992
77	23	·855	53	47	·910	29	71	·960			

* Absolute Alcohol.
† Alcohol Fortius, Stronger Alcohol, *U. S.*
‡ Lightest spirit obtained by ordinary distillation.
ℨ Alcohol, *U. S.*
‖ Spiritus Rectificatus, *Br.*
¶ Spiritus Tenuior, Proof Spirit, *Br.*
** Alcohol Dilutum, *U. S.*

1. Absolute Alcohol. *Anhydrous Alcohol.* This, though formerly directed by the Edinburgh and Dublin Colleges, is not now officinal. By the term is implied pure alcohol, entirely free from water. In this state it cannot be obtained by ordinary distillation alone; the purest alcohol thus procured still containing 11 per cent. of water. To separate this it is customary to have recourse to substances having a very strong affinity for water, sufficient not only to abstract it from the alcohol, but to retain it at a temperature at which alcohol will distil over. Soubeiran recommends the following as an easy method for obtaining it, free from water, abundantly and economically. 1st. Rectify alcohol, marking 86° of the centesimal alcoholmeter of Gay-Lussac (rectified spirit), by distilling it from carbonate of potassium. This operation raises its strength to 94° or 95°. 2d. Raise this alcohol to 97° by distilling it with fused chloride of calcium, or by digesting it with quicklime (from which it must be afterwards poured off), in the proportion of a pint of the alcohol to 1½ ounces of the chloride, or 2¼ ounces of the lime. 3d. Distil the product of this operation slowly with quicklime, in the proportion of 3¾ ounces to the pint. The product will be absolute alcohol. The operation may be shortened to two steps, by distilling the alcohol of 94° or 95° with an excess of quicklime (7½ ounces to the pint). In all cases, before decanting or distilling, the alcohol must be digested for two or three days with the lime, at a temperature between 95° and 100° F. Lime will not answer as a substance to be distilled from, unless it be in sufficient excess; for otherwise, towards the end of the distillation, the hydrate of lime formed will yield up its water to the alcohol, and weaken the distilled product.

Properties. Absolute alcohol is a colourless, volatile liquid, of an agreeable odour and burning taste. It boils at 172°, and is not congealed by a cold of 166° below zero. Its sp. gr. is 0·7978 at 68°, according to Regnault; 0·79381 at 60°, according to Drinkwater. The sp. gr. of its vapour is 1·59. Its freedom from water may be ascertained by dropping into it a piece of anhydrous baryta, which will remain unchanged if the alcohol be free from water; but otherwise will fall to powder. Another method for determining the same point is to allow alcohol to stand for some time, in a stoppered bottle, on anhydrous sulphate of copper. If the alcohol be anhydrous, the salt will remain white; otherwise it will become blue. (*Casoria.*) Absolute alcohol should be free from fusel oil.

Absolute alcohol burns with a pale flame without residue, the products being carbonic acid and water. Its vapour, passed through a porcelain tube filled with pumice-stone and heated to redness, yields carbon, gaseous carbohydrogens, aldehyd, naphthalin, benzin, phenic acid, and various other substances. (*Berthelot.*) It unites in all proportions with ether and water. Its union with water is attended by condensation and a rise of temperature. When 51·9 volumes of alcohol are mixed with 48·1 of water, corresponding with one eq. of the former to six of the latter, the decrease of volume is at the maximum, amounting to 3·4 per cent. Berthelot has announced the formation of alcohol synthetically, by uniting olefiant gas with water. In this discovery he was anticipated by the late Mr. Hennel, who published it in 1828.

Composition. Absolute alcohol consists of four eqs. of carbon 24, six of hydrogen 6, and two of oxygen 16 = 46; or, in volumes, of four volumes of the vapour of carbon, six of hydrogen, and one of oxygen, condensed into two volumes. Its empirical formula is, therefore, $C_4H_6O_2$. Viewed as a hydrated oxide of ethyl, its formula is $C_4H_5,O+HO$.

It has been stated at *page* 84, that during the vinous fermentation sugar disappears, and that the sole products had been supposed to be alcohol and carbonic acid, which, taken together, were equal in weight to the sugar lost. Now, the comparative composition of the substances concerned supports the opinion that these are the sole derivatives of a portion of the sugar lost. Preparatory to the fermentation, the cane sugar is changed into *grape sugar*, or, according to Mitscherlich and Soubeiran, into *uncrystallizable sugar*. These two sugars, dried at 212°, consist of $C_{12}H_{12}O_{12}$. Supposing one eq. of this fermentable sugar to be the subject-matter of the change, it will be found to have a composition which admits of its being broken up into two eqs. of alcohol and four of carbonic acid; for $C_{12}H_{12}O_{12}=2(C_4H_6O_2)$ and $4(CO_2)$.

But it does not follow that all the sugar has been converted into alcohol and carbonic acid; and Pasteur, as before stated, has shown that a portion lost has not been thus converted, but has been partly appropriated to the growth of the yeast plant of the ferment, and partly changed into glycerin and succinic acid.

2. Alcohol Fortius. *U. S. Stronger Alcohol*, sp. gr. 0·817. This was an officinal of the Dublin College, which gave a formula for its preparation, and stated its sp. gr. at 0·818. The Stronger Alcohol introduced into the Materia Medica of the U. S. Pharmacopœia, at the revision of 1860, though of the sp. gr. 0·817, and therefore a little stronger than the late Dublin preparation, may for all practical purposes be considered as identical with it. To prepare it on a small scale, carbonate of potassium, previously ignited in a heated mortar, may be mixed with officinal alcohol (sp. gr. 0·835) in a bottle, and shaken occasionally for about four hours; the mixture being, in the mean time, maintained at the temperature of about 100°. Upon resting, the liquid divides into two strata, the lower consisting of a watery solution of carbonate of potassium, the upper of the stronger alcohol, which is to be separated, and distilled so as to obtain the measure of about nine-tenths of the original alcohol employed.

On a large scale, we are informed that alcohol of this strength is now prepared in the U. States, very abundantly, by simple distillation by means of a modified distillatory apparatus. The modification consists in substituting for a single refrigerated receiver, a series of receivers, kept at such temperatures that, in the first of them, the watery vapour shall condense with comparatively little of the alcoholic, which, as it passes through the successive recipients, is more and more deprived of water, until, when condensed in the last, it yields a spirit at least as strong as the officinal Stronger Alcohol of the sp. gr. 0·817. At the same time that the spirit is thus strengthened, it becomes, on the same principle, more and more freed from fusel oil, until at length almost wholly deprived of it.

The properties of this form of spirit do not materially differ from those of officinal alcohol, except in its exemption from fusel oil. The test of the absence of this impurity, or of its presence in only very minute proportion, is that, when "treated with a few drops of solution of nitrate of silver, and exposed to a bright light, the alcohol either remains unchanged, or lets fall a very scanty dark precipitate." *U. S.* Stronger alcohol is used exclusively in the preparation of other officinals, as ether, purified chloroform, ethereal oil, spirit of nitrous ether, &c., for which purpose it was introduced into the Pharmacopœia.

3. Alcohol. *U. S.* Spiritus Rectificatus. *Br. Officinal Alcohol. Rectified Spirit.* This is the form of spirit resulting from the ordinary distillation of ardent spirit, though not the strongest which can be obtained by a repetition of that process, having the sp. gr. 0·835, U. S., or 0·838, Br., while that of the strongest is 0·825. The British preparation contains 16, the U. S. only 15 per cent. of water. Officinal alcohol, though of standard strength, may still be impregnated with a volatile oil, called *fusel oil.* This is usually removed by digesting the alcohol with charcoal. It may also be removed, as well as other impurities, by passing the impure spirit through a filtering bed, composed of sand, wood-charcoal, boiled wheat, and broken oyster-shells, arranged in layers according to the method of Mr. W. Schaeffer. (*Am. Journ. of Pharm.*, Nov. 1854, p. 536.) Another method, proposed by M. Breton, is to add a few drops of olive oil to the spirit in a bottle, which is then to be shaken, allowed to settle, and decanted. The olive oil dissolves and retains the fusel oil. (*Chem. Gaz.*, April 15, 1859, p. 160.) It may be detected by adding a little of the solution of nitrate of silver to the alcohol, and then exposing it to a bright light. If fusel oil be present, it will be converted into a black powder. Officinal alcohol will not withstand this test; as the best contains a little of the foreign oil. According to Mr. E. N. Kent, of New York, nitrate of silver will not detect fusel oil, but affords its indications by reacting with other organic substances. For detecting fusel oil, Mr. Kent finds pure sulphuric acid the best test. To apply it he half fills a test tube with the spirit to be tested, and then fills it up very slowly with pure concentrated sulphuric acid. If the spirit be pure, it will remain colourless, otherwise it will become coloured, the tint being deeper in proportion to the

amount of the impurity. (*New York Journ. of Pharm.*, Aug. 1854.) "Four fluid-ounces, with thirty grain-measures of *the volumetric solution of nitrate of silver*, exposed for 24 hours to bright light, and then decanted from the black powder which has formed, undergoes no further change when again exposed to light with more of the test." *Br.* This admits the presence of a small but limited proportion of fusel oil. The U. S. Pharmacopœia directs that officinal alcohol, when diluted with 20 parts of distilled water, should have little or no foreign odour; the Br. Pharmacopœia, that its odour and taste should be purely alcoholic.

The best alcohol, made in Philadelphia, is that manufactured under Atwood's patent process, in which manganic acid is used to destroy the fusel oil and other foreign substances. This alcohol withstands the tests of nitrate of silver and sulphuric acid remarkably well.

4. Alcohol Dilutum. *U. S.* Spiritus Tenuior. *Br. Diluted Alcohol. Proof Spirit.* The U. S. preparation, which is placed in the Materia Medica, consists of equal measures of officinal alcohol and water, and has the sp. gr. 0·941; the British, for which a process is given, is made by mixing five pints of Rectified Spirit with three pints of Distilled Water, and has the sp. gr. 0·920. The latter is much the stronger of the two, containing only 51 per cent. of water, while the U. S. preparation contains 61 per cent. Considering the purpose to which it is chiefly applied, that of making tinctures, our officinal diluted alcohol is preferable to the British proof spirit; as it has enough alcohol both for solvent effect and preservative influence; and the less there is, when these objects are answered, the better.

Medical Properties, &c. Alcohol is a very powerful diffusible stimulant. It is the intoxicating ingredient in all spirituous liquors, including under this term wines, porter, ale, cider, and every other liquid which has undergone the vinous fermentation. In a diluted state, it excites the system, renders the pulse full, and gives additional energy to the muscles, and temporary exaltation to the mental faculties. It is found to lessen the amount of the excretions, from which fact some physiologists have inferred that it diminishes the disintegration of the tissues. But this is not likely; since the effect of stimulation is to increase function in the tissues, and consequently to cause their waste. Dr. Wood holds the more probable opinion, that alcoholic liquors, besides furnishing some nutriment, act by promoting digestion and sanguification, thus causing a more thorough appropriation of food to nutrition; and that the saving, thus effected, more than counterbalances the waste of the tissues, implied by increased vital action. (See his *Therapeutics*, 3d ed., i. 655.)

In some states of acute disease, characterized by excessive debility, alcohol is a valuable remedy. In chronic diseases, physicians should be cautious in prescribing liquids containing it, for fear of begetting intemperate habits. Externally, alcohol is sometimes applied to produce cold by evaporation; but, when this is repressed, it acts as a stimulant. A mixture of equal parts of rectified spirit and white of egg forms an excellent application to excoriations from pressure, in their early stage, occurring in protracted diseases. It is to be applied frequently by a fine brush or feather, and renewed as it dries, until an albuminous coating is formed over the excoriated surface.

As an article of daily use, alcoholic liquors produce the most deplorable consequences. Besides the moral degradation, their habitual use gives rise to dyspepsia, hypochondriasis, visceral obstructions, dropsy, paralysis, and not unfrequently mania. Colour-blindness is also said to be an occasional result of their excessive use. (R. H. Dirby, *Med. and Surg. Reporter*, April 8, 1871, p. 292.)

Effects as a Poison. When taken in large quantities, alcohol, in the various forms of ardent spirit, produces a true apoplectic state, and occasionally speedy death. The face becomes livid or pale, the respiration stertorous, and the mouth frothy; and sense and feeling are more or less completely lost. Where the danger is imminent, an emetic may be administered, or the stomach-pump used. The affusion of cold water is often useful. An enema of two tablespoonfuls of common salt in a pint of warm water is said to dissipate rapidly the more serious symptoms. As a counter-poison, acetate of ammonium has been found to act with advantage. After death, abundant evidence is furnished of the absorption of the alcohol. By Dr. Percy it has been detected in the brain, by others in the ventricles, and by Dr. Wright in the

urine. According to Dr. Ducheck, alcohol undergoes, in the system, continued combustion, producing intermediate products, among which is aldehyd, to the presence of which in the blood he attributes intoxication. Mr. R. D. Thomson has proposed the following test for detecting alcohol in medico-legal investigations. Distil one-third of the suspected liquid, and to the distillate add a crystal or two of chromic acid, and stir. If the smallest quantity of alcohol be present, green oxide of chromium, and aldehyd perceptible to the smell, will be developed. Instead of chromic acid, a few grains of powdered bichromate of potassium, acted on by a few drops of sulphuric acid, may be used. Dr. Ed. Strauch objects to this test as liable to some ambiguity, and proposes platinum-black as preferable. For a description of the mode in which he uses it, the reader is referred to the *Chemical Gazette* for Aug. 1, 1854.

It is, however, very rarely that any of the forms of alcohol here described are used internally in their ordinary state; the various forms of ardent spirit and fermented liquors being preferred for this purpose, and these are described elsewhere. The purer forms of alcohol, whether strong or diluted, are employed almost exclusively in pharmacy; as in the preparation of medicines, such as ether, into the composition of which they enter; for the preservation of organic substances; in the extraction of the active principles of vegetables, as in the tinctures; for dissolving bodies soluble in alcohol much more readily than in water, or insoluble in the latter fluid; and for various other pharmaceutic purposes. Nélaton, however, uses rectified spirit as a local application to wounds to be healed by the first intention, washing the surfaces with the liquid, before bringing them together, until hemorrhage ceases.

Diluted alcohol is employed as an addition to the compound infusion of gentian, and to some of the distilled waters and preparations of vinegar, in order to preserve them from decomposition; as a menstruum for extracting the virtues of plants, preparatory to the formation of extracts and syrups; and in preparing many of the spirits, and a few of the medicated wines. But it is in forming the tinctures that diluted alcohol is chiefly used. Some of these are made with officinal alcohol (rectified spirit), but the majority with diluted alcohol (proof spirit) as the menstruum. As the latter contains more than half its weight of water, it is well fitted for acting on those vegetables, the virtues of which are partly soluble in water and partly in alcohol. The apothecary, however, should never substitute the commercial proof spirit for diluted alcohol, even though it may be of the same strength, on account of the impurities in the former; but, when it is recollected how variable the so-called proof spirits are in strength, the objection to their use in pharmacy becomes still stronger. Thus, according to Mr. Brande, gin contains 51·6 per cent. of alcohol of 0·825; and the percentage of the same alcohol is 53·39 in brandy, 53·68 in rum, 53·90 in Irish whisky, and 54·32 in Scotch whisky. The alcohol on which these results are based already contains 11 per cent. of water.

Pharm. Uses. 1. Of *Alcohol Fortius*, U. S. In the preparation of Aloe Purificata, *U. S.;* Atropiæ Sulphas, *U. S.;* Ceratum Extracti Cantharidis, *U. S.;* Chloroformum Purificatum, *U. S.;* Digitalinum, *U. S.;* Hydrargyri Iodidum Viride, *U. S.*—2. Of *Alcohol*, U. S., *Spiritus Rectificatus*, Br. In the preparation of Aconitia; Ammonii Iodidum, *U. S.;* Aqua Camphoræ, *U. S.;* Atropia; Beberiæ Sulphas, *Br.;* Cinchoniæ Sulphas, *U. S.;* Digitalinum, *Br.;* Emplastrum Aconiti, *U. S.;* Emplast. Assafœtidæ, *U. S.;* Emplast. Belladonnæ, *Br.;* Extracta; Extracta Alcoholica, *U. S.;* Extracta Fluida, *U. S.;* Extracta Liquida, *Br.;* Fel Bovinum Purificatum, *Br.;* Ferri Sulphas Granulata, *Br.;* Hydrargyri Iodidum Viride, *Br.;* Morphia, *U. S.;* Quiniæ Sulphas, *U. S.;* Resinæ; Santoninum, *Br.;* Strychnia; Syrupus Aurantii Corticis, *U. S.;* Unguentum Aconitiæ, *Br.;* Unguentum Atropiæ, *Br.;* Veratria.—3. Of *Alcohol Dilutum*, U. S., *Spiritus Tenuior* or *Proof Spirit*, Br. In the preparation of Extracta; Extracta Alcoholica, *U. S.;* Extracta Fluida, *U. S.;* Santoninum, *U. S.;* Strychnia, *U. S.;* Syrupi; Unguentum Iodi, *Br.*

Off. Prep. 1. Of *Alcohol Fortius*, U. S. Æther, *U. S.;* Collodium, *U. S.;* Collodium cum Cantharide, *U. S.;* Oleum Æthereum, *U. S.;* Spiritus Ætheris Nitrosi, *U. S.;* Spiritus, *U. S.*—2. Of *Alcohol*, U. S., *Spiritus Rectificatus*, Br. Acidum Sulphuricum Aromaticum; Æther, *Br.;* Chloroformum, *Br.;* Collodium, *Br.;* Essentiæ, *Br.;* Glyceritum Picis Liquidæ, *U. S.;* Infusum Gentianæ Comp., *U. S.;*

Linimentum Aconiti; Liniment. Belladonnæ, *Br.;* Liniment. Camphoræ Comp., *Br.;* Liniment. Crotonis, *Br.;* Liniment. Iodi, *Br.;* Liniment. Saponis; Liniment. Sinapis Comp., *Br.;* Liquor Atropiæ, *Br.;* Liquor Morphiæ Acetatis, *Br.;* Liquor Morphiæ Hydrochloratis, *Br.;* Liquor Plumbi Subacetatis Dilutus, *Br.;* Liquor Strychniæ, *Br.;* Oleoresina Zingiberis, *U.S.;* Spiritus; Succus Conii; Succus Scoparii, *Br.;* Succus Taraxaci; Syrupi; Tincturæ.—3. Of *Alcohol Dilutum*, U.S., *Spiritus Tenuior* or *Proof Spirit*, Br. Mistura Gentianæ Comp., *Br.;* Spiritus, *U.S.;* Spiritus Armoraciæ Compositus, *Br.;* Syrupus Rhei Aromaticus, *U.S.;* Tincturæ; Vinum Rhei, *U.S.* B.

ALCOHOL AMYLICUM. *U.S., Br.*

Amylic Alcohol. Fusel Oil.

"A peculiar alcohol, obtained from fermented grain or potatoes, by continuing the process of distillation after the ordinary spirit has ceased to come over. Its sp. gr. is 0·818." *U.S.* Amylic alcohol, $C_{10}H_{12}O_2$, with a small proportion of other spirituous substances. An oily liquid contained in the crude spirit produced by the fermentation of saccharine solutions with yeast, and separated in the rectification of such crude spirit. *Br.*

Syn. Hydrated Oxide of Amyl. Grain Oil. Potato Spirit Oil.

This was an officinal of the late Dublin Pharmacopœia, which directed it to be prepared in the following manner. "Take of the light liquid, which may be obtained at any large distillery by continuing the distillation for some time after the pure spirit has been drawn off, *any convenient quantity.* Introduce it into a small still or retort connected with a condenser, and apply heat so as to cause distillation. As soon as the oil begins to come over unmixed with water, the receiver should be changed, and, the distillation being resumed and carried nearly to dryness, the desired product will be obtained. The liquid drawn over during the first part of the distillation will consist of an aqueous fluid, surmounted by a stratum of the Fusel Oil. This latter, though impregnated with a minute quantity of water, should be separated and preserved, as being sufficiently pure for use."

This oil is always present in the products of alcoholic fermentation. It is an ingredient in the ardent spirit obtained from various grains, but is most abundant in that procured from fermented potatoes. In grain spirit it is present in the proportion of about one part in five hundred by measure. When grain or potato whisky is distilled for the purpose of obtaining alcohol, the pure spirit will continue to come over for a certain time, after which, if the distillation be continued, a milky liquid will be obtained, which, upon standing, will be covered with a stratum of this peculiar oil. Subjected to distillation, the milky liquid will at first boil at a comparatively low temperature, and yield water and a little of the oil; but after a time the boiling point will rise to 269°, when the oil will come over pure. By changing the receiver when the oil begins to distil free from water, the oil is collected separate.

Properties. Amylic alcohol is an oily, colourless liquid, of a strong, offensive odour, and acrid, burning taste. As usually prepared it has a pale-yellow colour. Its sp. gr. is 0·818; that of its vapour 3·15. It boils at 269° (between 268° and 272°, *U.S.;* 270° *Br.*), and congeals at 4° below zero, in the form of crystalline leaves. It is very sparingly soluble in water, but unites in all proportions with alcohol, ether, and essential oils. It dissolves iodine, sulphur, and phosphorus, and is a good solvent for fats, resins, and camphor. When dropped upon paper it does not leave a permanent greasy stain. It does not take fire like alcohol by the contact of flame, but requires to be heated to a temperature of about 130° before it begins to burn. According to M. Pasteur, there are two amylic alcohols, chemically the same, but optically distinct. Amylic alcohol consists of ten eqs. of carbon 60, twelve of hydrogen 12, and two of oxygen 16=88. It is generally considered to be a hydrated oxide of the compound radical *amyl* ($C_{10}H_{11}$); and on this view its formula will be $C_{10}H_{11}O+HO$. Heated with anhydrous phosphoric acid, it loses the elements of two eqs. of water, and forms a carbohydrogen, $C_{10}H_{10}$, homologous with

ethylen, called amylen or valeren, which has been proposed as an anæsthetic. (See *Amylen* in Part III.) When subjected to oxidizing agents, it loses two eqs. of hydrogen and gains two of oxygen, and becomes $C_{10}H_9O_3+HO$, or *amylic acid*, which is identical with *valerianic acid*, the acid found in valerian. Hence the test given in the Br. and U. S. Pharmacopœias; "exposed to the air in contact with platinum-black, it is slowly oxidized, yielding valerianic acid." *Br., U. S.* This acid bears the same relation to amylic alcohol that acetic acid does to ethylic alcohol, and formic acid to methylic alcohol. Amyl has been isolated by Dr. E. Frankland. It is a colourless pellucid liquid, of the sp. gr. 0·7704. (*Chem. Gaz.*, March 15, 1850.) Its hydruret (hydride), $C_{10}H_{11}H$, has been discovered to be an energetic anæsthetic by Dr. Simpson, of Edinburgh.

Crude fusel oil may be obtained from the alcohol distillers. Mr. Kent, of New York, found in it, as impurities, water, alcohol, acetic and amylic acids, oxide of iron, and an amyl compound, analogous to œnanthic ether. According to Messrs. T. and H. Smith, the crude oil is a mixture of propylic, butylic, and amylic alcohols, and of other alcohols much higher in the series.

Fusel oil was made officinal by the Dublin College, in its Pharmacopœia of 1850, as an artificial source of valerianic acid, to be used in forming valerianate of sodium, from which, by double decomposition, three other valerianates, namely, those of iron, zinc, and quinia, were directed by the College to be prepared. It was introduced into the U. S. Pharmacopœia for a similar purpose, but at the late revision, valerianic acid was transferred from the Preparations to the Materia Medica Catalogue, and amylic alcohol is no longer wanted for this purpose.

Amylic alcohol is an active irritant poison.

Off. Prep. Ammonii Valerianas, *U. S.*; Quiniæ Valerianas, *U. S.*; Sodæ Valerianas, *Br.* B.

ALLIUM. *U. S.*

Garlic.

The bulb of Allium sativum. *U. S.*

Ail, *Fr.;* Knoblauch, *Germ.;* Aglio, *Ital.;* Ajo, *Span.*

ALLIUM. *Sex. Syst.* Hexandria Monogynia.—*Nat. Ord.* Liliaceæ.

Gen. Ch. Corolla six-parted, spreading. *Spathe* many-flowered. *Umbel* crowded. *Capsule* superior. *Willd.*

This is a very extensive genus, including more than sixty species, most of which are European. Of the nine or ten indigenous in this country, none are officinal. Dr. Griffith states that the bulb of *A. Canadense* has been substituted for the cultivated garlic, and found equally efficient. (*Med. Bot.* p. 653.) Of the European species several have been used from a very early period, both as food and medicine. *A. sativum*, or garlic, is the only one now officinal; and to this we shall here confine our observations, simply stating that there are few genera, of which the several species resemble one another more closely in sensible and medical properties than the present. For an account of *A. cepa*, or onion, and *A. Porrum*, or leek, see Part III. of this work.

Allium sativum. Willd. *Sp. Plant.* ii. 68; Woodv. *Med. Bot.* p. 749, t. 256. This is a perennial plant, and, like all its congeners, bulbous. The bulbs are numerous, and enclosed in a common membranous covering, from the base of which the fibres that constitute the proper root descend. The stem is simple, and rises about two feet. The leaves are long, flat, and grass-like, and sheathe the lower half of the stem. At the termination of the stem is a cluster of flowers and bulbs mingled together, and enclosed in a pointed spathe, which opens on one side and withers. The flowers are small and white, and make their appearance in July. This species of garlic grows wild in Sicily, Italy, and the south of France; and is cultivated in all civilized countries.

The part employed, as well for culinary purposes as in medicine, is the bulb. The bulbs are dug up with a portion of the stem attached, and, having been dried in the sun, are tied together in bunches, and thus brought to market. They are said to lose, by drying, nine parts of their weight out of fifteen, with little diminution of

their sensible properties. This species of Allium is commonly called *English garlic*, to distinguish it from those which grow wild in our fields and meadows. Garlic bulbs are apt to germinate and thus to undergo serious injury. Mr. A. P. Sharp preserves them by placing them in a bottle, pouring on them a little alcohol, about two fluidounces to a quart, and securely closing the bottle by a stopper of glass or cork. All tendency to germinate is thus lost, and the bulbs will retain their peculiar smell and taste unchanged for years. (*Proceed. of the Am. Pharm. Assoc.*, 1864.)

Properties. Garlic, as found in the shops, is somewhat spherical, flattened at the bottom, and drawn towards a point at the summit, where a portion of the stem several inches in length projects. It is covered with a white, dry, membranous envelope, consisting of several delicate laminæ, within which the small bulbs are arranged around the stem, having each a distinct coat. These small bulbs, commonly called *cloves* of garlic, are usually five or six in number, of an oblong shape, somewhat curved, and in their interior are whitish, moist, and fleshy.* They have a disagreeable pungent odour, so peculiar as to have received the name of *alliaceous*. Their taste is bitter and acrid. The peculiar smell and taste, though strongest in the bulb, are found to a greater or less extent in all parts of the plant. They depend on an *essential oil*, which is very volatile, and may be obtained by distillation, passing over with the first portions of water. As first obtained, the oil is of a dark brownish-yellow colour, heavier than water, and decomposed at its boiling temperature. It may be purified by repeated distillation in a salt-water bath, and is then lighter than water, of a pale-yellow colour, and not decomposed by boiling. According to Wertheim, it consists of a peculiar organic radical, called *allyl* (C_6H_5), combined with one equivalent of sulphur, and is therefore *sulphuret of allyl*. From one hundred weight of garlic Wertheim obtained from three to four ounces of the impure oil, and about two-thirds as much of the rectified. (*Chem. Gaz.*, iii. 177.) The impure oil has an exceedingly pungent odour, and strong acrid taste; and, when applied to the skin, produces much irritation, and sometimes even blisters. The pure oil combines with nitrate of silver, forming a precipitate, soluble in heated alcohol and afterwards separating in crystals. This compound consists of one eq. of the oil and two eqs. of the salt, and on the addition of ammonia gives up the oil unchanged. (*Journ. de Pharm. et de Chim.*, 4e sér., v. 237, A. D. 1867.) Besides this oil, fresh garlic, according to Cadet-Gassicourt, contains, in 1406 parts, 520 of mucilage, 37 of albumen, 48 of fibrous matter, and 801 of water. Bouillon-Lagrange mentions, among its constituents, sulphur, a saccharine matter, and a small quantity of fecula. The fresh bulbs yield upon pressure nearly a fourth part of juice, which is highly viscid, and so tenacious as to require dilution with water before it can be easily filtered. When dried, it serves as a lute for porcelain. It has the medical properties of the bulbs. Water, alcohol, and vinegar extract the virtues of garlic. Boiling, however, if continued for some time, renders it inert.

Medical Properties and Uses. The use of garlic as a medicine and condiment, ascends to the highest antiquity. When it is taken internally, the oil is speedily absorbed, and, pervading the system, becomes sensible in the breath and various secretions. Even externally applied to the soles of the feet, it imparts its odour to the breath, urine, and perspiration, and, according to some writers, may be tasted in the mouth. Its effects on the system are those of a general stimulant. It quickens the circulation, excites the nervous system, promotes expectoration in debility of the lungs, produces diaphoresis or diuresis according as the patient is kept warm or cool, and acts upon the stomach as a tonic and carminative. It is said also to be emmenagogue. Applied to the skin, it is irritant and rubefacient, and moreover exercises, in some degree, its peculiar influence upon the system, in consequence of absorption. Moderately employed, it is beneficial in enfeebled digestion and flatulence; and by

*In a note, in the preceding edition of the Dispensatory, it was stated that a variety of garlic had been introduced into this market, having larger and fewer cloves or small bulbs than the officinal, and supposed to be the product of a hybrid between the common garlic and the leek. It was also said to be much inferior to the genuine drug. In the *Proceedings of the American Pharmaceutical Association* for 1860, is a paper by Prof. Robert P. Thomas, which satisfactorily shows that this is really, as supposed, the product of a hybrid, probably between *A. saticum* and *A. Porrum*. (*Note to the twelfth edition.*)

many it is habitually used as a condiment. It has been given with advantage in chronic catarrh, and other pectoral affections in which the symptoms of inflammation have been subdued, and a relaxed state of the vessel remains. We have used it habitually, and with great benefit, in such affections in children, as well as in the nervous and spasmodic coughs to which the very young are peculiarly liable. Some have recommended it in old atonic dropsies and calculous disorders; and it has been employed in the treatment of intermittents. It is thought also to be an excellent anthelmintic, especially in cases of ascarides, in which it is given both by the mouth and the rectum. The juice is said sometimes to check nervous vomiting in the dose of a few drops. If taken too largely, or in excited states of the system, garlic is apt to occasion gastric irritation, flatulence, hemorrhoids, headache, and fever. As a medicine, it is at present more used externally than inwardly. Bruised, and applied to the feet, it acts very beneficially, as a revulsive, in disorders of the head; and is especially useful in the febrile complaints of children, by quieting restlessness and producing sleep. Its juice mixed with oil, or the garlic itself bruised and steeped in spirit, is frequently used as a liniment in infantile convulsions and other spasmodic or nervous affections in children. The same application has been made in cutaneous eruptions. A clove of garlic, or a few drops of the juice, introduced into the ear, are said to prove efficacious in atonic deafness; and the bulb, bruised, and applied in the shape of a poultice above the pubes, has sometimes restored action to the bladder, in retention of urine from debility of that organ. In the same shape it has been used to resolve indolent tumors.

Garlic may be taken in the form of a pill; or the clove may be swallowed either whole, or cut into pieces of a convenient size. Its juice is also frequently administered mixed with sugar. The infusion in milk was at one time highly recommended, and the syrup is officinal. The dose in substance is from half a drachm to a drachm, or even two drachms, of the fresh bulb. That of the juice is half a fluidrachm.

Off. Prep. Syrupus Allii, *U. S.* W.

ALOE.

Aloes.

ALOE BARBADENSIS. *U. S., Br. Barbadoes Aloes.*

The inspissated juice of the leaves of Aloe vulgaris (*Lamarck*). *U. S., Br.*

ALOE CAPENSIS. *U. S. Cape Aloes.*

The inspissated juice of the leaves of Aloe spicata (*Thunberg*), and of other species of Aloe. *U. S.*

ALOE SOCOTRINA. *U. S., Br. Socotrine Aloes.*

The inspissated juice of the leaves of Aloe Socotrina (*Lamarck*). *U. S.* The inspissated juice of the leaf of one or more undetermined species of Aloe. Produced chiefly in Socotra. *Br.*

Suc d'aloès, *Fr.;* Aloe, *Germ., Ital.;* Aloë, *Span.;* Musebber, *Arab.*

Most of the species belonging to the genus Aloe are said to yield a bitter juice, which has all the properties of the officinal aloes. It is impossible, from the various and sometimes conflicting accounts of writers, to determine exactly from which of the species the drug is in all instances actually derived. *Aloe spicata*, however, is generally acknowledged to be an abundant source of it; and *A. vulgaris* and *A. Socotrina* are usually ranked among the medicinal species. In Lindley's Flora Medica, *A. purpurascens*, *A. arborescens*, *A. Commelyni*, and *A. multiformis*, all natives of the Cape of Good Hope, are enumerated as yielding aloes; and others are, without doubt, occasionally resorted to. We shall confine ourselves to a description of the three following species, which probably yield most of the aloes of commerce.

ALOE. *Sex. Syst.* Hexandria Monogynia.—*Nat. Ord.* Liliaceæ.

Gen. Ch. Corolla erect, mouth spreading, bottom nectariferous. *Filaments* inserted into the receptacle. *Willd.*

Aloe spicata. Willd. *Sp. Plant.* ii. 185. This species of Aloe was first described by Thunberg. The stem is round, three or four feet high, about four inches in diameter, and leafy at the summit. The leaves are spreading, subverticillate, about two feet long, broad at the base, gradually narrowing to the point, channeled upon

their upper surface, and with remote teeth upon their edges. The flowers are bell-shaped, and spread horizontally in very close spikes. Beneath each flower is a broad, ovate, acute bracte, white, with three green streaks, and nearly as long as the corolla. Of the six petals, the three inner are ovate, obtuse, white, with three green lines, and broader than the outer, which otherwise resemble them. The stamens are much longer than the corolla. The *spiked aloe* is a native of Southern Africa, growing near the Cape of Good Hope, and, like all the other species, preferring a sandy soil. In some districts of the colony it is found in great abundance, particularly at Zwellendam, near Mossel Bay, where it almost covers the surface of the country. Much of the Cape aloes is said to be derived from this species.

A. Socotrina. Lamarck, *Encycl.* i. 85; De Cand. *Plantes Grasses, fig.* 85; Curtis's *Bot. Mag. pl.* 472; Carson's *Illust. of Med. Bot.* ii. 48, *pl.* 92.—*A. vera.* Miller, *Dict., ed.* 8, *No.* 55. The stem of this species is erect, eighteen inches or more in height, woody, and leafless below, where it is very rough from the remains of former leaves. At top it is embraced by green, sword-shaped, ascending leaves, somewhat concave on their upper surface, convex beneath, curved inward at the point, with numerous small white serratures at their edges. The flowers, which are in a cylindrical, simple raceme, are scarlet near the base, pale in the centre, and greenish at the summit, and have unequal stamens, of which three are longer than the corolla. The plant received its name from the Island of Socotra, of which it is said to be a native; and is supposed to be the source of the Socotrine aloes.

A. vulgaris. Lamarck, *Encycl.* i. 86; De Cand. *Plantes Grasses, fig.* 27; Carson's *Illust. of Med. Bot.* ii. 46, *pl.* 90. This species has a very short woody stem, and lanceolate embracing leaves, which are first spreading, then ascending, of a glaucous-green colour, somewhat mottled with darker spots, flat on the upper surface, convex beneath, and armed with hard reddish spines, distant from each other, and perpendicular to the margin. The flower-stem is axillary, of a glaucous-reddish colour, and branched, with a cylindrical-ovate spike of yellow flowers, which are at first erect, then spreading, and finally pendulous, and do not exceed the stamens in length. A. vulgaris is a native of south-eastern Europe and the north of Africa, and is cultivated in Italy, Sicily, Malta, and especially in the West Indies, where it contributes largely to furnish the Barbadoes aloes.

The proper aloetic juice was formerly thought to exist in longitudinal vessels beneath the epidermis of the leaves, and readily flows out when these are cut transversely; but, according to M. Edmond Robiquet, who has made elaborate researches in relation to this drug, these vessels are air-ducts, and the juice flows in the intercellular passages between them. The liquid obtained by expression from the parenchyma is mucilaginous, and possessed of little medicinal virtue. The quality of the drug depends much upon the mode of preparing it. The finest kind is that obtained by exudation, and subsequent inspissation in the sun. Most of the better sorts, however, are prepared by artificially heating the juice which has spontaneously exuded from the cut leaves. The chief disadvantage of this process is the conversion of a portion of the soluble active principle into an insoluble and comparatively inert substance, through the influence of an elevated temperature. The plan of bruising and expressing the leaves, and boiling down the resulting liquor, yields a much inferior product; as a large portion of it must be derived from the mucilaginous juice of the parenchyma. The worst plan of all is to boil the leaves themselves in water, and evaporate the decoction. The quality of the drug is also affected by the careless or fraudulent mixture of foreign matters with the juice, and the unskilful management of the inspissation.

Commercial History and Varieties. Four chief varieties of aloes are known in commerce; the Cape aloes, the Socotrine, the hepatic, and the Barbadoes, of which the first two are most used in this country.

1. Cape Aloes is imported from the Cape of Good Hope, either directly, or through the medium of English commerce. It is collected by the Hottentots and Dutch boors indiscriminately from *A. spicata* and other species, which grow wild in great abundance. Dr. L. Pappe, of Cape Town, states that the best aloes is derived from *Aloe ferox* (*Lam.*) growing at Zwellendam, and a weaker product from

A. Africana and *A. plicatilis* of Miller. (*Flor. Capens.* 28.) The process is very simple. According to Hallbeck, a Moravian missionary who resided at the Cape, a hole is made in the ground, in which a sheep skin is spread with the smooth side upward. The leaves are then cut off near the stem, and arranged around the hole, so that the juice which runs out may be received into the skin. The juice flows most freely in hot weather. (*United Breth. Mission. Intelligencer, N. Y.*, vi. 436.) When a sufficient quantity of the liquor has been collected, it is inspissated by artificial heat in iron cauldrons, care being taken, by constant stirring, to prevent its burning. When sufficiently concentrated, it is poured into boxes or skins, where it concretes upon cooling. The finest kind is collected at the Missionary Institution at Bethelsdorp, and hence called *Bethelsdorp aloes.* Its superiority is owing exclusively to the greater care observed in conducting the evaporation, and in avoiding the intermixture of earth, stones, and other impurities.

Cape aloes has sometimes been confounded with the Socotrine, from which, however, it differs very considerably in appearance. By the German writers it is called *shining aloes.* When freshly broken, it has a very dark-olive or greenish colour approaching to black, presents a smooth bright almost glassy surface, and, if held up to the light, appears translucent at its edges. The small fragments also are semi-transparent, and have a tinge of yellow or red, mixed with the deep olive of the opaque mass. The same tinge is sometimes observable in the larger pieces. The powder is of a fine greenish-yellow colour, and, being generally more or less sprinkled over the surface of the pieces as they are kept in the shops, gives them a somewhat yellowish appearance. Its odour is strong and disagreeable, but not nauseous, and in no degree aromatic. In mass, the drug has little or no smell. Cape aloes, when quite hard is very brittle, and readily powdered; but, in very hot weather, it is apt to become somewhat soft and tenacious, and the interior of the pieces is occasionally more or less so even in winter. It is usually imported in casks or boxes. Dr. Pereira says that a variety is sometimes imported into England from the Cape, of a reddish-brown colour like hepatic aloes. A variety of aloes has been imported into England from Natal, on the S. E. coast of Africa, and is known in the European market by the name of *Natal aloes.* It has a peculiar composition, which will be adverted to under the chemistry of the drug.

2. Socotrine Aloes. The genuine Socotrine aloes is produced in the Island of Socotra, which lies in the Straits of Babelmandel, about forty leagues to the east of Cape Guardafui; but we are told by Ainslie that the greater part of what is sold under that name is prepared in the kingdom of Melinda, upon the eastern coast of Africa; and Wellsted states that the aloes of the neighbouring parts of Arabia is the same as that of Socotra. The commerce in this variety of aloes is carried on chiefly by the maritime Arabs, who convey it either to India, or up the Red Sea by the same channel through which it reached Europe before the discovery of the southern passage into the Indian Ocean. Mr. Vaughan states that nearly the whole product of the island is carried to Maculla, on the southern coast of Arabia, and thence transhipped to Bombay. (*Pharm. Journ. and Trans.*, xii. 268.) The species of Aloe which yields it is not certainly known, but is probably A. Socotrina. According to Wellsted, the plant grows on the sides and summits of mountains, from five hundred to three thousand feet above the level of the plains. It is found in all parts of the island, but most abundantly on the western portion, where the surface is thickly covered with it for miles. It appears to thrive best in parched and barren places. Much less of the drug is collected than formerly, and in the year 1833 only two tons were exported. The whole produce was formerly monopolized by the Arabian Sultan of Kisseen; but at present the business of collecting the drug is entirely free to the inhabitants. The leaves are plucked at any period of the year, and are placed in skins into which the juice is allowed to exude. In what way the inspissation is effected we are not informed by Wellsted; but, according to Hermann, it is by exposure to the heat of the sun. The aloes is exported in skins. Its quality differs much according to the care taken in its preparation. (*Wellsted's Voyage, &c.*) A portion ascends the Red Sea, and through Egypt reaches the Mediterranean ports, whence it is sent to London. Another portion is carried to Bombay, and thence

transmitted to various parts of the world. That which reaches this country either comes by special order from London, or is brought by our India traders. We have known of two arrivals directly into the United States, said to be from Socotra, and have in our possession parcels of aloes brought by both. They are identical in character, and correspond with the following description.

Socotrine aloes is in pieces of a yellowish or reddish-brown colour, wholly different from that of the former variety. Sometimes the colour is very light, especially in the fresh and not fully hardened parcels; sometimes it is a deep brownish-red like that of garnets. It is rendered much darker by exposure to the air; and the interior of the masses is consequently much lighter-coloured than the exterior. Its surface is somewhat glossy, and its fracture smooth and conchoidal, with sharp and semi-transparent edges. The colour of its powder is a bright golden yellow. It has a peculiar, not unpleasant odour, and a taste, which, though bitter and disagreeable, is accompanied with an aromatic flavour. Though hard and pulverulent in cold weather, it is somewhat tenacious in summer, and softens by the heat of the hand. "It dissolves entirely in proof spirit, and during solution exhibits under the microscope numerous minute crystals." *Br.*

Under the name of Socotrine aloes, are occasionally to be met with in the market small parcels beautifully semi-transparent, shining, and of a yellowish, reddish, or brownish-red colour. These, however, are very rare, and do not deserve to be considered as a distinct variety. They are probably portions of the juice carefully inspissated in the sun, and may accompany the packages brought from any of the commercial sources of aloes.

When in mass, as imported from the East, Socotrine aloes is soft and plastic, and of a very light yellowish-brown colour in the interior. It becomes hard and brittle when broken into pieces; and the London dealers hasten the result by exposing it to a very gentle heat, so as to evaporate the moisture.

Pereira tells us that impure and dirty pieces of the drug are melted and strained, and that the skins from which the best portions have been removed are washed with water, which is then evaporated.

Occasionally the juice has been imported into London in casks, not thoroughly inspissated. In this state it is of the consistence of molasses, of an orange or yellowish colour, and of a strong fragrant odour. It separates, upon standing, into a transparent liquid, and an opaque, lighter-coloured, granular portion which subsides. Pereira found the latter portion to consist of innumerable minute prismatic crystals, and believed it to be identical with or closely analogous to the aloin of the Messrs. Smith. When the juice is heated, the deposit dissolves, and the whole being evaporated yields a solid, transparent product, having the properties of fine Socotrine aloes. (*Pharm. Journ.*, xi. 439.)

Much of the aloes sold as Socotrine has never seen the Island of Socotra, nor even the Indian seas. It has been customary to affix this title, as a mark of superior value, to those parcels of the drug, from whatever source they may have been derived, which have been prepared with unusual care, and are supposed to be of the best quality. Thus, both in Spain and the West Indies, the juice which is obtained without expression, and inspissated in the sun without artificial heat, has been called Socotrine aloes; and is probably little inferior to the genuine drug.

Socotrine aloes has been very long known under this name, and in former times held the same superiority, in the estimation of the profession, which it still to a certain degree retains.

3. Hepatic Aloes. Much confusion and uncertainty have prevailed in relation to this kind of aloes. The name was originally applied to a product from the East Indies, of a reddish-brown or liver colour, which gave origin to the designation. From a supposed resemblance between this and the aloes from the West Indies, the name was very commonly applied also to the latter variety, and was even extended to portions of the drug collected in Spain and other parts of the South of Europe. But the West India aloes is decidedly different from any now brought from the East, and deserves the rank of a distinct variety, with the name of Barbadoes aloes. In this country, we seldom meet with aloes bearing the name of the hepatic, although

much that is sold as Socotrine probably deserves it. In the drug commerce of London, it is still recognised as a distinct variety. It is imported into England chiefly from Bombay; but, according to Ainslie, is not produced in Hindostan, being taken thither from Yemen in Arabia. It is probably obtained from the same plants which yield the Socotrine, but prepared with less care, or by a different process.* In relation to the Socotrine and hepatic aloes, we should probably not be far wrong in considering the former as embracing the finest, and the latter the inferior parcels of the same variety; and it is in fact stated that they sometimes come together, a large mass of the hepatic being crossed by a vein of the Socotrine.

Hepatic aloes is reddish-brown, but darker and less glossy than the Socotrine. Its odour is somewhat like that of the Socotrine, but less agreeable; its taste nauseous, and intensely bitter. The fracture is not so smooth, nor the edges so sharp and transparent as in either of the first-mentioned varieties. It softens in the hand, and becomes adhesive. The powder is of a dull-yellow colour.

4. Barbadoes Aloes. This is the name by which the aloes produced in the West Indies is generally designated. The aloes plants are largely cultivated in the poorer soils of Jamaica and Barbadoes, especially of the latter island. The species from which most of the drug is procured is *A. vulgaris;* but *A. Socotrina*, *A. purpurascens*, and *A. arborescens* are also said to be cultivated. The process employed appears to be somewhat different in different places, or at least as described by different authors. A fine kind was formerly prepared by the spontaneous inspissation of the juice, placed in bladders or shallow vessels, and exposed to the sun. The common Barbadoes aloes, however, is now made, either by boiling the juice to a proper consistence, or by first forming a decoction of the leaves, chopped and suspended in water in nets or baskets, and then evaporating the decoction. In either case, when the liquor has attained such a consistence that it will harden on cooling, it is poured into calabashes and allowed to concrete. A gentleman from Barbadoes, who had seen the aloes prepared, recently informed Mr. Squire that the leaves are cut transversely, and so placed that the juice flows from the incised surfaces into a trough, which inclines to the boiler. (*Med. T. and Gaz.*, Jan. 1868, p. 75.) It is imported into England in gourds weighing from 60 to 70 pounds, or even more. In consequence of the great demand for it in veterinary practice, it commands a high price in Great Britain.

The colour of Barbadoes aloes is not uniform. Sometimes it is dark-brown or almost black, sometimes of a reddish-brown or liver colour, and again of some intermediate shade. It has usually a dull fracture, and is almost perfectly opaque, even at the edges, and in thin layers. It is also distinguishable by its odour, which is disagreeable and even nauseous. The powder is of a dull olive-yellow. According to Mr. Giles, it yields 80 per cent. of aqueous extract, and is even more active than the Socotrine. (*Pharm. Journ.*, Dec. 1860, p. 301.) "It dissolves almost entirely in proof spirit, and during solution exhibits under the microscope numerous crystals." *Br.* According to M. Marais, Barbadoes aloes, from whatever part of the W. Indies derived, and however differing in colour, when dissolved in distilled water in the proportion of one part to 100,000 parts, has, in a high degree, the property of giving rise to a fine rose-colour on the addition of chloride of gold or tincture of iodine; while all other varieties, whether coming from Africa or India, with the exception of the hepatic, produce with these reagents either a feeble colour, slow in occurring, or no change of colour whatever. (*Journ. de Pharm.*, 4e sér., v. 326.)

Besides these varieties of aloes, others are mentioned by authors. A very inferior kind, supposed to consist of the dregs of the juice which furnished the better sorts, almost black, quite opaque, hard, of a rough fracture and very fetid odour, and full of various impurities, was formerly sold under the name of *fetid*, *caballine*, or *horse aloes*. It was used exclusively for horses; but, in consequence of the cheapness of better kinds, has been banished from veterinary practice, and it is not now

* Dr. Pereira inferred, we think somewhat prematurely, from his observations on the juice of aloes before referred to, that the Socotrine is prepared by evaporation by artificial heat, to which it owes its transparency; while the hepatic is opaque, because dried in the sun. If this were the case, Barbadoes aloes, which is wholly opaque, more so even than the hepatic, should have been dried in the sun, instead of being inspissated by heat, as it really is. (*Note to the tenth edition.*)

found in the market. Aloes has been imported from Muscat, and a considerable quantity came over in a vessel sent by the Sultan to the United States. Some of a similar origin has been called *Mocha aloes* in London; but it is nothing more than an inferior sort of hepatic. Several inferior kinds, produced in different parts of Hindostan, have been described by Pereira under the name of *India aloes;* but they are not brought, unless accidentally, into the markets of Europe or this country.

General Properties. The odour of aloes is different in the different varieties. The taste is in all of them intensely bitter and very tenacious. The colour and other sensible properties have been sufficiently described. Several distinguished chemists have investigated the nature and composition of aloes. Braconnot found it to consist of a bitter principle, soluble in water, and in alcohol of 38° B., which he considered peculiar, and named *resino-amer* (*resinous bitter*); and of another substance, in smaller proportion, inodorous and nearly tasteless, very soluble in alcohol, and scarcely soluble in boiling water, which he designated by the name of *flea-coloured principle.* These results were essentially confirmed by Trommsdorff, Bouillon-Lagrange, and Vogel, who considered the former substance as extractive matter, and the latter as a kind of resin. Besides these principles, Trommsdorff discovered, in a variety of hepatic aloes, a proportion of insoluble matter which he considered as albumen; and Bouillon-Lagrange and Vogel found that the Socotrine also yielded, by distillation, a small quantity of volatile oil, which they could not obtain from the hepatic. The proportions of the ingredients were found to vary greatly in the different varieties of the drug; and the probability is, that scarcely any two specimens would afford precisely the same results. Braconnot found about 73 per cent. of the *bitter*, and 26 of the *flea-coloured principle.* Trommsdorff obtained from Socotrine aloes about 75 parts of extractive and 25 of resin; and from the hepatic, 81·25 of extractive, 6·25 of resin, and 12·50 of albumen, in 100 parts. The former variety, according to Bouillon-Lagrange and Vogel, contains 68 per cent. of extractive and 32 of resin; the latter 52 of extractive, 42 of resin, and 6 of the albuminous matter of Trommsdorff. We are not aware that any analysis has been published of the Cape aloes as a distinct variety.

Berzelius considers the resin of Trommsdorff and others to belong to that form of matter which he calls *apothême* (see *Extracts*), and which is nothing more than extractive, altered by the action of the air. It may be obtained separate by treating aloes with water, and digesting the undissolved portion with oxide of lead, which unites with the apothême forming an insoluble compound, and leaves a portion of the unaltered extractive, which had adhered to it, dissolved in the water. The oxide of lead may be separated by nitric acid very much diluted; and the apothême remains in the form of a brown powder, insoluble in cold water, very slightly soluble in boiling water, to which it imparts a yellowish-brown colour, soluble in alcohol, ether, and alkaline solutions, and burning like tinder without flame, and without being melted. The *bitter extractive*, which constitutes the remainder of the aloes, may be obtained by treating the watery infusion with oxide of lead, to separate a portion of the apothême which adheres to it, and evaporating the liquor. It is a yellowish, translucent, gum-like substance, fusible by a gentle heat, of a bitter taste, soluble in ordinary alcohol, but insoluble in anhydrous alcohol, and in ether.

A subsequent analysis of aloes by M. Edmond Robiquet yielded the following results. A portion of hyacinthine, transparent aloes, considered as genuine Socotrine, was found to consist, in 100 parts, of 85 of *aloetin*, 2 of ulmate of potassium, 2 of sulphate of calcium, 0·25 of gallic acid, 8 of albumen, and traces of carbonate of potassium, carbonate of calcium, and phosphate of calcium. To get pure aloetin, M. Robiquet exhausted aloes in powder with cold water; concentrated the infusion; added an excess of acetate of lead, which precipitated the gallate, ulmate, and albuminate of that metal; poured into the clear liquor solution of ammonia; separated the yellowish-orange coloured precipitate, consisting of oxide of lead combined with aloetin, washed it with boiling water, and then decomposed it by a current of sulphuretted hydrogen with the exclusion of atmospheric air. Sulphuret of lead was deposited, and a colourless liquid floated above it, which, being decanted, and evaporated in vacuo, yielded aloetin in slightly yellowish scales. Thus

procured, aloetin is uncrystallizable, very soluble in water and alcohol, but slightly soluble in ether, and quite insoluble in the fixed and volatile oils. It is entirely dissipated at a red heat. If exposed to the air during desiccation, it becomes intensely red, in consequence of the absorption of a little oxygen, which, however, scarcely affects its properties in other respects. It possesses strongly the bitter taste and purgative property of aloes, and might be used as a substitute; 8 parts of it representing 10 of Socotrine and 50 of Cape aloes. (*Journ. de Pharm.*, 3e sér., x. 173.)*

Aloin. The bitter substances noticed above, viz., the *resino-amer* of Braconnot, the *bitter extractive* of Berzelius and others, and the *aloetin* of Robiquet, probably contain the active principle of aloes, but combined with impurities which render it insusceptible of crystallization. Messrs. T. and H. Smith, of Edinburgh, have succeeded in obtaining it quite pure and in crystals, and name it *aloin.* This has been examined by Mr. Stenhouse, and found, when quite free from water, to have a definite composition, represented by the formula $C_{34}H_{18}O_{14}$. There can be no doubt that it is the active principle of aloes; as it has been found to operate invariably as a cathartic in the dose of one or two grains, and occasionally in that of half a grain.

It is obtained most readily from Barbadoes aloes. The process consists of mixing this, previously powdered, with sand, exhausting it with cold water, evaporating the infusion in *vacuo* to the consistence of syrup, and allowing the residue to rest in a cool place. In two or three days the concentrated liquid becomes filled with a brownish-yellow granular mass of minute crystals, which is impure aloin. This is separated by pressure between folds of bibulous paper, from a greenish-brown matter that contaminates it, and then repeatedly crystallized from hot water, the temperature of which should not exceed 150°, as aloin is rapidly oxidized at the boiling point. By dissolving it in hot alcohol, and allowing the solution to cool, it is obtained, in the shape of minute needle-shaped crystals, arranged in a star-like form. These are pale-yellow, at first sweetish to the taste, but soon intensely bitter; combustible without residue; slightly soluble in cold water or alcohol, but readily dissolved by these liquids when moderately heated; soluble also readily in alkaline solutions, which are rendered of an orange-yellow colour, and become rapidly darker, especially when heated, in consequence of the oxidation of the aloin, and its conversion into resin. By the action of strong nitric acid it is converted into chrysammic acid. It is neither acid nor alkaline; but with strong solution of subacetate of lead, is precipitated in

* *Aloetic* and *Chrysammic acids.* Aloes treated with nitric acid yields three distinct acids; the aloetic, chrysammic, and picric, separable by the different solubilities of their potassa salts. If these salts be dissolved in boiling water, the chrysammate is first deposited, then, especially after a little evaporation, the picrate, while the aloetate remains. To separate the aloetic acid, the residuary solution is treated with acetate of barium, and evaporated on a water-bath. The aloetate is deposited in warty crystals, which are washed with cold water, then dissolved by hot water, and decomposed by dilute nitric acid. Aloetic acid separates, in the state of a yellow, amorphous powder, which melts at 248° F., losing one eq. of water. It has a bitter and acrid taste, detonates when heated on a plate of platinum, is freely soluble in alcohol, slightly in cold water, but is dissolved by hot water, to which it imparts a purple colour, which is changed to yellow by acids and to red by alkalies. The aloetates of potassium and of sodium are very soluble in water. Aloetic acid was called by Scheele and Braconnot, "*the artificial bitter of aloes.*" (Finckh, *Ann. Chem. Pharm.*, cxxiv. p. 236; *J. de Pharm.*, 4e sér., ii. 77.)—*Note to the thirteenth edition.*

For the method of obtaining chrysammic acid from the aloin of Barbadoes aloes, the reader is referred to an article by W. A. Tilden, in the *Chemical News* (May 20, 1872, p. 244). This acid is of a fine yellow colour, and crystallizes from its watery solution in small tables resembling fern-leaves. Evaporated with pure sulphuric acid, they leave no residue. The aloetic acid, by further treatment with nitric acid, is converted into chrysammic acid. (*Note to the fourteenth edition.*)

Mr. T. B. Groves has obtained aloin largely from Socotrine aloes. In the process of the Messrs. Smith, cold water was used in the extraction of the principle. But aloin is feebly soluble in cold water, while readily so in the same liquid heated. Mr. Groves availed himself of this fact. He exhausted the aloes by means of boiling water, acidulated the decoction slightly with muriatic acid, separated the precipitated matter by filtration, evaporated the liquor to the consistence of syrup, and set it aside to crystallize. In a fortnight the liquid had become a mass of crystals, which were separated by draining and compression, and purified by repeated solution in boiling water, and crystallization. The pure aloin obtained amounted to 10 per cent. of the aloes used. (*Pharm. Journ.*, xvi. 129.)—*Note to the eleventh edition.*

A more recent view of the constitution of aloes, resulting from the experiments of M. Kosmann, an apothecary at Thann, in France, is that it belongs to the family of glucosides; consisting of two electronegative resins, having acid properties in different degrees, and a carbohydrogen, which is converted into glucose or grape sugar by the action either of acids, or strong alkalies. (*Journ. de Pharm.*, Sept. 1861, p. 177.)—*Note to the twelfth edition.*

combination with the oxide of that metal. (See *Ed. Monthly Journ. of Med. Sci.*, xii. 127, Feb. 1851, and *Pharm. Journ. and Trans.*, xi. 458.) There can be little doubt that aloin exists also in Socotrine and Cape aloes; and the Messrs. Smith, though they at first failed in obtaining it from these varieties, have subsequently succeeded with the Socotrine.

A variety of aloes obtained from Natal was examined by Flückeger, and found to contain, instead of aloin, an analogous but different principle, which he proposed to name *nataloin*. For the mode of preparing it, and its peculiar properties, see *Pharmaceutical Journal* (Sept. 1871, p. 193). Contrary to Flückeger's conclusion, his nataloin was found to yield, like aloin, under the action of nitric acid, both oxalic and picric acids. (*Ibid.*, Dec. 1871, p. 441.) It has been proposed to call the proper aloin, *barbaloin*, in reference to its source; but this appears to be unnecessary, especially as Socotrine aloes has been found to contain it. Nataloin is readily distinguished from aloin by its relatively slight solubility in water or alcohol, by its crystalline form, and by yielding with nitric acid not chrysammic acid, but oxalic and picric acids. (*Ibid.*, May, 1872, p. 951.)

Aloes yields its active matter to cold water, and when good is almost wholly dissolved by boiling water; but the inert portion, or apothême of Berzelius, is deposited as the solution cools. It is also soluble in alcohol, rectified or diluted. Long boiling impairs its purgative properties by oxidizing the aloin, and rendering it insoluble. The alkalies, their carbonates, and soap alter in some measure its chemical nature, and render it of easier solution. It is inflammable, swelling up and decrepitating when it burns, and giving out a thick smoke which has the odour of the drug.

Those substances only are incompatible with aloes which alter or precipitate the soluble matter; as the insoluble portion is without action upon the system. Among these is the infusion of galls, which we have found, probably through its tannic acid, to afford a copious precipitate with an aqueous solution of aloes. It is said that such a solution will keep a long time, even for several months, without exhibiting mouldiness or putrescency, though it becomes ropy.

Medical Properties and Uses.—Aloes was known to the ancients. It is mentioned in the works of Dioscorides and Celsus, the former of whom speaks of two kinds. The varieties are similar in their mode of action. They are all cathartic, operating very slowly but certainly, and having a peculiar affinity for the large intestines. Their action, moreover, appears to be directed rather to the muscular coat than to the exhalant vessels; and the discharges which they produce are, therefore, seldom very thin or watery. In a full dose they quicken the circulation, and produce general warmth. When frequently repeated, they are apt to irritate the rectum, giving rise, in some instances, to hemorrhoids, and aggravating them when already existing. Aloes has also a decided tendency to the uterine system. Its emmenagogue effect, which is often very considerable, is generally attributed to a sympathetic extension of irritation from the rectum to the uterus; but we can see no reason why the medicine should not act specifically upon this organ; and its influence in promoting menstruation is by no means confined to cases in which its action upon the neighbouring intestine is most conspicuous. A peculiarity in the action of this cathartic is, that an increase of the quantity administered, beyond the medium dose, is not attended by a corresponding increase of effect. Its tendency to irritate the rectum may be obviated, in some measure, by combining with it soap or an alkaline carbonate; but it does not follow, as supposed by some, that this modification of its operation is the result of increased solubility; for aloes given in a liquid state produces the same effect as when taken in pill or powder, except that it acts somewhat more speedily. Besides, when externally applied to a blistered surface, it operates exactly in the same manner as when internally administered, thus proving that its peculiarities are not dependent upon the particular form in which it may be given, but on specific tendencies to particular parts. (Gerhard, *N. Am. Med. and Surg. Journ.*, x. 155.) With its other powers, aloes combines the property of slightly stimulating the stomach. It is, therefore, in minute doses, an excellent remedy in habitual costiveness attended with torpor of the digestive organs. It has been supposed to stimulate the hepatic secretion, and certainly acts sometimes very happily in jaundice, producing bilious

stools even after calomel has failed. From its special direction to the rectum, it has been found peculiarly useful in the treatment of ascarides. In amenorrhœa it is perhaps more frequently employed than any other remedy, entering into almost all the numerous empirical preparations habitually resorted to by females in that complaint, and enjoying a no less favourable reputation in regular practice. It is frequently combined with more irritating cathartics, in order to regulate their liability to excessive action. In amenorrhœa it is said to be peculiarly efficacious, when given, in the form of enema, about the period when the menses should appear. Aloes is contraindicated by hemorrhoids, and is unsuitable, unless modified by combination, to the treatment of inflammatory diseases.

The medium dose is 10 grains; but as a laxative it will often operate in the quantity of 2 or 3 grains; and when a decided impression is required, the dose may be augmented to 20 grains. In consequence of its excessively bitter and somewhat nauseous taste, it is most conveniently administered in pills.*

Off. Prep. Aloe Purificata, *U. S.;* Enema Aloës, *Br.;* Extractum Aloës Barbadensis, *Br.;* Ext. Aloës Socotrinæ, *Br.;* Pilulæ Aloës, *U. S.;* Pil. Aloës Barbadensis, *Br.;* Pil. Aloës et Assafœtidæ; Pil. Aloës et Ferri, *Br.;* Pil. Aloës et Mastiches, *U. S.;* Pil. Aloës et Myrrhæ, *Br.;* Pil. Aloës Socotrinæ, *Br.;* Pil. Cambogiæ Comp., *Br.;* Pil. Colocynth. Comp., *Br.;* Pil. Colocynthidis et Hyoscyami, *Br.;* Pil. Rhei Comp.; Pulvis Aloës et Canellæ, *U. S.;* Tinctura Aloës; Tinct. Aloës et Myrrhæ, *U. S.;* Tinct. Benzoini Comp.; Vinum Aloës. W.

ALTHÆA. *U. S.*

Marshmallow.

The root of Althæa officinalis. *U. S.*

Guimauve, *Fr.;* Eibisch, *Germ.;* Altea, *Ital.;* Altea, Malvavisco, *Span.*

Althæa. *Sex. Syst.* Monadelphia Polyandria.—*Nat. Ord.* Malvaceæ.

Gen. Ch. Calyx double, the exterior six or nine-cleft. *Capsules* numerous, one-seeded. *Willd.*

Althæa officinalis. Willd. *Sp. Plant.* iii. 770; Woodv. *Med. Bot.* p. 552, t. 198. Marshmallow is an herbaceous perennial, with a perpendicular branching root, and erect woolly stems, from two to four feet or more in height, branched and leafy towards the summit. The leaves are alternate, petiolate, nearly cordate on the lower part of the stem, oblong-ovate and obscurely three-lobed above, somewhat angular, irregularly serrate, pointed, and covered on both sides with a soft down. The flowers are terminal and axillary, with short peduncles, each bearing one, two, or three flowers. The corolla has five spreading, obcordate petals, of a pale-purplish colour. The fruit consists of numerous capsules united in a compact circular form, each containing a single seed. The plant grows throughout Europe, inhabiting salt marshes, the banks of rivers, and other moist places. It is found also in this country on the borders of salt marshes. In some parts of the Continent of Europe, it is largely cultivated for medical use. The whole plant abounds in mucilage. The flowers, leaves, and root are mucilaginous, and were formerly officinal; but the last only is employed to any considerable extent in this country.

The roots should be collected in autumn from plants at least two years old. They are cylindrical, branched, as thick as the finger or thicker, from a foot to a foot and a half long, externally of a yellowish colour, which becomes grayish by drying, within

* Dr. Paris enumerates the following empirical preparations, containing aloes as a leading ingredient:—Anderson's pills, consisting of aloes, jalap, and oil of aniseed; Hooper's pills, of aloes, myrrh, sulphate of iron, canella, and ivory-black; Dixon's antibilious pills, of aloes, scammony, rhubarb, and tartarized antimony; Speediman's pills, of aloes, myrrh, rhubarb, extract of chamomile, and essential oil of chamomile; Dinner pills, of aloes, mastich, red roses, and syrup of wormwood; Fothergill's pills, of aloes, scammony, colocynth, and oxide of antimony; Peter's pills, of aloes, jalap, scammony, gamboge, and calomel; and Radcliff's Elixir, of aloes, cinnamon, zedoary, rhubarb, cochineal, syrup of buckthorn, and spirit and water as the solvent; to which may be added Lee's Windham pills, consisting of gamboge, aloes, soap, and nitrate of potassa; and Lee's New London pills, of aloes, scammony, gamboge, calomel, jalap, soap, and syrup of buckthorn.

white and fleshy. They are usually prepared for the market by removing the epidermis. Our shops are supplied from Europe.

Properties. Marshmallow root comes to us in pieces three or four inches or more in length, usually not so thick as the finger, generally round, but sometimes split, white externally and downy from the mode in which the epidermis is removed, light and easily broken with a short somewhat fibrous fracture, of a peculiar faint smell, and a mild, mucilaginous, sweetish taste. Those pieces are to be preferred which are plump and but slightly fibrous. The root contains a large proportion of mucilage, besides starch and saccharine matter, which it yields readily to boiling water. The mucilage, without the starch, is extracted by cold water, which thus becomes ropy. A principle was discovered in the root by M. Bacon, which he supposed to be peculiar to the marshmallow, but which has been ascertained to be identical with the *asparagin* of Robiquet. MM. Boutron-Charlard and Pelouze found it to belong to that class of organic principles, which are convertible by strong acids, and other agencies, into ammonia and peculiar acids, and which are designated by the termination *amide*. Thus asparagin, which in this view should be called *asparamide*, is converted into ammonia and *asparmic*, or, as it was formerly named, *aspartic acid;* and one eq. of the resulting asparmate of ammonium corresponds with one eq. of asparamide and one of water. (*Journ. de Pharm.*, xix. 208.) Asparagin, being now considered as a derivative from malate of ammonium, has received the name of *malamide*, and asparmic acid is called, by a corresponding change, *malamidic acid.* (*Gregory's Chemistry.*) It is found in various other plants besides the marshmallow, as in the shoots of asparagus, in vetches grown in the dark, in all the varieties of the potato, and in the roots of the comfrey and liquorice plant. According to Professor Pira, asparagin has acid properties. It has no therapeutical value. Marshmallow is said to become somewhat acid by decoction. Those pieces should be rejected which are woody, discoloured, mouldy, of a sour or musty smell, or a sourish taste.

The roots of other *Malvaceæ* are sometimes substituted for that of marshmallow, without disadvantage, as they possess similar properties. Such are those of *Althæa rosea* or *hollyhock*, and *Malva Alcea*. The dark purple flowers of a variety of A. rosea are proposed by Prof. Aitkens, of the Univ. of Md., as a test for acids and alkalies. A strong infusion of these flowers imparts to slips of white filtering paper immersed in it a permanent purplish-blue colour, which is reddened by acids, and rendered bluish-green by alkalies.

Medical Properties and Uses. The virtues of marshmallow are exclusively those of a demulcent. The decoction of the root is much used in Europe in irritation and inflammation of the mucous membranes. The roots themselves, boiled and bruised, are sometimes employed as a poultice. The leaves and flowers are applied to similar uses. In France, the powdered root is much used in the preparation of pills and electuaries. Some prefer it to powdered liquorice root in the preparation of the mercurial pill. W.

ALUMEN. *U.S., Br.*

Alum.

Aluminæ et Ammoniæ Sulphas. *U.S.* 1860.

Sulphate of aluminium and ammonium. *U.S.* A sulphate of ammonia and alumina crystallized from solution in water, $NH_4O,SO_3,Al_2O_3,3SO_3+24HO$. *Br.*

Syn. Ammonia-alum. *U.S.*

ALUMINII ET POTASSII SULPHAS. *U.S.*

Sulphate of Aluminium and Potassium.

Syn. Alumen, *U.S. Pharm.* 1860. Potassa-alum.

Alun, *Fr., Dan., Swed.;* Alaun, *Germ.;* Allume, *Ital.;* Allumbre, *Span.*

The name alum has been applied indifferently to two salts, one consisting of tersulphate of aluminium combined with sulphate of ammonium, the other of the same salt of alumina combined with sulphate of potassium; and distinguished as

ammonia-alum and *potassa-alum*. Both are recognised by the U. S. Pharmacopœia, which confines the name of alum to the former, because this salt is the one most commonly used by that title, giving its proper chemical name to the other. The Br. Pharmacopœia recognises only the ammonia-salt.

SULPHATE OF ALUMINIUM AND POTASSIUM. *U. S.* Potassa-alum is manufactured occasionally from earths which contain it ready formed, but most generally from minerals which, from the fact of their containing most or all of its constituents, are called *alum ores*. The principal alum ores are the *alum stone*, which is a native mixture of sulphate of aluminium and sulphate of potassium, found in large quantities at Tolfa and Piombino in Italy; and certain natural mixtures of bisulphuret of iron with alumina, silica, and bituminous matter, called *aluminous schist* or *alum-slate*.

At the Solfaterra, and other places in Southern Italy, alum was formerly extracted from earths containing it ready formed. The ground being of volcanic origin, and having a temperature of about 104°, an efflorescence of pure alum formed upon its surface. This was collected and lixiviated, and the solution crystallized by slow evaporation in leaden vessels sunk in the ground.

The alum stone is manufactured into alum by calcination, and subsequent exposure to the air for three months; the mineral being frequently sprinkled with water, in order that it may be brought to the state of a soft mass. This is lixiviated, and the solution obtained crystallized by evaporation. The alum stone may be considered as consisting of alum, united with a certain quantity of hydrate of alumina. The latter, by the calcination, loses its water, and becomes incapable of remaining united with the alum of the mineral, which is consequently set free. Alum of the greatest purity is obtained from this ore.

Alum-slate, when compact, is first exposed to the air for a month. It is then stratified with wood, which is set on fire. The combustion which ensues is slow and protracted. The sulphur is in part converted into sulphuric acid, which unites with the alumina; and the sulphate of aluminium thus formed generates a portion of alum with the potassa derived from the ashes of the wood. The iron, in the mean time, is almost wholly converted into sesquioxide, and thus becomes insoluble. The matter is lixiviated, and the solution crystallized into alum by evaporation. The mother-waters, containing sulphate of aluminium, are then drawn off, and made to yield a further portion of alum by the addition of sulphate of potassium or chloride of potassium; the latter being obtained usually from the soap-boilers.

When the alum-slate is easily disintegrated, it is not subjected to combustion, but merely placed in heaps, and occasionally sprinkled with water. The bisulphuret of iron gradually absorbs oxygen, and passes into sulphate of the protoxide, which effloresces on the surface of the heap. Part of the sulphuric acid formed unites with the alumina; so that, after the chemical changes are completed, the heap contains both the sulphate of iron and the sulphate of aluminium. At the end of about a year, the matter is lixiviated, and the solution of the two sulphates produced is concentrated to the proper degree in leaden boilers. The sulphate of iron crystallizes, while the sulphate of aluminium, being a deliquescent salt, remains in the mother-waters. These are drawn off, and treated with sulphate of potassium in powder, heat being at the same time applied. The whole is then allowed to cool, that the alum may crystallize. The crystals are then separated from the solution, and purified by a second solution and crystallization. They are next treated with water, just sufficient to dissolve them at the boiling temperature; and the saturated solution is run into casks or tubs, so constructed as to be easily taken to pieces, and set up again. In the course of ten or fifteen days, the alum concretes into a crystalline mass, from which the mother-liquor is let off. The vessel is then taken to pieces, and the salt, having been broken up, is packed in barrels for sale. This process for forming the alum in large masses is called *rocking*.

Alum is now largely manufactured by the direct combination of its constituents. With this view, clays are selected as free from iron and carbonate of calcium as possible, and calcined to sesquioxidize the iron, and render them more easily pulverizable; after which they are dissolved, by the assistance of heat, in weak sulphuric acid. Advantage has been found from mixing the clay, previously to calcination, with

powdered charcoal, coke, or other carbonaceous matter, in the proportion of about one to six of the clay, and then applying heat by a reverberatory furnace till all the carbon is consumed. It is asserted that the alumina is thus rendered more soluble in the acid. (*Pharm. Journ. and Trans.*, Dec. 1857, p. 328.) The sulphate of aluminium, thus generated, is next crystallized into alum by the addition of sulphate of potassium in the usual manner. Alum is made in this way from the ashes of the Boghead cannel-coal, which occurs near Edinburgh. These ashes, which form the residue of the combustion of the coke derived from the coal used for making gas, contain a considerable quantity of alumina in a state readily soluble in acids.

ALUMEN, *U. S., Br.* ALUMINII ET AMMONII SULPHAS. *Sulphate of Aluminium and Ammonium. Ammonia-alum.* Besides the potassa-alum, which was formerly the only officinal variety of this salt, there are several others, in which the potassa is replaced by some other base, as, for example, ammonia or soda. Of these, *ammonia-alum*, or the sulphate of aluminium and ammonium, was introduced into the U. S. Pharmacopœia at its revision in 1860, and in the present U. S. and Br. Pharmacopæias, has been adopted by the name of alumen. It is made by adding sulphate of ammonium to the solution of sulphate of aluminium. This kind of alum has come into very general use, owing to the rise in value of potassa, and to the comparative cheapness of ammonia, obtained in the process for ferrocyanide of potassium, or derived from the liquor of gas-works. Ammonia-alum is extensively manufactured by Powers & Weightman of this city. Scotch alum, made near Paisley, generally contains both potassa and ammonia. Ammonia-alum resembles potassa-alum so exactly that it cannot be distinguished by simple inspection; and in composition it is perfectly analogous to the potassa-salt. It may, however, be distinguished by subjecting it to a strong calcining heat, after which alumina will be the sole residue; or by rubbing it with potassa or lime and a little water, when the smell of ammonia will be perceived.

Properties. Alum is a white, slightly efflorescent salt, crystallizing in regular octohedrons, and possessing an acid, sweetish, astringent taste.* It dissolves in between fourteen and fifteen times its weight of cold, and three-fourths of its weight of boiling water. Its solution is precipitated by ammonia and potassa and their carbonates, which throw down a gelatinous subsulphate of aluminium, of variable composition, dependent upon the proportion of the precipitant employed. Alum is insoluble in alcohol and brandy. Its sp. gr. is 1·71. It reddens litmus, but changes the blue tinctures of the petals of plants to green. When heated a little above 212°, it undergoes the aqueous fusion; and, if the heat be continued, it loses its water, swells up, becomes a white, opaque, porous mass, and is converted into the officinal *dried alum.* (See *Alumen Exsiccatum.*) Exposed to a red heat, it gives off oxygen, together with sulphurous and anhydrous sulphuric acids; and the residue consists of alumina and sulphate of potassium. When calcined with finely divided charcoal, it forms a spontaneously inflammable substance, called *Homberg's pyrophorus*, which consists of a mixture of sulphuret of potassium, alumina, and charcoal.

The characters of the ammonia-alum, as stated in the British Pharmacopœia, are that its solution gives with caustic potassa or soda a white precipitate, soluble in an excess of the reagent, with the evolution of ammonia, especially when heated; and an immediate precipitate with chloride of barium; and does not acquire a blue colour from the addition of yellow or red prussiate of potassium, proving the absence of iron.

Several varieties of alum are known in commerce. *Roche alum*, so called from its having come originally from Rocca, in Syria, is a sort which occurs in fragments about the size of an almond, and of a pale-rose colour, which is given to it, according to Pereira, by bole or rose-pink. *Roman alum*, which is the purest variety found in commerce, also occurs in small fragments, covered with a reddish-brown powder, resembling ochre, which is put on by the manufacturers. It has been supposed that the powder contains iron; but this is probably a mistake. Roman alum crystallizes in cubes, from the fact that the crystals are deposited from a solution always containing an excess of alumina, which decomposes any iron salt that may be present. This crystalline form of alum is, therefore, an index of its freedom from iron.

* It may be made to crystallize in cubes by carefully evaporating a solution, to which ammonia has been added in as large quantities as possible without making the solution turbid. (M. de Hauer, *Journ. de Pharm. et de Chim.*, 4e sér., iii. 309.)—*Note to the thirteenth edition.*

All the alums of commerce contain more or less sulphate of iron, varying from five to seven parts in the thousand. The iron is readily detected by adding to a solution of the suspected alum a few drops of the ferrocyanide of potassium, which will cause a greenish-blue tint, if iron be present. It may be detected also by precipitating the alumina as a subsulphate with a solution of potassa, and afterwards adding the alkali in excess. This will redissolve the precipitate, with the exception of any iron, which will be left in the state of sesquioxide. The proportion of iron usually present, though small, is injurious when the salt is used in dyeing. It may, however, be purified, either by dissolving it in the smallest quantity of boiling water, and stirring the solution as it cools, or by repeated solutions and crystallizations.

Incompatibles. Alum is incompatible with the alkalies and their carbonates, lime and lime-water, magnesia and its carbonate, tartrate of potassium, and acetate of lead.

Composition. Alum was regarded as a sulphate of aluminium, until it was proved by Descroizilles, Vauquelin, and Chaptal to contain also sulphate of potassium, sulphate of ammonium, or both these salts. When its second base is potassa, it consists of one equivalent of tersulphate of aluminium 171·4, one of sulphate of potassium 87·2, and twenty-four of water 216 = 474·6. In the ammonia-alum, the equivalent of sulphate of potassium is replaced by one of the sulphate of ammonium, that is, sulphate of ammonia and water. *Alumina* is classed as an earth, and may be obtained by subjecting ammonia-alum to a strong calcining heat. It consists of two eqs. of a metal called *aluminium* 27·4, and three of oxygen 24 = 51·4. It is, therefore, a sesquioxide. The existence of this metal was rendered probable by Sir H. Davy in 1808; but it was not fairly obtained until 1828, when Wöhler procured it in an impure state, in globules of the size of a pin's head, by the action of potassium on chloride of aluminium. In 1854 Deville succeeded in obtaining the pure metal in ingots by decomposing the same chloride with sodium. Aluminium is silver-white, sonorous, unalterable in the air, and lighter than glass, having the sp. gr. 2·56 only. Its fusing point is somewhat lower than that of silver. It is not attacked by sulphuric or nitric acid, nor tarnished by sulphuretted hydrogen. Its proper solvent is muriatic acid. After silver, gold, and platinum, it is the least alterable of the metals. According to Mr. A. Monier, of Camden, N. J., who first obtained the metal in this country, it is not in the least oxidized by fusion with nitre, a property which affords a ready means of purifying it from other metals. (*Am. Journ. of Pharm.*, March, 1857.) By reason of its valuable properties, it will be applied to many purposes in the arts, if obtainable in sufficient quantities, and at a moderate cost.

Medical Properties, &c. Alum, in ordinary doses, is astringent and antispasmodic, in large doses, purgative and emetic. It is employed as an astringent in passive hemorrhages, colliquative sweats, diabetes, and chronic dysentery and diarrhœa; also in gleet and leucorrhœa, in which diseases it is sometimes combined with cubebs. In connection with ice, it has been found effectual by Dr. de Ricci in a very bad case of hæmatemesis. (*Dub. Quart. Journ. of Med. Sci.*, Aug. 1860.) It has been recommended in dilatation of the heart, and in aortic aneurism, and as an antispasmodic in hooping-cough. As a purgative, it has been employed in colica pictonum. This practice was introduced by Grashuis, a Dutch physician, in 1752, was imitated by Dr. Percival with great success, and has been revived in recent times with the happiest results. It allays nausea and vomiting, relieves flatulence, mitigates the pain, and opens the bowels with more certainty than any other medicine. Sometimes it is advantageously conjoined with opium and camphor. It is also efficacious in nervous colic. Sir James Murray found it a useful remedy in the peculiar affection of the stomach, characterized by the frequent vomiting of a large quantity of glairy fluid. He gave it in doses of ten or twelve grains three or four times a day, mixed with an equal quantity of cream of tartar to prevent constipation, and a little ginger to obviate flatulence. By Dr. C. D. Meigs alum has been strongly recommended, after an experience of more than twenty years, as an excellent emetic in pseudomembranous croup. In these cases, it has the merit of acting with promptness and certainty, and without producing that extreme prostration which often follows the use of antimonials. His son, Dr. J. F. Meigs, has also borne testimony to its value in this disease. In a case in which an ounce of opium had been swallowed, Dr. C. D. Meigs found alum

an efficient emetic. After 30 grains of sulphate of zinc had been given without effect, half an ounce of alum was administered, followed by copious vomiting. Soon afterward, a second half ounce was given, with the same effect; and the result was that the patient recovered.

In various anginose affections, alum is found highly useful, applied topically either in powder or solution. When the affection is attended with membranous exudation, its efficacy has been particularly insisted on by Bretonneau, applied in solution prepared with vinegar and honey for adults, and in powder, by *insufflation*, in the cases of children. When used in the latter way, a drachm of finely powdered alum may be placed in one end of a tube, and then blown by means of the breath into the throat of the child. Velpeau, in 1835, extended the observations of Bretonneau, and has used alum successfully not only in simple inflammatory sorethroat, but in those forms of angina dependent on smallpox, scarlatina, &c. In these cases, the powdered alum may be applied several times a day to the fauces, by means of the index finger. In relaxation of the uvula, and in the beginning of sorethroat, a solution of alum is one of our best gargles. It forms also a useful astringent wash in mercurial sore-mouth. In the form of lozenge, made with sugar and tragacanth, and allowed slowly to dissolve in the mouth, it is peculiarly applicable to chronic throat affections. In gleet and leucorrhœa the solution is an approved remedy, either alone or conjoined with sulphate of zinc. It is frequently applied as a styptic, in epistaxis, by means of a plug soaked in a saturated solution, and pressed up the nostril, and in menorrhagia, by the aid of a sponge soaked in a similar solution, and introduced into the vagina. It may be applied also by injection, both in these hemorrhages and in that from the rectum. In the latter stages of conjunctivitis it is often useful, and in the purulent ophthalmia of infants is our most efficacious remedy. In these cases, it is usually applied in the form of *cataplasm*, made by coagulating the whites of two eggs with a drachm of alum.

The ordinary dose of alum is from ten to twenty grains, repeated every two or three hours, mixed with syrup or molasses. Sir James Murray objects to its administration in solution, and greatly prefers the form of an impalpable powder, mixed with molasses, as furnishing the means of presenting the remedy slowly to the surfaces intended to be acted upon. In hooping-cough the dose is from two to ten grains, according to the age of the child, repeated three times a day; in colica pictonum, from half a drachm to two drachms every three or four hours. In croup the dose, as an emetic, is a teaspoonful of the powder, mixed with honey, syrup, or molasses, and repeated every ten or fifteen minutes, until free vomiting is induced. An elegant mode of giving alum in solution is in the form of *alum-whey*, made by boiling two drachms of alum with a pint of milk, and then straining to separate the curd. The dose is a wineglassful, containing about fifteen grains of alum. As a collyrium, the solution is made of various strengths; as four, six, or eight grains to the fluid-ounce of water. A solution, containing from half an ounce to an ounce in a pint of water, and sweetened with honey, is a convenient gargle. Solutions for gleet, leucorrhœa, ulcers, &c., must vary in strength according to the state of the parts to which they are applied.

In overdoses the use of alum is not without danger; and a fatal case is recorded by Dr. Ricquet, of Liege, in which death resulted from about an ounce, taken in solution, by mistake for a dose of Epsom salts. A sensation of burning in the mouth, throat, and stomach occurred immediately upon the swallowing of the poisonous dose, followed by bloody vomiting, and death in the midst of inexpressible suffering. Upon post-mortem examination there was found a grayish-yellow coating covering the mucous membrane of the mouth, pharynx, and œsophagus; the tongue and uvula were swollen; and the stomach, bowels, and kidneys were injected. (*Journ. de Pharm.*, Oct. 1873, p. 333.)

Alum is sometimes used to adulterate bread, with the view to increase its whiteness, and to conceal the defects of the flour.

Off. Prep. of Alum. Alumen Exsiccatum; Aluminii Sulphas, *U. S.* B.

AMMONIA.

Ammonia.

All the ammoniacal compounds owe their distinctive properties to the presence of a peculiar gaseous substance, composed of nitrogen and hydrogen, called *ammonia*. This is most easily obtained by the action of lime on muriate of ammonium or sal ammoniac; when the lime unites with the muriatic acid, so as to form chloride of calcium and water, and expels the ammonia. It is transparent and colourless, like common air, but possesses an acrid taste, and exceedingly pungent smell. It has a powerful alkaline reaction, and, from this property and its gaseous nature, was called the *volatile alkali* by the earlier chemists. Its sp. gr. is 0·59. It is irrespirable, the glottis closing spasmodically when the attempt is made to breathe it. It consists of one eq. of nitrogen 14, and 3 of hydrogen 3 = 17; or, in volumes, of one volume of nitrogen and three volumes of hydrogen, condensed into two. Its symbol is NH_3.

The salts of ammonia may be divided into hydracid salts and oxacid salts. Thus, when muriatic acid unites with ammonia, we have the hydracid salt called heretofore muriate of ammonia, with the symbol NH_3,HCl. But Berzelius supposed that, in the act of uniting, the hydrogen of the muriatic acid is transferred to the elements of the ammonia, and that the compound thus formed, uniting with the chlorine, gives rise to a salt, represented by NH_4Cl. To this hypothetical compound (NH_4) Berzelius gave the name of *ammonium*, and consequently to muriate of ammonia (now muriate of ammonium) the appellation of *chloride of ammonium*.

Applying the same view to the oxacid salts of ammonia, Berzelius conceived that they are compounds of *oxide of ammonium* (NH_4O) with their several acids. It is found that the true oxacid salts of ammonia always contain one eq. of water, which cannot be separated from them without destroying their identity; and it is supposed that the elements of this eq. of water, united with the elements of one eq. of ammonia, form oxide of ammonium. To apply Berzelius's view to sulphate of ammonia, as this salt was called before the recent reformation of the nomenclature of salts, it is usually considered a monohydrated sulphate of ammonia ($NH_3, SO_3 + HO$); but he made it the sulphate of oxide of ammonium without water (NH_4O,SO_3).

The atmosphere contains a minute proportion of ammonia, probably in the state of carbonate. The alkali is sometimes also found in snow. (A. Vogel, *Neues Repert. für Pharm.*, 1872, p. 327.)

Ozonized oxygen oxidizes the elements of ammonia, producing water and nitric acid, which latter, by uniting with undecomposed ammonia, generates nitrate of ammonium. Ordinary oxygen, under the influence of platinum-black, or finely divided copper, likewise oxidizes the elements of ammonia, the nitrogen to the extent only of forming nitrous acid, with the result of producing nitrite of ammonium. (Schönbein, *Chem. Gaz.*, March 16, 1857.)

Medical Properties. The compounds of ammonia are stimulant, antispasmodic, antacid, and alexipharmic. According to Dr. Ogier Ward, they possess the property of dissolving the protein principles of the blood; and, while their primary action is stimulant, their remote operation is sedative, resolvent, and attenuant, implying the power of carrying the products of inflammation out of the system. (*Am. Journ. of the Med. Sci.*, April, 1857, from the *Lancet*.)

The following table contains a list of the principal officinal preparations of ammonia, with their synonymes.

I. In Aqueous Solution.

Aqua Ammoniæ Fortior, *U. S.*; Liquor Ammoniæ Fortior, *Br.*—*Stronger Water of Ammonia. Stronger Solution of Ammonia.*

Linimentum Camphoræ Compositum, *Br.*—*Compound Liniment of Camphor.*

Aqua Ammoniæ, *U. S.*; Liquor Ammoniæ, *Br.*—*Water of Ammonia. Solution of Ammonia.*

Hydrargyrum Ammoniatum, *U S.*, *Br.*—*Ammoniated Mercury. White Precipitate.*

Linimentum Ammoniæ, *U. S., Br.*—*Liniment of Ammonia. Volatile Liniment.*

Linimentum Hydrargyri, *Br.*—*Liniment of Mercury.*

II. In Spirituous Solution.

Spiritus Ammoniæ, *U. S.*—*Spirit of Ammonia.*

Spiritus Ammoniæ Aromaticus, *U. S., Br.*—*Aromatic Spirit of Ammonia.*

Tinctura Guaiaci Ammoniata, *U. S., Br.*—*Ammoniated Tincture of Guaiac.*

Tinctura Valerianæ Ammoniata, *U. S., Br.*—*Ammoniated Tincture of Valerian.*

Spiritus Ammoniæ Fœtidus, *Br.*—*Fetid Spirit of Ammonia.*

Tinctura Opii Ammoniata, *Br.*—*Ammoniated Tincture of Opium.*

III. In Saline Combination.

Aluminii et Ammonii Sulphas, *U. S.;* Alumen, *U. S., Br.*—*Sulphate of Aluminium and Ammonium. Ammonia-Alum.*

Ammonii Benzoas, *U. S.;* Ammoniæ Benzoas, *Br.*—*Benzoate of Ammonium.*

Ammonii Carbonas, *U. S.;* Ammoniæ Carbonas, *Br.*—*Carbonate of Ammonium. Mild Volatile Alkali.*

Cuprum Ammoniatum, *U. S.*—*Ammoniated Copper.*

Liquor Ammonii Acetatis, *U. S.;* Liquor Ammoniæ Acetatis, *Br.*—*Solution of Acetate of Ammonium. Spirit of Mindererus.*

Ammoniæ Hydrochloras, *Br.* 1864: Ammonii Chloridum, *U. S., Br.*—*Muriate of Ammonium. Hydrochlorate of Ammonia. Chloride of Ammonium. Sal Ammoniac.*

Ammonii Iodium, *U. S.*—*Iodide of Ammonium.*

Ammonii Nitras, *U. S.*—*Nitrate of Ammonium.*

Ammoniæ Phosphas, *Br.*—*Phosphate of Ammonia.*

Ammonii Sulphas, *U. S.*—*Sulphate of Ammonium.*

Ammonii Valerianas, *U. S.*—*Valerianate of Ammonium.*

Ammonii Bromidum, *U. S., Br.*—*Bromide of Ammonium. Hydrobromate of Ammonia.*

Ferri et Ammonii Citras, *U. S., Br.*—*Citrate of Iron and Ammonium.*

Ferri et Ammonii Sulphas, *U. S.*—*Sulphate of Iron and Ammonium.*

Ferri et Ammonii Tartras, *U. S.*—*Tartrate of Iron and Ammonium.*

Hydrargyrum Ammoniatum, *U. S., Br.*—*Ammoniated Mercury.*

Liquor Ammoniæ Citratis, *Br.*—*Solution of Citrate of Ammonia.*

Liquor Bismuthi et Ammoniæ Citratis, *Br.*—*Solution of Bismuth and Ammonia.* B.

AQUA AMMONIÆ FORTIOR. *U. S.*

Stronger Water of Ammonia.

An aqueous solution of ammonia of the specific gravity 0·900, and containing 26 per cent. by weight of the gas. *U. S.*

Off. Syn. LIQUOR AMMONIÆ FORTIOR. *Strong Solution of Ammonia.* Ammoniacal gas, NH_3, dissolved in water, and constituting 32·5 per cent. of the solution. *Br.*

This preparation is too strong for internal exhibition, but forms a convenient ammoniacal solution for reduction, with distilled water, to the strength of ordinary officinal water of ammonia (Aqua Ammoniæ), or for preparing strong rubefacient and vesicating lotions and liniments.

The U. S. Pharmacopœia includes this solution in the list of the Materia Medica; but in the British, the following formula is given for its preparation.

"Take of Chloride of Ammonium, in coarse powder, *three pounds* [avoirdupois]; Slaked Lime *four pounds* [avoird.]; Distilled Water *thirty-two fluidounces.* Mix the Lime with the Chloride of Ammonium, and introduce the mixture into an iron bottle, placed in a metal pot surrounded by sand. Connect the iron tube, which screws air-

tight into the bottle, in the usual manner, by corks, glass tubes, and caoutchouc collars, with a Woulf's bottle capable of holding a pint [Imperial measure]; connect this with a second Woulf's bottle of the same size, the second bottle with a matrass of the capacity of three pints [Imp. meas.], in which twenty-two [fluid]ounces of the Distilled Water are placed, and the matrass, by means of a tube bent twice at right angles, with an ordinary bottle containing the remaining ten [fluid]ounces of Distilled Water. Bottles 1 and 2 are empty, and the latter and the matrass which contains the twenty-two ounces of distilled water are furnished each with a siphon safety tube, charged with a very short column of mercury. The heat of a fire, which should be very gradually raised, is now to be applied to the metal pot, and continued until bubbles of condensible gas cease to escape from the extremity of the glass tube which dips into the water of the matrass. The process being terminated, the matrass will contain about forty-three fluidounces of the Strong Solution of Ammonia.

"Bottles 1 and 2 will now include, the first about sixteen, the second about ten fluidounces of a coloured ammoniacal liquid. Place this in a flask closed by a cork, which should be perforated by a siphon safety tube containing a little mercury, and also by a second tube bent twice at right angles, and made to pass to the bottom of the terminal bottle used in the preceding process. Apply heat to the flask until the coloured liquid it contains is reduced to three-fourths of its original bulk. The product now contained in the terminal bottle will be nearly of the strength of Solution of Ammonia, and may be made exactly so by the addition of the proper quantity of Distilled Water, or of Strong Solution of Ammonia." *Br.*

In this process the ammonia is disengaged in the usual manner from muriate of ammonium by the action of lime, as explained under the head of *Aqua Ammoniæ*. But it is perceived, by the details of the process, that the purpose is to obtain both the *stronger* and *ordinary* solution of ammonia at one operation. This is done by connecting the iron bottle containing the materials with a series of four receivers, the first two being empty Woulf's bottles, the third a matrass containing twenty-two fluidounces of distilled water, and the fourth an ordinary bottle containing the remainder of the distilled water. In the first two bottles, impurities are condensed with a considerable portion of ammonia; in the matrass, the officinal Strong Solution of Ammonia (*Br.*) has been formed by the absorption of the gas; and, in the fourth, is a weaker ammoniacal liquid formed by the absorption of a portion of the gas which has passed through the matrass unabsorbed. This last liquid is raised to the strength of the officinal Solution of Ammonia (*Br.*) by forcing into it a portion of ammoniacal gas from the impure contents of the first two bottles. We presume that the receivers are to be kept cool by means of cold water or ice, though no such direction is given in the process. If the solution in the fourth bottle be not of the required officinal strength (sp. gr. 0·959), it may be made so by the addition of stronger solution from the matrass, if too weak, or of distilled water, if too strong.

Water of ammonia is seldom made by the formula of the Pharmacopœia, but is prepared on a large scale, from one of the products of the coal gas manufacture, by the following more economical process. *Gas liquor* is distilled, and the distillate, which is principally hydrosulphuret of ammonia, is converted into sulphate of ammonium by sulphuric acid. The rough sulphate is then gently distilled with milk of lime, the still being connected with a series of glass carboys, arranged like Woulf's bottles, and three-fourths filled with distilled water. In this way solution of ammonia may be obtained of maximum strength. (See a paper by Mr. W. Lawson, in the *Am. Journ. of Pharm.* for July, 1855, p. 362, from the *Pharm. Journ. and Trans.* for April, 1855.)

Properties of Aqueous Ammonia of Maximum Strength. This is a colourless liquid, of an acrid taste, and very pungent smell. It is strongly alkaline, and immediately changes turmeric, when held over its fumes, to reddish-brown. Cooled to 40° below zero, it concretes into a gelatinous mass, and at 130° boils, owing to the rapid disengagement of the gas. Its sp. gr. is 0·875 at 50°. Anhydrous ammonia is said to dissolve metallic sodium, and the solution is intensely blue. (*Chem. News*, Nov. 4, 1870, p. 217.)

Properties of the Officinal Stronger Water of Ammonia. This has similar properties to those above mentioned. Its sp. gr. is 0·900, *U. S.*, 0·891, *Br.* When of the former density, it contains 26 per cent. of the gas, when of the latter 32·5 per cent. "By weight, 52·3 grains require for neutralization 1000 grain-measures of *the volumetric solution of oxalic acid.* One fluidrachm contains 15·83 grains of Ammonia, NH_3." *Br.* The stronger water of ammonia of the shops usually ranges in density from 0·900 to 0·920. Even when of proper officinal strength at first, it generally becomes weaker by the escape of ammonia. To prevent its deteriorating, it should be kept in closely stopped bottles in a cool place. If precipitated by lime-water, it contains carbonic acid. After having been saturated with nitric acid, a precipitate by carbonate of ammonium indicates earthy impurity, by nitrate of silver, a chloride, and by chloride of barium, a sulphate. "When diluted with four times its volume of distilled water, it does not give precipitates with solution of lime, oxalate of ammonia, sulphide of ammonium, or ammonio-sulphate of copper" (*Br.*); indicating the absence of carbonates, lime, metals, and sulphurets.

Aqua Ammoniæ Fortior is a convenient preparation for making *Aqua Ammoniæ* (sp. gr. 0·960, *U. S.*, 0·959, *Br.*) by dilution with distilled water. To effect this reduction, the U. S. stronger solution requires to be diluted with about one and a half measures of distilled water; the British, with two measures.

When purchasing the Stronger Solution of Ammonia, the apothecary should not trust to its being of the officinal strength; but should ascertain the point by taking its density, either by the specific gravity bottle or the hydrometer. Another method of ascertaining its density is by the *ammonia-meter* of Mr. J. J. Griffin, of London, described and figured in the *Pharm. Journ. and Trans.* (x. 413). In reducing it to make Aqua Ammoniæ, the same precaution should be taken; and, if the mixture should not have the sp. gr. 0·960, it should be brought to that density by the addition either of the stronger solution or of distilled water, as the case may require.

Medical Properties and Uses. This solution is too strong for medical use in its unmixed state. Sufficiently diluted with spirit of camphor and rosemary, it has been much employed as a prompt and powerful rubefacient, vesicatory, or escharotic, in various neuralgic, gouty, rheumatic, spasmodic, and inflammatory affections, in which strong and speedy counter-irritation is indicated. When mere rubefaction is desired, a mixture may be used composed of five fluidounces of the ammoniacal liquid and eight of the diluent liquids; and this will answer even for blistering or cauterizing, unless a very prompt effect is necessary. In the latter case, a lotion may be resorted to consisting of five measures of the ammoniacal to three of the diluent liquid. These mixtures are applied by means of linen folded several times, or a thick piece of flannel saturated with the liniment. A convenient mode is to fill the wooden cover of a large pill or ointment box, an inch or two in diameter, with patent lint, saturate this with the liquid, and press it upon the part. The ammonia is thus prevented from escaping, and a definite boundary given to the inflammation. The application will generally produce rubefaction in from one to eight minutes, vesication in from three to ten minutes, and a caustic effect in a somewhat longer time.

When a solution of ammonia of 25° (sp. gr. 0·905) is mixed with fatty matter, the mixture forms the *vesicating ammoniacal ointment* of Dr. Gondret. The amended formula of this ointment is as follows. Take of lard 32 parts, oil of sweet almonds 2 parts. Melt them together by the *gentle* heat of a candle or lamp, and pour the melted mixture into a bottle with a wide mouth. Then add 17 parts of solution of ammonia of 25°, and mix, with continued agitation, until the whole is cold. The ointment must be preserved in a bottle with a ground stopper, and kept in a cool place. When well prepared, it vesicates in ten minutes.

A case of poisoning by stronger solution of ammonia, successfully treated by Dr. H. W. Reed, in which the stomach-pump, dilute acetic acid, olive oil, milk, hot fomentations, and strong purgative enemata were used, is related in the London *Med. Times and Gaz.* (xi. 59). The subsequent irritation and inflammation were combated chiefly by morphia, and by leeches to the stomach and throat. The immediate effects, after swallowing the ammonia, were those of the strong corrosive poisons. There may be danger of excessive irritation and inflammation of the nostrils, mouth,

and air-passages, from the inadvertent inhalation of the gas escaping from a bottle of the stronger water of ammonia, when freshly opened; and serious consequences have occurred from this cause, or the accidental breaking of the bottle. The best antidote, under these circumstances, would be the inhalation of the vapours of vinegar or acetic acid.

Pharm. Use. In the preparation of Aconitia, *U. S.*

Off. Prep. Ammoniæ Phosphas, *Br.;* Linimentum Camphoræ Compositum, *Br.;* Liquor Ammoniæ, *Br.;* Liquor Ammoniæ Citratis, *Br.;* Liquor Bismuthi et Ammoniæ Citratis, *Br.;* Spiritus Ammoniæ Aromaticus, *Br.;* Spiritus Ammoniæ Fœtidus, *Br.;* Tinctura Opii Ammoniata, *Br.* B.

AMMONII CARBONAS. *U. S.*

Carbonate of Ammonium.

Off. Syn. Ammoniæ Carbonas, *Br.* Ammoniæ Sesquicarbonas, *Lond., Dub.* $2NH_4O,3CO_2$. *Br.*

This was transferred, in the revision of the U. S. Pharmacopœia of 1850, from the Preparations to the Materia Medica, certainly the proper place for it, as it is prepared only by the manufacturing chemist.

There have been many methods of obtaining carbonate of ammonium, in all of which the ammonia originated in organic decomposition. It was probably originally prepared from putrid urine. A patent was taken out in England for manufacturing it from guano, and another for making it by the direct combination of its constituents; the carbonic acid and ammoniacal gases being introduced simultaneously into leaden chambers. (*Chem. News*, Dec. 29, 1865.) But at present the salt is manufactured by subliming a mixture of either the muriate or sulphate with chalk. Muriate of ammonium and chalk (carbonate of calcium) are heated together in iron pots or retorts, and sublimed into large earthen or leaden receivers. By the reciprocal action of the salts employed, the carbonic acid of the chalk unites with the ammonia of the muriate, generating carbonate of ammonium, and the muriatic acid with the lime, forming water and chloride of calcium. The carbonate and water sublime together as hydrated carbonate of ammonium, and the residue is chloride of calcium. The relative quantities of chalk and muriate of ammonium, for mutual decomposition, are 50 of the former, and 53·5 of the latter, or one eq. of each. But a great excess of chalk is usually taken, in order to ensure the perfect decomposition of the muriate of ammonium, any redundancy of which would sublime with the carbonate and render it impure.

Sulphate of ammonium may be substituted for the muriate with much economy, as was shown by Payen. This double decomposition between sulphate of ammonium and carbonate of calcium takes place in the dry way only, that is, by sublimation. In the wet way, the double decomposition is reversed; carbonate of ammonium and sulphate of calcium reacting so as form sulphate of ammonium and carbonate of calcium. Large quantities of this carbonate are manufactured indirectly from *coal-gas liquor* and *bone-spirit;* the ammoniacal products in these liquors being converted successively into sulphate, muriate, and carbonate of ammonium. (See *Ammonii Chloridum.*) The salt as first obtained has a slight odour of tar, and leaves a blackish carbonaceous matter when dissolved in acids. Hence it requires to be purified, which is effected in iron pots, surmounted with leaden heads.

Properties. Carbonate (*sesquicarbonate*) of ammonium, recently prepared, is in white, moderately hard, translucent masses, of a fibrous and crystalline appearance, a pungent, ammoniacal smell, and a sharp penetrating taste. It possesses an alkaline reaction, and, when held under a piece of turmeric paper, changes it to brown, owing to the escape of monocarbonate of ammonium. When long or insecurely kept, it gradually passes into the state of bicarbonate, becoming opaque and friable, and falling into powder. It is soluble without residue in about four times its weight of cold water, but is decomposed by boiling water into two eqs. of monocarbonate which dissolve, and one eq. of carbonic acid, which escapes with effervescence. According to Dr. Barker (*Observations on the Dublin Pharmacopœia*), it dissolves abundantly in

diluted alcohol, as also in heated alcohol of the sp. gr. 0·836, with effervescence of carbonic acid. The Br. Pharmacopœia states that it is more soluble in spirit than water. When heated on a piece of glass, it should evaporate without residue, and, if turmeric paper held over it undergoes no change, it has passed into bicarbonate. As now prepared from coal-gas liquor, it sometimes contains traces of tarry matter, which gives a dark colour to its solution in acids. When it is saturated with nitric acid, neither chloride of barium nor nitrate of silver causes a precipitate. The non-action of these tests shows the absence of sulphate and muriate of ammonium. It is decomposed by acids, the fixed alkalies and their carbonates, lime-water and magnesia, solution of chloride of calcium, alum, acid salts such as bitartrate and bisulphate of potassium, solutions of iron (except the tartrate of iron and potassium and analogous preparations), corrosive sublimate, the acetate and subacetate of lead, and the sulphates of iron and zinc. "Fifty-nine grains dissolved in one [fluid]ounce of distilled water, will be neutralized by 1000 grain-measures of *the volumetric solution of acetic acid.* Twenty grains neutralize 23·5 grains of citric acid and 25·5 grains of tartaric acid." *Br.*

Composition. The salt consists of three eqs. of carbonic acid 66, two of ammonia 34, and two of water 18 = 118; or, which comes to the same thing, of one eq. of bicarbonate 61, and one of monocarbonate 39, combined with the same quantity of water. The medicinal carbonate of ammonium is, therefore, when perfect, a *sesquicarbonate*, as it is defined in the British Pharmacopœia. On the ammonium theory, the two eqs. of water disappear, and the salt becomes a sesquicarbonate of oxide of ammonium. Dalton and Scanlan have rendered it probable that it really consists of the two salts above mentioned; for, when treated with a small quantity of cold water, monocarbonate is dissolved and bicarbonate left. When converted into bicarbonate by exposure to the air, each eq. of the medicinal salt loses one eq. of monocarbonate, a change which leaves the acid and base in the proper proportion to form the bisalt. The mutual decomposition of the salts, employed in its preparation, would generate, if no loss occurred, the monocarbonate, and not the sesquicarbonate. The way in which the latter salt is formed may be thus explained. By the mutual decomposition of three eqs. of muriate of ammonium and three of chalk, three eqs. of monocarbonate of ammonium, three of water, and three of chloride of calcium are generated. During the operation, however, one eq. of ammonia, and one of water, forming together oxide of ammonium, are lost; so that there remain to be sublimed, three eqs. of carbonic acid, two of ammonia, and two of water; or, in other words, the constituents in the proper proportion for forming the hydrated sesquicarbonate of ammonium, or sesquicarbonate of oxide of ammonium. When the salt is re-sublimed in the process of purification, two eqs. are said to lose one eq. of carbonic acid, and to become one eq. of the 5-4 carbonate. Accordingly, the medicinal carbonate, after having been submitted to a second sublimation, is not a perfect sesquicarbonate.

Medical Properties and Uses. Carbonate of ammonium is stimulant, diaphoretic, antispasmodic, powerfully antacid, and in large doses emetic. Under certain circumstances it may prove expectorant; as when, in the last stages of phthisis, it facilitates the excretion of the sputa by increasing the muscular power. As a stimulant, it is exhibited principally in typhus fever, and very frequently in connection with wine-whey. Its principal advantage, in this disease, is its power to increase the action of the heart and arteries without unduly exciting the brain. It is employed, with a view to the same effect, and as an antacid, in certain stages of atonic gout, and in the gastric derangement supervening on habits of irregularity and debauchery. As a diaphoretic, it is resorted to in gout and chronic rheumatism, particularly the latter, in conjunction with guaiac. Dr. Pereira has employed it in many cases of epilepsy with benefit. In diabetes it has been recommended by Dr. Barlow in England, and Bouchardat in France. In cases of scrofula attended with languid circulation and dry skin, it is said to produce excellent effects. It is very seldom used as an emetic; but is supposed to act with advantage, in this way, in some cases of paralysis. In psoriasis and lepra vulgaris, Cazenave has used it with remarkable success. Two cases of glanders, successfully treated chiefly with five-grain doses of carbonate of ammonium, repeated every hour or two hours, are reported by Dr. Mackenzie, of London. (*Ranking's Abstract*, No. 18, p. 230.) As an external application, it is

rubefacient, and may be employed in several ways. Reduced to fine powder, and mixed with some mild ointment, it is useful in local rheumatism. One part of it, incorporated with three parts of extract of belladonna, forms a plaster very efficacious in relieving local and spasmodic pains. Coarsely bruised, and scented with oil of lavender, it constitutes the common smelling salts, so much used as a nasal stimulant in syncope and hysteria.* The ordinary dose is five grains, every two, three, or four hours, given in the form of pill or mixture. The dose as an emetic is thirty grains, repeated if necessary, and assisted by free dilution. It should never be given in powder, on account of its volatile nature. Pills of it may be made with a vegetable extract, as of gentian, and should be dispensed in a wide-mouthed vial, and not in a box. Carbonate of ammonium is sometimes directed to be made into pills with sulphate of quinia. According to Mr. J. M. Maisch, these salts are incompatible; and, unless the physician wishes to give sulphate of ammonium and free quinia, they should not be ordered together. If so ordered, Mr. Maisch suggests that they should be rubbed up with a little strong alcohol, in order that all the carbonic acid may be evolved, before they are made into pills. If this be not done, each pill will swell and burst from the gradual extrication of the acid. (*Am. Journ. of Pharm.*, xxviii. 309.)

Carbonate of ammonium is sometimes employed to make effervescing draughts, 20 grains of the salt requiring for this purpose 6 fluidrachms of lemon-juice, 24 grains of citric acid, or 25½ grains of tartaric acid.

Off. Prep. Cuprum Ammoniatum, *U. S.;* Ferri et Ammonii Tartras, *U. S.;* Liquor Ammoniæ Acetatis, *Br.;* Liquor Ammonii Acetatis, *U. S.;* Spiritus Ammoniæ Aromaticus. B.

AMMONII CHLORIDUM. *U. S., Br.*

Chloride of Ammonium.

Off. Syn. AMMONIÆ MURIAS. *Muriate of Ammonia. U. S.* 1860. *Chloride of Ammonium.* NH_4Cl. *Br.* AMMONIÆ HYDROCHLORAS, *Hydrochlorate of Ammonia. Br.* 1864.

Sal ammoniac, Hydrochlorate of ammonia; Hydrochlorate d'ammoniaque, Sel ammoniac, *Fr.;* Salmiak, *Germ.;* Sale ammoniaco, *Ital.;* Sal ammoniaco, *Span.*

This salt is placed in the Materia Medica list of the U. S. Pharmacopœia. It originally came from Egypt, where it was obtained by sublimation from the soot resulting from the burning of camels' dung, which is used in that country for fuel. It has also long been known in China, where it is obtained from the water of certain volcanic springs, and exists in commerce in various states of purity.

Preparation. At present muriate of ammonium is derived from two principal sources; the ammoniacal liquor, called *gas liquor*, found in the condensing vessels of coal gas-works, and the brown, fetid ammoniacal liquor, known under the name of *bone-spirit*, which is a secondary product, obtained from the destructive distillation of bones, in the manufacture of bone-black. These two liquors are the chief sources of ammoniacal compounds; for they are both used to procure muriate of ammonium, and this salt is employed directly or indirectly for obtaining all the other salts of ammonia. Other sources are stale urine, coal soot, guano, peat, and bituminous schist.

Gas liquor contains carbonate, hydrocyanate, hydrosulphate, and sulphate of ammonium, but principally the carbonate. It is saturated with sulphuric acid, and the solution obtained, after due evaporation, furnishes brown crystals of sulphate of ammonium. These are then sublimed with chloride of sodium in iron pots, lined with clay, and furnished with a leaden dome or head. By the mutual action of the sulphate, water, and chloride, there are formed muriate of ammonium which sublimes, and sulphate of sodium which remains behind. Thus NH_3,HO,SO_3 and NaCl become NH_3HCl and NaO,SO_3. Sometimes, instead of the ammonia of the gas liquor being first converted into the sulphate, it is made at once into muriate by the addition of muriatic

*In Mounsey's recipe for the English preparation, called *Preston salts*, the essence to be added to the carbonate is made as follows. Take of oil of cloves ℥ss; oil of lavender ℥j; oil of bergamot ℥iiss; stronger solution of ammonia (sp. gr. 0·880) f℥x. Mix. The bottles are to be filled with carbonate of ammonium, half with the salt coarsely bruised, and the remainder with it in fine powder; and then as much of the above essences as the salt will absorb is to be added. (*Pharm. Journ. and Trans.*, xiii. 628.)

acid or chloride of calcium. When chloride of calcium is employed, the chief reaction takes place between carbonate of ammonium and the chloride, whereby muriate of ammonium is formed in solution, and carbonate of calcium precipitated. The solution is duly evaporated, whereby brown crystals of the muriate are obtained. These, after having been dried, are purified by sublimation in an iron subliming pot, coated with a composition of clay, sand, and charcoal, and covered with a dome of lead. These pots are sometimes sufficiently large to hold 500 pounds. "A gentle fire is kept up under the subliming pot for seven or eight days, when, the dome having cooled down, and the sal ammoniac somewhat contracted, so as to loosen from the sides, the dome is thrown off from the iron pot, and about two or three hundred weight of white, semi-transparent sal ammoniac are knocked off in cakes." (Pereira, *Mat. Med.*, 3d ed., p. 446.)

In the destructive distillation of bones for making bone-black, the distilled products are the bone-spirit already mentioned, being chiefly an aqueous solution of carbonate of ammonium, and an empyreumatic oil, called *animal oil.* These products all result from a new arrangement of the ultimate constituents of the animal matter. Thus, hydrogen and oxygen form the water; carbon and oxygen, the carbonic acid; nitrogen and hydrogen, the ammonia; and carbon, hydrogen, and oxygen, the animal oil.

Chloride of ammonium may be obtained from the bone-spirit in the manner just described for procuring it from gas liquor. Sometimes, however, the sulphate of ammonium is not made by direct combination, but by digesting the bone-spirit with ground plaster of Paris (sulphate of calcium). By double decomposition, sulphate of ammonium and carbonate of calcium are formed. The sulphate of ammonium is then converted into the chloride by sublimation with common salt, in the manner just explained. The chloride "may be formed by neutralizing hydrochloric acid with ammonia, and evaporating to dryness." *Br.*

Other processes have been proposed or practised for obtaining chloride of ammonium. For an account of the manufacture of ammoniacal salts, and for a list of the patents issued in Great Britain, since 1827, for their preparation, the reader is referred to the *Pharm. Journ. and Trans.* (xii. 29, 63, and 113).

Commercial History. All the chloride of ammonium consumed in the United States is obtained from abroad. Its commercial varieties are known under the names of the *crude* and *refined.* The crude is imported from Calcutta in chests containing from 350 to 400 pounds; and is consumed almost exclusively by coppersmiths and other artisans in brass and copper, being employed for the purpose of keeping the metallic surfaces bright, preparatory to brazing. The refined comes to us exclusively from England, packed in casks containing from 5 to 10 cwt.

Properties. Chloride of ammonium is a white, translucent, tough, fibrous salt, occurring in large cakes, about two inches thick, convex on one side and concave on the other. It has a pungent, saline taste, but no smell. Its sp. gr. is 1·45. It dissolves in three parts of cold, and one of boiling water, and cold is produced during its solution. It is less soluble in rectified spirit than in water, and sparingly so in absolute alcohol. This salt is very difficult to powder in the ordinary way. Its pulverization, however, may be readily effected by making a boiling saturated solution of the salt, and stirring it as it cools. The salt is thus made to granulate, and in this state, after having been drained from the remaining solution and dried, may be easily powdered. At a red heat it sublimes without decomposition, and without residue. Exposed to a damp atmosphere it becomes slightly moist. It has the property of increasing the solubility of corrosive sublimate in water. It is decomposed by the strong mineral acids, and by the alkalies and alkaline earths; the former disengaging muriatic acid, the latter ammonia, both sensible to the smell. Chloride of ammonium is usually employed for obtaining gaseous ammonia, which is conveniently disengaged by lime. It is incompatible with acetate of lead and nitrate of silver, producing a precipitate with the former of chloride of lead, with the latter of chloride of silver.

Chloride of ammonium is little subject to adulteration. If not entirely volatilized by heat and soluble in water, it contains impurity. Still, as ordinarily prepared, it contains iron in the state of protochloride. This metal may be detected by boiling a small portion of a saturated solution of the salt with a drop or two of nitric acid,

and then adding ferrocyanide of potassium, when the characteristic blue colour occasioned by iron will be produced. If the salt is entirely volatilized by heat, and yet produces a precipitate with chloride of barium, the presence of sulphate of ammonium is indicated.

Composition. Chloride of ammonium consists of one eq. of chlorine and one of ammonium (NH_4Cl). Viewed as *muriate of ammonium*, it is composed of one eq. of muriatic acid 36·5, and one of ammonia 17 = 53·5.

Medical Properties. Chloride of ammonium acts primarily as a stimulant, purging in large doses, but rather constipating in small ones. Its secondary action is that of a resolvent, conjoined with a tonic power, derived probably from the presence of chlorine. By reason of these properties, it forms, according to Dr. O. Ward, an excellent substitute for mercury, in cases where that medicine, on account of its debilitating effect, is inadmissible. It has been recommended in chronic rheumatism; in pleuritis, chronic bronchitis, peritonitis, dysentery, and other inflammations of the serous and mucous membranes, after the first violence of the disease has abated; in chronic inflammation and enlargement of the thoracic and abdominal viscera, especially of the liver; in portal dropsy and hydrothorax; in scrofulous and syphilitic enlargements of the lymphatic glands; and in amenorrhœa, when dependent on deficient action of the uterus. Several cases of pectoral disease simulating incipient phthisis are reported, in Otto's Bibliothek for 1834, to have been cured by this salt. According to Dr. Watson, it is a very efficacious remedy in hemicrania. In the opinion of Dr. Ebden, of the Bengal medical service, it is a powerful remedy for neuralgic affections generally; such as tic douloureux, nervous headache, toothache, sciatica, and neuralgic dysmenorrhœa. He gives it in the amount of from twenty-five to thirty-five grains in a fluidounce of camphor mixture, or of mint-water, every twenty minutes, for three doses. Usually, after the second dose, the immediate pain is relieved. (*Ranking's Abstract*, No. xx. 55.) In 1851, Dr. Aran reported his success with this remedy in intermittent fever to the Academy of Medicine, of Paris, having cured eleven out of thirteen cases. M. Marrotte has used it advantageously, as a substitute for sulphate of quinia, in the treatment of affections assuming a remittent or intermittent character. (*Arch. Gén.*, 5e sér., ix. 734.) M. Fischer, of Dresden, in 1821, recommended it in chronic enlargement of the prostate; and, since then, several German practitioners have confirmed his statement. Dr. A. Lindsay, of Glasgow, has investigated the physiological and therapeutical effects of chloride of ammonium. Taken in health he found it to improve the appetite, and to give a certain buoyancy to the spirits. In his hands it proved particularly efficacious in chronic rheumatism, and chronic bronchitis. In the latter disease, when the sputa were tough and tenacious, it speedily improved their quality. (*Med. Exam.* for Jan. 1856, from the *Glasgow Med. Journ.*) Similar testimony is borne to its value in chronic bronchitis by M. Delvaux, of Brussels, who found it to diminish dyspnœa, mitigate cough, and facilitate expectoration. (*Ann. de Thérap.*, 1855, p. 99.)

The dose of chloride of ammonium is from five to thirty grains, repeated every two or three hours, and given in sweetened water or mucilage. When given in enlarged prostate, the dose recommended is fifteen grains every two hours, gradually increased until nearly half an ounce is taken daily. When the dose is greater than the system can safely bear, it produces disordered digestion, a miliary eruption, profuse sweats, and scorbutic symptoms.

Externally, chloride of ammonium is used in solution, as a stimulant and resolvent, in contusions, indolent tumours, &c. An ounce of the salt, dissolved in nine fluidounces of water and one of alcohol, forms a solution of convenient strength. When the solution is to be used as a wash for ulcers, or an injection in leucorrhœa, it should not contain more than from one to four drachms of the salt to a pint of water. Such a solution, with addition of wine of opium, had been advantageously employed by M. Guinau de Mussy in milky engorgement and scrofulous swellings of the breast, being applied upon cataplasms. A case of senile gangrene in a woman of 83, of the most painful and alarming character, has recently been recorded, in which the immersion of the feet in a pediluvium consisting of half a pound of muriate of ammonium dissolved in water, afforded relief in two hours: and, being

followed by fomentations with the same solution, resulted in a complete cure. (*Annuaire de Thérap.*, A.D. 1868, p. 105.)

The vapour of chloride of ammonium has been administered by inhalation, employed several times a day, in chronic catarrh, with marked advantage, by Dr. Gieseler, of Germany. Dr. Herman Beigel, of London, strongly recommends its inhalation in the nascent state, resulting from a mixture of the two gases composing it. Three bottles are used, one containing water of ammonia, the second an equivalent quantity of liquid muriatic acid, and the third half filled with water, connected with the first two by tubes, and supplied itself with a tube for inhalation. By inhalation the patient draws the two gases from their respective bottles into the third, where they combine to form the chloride of ammonium, which is freed from any excess of either gas by the water. The greater or less force of the inspiration will determine the depth to which the medicine will penetrate; and this will depend on the part of the respiratory passages specially affected. (*Lancet*, Oct. 1867, p. 512.) Another mode of inhaling chloride of ammonium, is in *spray*, by means of the atomizer; from 10 to 20 grains being dissolved for the purpose in a fluidounce of water.

Pharm. Uses. In preparing Ammonii Valerianas, *U.S.;* Aqua Ammoniæ, *U.S.;* Liquor Ammoniæ Fortior, *Br.;* Spiritus Ammoniæ, *U.S.*

Off. Prep. Ammonii Chloridum Purificatum, *U.S.* B.

AMMONII NITRAS. *U.S.*

Nitrate of Ammonium.

An extraordinary property possessed by this salt of absorbing ammoniacal gas, and giving it out again at a moderate heat unchanged, renders it capable of useful pharmaceutical application; but the chief cause of its introduction into the U. S. Pharmacopœia, at its late revision, was probably the demand for it as the source whence nitrous oxide is produced.

Nitrate of ammonium may be prepared by treating sesquicarbonate of ammonium by nitric acid so long as effervescence takes place or to saturation, filtering, and evaporating the solution. By careful evaporation and slow refrigeration, the salt may be obtained in well defined crystals. If crystallized after rapid concentration by boiling, and then suddenly cooling, it forms long flexible and elastic threads. If the solution be heated till all the water is driven off, the nitrate of ammonia forms, on cooling, an opaque mass.

It is described as follows in the Pharmacopœia. "A white, deliquescent, crystalline salt, in long, prismatic crystals, or in fused masses; soluble in about half its weight of water at 70°, more so in boiling water; and soluble in twice its weight of alcohol. It affords no precipitate with chloride of barium or nitrate of silver; mixed with sulphuric acid it evolves nitric acid vapour; subjected to a heat of 400° to 450°, it is entirely volatilized into nitrous oxide gas and watery vapour." *U.S.*

At all temperatures between —15° C. and + 25° C., if exposed to a current of dry ammoniacal gas, its crystals absorb the gas and melt, yielding a colourless liquid, which, if the absorption has taken place at —10° C., contains 2 eqs. of the gas for each eq. of the salt, and would be represented by the formula NH_4,NO_3+2NH_3. It is not frozen by a mixture of salt and snow. Its sp. gr. is 1·05. Heated moderately it boils, with loss of ammonia, and is changed into a crystalline mass, containing 21·25 parts of the gas in 100 of the salt by weight, and corresponds with the formula, NH_4,NO_3+NH_3, thus retaining one-half the gas absorbed. By exposure to increased heat, this loses ammonia, and at 80° C. has been reconverted to pure nitrate of ammonium. This preparation may be used for obtaining small quantities of pure ammonia, when wanted, by exposing it to a gentle heat in a small retort. To be fit for this purpose, it must be kept at a low temperature. (*Pharm. Journ.*, June, 1872, p. 1012, from *Comptes Rendus*, lxxvi. p. 1261.)

For the mode of preparing nitrous oxide gas from nitrate of ammonium, the reader is referred to the article on Nitrous Oxide in Part III. of this work. W.

AMMONII SULPHAS. *U.S.*

Sulphate of Ammonium.

This salt has been introduced into the Materia Medica list of the U. S. Pharmacopœia, as a substance employed in the preparation of other medicines. It is usually obtained as one of the steps in the preparation of muriate of ammonium. (See *Ammonii Chloridum.*) The impure salt resulting from the sublimation of gas liquor or fetid bone-spirit, saturated with sulphuric acid, is submitted repeatedly to solution and crystallization until obtained pure. It is in colourless rhombic prisms, unalterable in the air at common temperatures, but effloresceing in heated air with the loss of half its water, soluble in twice its weight of cold and its own weight of boiling water, fusible by heat, and wholly volatilizable, but, according to Berzelius, with partial decomposition. It contains 24·3 per cent. of water. It is known to be a sulphate by giving a white precipitate with chloride of barium, and scarcely any with a dilute solution of nitrate of silver, and to contain ammonia by emitting the smell of that gas when rubbed with hydrate of lime or of potassa. It is not used as a medicine, but enters into the composition of two officinals; ammonia-alum and the sulphate of iron and ammonium.

Off. Prep. Ferri et Ammonii Sulphas, *U.S.* B.

AMMONIACUM. *U.S., Br.*

Ammoniac.

A gum-resinous exudation from Dorema Ammoniacum (Don, *Trans. of the Linn. Soc.*). *U.S., Br.*

Gomme ammoniaque, *Fr.;* Ammoniak, *Germ.;* Gomma ammoniaco, *Ital.;* Gomma amoniaco, *Span.;* Ushek, *Arab.;* Semugh belsheren, *Persian.*

Much uncertainty long existed as to the ammoniac plant. It was generally believed to be a *Ferula* till Willdenow raised, from some seeds mixed with the gum-resin found in the shops, a plant which he ascertained to be a *Heracleum*, and named *H. gummiferum*, under the impression that it must be the source of the medicine. On this authority, the plant was adopted by the British Colleges, and recognised in former editions of our national Pharmacopœia. Willdenow expressly acknowledged that he could not procure from it any gum-resin, but ascribed the result to the influence of climate. The *Heracleum*, however, did not correspond exactly with the representations given of the ammoniac plant by travellers; and Sprengel ascertained that it was a native of the Pyrenees, and never produced gum. Mr. Jackson, in his account of Morocco, imperfectly described a plant of that country, supposed to be a *Ferula*, from which gum-ammoniac is procured by the natives. This plant was ascertained by Dr. Falconer to be *Ferula Tingitana* (Royle's *Mat. Med.*), and its product is thought to be the ammoniacum of the ancients, which was obtained from Africa; but this is not the drug now used under that name, which comes exclusively from Persia.* M. Fontaniér, who resided many years in Persia, saw the ammoniac plant growing in the province of Fars, and sent a drawing of it with specimens to Paris. From these it was inferred to be a species of Ferula; and Merat and De Lens proposed for it the name, originally given to it by Lemery, of *F. ammonifera*. It was subsequently, however, ascertained, from specimens obtained in Persia by Colonel Wright, and examined by Dr. David Don, that it belonged to a genus allied to Ferula, but essentially different, which was named by Dr. Don, *Dorema*. It is de-

* The *African Ammoniacum*, of which small quantities are sometimes found in the London market, has been described by Mr. Daniel Hanbury as follows. It is "in large, compact, dark, heavy masses, formed of agglutinated tears of a gum-resin of hard, waxy consistence. The tears are opaque, white or of a pale-greenish-yellow, mixed with others of a blackish-brown, which, with vegetable and earthy impurities, constitute a large portion of the mass." The odour of the drug is feeble, and quite different from that of the Persian gum-resin; its taste slightly acrid and very persistent. (*Pharm. Journ.*, March, 1873, p. 741.) Examined by Mr. John Moss, it was found to consist of 67·76 per cent. of resin, 9·014 of gum, 4·29 of water and volatile oil, and 18·85 of bassorin and insoluble matters. (*Ibid.*, p. 742.) This product is used chiefly for incense in Mohammedan countries, and sent largely eastward by the caravans, or in vessels from the ports of Morocco to Alexandria. (*Note to the fourteenth edition.*)

scribed in the 16th vol. of the Linn. Transactions, under the name of *Dorema Ammoniacum*. This is now acknowledged by the officinal authorities. The same plant was described and figured by Jaubert and Spach, in their "*Illustrations of Oriental Plants*" (Paris, 1842, t. 40, p. 78), by the name of *Diserneston gummiferum*, under the erroneous impression that it belonged to a previously undescribed genus.

The ammoniac plant is umbelliferous, and belongs to the class and order Pentandria Digynia of Linnæus. It grows spontaneously in Farsistan, Irauk, Chorassan, and other Persian provinces. Dr. Grant found it abundantly in Syghan near Bameean, on the northwest slope of the Hindoo Coosh mountains. It attains the height of six or seven feet, and in the spring and early part of summer abounds in a milky juice, which flows out upon the slightest puncture. From the accounts of travellers, it appears that, in the month of May, the plant is pierced in innumerable places by an insect of the beetle kind. The juice, exuding through the punctures, concretes upon the stem, and when quite dry is collected by the natives. M. Fontaniér states that the juice exudes spontaneously, and that the harvest is about the middle of June. According to Dr. Grant, the drug is collected in Syghan, like assafetida, from the root of the plant. The gum-resin is sent to Bushire, whence it is transmitted to India, chiefly to Bombay. A small portion is said to be taken to the ports of the Levant, and thence distributed. The name of the drug is thought to have been derived from the temple of Jupiter Ammon in the Libyan desert, where the ammoniac of the ancients is said to have been collected; but Dr. Don considers it a corruption of *Armeniacum*, originating in the circumstance that the gum-resin was formerly imported into Europe through Armenia.

Properties. Ammoniac comes either in the state of tears, or in aggregate masses, and in both forms is frequently mixed with impurities. That of the tears, however, is preferable, as the purest may be conveniently picked out and kept for use. These are of an irregular shape, usually more or less globular, from two to eight lines in diameter, opaque, yellowish on the outside, whitish within, compact, homogeneous, brittle when cold, and breaking with a conchoidal, shining fracture. The masses are of a darker colour and less uniform structure, appearing, when broken, as if composed of numerous white or whitish tears, embedded in a dirty-gray or brownish substance, and frequently mingled with foreign matters, such as seeds, fragments of vegetables, and sand or other earth. We have seen masses composed of agglutinated tears alone.

The smell of ammoniac is peculiar, and stronger in the mass than in the tears. The taste is slightly sweetish, bitter, and somewhat acrid. The sp. gr. is 1·207. When heated, the gum-resin softens and becomes adhesive, but does not melt. It burns with a white flame, swelling up, and emitting a smoke of a strong, resinous, slightly alliaceous odour. It is partly soluble in water, alcohol, ether, vinegar, and alkaline solutions. Triturated with water, it forms an opaque milky emulsion, which becomes clear upon standing. The alcoholic solution is transparent, but is rendered milky by the addition of water. Bucholz obtained from 100 parts of ammoniac, 22·4 parts of gum, 72·0 of resin, 1·6 of bassorin, and 4·0 of water including volatile oil and loss. Braconnot obtained 18·4 per cent. of gum, 70·0 of resin, 4·4 of a gluten-like substance (bassorin), and 6·0 of water, with 1·2 per cent. of loss. Hagen succeeded in procuring the volatile oil in a separate state by repeated distillation with water. It has a penetrating disagreeable odour, and a taste at first mild, but afterwards bitter and nauseous. The resin of ammoniac is dissolved by alcohol, and by the fixed and volatile oils; but it is divided by ether into two resins, of which one is soluble, the other insoluble in that menstruum.

Medical Properties and Uses. This gum-resin is stimulant and expectorant, in large doses cathartic, and, like many other stimulants, may be so given as occasionally to prove diaphoretic, diuretic, or emmenagogue. It has been employed in medicine from the highest antiquity, being mentioned in the writings of Hippocrates. The complaints in which it is most frequently used are chronic catarrh, asthma, and other pectoral affections attended with deficient expectoration without acute inflammation, or with a too copious secretion from the bronchial mucous membrane, dependent upon debility of the vessels. It is thought to have been useful in some cases of

amenorrhœa, and in chlorotic and hysterical conditions of the system arising out of that complaint. It has also been prescribed in obstructions or chronic engorgements of the abdominal viscera, under the vague notion of its deobstruent power. Any good which it may do in these affections, is more probably ascribable to its revulsive action upon the alimentary mucous membrane. Authors speak of its utility in long and obstinate colics dependent on mucous matter lodged in the intestines; but it would be difficult to ascertain in what cases such mucous matter existed, and, even admitting its presence, to decide whether it was a cause or a result of the diseased action. Ammoniac is usually administered in combination with other expectorants, with tonics, or emmenagogues. It is much less used than formerly. Externally applied, in the shape of a plaster, it is thought to be useful as a discutient or resolvent in white swellings of the joints, and other indolent tumours. (See *Emplastrum Ammoniaci.*) It is given in substance, in the shape of pill or emulsion. The latter form is preferable. (See *Mistura Ammoniaci.*) The dose is from ten to thirty grains.

Off. Prep. Emplastrum Ammoniaci, *U. S.;* Emplast. Ammoniaci cum Hydrargyro; Emplast. Galbani, *Br.;* Mistura Ammoniaci; Pilula Ipecacuanhæ cum Scilla, *Br.;* Pil. Scillæ Compositæ. W.

AMYGDALA AMARA. *U. S., Br.*

Bitter Almond.

The kernel of the fruit of Amygdalus communis, variety *amara.* (*De Candolle.*) *U. S.* The seed of the bitter almond tree, Amygdalus communis, *var.* amara. *Br.*

Amande amère, *Fr.;* Bittere Mandeln, *Germ.;* Mandorle amare, *Ital.;* Almendra amarga, *Span.*

AMYGDALA DULCIS. *U. S., Br.*

Sweet Almond.

The kernel of the fruit of Amygdalus communis, variety *dulcis.* (*De Candolle.*) *U. S.* The seed of the sweet almond tree. *Br.*

Amande douce, *Fr.;* Süsse Mandeln, *Germ.;* Mandorle dolci, *Ital.;* Almendra dulce, *Span.*

AMYGDALUS. *Sex. Syst.* Icosandria Monogynia.—*Nat. Ord.* Amygdaleæ.

Gen. Ch. Calyx five-cleft, inferior. *Petals* five. *Drupe* with a nut perforated with pores. *Willd.*

Amygdalus communis. Willd. *Sp. Plant.* ii. 982; Woodv. *Med. Bot.* p. 507, t. 183. The almond-tree rises usually from fifteen to twenty feet in height, and divides into numerous spreading branches. The leaves stand upon short foot-stalks, are about three inches long, and three-quarters of an inch broad, elliptical, pointed at both ends, veined, minutely serrated, with the lower serratures and petioles glandular, and are of a bright-green colour. The flowers are large, of a pale-red colour varying to white, with very short peduncles, and petals longer than the calyx, and usually stand in pairs upon the branches. The fruit is of the peach kind, with the outer covering thin, tough, dry, and marked with a longitudinal furrow, where it opens when fully ripe. Within this covering is a rough shell, containing the kernel or almond.

There are several varieties of this species of Amygdalus, differing chiefly in the size and shape of the fruit, the thickness of the shell, and the taste of the kernel. The two most important are *Amygdalus* (*communis*) *dulcis* and *Amygdalus* (*communis*) *amara*, the former bearing sweet, the latter bitter almonds. Another variety is the *fragilis* of De Candolle, which yields the *soft-shelled almonds.*

The almond-tree is a native of Persia, Syria, and Barbary, and is very extensively cultivated in various parts of the south of Europe. It has been introduced into the United States; but in the northern and middle sections the fruit does not usually come to perfection. We are supplied with sweet almonds chiefly from Spain and the south of France. They are distinguished into the soft-shelled and hard-shelled, the former of which come from Marseilles and Bordeaux, the latter from Malaga. From the latter port they are sometimes brought to us without the shell. In British commerce, the two chief varieties are the *Jordan* and *Valencia* almonds, the former im-

ported from Malaga, the latter from Valencia.* The former are longer, narrower, more pointed, and more highly esteemed than the latter. The bitter almonds are obtained chiefly from Morocco, and are exported from Mogador.

Properties. The shape and appearance of almonds are too well known to require description. Each kernel consists of two white cotyledons, enclosed in a thin, yellowish-brown, bitter skin, which is easily separable after immersion in boiling water. Deprived of this covering, they are called *blanched almonds.* On exposure to the air, they are apt to become rancid; but, if thoroughly dried, and kept in well closed glass vessels, they may be preserved unaltered for many years. The two varieties require each a separate notice.

1. AMYGDALA DULCIS. *Sweet Almonds.* These are without smell when blanched, and have a sweet, very pleasant taste, which has rendered them a favourite article of diet in all countries where they are readily attainable. They are, however, generally considered of difficult digestion. By the analysis of M. Boullay, it appears that they contain, in 100 parts, 5 parts of pellicle, 54 of fixed oil, 24 of albumen, 6 of uncrystallizable sugar, 3 of gum, 4 of fibrous matter, 3·5 of water, and 0·5 of acetic acid comprising loss. The albumen is somewhat peculiar, and is called *emulsin.* It may be obtained separate by treating the emulsion of almonds with ether, allowing the mixture, after frequent agitation, to stand until a clear fluid separates at the bottom of the vessel, drawing this off by a syphon, adding alcohol to it so as to precipitate the emulsin, then washing the precipitate with fresh alcohol, and drying it under the receiver of an air-pump. In this state it is a white powder, inodorous and tasteless, soluble in water, and insoluble in ether and alcohol. Its solution has an acid reaction, and, if heated to 212°, becomes opaque and milky, and gradually deposits a snow-white precipitate, amounting to about 10 per cent. of the emulsin employed. (*Am. Journ. of Pharm.*, xxi. 354, from *Liebig's Annalen.*) Its distinguishing property is that of producing certain changes, presently to be noticed, in amygdalin, which property it loses when its solution is boiled, though not by exposure in the solid state to a heat of 212°. (*Ibid.*, 357.) It consists of nitrogen, carbon, hydrogen, and oxygen, with a minute proportion of sulphur, and is probably identical with the *synaptase* of Robiquet. The fixed oil is described under the head of *Oleum Amygdalæ*, to which the reader is referred. Almonds, when rubbed with water, form a milky emulsion, the insoluble matters being suspended by the agency of the albuminous, mucilaginous, and saccharine principles.

2. AMYGDALA AMARA. *Bitter Almonds.* These are smaller than the preceding variety. They have the bitter taste of the peach kernel, and, though when dry inodorous or nearly so, have, when triturated with water, the fragrance of the peach blossom. They contain the same ingredients as sweet almonds, and like them form a milky emulsion with water. It was formerly supposed that they also contained hydrocyanic acid and volatile oil, to which their peculiar taste and smell, and their peculiar operation upon the system were ascribed. It was, however, ascertained by MM. Robiquet and Boutron that these principles do not pre-exist in the almond, but result from the reaction of water; and Wöhler and Liebig proved what was suspected by Robiquet, that they are formed out of a peculiar substance denominated *amygdalin*, which is the characteristic constituent of bitter almonds. This substance, which was discovered by Robiquet and Boutron, is white, crystallizable, inodorous, of a sweetish-bitter taste, unalterable in the air, freely soluble in water and hot alcohol, very slightly soluble in cold alcohol, and insoluble in ether. Its elementary constituents are nitrogen, carbon, hydrogen, and oxygen; and it is supposed to be an *amide;* as, when treated with an alkali, it yields ammonia, and a peculiar acid which has been named *amygdalic acid.* Liebig and Wöhler recommend the following process for procuring it, in which the object of the fermentation is to destroy the sugar with which it is associated. Bitter almonds, previously deprived of their fixed oil

* Upon a visit to Spain, in the winter of 1860–61, the author was informed, when at Valencia, that the thin, paper-shelled almonds, exported from that town, were produced, not in the immediate neighbourhood of Valencia, but chiefly in the Balearic Islands, and the Province of Alicante, whence they are sent to that port; and, in a journey through the interior from Valencia to Alicante, he noticed that the almond-tree, then in full bloom, was very abundant in the region back of the latter city, while there were comparatively few near the former. (*Note to the twelfth edition.*)

by pressure, are to be boiled in successive portions of alcohol till exhausted. From the liquors thus obtained all the alcohol is to be drawn off by distillation; care being taken, near the end of the process, not to expose the syrupy residue to too great a heat. This residue is then to be diluted with water, mixed with good yeast, and placed in a warm situation. After the fermentation which ensues has ceased, the liquor is to be filtered, evaporated to the consistence of syrup, and mixed with alcohol. The amygdalin is thus precipitated in connection with a portion of gum, from which it may be separated by solution in boiling alcohol, which will deposit it upon cooling. If pure, it will form a perfectly transparent solution with water. Any oil which it may contain may be separated by washing with ether. One pound of almonds yields at least 120 grains of amygdalin. (*Annal. der Pharm.*, xxii. 329.)*

Amygdalin, mixed with emulsion of *sweet* almonds, gives rise, among other products, to the volatile oil of bitter almonds and hydrocyanic acid—the emulsin of the sweet almonds acting the part of a ferment, by causing a reaction between the amygdalin and water; and the same result is obtained when pure *emulsin* is added to a solution of amygdalin. It appears then that the volatile oil and hydrocyanic acid, developed in bitter almonds when moistened, result from the mutual reaction of amygdalin, water, and emulsin. Certain substances have the effect of preventing this reaction, as, for example, alcohol and acetic acid. It is asserted that emulsin procured from other seeds, as those of the poppy, hemp, and mustard, is capable of producing the same reaction between water and amygdalin, though in a less degree. (*Annal. der Pharm.*, xxviii. 290.) Amygdalin appears not to be poisonous when taken pure into the stomach; as there is nothing in the system capable of acting the part of emulsin. Nevertheless, large quantities given to a dog have produced narcotic effects.

Bitter almonds yield their fixed oil by pressure; and the volatile oil, impregnated with hydrocyanic acid, may be obtained from the residue by distillation with water. (See *Oleum Amygdalæ Amaræ.*)

Confectioners employ bitter almonds for communicating flavour to the syrup of orgeat. (See *Syrupus Amygdalæ.*) The kernel of the peach possesses similar properties, and is frequently used as a substitute. It has been ascertained that bitter almond paste, and other substances which yield the same volatile oil, such as bruised cherry-laurel leaves, peach leaves, &c., have the property of destroying the odour of musk, camphor, most of the volatile oils, creasote, cod-liver oil, the balsams, &c.; and M. Mahier, a French pharmaceutist, has employed them successfully to free mortars and bottles from the odour of assafetida, and other substances of disagreeable smell. All that is necessary is first to remove any oily substance by means of an alkali, and then to apply the paste or bruised leaves.

Medical Properties and Uses. Sweet almonds have no other influence on the system than that of a nutrient and demulcent. The emulsion formed by triturating them with water is a pleasant vehicle for the administration of other medicines, and is itself useful in catarrhal affections. From their nutritive properties, and the absence of starch in their composition, they have been recommended by Dr. Pavy as an ingredient in the diet of diabetic patients. (*Guy's Hosp. Rep.*, 1862, p. 213.) Bitter almonds are more active, and might be employed with advantage in cases to which hydrocyanic acid is applicable. An emulsion made with them has proved useful in pectoral affections with cough, and is said to have cured intermittents. It probably operates by diminishing the excitability of the nervous centres. Dr. A. T. Thomson found it useful as a lotion in acne rosea and impetigo. Bitter almonds are said by Hufeland to have been successfully employed for the expulsion of the tapeworm. In some persons they produce urticaria, in the smallest quantities. Largely taken, they have sometimes proved deleterious. Landerer mentions the case of a lady, who was alarmingly affected by a bath, made from the residue of bitter almonds after expression of the fixed oil. (See *Am. Journ. of Pharm.*, xxviii. 321.)

* Amygdalin appears to be extensively diffused in plants, having been noticed not only in the different genera of the Amygdaleæ, as *Amygdalus, Cerasus*, and *Prunus*, but also by Wicke in various Pomaceæ, as *Pyrus Malus, Sorbus Aucuparia, Sorbus hybrida, Sorbus torminalis, Amelanchier vulgaris, Cotoneaster vulgaris*, and *Cratægus Oxycantha*. (*Ann. der Chem. und Pharm.*, lxxix. 79.) It may be advantageously procured from peach kernels, which have been found to yield 80 grains for each avoirdupois pound, or more than 1 per cent. (*Am. Journ. of Pharm.*, xxvii. 227.)

Wöhler and Liebig propose, as a substitute for cherry-laurel water, which owes its effects to the hydrocyanic acid it contains, but is objectionable from its unequal strength, an extemporaneous mixture, consisting of seventeen grains of amygdalin, and one fluidounce of an emulsion made with two drachms of *sweet* almonds, and a sufficient quantity of water. This mixture contains, according to the above named chemists, one grain of anhydrous hydrocyanic acid, and is equivalent to two fluidounces of fresh cherry-laurel water. If found to answer in practice, it will have the advantage of certainty in relation to the dose; as amygdalin may be kept any length of time unaltered. If the calculation of Wöhler and Liebig is correct as to the quantity of acid it contains, not more than a fluidrachm should be given as a commencing dose.

Off. Prep. of Sweet Almonds. Mistura Amygdalæ, *U. S.*; Pulvis Amygdalæ Compositus, *Br.*; Syrupus Amygdalæ, *U. S.*

Off. Prep. of Bitter Almonds. Syrupus Amygdalæ, *U. S.* W.

AMYLUM. *U. S., Br.*

Starch.

The fecula of the seed of Triticum vulgare. (Kunth, *Gramineæ*, 438.) *U. S.* The starch procured from the seeds of common wheat, Triticum vulgare. *Br.*

Amidon, *Fr.;* Stärkmehl, *Germ.;* Amido, *Ital.;* Almidon, *Span.*

Starch is a proximate vegetable principle contained in most plants, and especially abundant in the various grains, such as wheat, rye, barley, oats, rice, maize, &c.; in other seeds, as peas, beans, chestnuts, acorns, &c.; and in numerous tuberous roots, as those of the potato (*Solanum tuberosum*), the sweet potato (*Convolvulus Batatus*), the arrow-root, the cassava plant, and different species of Curcuma. The process for obtaining it consists essentially in reducing the substances in which it exists to a state of minute division, agitating or washing them with cold water, straining or pouring off the liquid, and allowing it to stand till the fine fecula which it holds in suspension has subsided. This, when dried, is starch, more or less pure, according to the care taken in conducting the process. The starch of commerce is procured chiefly from wheat, sometimes also from potatoes. Our space will not allow us to enter into details in relation to the particular steps of the operation to which those substances are subjected; and the omission is of less consequence, as starch is never prepared by the apothecary.

Starch is white, pulverulent, opaque, and, as found in the shops, is usually in columnar masses, having a somewhat crystalline aspect, and producing a peculiar sound when pressed between the fingers. Its specific gravity is 1·505 at 67° F. (*Payen.*) When exposed to a moist air, it absorbs a considerable quantity of water, which may be driven off by a gentle heat. It is insoluble in alcohol, ether, and cold water; but unites with boiling water, which, on cooling, forms with it a soft semi-transparent paste, or a gelatinous opaline solution, according to the proportion of starch employed. The paste placed on folds of blotting paper, renewed as they become wet, abandons its water, contracts, and assumes the appearance of horn. If the proportion of starch be very small, the solution, after slowly depositing a very minute quantity of insoluble matter, continues permanent, and upon being evaporated yields a semi-transparent mass, which is partially soluble in cold water. The starch has, therefore, been modified by the combined agency of water and heat; nor can it be restored to its original condition. Exposed, in the dry state, to a temperature somewhat above 212°, it undergoes, according to Caventou, a similar modification; and a degree of heat sufficient to roast it slightly converts it into a substance soluble in cold water, called *British gum*, and applicable to the same purposes as gum in the arts.* The same change in regard to solubility is, to a certain extent, produced by mechanical means, as by trituration in a mortar; and that the effect is not

* The chief constituent of this substance is dextrin; but there is also produced another substance to which it owes its brown colour, and for which M. Gélis proposes the name *pyrodextrin*. This is solid, black, insipid, inodorous, insoluble in alcohol or ether, but readily dissolved by water, with which it forms a viscid solution. It is always produced when substances containing much starch are exposed to a high heat. (*Journ. de Pharm.*, 3e sér., xxxiii. 405.)—*Note to the twelfth edition.*

the result of heat evolved by friction is evinced by the fact, that it takes place when the starch is triturated with water.

Iodine forms with starch, whether in its original state or in solution, a blue compound; and the tincture of iodine is the most delicate test of its presence in any mixture. The colour varies somewhat according to the proportions employed. When the two substances are about equal, the compound is of a beautiful indigo-blue; if the iodine is in excess, it is blackish-blue; if the starch, violet-blue. A singular property of the iodide of starch is that its solution becomes colourless if heated to about 200°, and afterwards recovers its blue colour upon cooling. By boiling, the colour is permanently lost. Alkalies unite with starch, forming soluble compounds, which are decomposed by acids, the starch being precipitated. It is thrown down from its solution by lime-water and baryta-water, forming insoluble compounds with these earths. The solution of subacetate of lead precipitates it in combination with the oxide of the metal. Starch may be made to unite with tannin by boiling their solutions together; and a compound results, which, though retained by the water while hot, is deposited when it cools. By long boiling with diluted sulphuric, muriatic, or oxalic acid, it is converted into *dextrin** and glucose or grape sugar. A similar conversion into dextrin and glucose is effected by means of a principle called *diastase*, discovered by MM. Payen and Persoz in the seeds of barley, oats, and wheat, after germination. (See *Hordeum.*) Strong muriatic and nitric acids dissolve it; and the latter, by the aid of heat, converts it into oxalic and malic acids. By the action of strong nitric, sulphuric, or crystallizable acetic acid, used with certain precautions, the starch is rendered soluble, and may be obtained in this state by separating the acid by means of alcohol. (*Chem. Gaz.*, Dec. 1, 1854, p. 450.) By the continued action of concentrated sulphuric acid it is decomposed. When it is dissolved in strong nitric acid, and precipitated by water, a white powder is thrown down, called *xyloidin*, in which one equivalent of the hydrogen of the starch is replaced by one eq. of hyponitric acid (NO_4); the formula of xyloidin being, according to Bechamp and Laurent, $C_{12}H_9NO_{14}$. Mixed with hot water and exposed to a temperature of 70° or 80°, it undergoes chemical changes, which result in the formation of several distinct principles, among which are sugar, a gummy substance (perhaps *dextrin*), and a modification of starch which De Saussure called *amidine*. With yeast starch undergoes the vinous fermentation, being, however, first converted into sugar. Mixed with cheese and chalk it is said to yield alcohol without the previous saccharine conversion. (Berthelot, *Journ. de Pharm.*, 3e sér., xxxii. 260.)

Nature of Starch. The views now generally entertained in relation to starch, by which the above-mentioned phenomena may be most conveniently explained, are those originally presented by Raspail, and subsequently confirmed and extended by Guibourt, Guérin, and others. According to these views, starch consists of organ-

* *Dextrin* is a substance resembling gum in appearance and properties, but differing from it in not affording mucic acid by the action of nitric acid. It is largely dissolved by water, hot or cold, and forms a mucilaginous solution, from which it is precipitated by alcohol. This fluid has no action on dextrin. Large quantities of dextrin are now manufactured in England, and employed for various purposes in the arts, under the name of *artificial gum*. It is found in the market in the form of mucilage, in that of a white brilliant powder, and in small masses or fragments resembling natural gum. According to M. Emile Thomas, it may be distinguished from gum arabic by the taste and smell of potato oil which it always possesses. It is made by the action either of acids or of diastase on starch. For particulars as to the manufacture, the reader is referred to a paper by M. Thomas, republished in the *American Journal of Pharmacy* (vol. xix. p. 284).

Dextrin, according to Payen, is converted into glucose, through the action of diastase; but the glucose impedes the action unless removed; as, however, during the alcoholic fermentation, the glucose is consumed, no obstacle prevents the influence of diastase. Hence dextrin by conversion into sugar may contribute to the alcoholic product. (*Journ. de Pharm.*, 4e sér., i. 363.)—*Note to the thirteenth edition.*

Adulteration and purification of dextrin. Commercial dextrin is said to be occasionally very impure. Several parcels, analyzed by Dr. H. Hayes, were found to contain an average of about 45 per cent. of impurities, consisting mainly of insoluble matter with sugar and water. He recommends, as the best method of purifying it, to dissolve ten parts of the impure dextrin, with agitation, in 18 parts of distilled water, in a cylindrical vessel; to decant the solution when it has become clear on standing, and mix it with 1·5 or 2 per cent. of alcohol of 95. The liquid is then decanted from the doughy precipitate formed, which is dissolved in a little distilled water; and the solution spread on glass or porcelain plates to dry, in a warm place. (*Am. Journ. of Pharm.*, July, 1870, p. 327, from Wittstein's V. Jahr., 1870, 113–115.)—*Note to the fourteenth edition.*

ized granules, which, examined by the microscope, appear to be of various form and size. Different opinions have been held as to the precise structure of the granules. The one first adopted is that they consist of a thin exterior coating, and of an interior substance; the former wholly insoluble, the latter soluble in water. The former constitutes, according to M. Payen, only 4 or 5 thousandths of the weight of starch. In relation to the interior portion, there is not an exact coincidence of opinion. M. Guérin supposed that it consisted of two distinct substances, one soluble in cold water, the other soluble at first in boiling water, but becoming insoluble by evaporation. Thus, when one part of starch is boiled for fifteen minutes in one hundred parts of water, and the liquid is allowed to stand, a small portion, consisting of the broken teguments, is gradually deposited. If the solution be now filtered and evaporated, another portion is deposited which cannot afterwards be dissolved. When wholly deprived of this portion, and evaporated to dryness, the solution yields the part soluble in cold water. According to MM. Payen and Persoz, the interior portion of the globules consists only of a single substance, which is converted into the two just mentioned by the agency of water; and Thenard is inclined to the same opinion. An appropriate name for the interior soluble portion of starch is *amidin*, which has been adopted by some chemists. Starch, in its perfect state, is not affected by cold water, because the exterior insoluble teguments prevent the access of the liquid to the interior portion; but, when the pellicle is broken by heat, or by mechanical means, the fluid is admitted, and the starch partially dissolved.

Another view of the structure of the starch granule, founded on microscopic observation, has been advanced by Schleiden. According to this view, it consists of concentric layers, all of which have the same chemical composition; but the outer layers, having been first formed, have more cohesion than the inner, and are consequently more difficult of solubility. The rings observed upon the surface of the granules, in some varieties, are merely the edges of these layers; and the point or hylum about which the rings are concentrically placed, is a minute hole, through which probably the substance of the interior layers was introduced. (*Pharm. Central Blatt*, 1844, p. 401.)

Mr. J. J. Field thinks he has demonstrated that the granule consists, as at first supposed, of an interior matter surrounded by a distinct membranous envelope. Having saturated some canna starch with glycerin, and then added a little water, an endosmose of the thinner outer liquid took place into the granules, distending them so as to rupture their investing membrane, which was distinctly visible, under the microscope, in longitudinal wrinkles. The concentric rings he thinks nothing more than folds of the membrane, produced probably by the contraction of the granules. (*Pharm. Journ.*, xiv. 253.) The idea has been advanced that the starch granule is a true vegetable cell with a nucleus, which surrounds itself by a cell-wall, which then secretes the contents of the cell in successive layers. This view combines that of Schleiden with that of Raspail. (Grundy, *Ibid.*, p. 447.) In accordance with it, the hylum may be considered as the effete nucleus in the cell-wall. The cell-wall has been supposed to have a different composition from the interior; as, when separated, as above stated, by the action of boiling water, which leaves it alone undissolved, it is not coloured blue by iodine. (*Ibid.*, p. 448.) If the granule be really a cell, it probably contains nitrogenous matter; and this may exist in the envelope. This idea is supported by the fact that, when treated with boiling solution of potassa, starch gives out a little ammonia. (*Journ. de Pharm.*, Juin, 1855, p. 409.)

The tegumentary portion of starch, for which the name of *amylin* has been proposed, is, when entirely freed from the interior soluble matter, wholly insoluble in water even by prolonged boiling, insoluble in alcohol, and said to suffer no change by the action of diastase. The acids, however, act upon it as they do upon starch. It is thought to approach nearer in properties to lignin than to any other principle.

Varieties. Starch, as obtained from different substances, is somewhat different in its characters. *Wheat starch*, when examined with a microscope, is found to consist of granules of various sizes, the smaller being spheroidal, the larger rounded and flattened, with the hylum in the centre of the flattened surface, and surrounded by concentric rings, which often extend to the edge. The granules are mixed with loose

integuments, resulting from the process of grinding. This variety of starch has a certain degree of hardness and adhesiveness, owing, according to Guibourt, to the escape of a portion of the interior substance of the broken granules, which attracts some moisture from the air, and, thus becoming glutinous, acts as a bond between those which remain unbroken. Another opinion attributes this peculiar consistence to the retention of a portion of the gluten of the wheat flour, which causes the granules to cohere. Under the name of *corn starch*, a variety of fecula obtained from the meal of maize or Indian corn, is much used for nutritive purposes in the U. States. It is an excellent preparation. The granules of maize starch are very small, with a diameter not exceeding, according to Payen, one-sixth of that of the potato, and little more than one-half that of the wheat granules. (*Gmelin*, xv. 79.) *Potato starch* is employed in various forms, being prepared so as to imitate more costly amylaceous substances, such as arrow-root and sago. In its ordinary state, it is more pulverulent than wheat starch, has a somewhat glistening appearance, and may be distinguished, with the aid of the microscope, by the size of its granules, which are larger than those of any other known fecula, except canna or *tous les mois*. They are exceedingly diversified in size and shape, though their regular form is thought to be ovate. They are characterized by concentric rings or rugæ, which are most readily distinguishable in the fresh starch, and are said by Raspail to disappear upon desiccation. These surround a minute circular hole or hylum upon the surface of the granule. In some instances there are two of these holes, one at each end, or both at the same end. The characters of other kinds of fecula will be given under the heads of the several officinal substances of which they constitute the whole or a part. Starch consists of carbon, hydrogen, and oxygen; its formula, from whatever source it may be derived, being $C_{12}H_{10}O_{10}$, or, doubling the numbers, $C_{24}H_{20}O_{20}$.

According to Chevallier, starch is sometimes adulterated with carbonate and sulphate of calcium; and the fraud is also practised of saturating it with moisture, of which it will absorb 12 per cent. without any obvious change.

Medical Properties, &c. Starch is nutritive and demulcent, but in its ordinary form is seldom administered internally. Powdered and dusted upon the skin, it is sometimes used to absorb irritating secretions, and prevent excoriation. Dissolved in hot water and allowed to cool, it is often employed in enemata, either as a vehicle, or as a demulcent application in irritated states of the rectum. It may be used as an antidote to iodine taken in poisonous quantities.*

Off. Prep. Glycerinum Amyli, *Br.;* Mucilago Amyli, *Br.;* Pulvis Tragacanthæ Compositus, *Br.* W.

ANETHI FRUCTUS. *Br.*

Dill Fruit.

The fruit of Anethum graveolens. *Br.*

OLEUM ANETHI. *Br.*

Oil of Dill.

The oil distilled in Britain from dill fruit.

Aneth à odeur forte, *Fr.;* Dill, *Germ.;* Aneto, *Ital.;* Eneldo, *Span.*

ANETHUM. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Umbelliferæ or Apiaceæ.

* *Glycerite of Starch.* A preparation which may be thus denominated (*Glycerolé d'Amidon*, Fr.) has been recommended as a substitute for unctuous preparations, whether as a demulcent application, or as an excipient of other substances, such as sulphate of copper, corrosive sublimate, red oxide of mercury, &c., intended for external use; its advantage being that it is not likely to become irritant to the surface through chemical change. It may be prepared by heating together 15 parts of glycerin and one of starch, with constant stirring until the mixture becomes clear. (*Journ. de Pharm.*, Mai, 1862, p. 363.) We propose the word *glycerate* for the title of solutions in which glycerin is the menstruum, as preferable to *glycerole*, perverted from the French *glycerolé*, and inappropriate, as words with this termination are used to designate a class of organic proximate principles, as *benzole*, &c. The U. S. Pharmacopœia has, we think judiciously, adopted the name of *Glycerites* for these combinations, because they cannot then be confounded with the salts of glyceric acid. (*Note to the twelfth and fourteenth editions.*)

Gen. Ch. Fruit nearly ovate, compressed, striated. *Petals* involuted, entire. *Willd.*

Anethum graveolens. Willd. *Sp. Plant.* i. 1469; Woodv. *Med. Bot.* p. 125, t. 48. Dill is an annual plant, three or four feet high, with a long spindle-shaped root; an erect, striated, jointed branching stem; and bipinnate or tripinnate, glaucous leaves, which stand on sheathing footstalks, and have linear and pointed leaflets. The flowers are yellow, and in large, flat, terminal umbels, destitute of involucre. The plant is a native of Spain, Portugal, and the south of France; and is found growing wild in various parts of Africa and Asia. It is cultivated in all the countries of Europe, and has been introduced into our gardens. The seeds, as the fruit is commonly called, are the only part used. They are usually rather more than a line in length, and less than a line in breadth, of an oval shape, thin, concave on one side, convex and striated on the other, of a brown colour, and surrounded by a yellowish membranous expansion. Their smell is strong and aromatic, but less agreeable than that of fennel seed; their taste, moderately warm and pungent. These properties depend on a volatile oil, which may be obtained separate by distillation. The bruised seeds impart their virtues to alcohol and to boiling water.

Oil of dill is of a pale-yellow colour, with the odour of the fruit, and a hot, sweetish, acrid taste. Its sp. gr. is said to be 0·881. The fruit yields about 3·5 per cent. of it. The oil is sometimes used for preparing dill water.

Medical Properties. Dill seeds have the properties common to the aromatics, but are very seldom used in this country. They may be given in powder or infusion. The dose of the fruit is from fifteen grains to a drachm, of the oil three or four drops.

Off. Prep. of Dill. Aqua Anethi, *Br.* W.

ANGUSTURA. *U.S.*

Angustura.

The bark of Galipea officinalis (Hancock, *Trans. of the Medico-bot. Soc.*). *U. S.*

Off. Syn. CUSPARIÆ CORTEX. The bark of Galipea Cusparia. *Br.*

Angusture, *Fr.;* Angusturarinde, *Germ.;* Corteccia dell' Angustura, *Ital.;* Corteza de Angostura, *Span.*

The subject of Angustura bark, in its botanical relations, has been involved in some confusion. The drug was at first supposed to be derived from a species of Magnolia, and was referred by some to *Magnolia glauca* of this country. Humboldt and Bonpland were the first to throw light upon its true source. When at Angustura, a South American city on the Orinoco, they received specimens of the foliage of the plant from which the bark was obtained; and afterwards believed that they had found the same plant in a tree growing in the vicinity of Cumana. This latter they had the opportunity of personally inspecting, and were therefore enabled to describe accurately. Unable to attach it to any known genus, they erected it into a new one with the title of *Cusparia*, a name of Indian origin, to which they added the specific appellation of *febrifuga*. On their authority, *Cusparia febrifuga* was generally believed to be the true source of the medicine, and was recognised as such by the London College. A specimen having in the mean time been sent by them to Willdenow, the name of *Bonplandia* was imposed on the new genus by that celebrated botanist; and it was subsequently adopted by Humboldt and Bonpland themselves, in their great work on equinoctial plants. Hence the title of *Bonplandia trifoliata*, by which the tree is described in many works on Materia Medica. De Candolle, however, having found in the description all the characters of the genus *Galipea* of Aublet, rejected both these titles, and substituted that of *Galipea Cusparia*, which was adopted by the London College, and has been retained in the British Pharmacopœia. But, after all these commutations, it appears from the researches of Dr. Hancock, who resided for several months in the country of the Angustura bark tree, that the plant described by Humboldt and Bonpland is not that which yields the medicine, but probably another species of the same genus. Among other striking differences between them is that of their size; the tree described by Humboldt and Bonpland being not less than sixty or eighty feet in height, while that from which the bark is obtained is never more than twenty feet. Hancock proposes

for the latter the title of *Galipea officinalis*, which has been adopted in the U. S. Pharmacopœia.

Galipea. *Sex. Syst.* Diandria Monogynia. — *Nat. Ord.* Rutaceæ.

Gen. Ch. Corolla inferior, irregular, four or five cleft, hypocrateriform. *Stamens* four; two sterile. *Loudon's Encyc.*

Galipea officinalis. Hancock, *Trans. Lond. Medico-bot. Soc.* This is a small tree, irregularly branched, rising to the medium height of twelve or fifteen feet, with an erect stem from three to five inches in diameter, and covered with a smooth gray bark. The leaves are alternate, petiolate, and composed of three leaflets, which are oblong, pointed at each extremity, from six to ten inches in length, from two to four in breadth, and supported upon the common petiole by short leaf-stalks. They are very smooth and glossy, of a vivid green colour, marked occasionally with small whitish round spots, and when fresh, of a strong odour resembling that of tobacco. The flowers are numerous, white, arranged in axillary and terminal peduncled racemes, and of a peculiar unpleasant odour. The fruit consists of five bivalve capsules, of which two or three are commonly abortive. The seeds, two of which are contained in each capsule, one often abortive, are round, black, and of the size of a pea. The tree grows abundantly on the mountains of Carony, between the 7th and 8th degrees of N. latitude; and is well known in the missions, near the Orinoco, upwards of 200 miles from the ocean. It flourishes at the height of from six hundred to one thousand feet above the level of the sea. Its elegant white blossoms, which appear in vast profusion in August and September, add greatly to the beauty of the scenery.

The bark is generally brought from the West Indies, packed in casks; but, according to Mr. Brande, the original package, as it comes from Angustura, consists of the leaves of a species of palm, surrounded by a network of sticks.

Properties. The pieces are of various lengths, for the most part slightly curved, rarely quilled, sometimes nearly flat, from half a line to a line or more in thickness, pared away towards the edges, covered externally with a light yellowish-gray or whitish wrinkled epidermis, easily scraped by the nail, and internally of a yellowish-fawn colour. They are very fragile, breaking with a short, resinous fracture, and yield, on being pulverized, a pale-yellow powder; but, when macerated for a short time in water, they become soft and tenacious, and may be cut into strips with scissors. The cut surface usually exhibits under the microscope numerous white points or minute lines. *Br.* The smell of Angustura bark is peculiar and disagreeable when fresh, but becomes fainter with age; the taste is bitter and slightly aromatic, leaving a sense of pungency at the end of the tongue. According to Fischer, it contains volatile oil, bitter extractive, a hard and bitter resin, a soft resin, a substance analogous to caoutchouc, gum, lignin, and various salts. The volatile oil, which may be obtained by distillation with water, is of a pale-yellowish colour, lighter than water, of an acrid taste, and with the odour of the bark. Its formula is given as $C_{13}H_{12}O$ by Dr. C. Herzog, who states that its boiling point is 511° F., probably one of the highest of the volatile oils. (*Chem. Gaz.*, May 15, 1858.) *Cusparin* is the name given by Saladin to a principle, deposited in tetrahedral crystals, when an infusion of the bark is treated with absolute alcohol, at common temperatures, and allowed to evaporate spontaneously. It is neutral, fusible at a gentle heat, by which it loses 23·09 per cent. of its weight, soluble in 200 parts of cold and 100 parts of boiling water, soluble in the concentrated acids and in the alkalies, and precipitated by the infusion of galls. (*Journ. de Pharm.*, xxii. 662.) Herzog was unable to isolate this principle. The virtues of the bark reside in the volatile oil and bitter constituent, and are extracted by water and alcohol.

Dr. A. T. Thomson states that precipitates are produced with the infusion by the solutions of sulphate of iron, tartrate of antimony and potassium, sulphate of copper, acetate and subacetate of lead, bichloride of mercury, nitrate of silver, and pure potassa; by nitric and sulphuric acids; and by the infusions of galls and yellow cinchona; but how far these substances are medicinally incompatible with the bark, it would be difficult to determine.

False Angustura. Under this title, European writers describe a bark which was introduced on the continent mixed with true Angustura bark, and, being pos-

sessed of poisonous properties, produced in some instances unpleasant effects, when dispensed by mistake for that medicine. It is distinguished by its greater thickness, hardness, weight, and compactness; by its resinous fracture; by the appearance of its epidermis, which is sometimes covered with a ferruginous efflorescence, sometimes is yellowish-gray, and marked with prominent white spots; by the brownish colour and smoothness of its internal surface, which is not, like that of the genuine bark, separable into laminæ; by the white slightly yellow powder which it yields; by its total want of odour, and its intense tenacious bitterness. When steeped in water, it does not become soft, like the true Angustura. Analyzed by Pelletier and Caventou, it was found to contain a peculiar alkaline principle which they called *brucia*, and upon which its poisonous operation depends. (See *Nux Vomica.*) In consequence of the presence of this principle, a drop of nitric acid upon the internal surface of the bark produces a deep-red spot. The same acid, applied to the external surface, renders it emerald-green. In true Angustura bark, a dull-red colour is produced by the acid on both surfaces. The *false Angustura* was at first supposed to be derived from *Brucea antidysenterica;* and was afterwards referred to some unknown species of Strychnos, in consequence of containing *brucia*, which is a characteristic ingredient of that genus of plants. At present, it is ascribed to *Strychnos Nux Vomica*, the bark of which, according to Dr. O'Shaughnessy, exactly corresponds with the description of false Angustura, and like it contains brucia.

Medical Properties and Uses. Angustura bark had been long used by the natives of the countries where it grows, before it became known elsewhere. From the continent its employment extended to the West Indies, where it acquired considerable reputation. It was first taken to Europe about eighty years since. It is now ranked among the officinal remedies throughout Europe and America; but it has not sustained its early reputation, and in the United States is not much prescribed. Its operation is that of a stimulant tonic. In large doses it also evacuates the stomach and bowels, and is often employed for this purpose in South America. It was at one time considerably used as a febrifuge in the place of Peruvian bark; but has not been found generally successful in the intermittents of northern latitudes. It is said to be peculiarly efficacious in bilious diarrhœas and dysenteries; and has been recommended in dyspepsia and other diseases requiring a tonic treatment. The testimony, however, of practitioners in Europe and the United States is not strongly in its favour; and it is probably better adapted to tropical diseases than to those of temperate climates. Hancock employed it extensively in the malignant bilious intermittent fevers, dysenteries, and dropsies of Angustura and Demarara; and speaks in strong terms of its efficacy in these complaints. He used it in the form of fermented infusion, as recommended by the native practitioners.

It may be given in powder, infusion, tincture, or extract. The dose in substance is from ten to thirty grains. In larger quantities it is apt to produce nausea. From five to fifteen grains is the dose of the extract, which, however, according to Dr. Hancock, is inferior to the powder or infusion. To obviate nausea, it is frequently combined with aromatics.

Off. Prep. Infusum Angusturæ, *U. S.;* Infusum Cuspariæ, *Br.* W.

ANISUM. *U. S.*

Anise.

The fruit of Pimpinella Anisum. *U. S.*

Graines d'anis, *Fr.;* Anissame, *Germ.;* Semi d'aniso, *Ital.;* Simiente de anis, *Span.;* Anison, *Arab.*

PIMPINELLA. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Umbelliferæ or Apiaceæ. *Gen. Ch. Fruit* ovate-oblong. *Petals* inferior. *Stigma* nearly globular. Willd.

Pimpinella Anisum. Willd. *Sp. Plant.* i. 1473; Woodv. *Med. Bot.* p. 135, t. 52. This is an annual plant, about a foot in height, with an erect, smooth, and branching stem. The leaves are petiolate, the lower roundish-cordate, lobed, incised-serrate, the middle pinnate-lobed with cuneate or lanceolate lobes, the upper trifid, undivided, linear. The flowers are white, and in terminal compound umbels, destitute of involucres.

The anise plant is a native of Egypt and the Levant, but has been introduced into the south of Europe, and is cultivated in various parts of that continent. It is also cultivated occasionally in the gardens of this country. The fruit is abundantly produced in Malta and Spain, and especially so in Romagna, in Italy, whence it is largely exported through Leghorn. The Spanish is smaller than the German or French, and is usually preferred.

Anise seeds (botanically fruit) are about a line in length, oval, striated, somewhat downy, attached to their footstalks, and of a light greenish-brown colour, with a shade of yellow. Their odour is fragrant, and increased by friction; their taste, warm, sweet, and aromatic. These properties, which depend upon a peculiar volatile oil, are imparted sparingly to boiling water, freely to alcohol. The volatile oil exists in the envelope of the seeds, and is obtained separate by distillation. (See *Oleum Anisi.*) Their internal substance contains a bland fixed oil. By expression, a greenish oil is obtained, which is a mixture of the two. The seeds are sometimes adulterated with small fragments of argillaceous earth, which resembles them in colour; and their aromatic qualities are occasionally impaired by a slight fermentation, which they are apt to undergo in the mass, when collected before maturity.

A case of poisoning is on record from the accidental admixture of the fruits of Conium maculatum, which bear some resemblance to those of anise, but may be distinguished by their crenate or notched ridges. They are, moreover, broader in proportion to their length, and are generally separated into half-fruits, while those of anise are whole.

Star aniseed, the *badiane* of the French writers, though analogous in sensible properties to the common aniseed, is derived from a different plant, being the fruit of *Illicium anisatum*, an evergreen tree growing in China, Japan, and Tartary. The fruit consists of from five to ten brownish ligneous capsules, four or five lines long, united together in the form of a star, each containing a brown shining seed. It is much used in France to flavour liquors; and the volatile oil, upon which its aromatic properties depend, and of which it is said to yield about 2·3 per cent., is imported into this country from the East Indies, and sold as common oil of anise, to which, however, it is thought by some to be much superior.

Dr. Ruschenberger, U. S. N., has shown that oil of anise has a remarkable power of deodorizing sulphuret of potassium; a drop of the oil having edtirely deprived of offensive odour a drachm of lard with which five grains of the sulphuret had been incorporated. (*Am. Journ. of Med. Sci.*, N. S., xlviii. 419.)

Medical Properties and Uses. Anise is a grateful aromatic carminative; and is supposed to have the property of increasing the secretion of milk. It has been in use from the earliest times. In Europe it is much employed in flatulent colic, and as a corrigent of griping or unpleasant medicines; but in this country fennel-seed is preferred. Anise may be given bruised, or in powder, in the dose of twenty or thirty grains or more. The infusion is less efficient. The volatile oil may be substituted for the seeds in substance. Much use is made of this aromatic for imparting flavour to liquors.

Off. Prep. Oleum Anisi. W.

ANTHEMIS. *U. S.*

Chamomile.

The flowers of Anthemis nobilis. *U. S.*

Off. Syn. ANTHEMIDIS FLORES. *Chamomile Flowers.* The dried single and double flower heads of the common chamomile, Anthemis nobilis; wild and cultivated. *Br.*

Camomille Romaine, *Fr.;* Romische Kamille, *Germ.;* Camomilla Romana, *Ital.;* Manzanilla Romana, *Span.*

ANTHEMIS. *Sex. Syst.* Syngenesia Superflua.— *Nat. Ord.* Compositæ Senecioni deæ. *De Cand.* Asteraceæ. *Lindley.*

Gen. Ch. Receptacle chaffy. *Seed-down* none or a membranaceous margin. *Calyx* hemispherical, nearly equal. *Florets of the ray* more than five. *Willd.*

Several species of Anthemis have been employed in medicine. *A. nobilis*, which is the subject of the present article, is by far the most important. *A. Cotula*, or mayweed, is also recognised by the U. S. Pharmacopœia. (See *Cotula.*) *A. Pyrethrum*, which affords the pellitory root, is among the officinal plants. (See *Pyrethrum.*) *A. arvensis*, a native of this country and of Europe, bears flowers which have an acrid bitter taste, and possess medical properties analogous though much inferior to those of common chamomile. They may be distinguished by their want of smell.* *A. tinctoria* is occasionally employed as a tonic and vermifuge in Europe.

Anthemis nobilis. Willd. *Sp. Plant.* iii. 2180; Woodv. *Med. Bot.* p. 47, t. 19. This is an herbaceous plant with a perennial root. The stems are from six inches to a foot long, round, slender, downy, trailing, and divided into branches, which turn upwards at their extremities. The leaves are bipinnate, the leaflets small, thread-like, somewhat pubescent, acute, and generally divided into three segments. The flowers are solitary, with a yellow convex disk, and white rays. The calyx is common to all the florets, of a hemispherical form, and composed of several small imbricated hairy scales. The receptacle is convex, prominent, and furnished with rigid bristle-like *paleæ*. The florets of the ray are numerous, narrow, and terminated with three small teeth. The whole herb has a peculiar fragrant odour, and a bitter aromatic taste. The flowers only are officinal.

This plant is a native of Europe, and grows wild in all the temperate parts of that continent. It is also largely cultivated for medicinal purposes. In France, Germany, and Italy, it is generally known by the name of *Roman chamomile.* By cultivation the yellow disk florets are often converted into the white ray florets. Thus altered, the flowers are said to be *double*, while those which remain unchanged are called *single;* but, as the conversion may be more or less complete, it generally happens that with each of the varieties there are intermingled some flowers of the other kind, or in different stages of the change. The double flowers are generally preferred; though, as the sensible properties are found in the greatest degree in the disk, the single are the most powerful. It is rather, however, in aromatic flavour than in bitterness that the radial florets are surpassed by those of the disk. If not well and quickly dried, the flowers lose their beautiful white colour, and are less efficient. The whitest should be preferred. The seeds yield by expression a fixed oil, which is said to be applied in Europe to various economical uses.†

Though not a native of America, chamomile grows wild in some parts of this country, and is occasionally cultivated in our gardens for family use; the whole herb being employed. The medicine, as found in our shops, consists chiefly of the double flowers, and is imported from Germany and England. From the former country the

*M. Pattone, an apothecary in the civil hospital of Alexandria, has announced the discovery in Anthemis arvensis of a new alkaloid, and a new organic acid, which he proposes to call, respectively, *anthemine* (*anthemia*) and *anthemic acid.* The former he procured by subjecting the flowers to distillation with water so as to separate all the volatile oil, expressing the residue, filtering the expressed liquor, evaporating this to the consistence of an extract, exhausting the extract by boiling alcohol of 85°, which dissolves the resinous matter and the peculiar acid, treating the residue with boiling distilled water, filtering the liquor and allowing it to cool, and then dropping in solution of ammonia until the liquid became decidedly alkaline. After a short time, beautiful, shining, prismatic crystals were deposited. To complete the process, the liquor was allowed to stand for 24 hours, after which the mother-water was decanted, and the crystals washed repeatedly with cold distilled water. Anthemia is inodorous and tasteless, very slightly soluble in cold water, somewhat more soluble in boiling water, *insoluble in alcohol and ether*, but freely dissolved by acetic acid. It is carbonized by a high heat. (*Journ. de Pharm.*, Mars, 1859, p. 198.) — *Note to the twelfth edition.*

†To those who may be disposed to cultivate the flowers for the shops, the following statements made by Mr. Jacob Bell, from observations at the flower gardens at Mitcham, in Surrey, England, may not be without interest. The plant is usually propagated by dividing the root, though the seeds are employed when it is desired to introduce new varieties. Each root will serve as the source of thirty or forty plants. They are set in rows a yard apart, at intervals of about eighteen inches. The proper period for planting is March; and the flowers are in perfection in July, but continue to appear throughout the season. Extremely wet or extremely dry weather is injurious to the crop. It is more productive in a rather heavy loam, than either in light sandy soil, or in stiff clay. It requires little manure, but attention to weeding is necessary. Over-manuring increases the leaves at the expense of the flowers. When gathered, the flowers are dried upon canvas trays in a drying room, artificially warmed, where they remain about a day. The crop varies from three to ten hundred weight per acre. The single flowers are more productive than the double by weight; but, as they command a less price, the value of the crop is about the same. (*Pharm. Journ. and Trans.*, x. 118.) — *Note to the ninth edition.*

flowers of *Matricaria Chamomilla* are also occasionally imported, under the name of chamomile. (See *Matricaria.*) In France, the flowers of two other plants are sold in the shops, indiscriminately with those of Anthemis nobilis; viz. those of *Pyrethrum Parthenium* (the *Chrysanthemum Parthenium* of Persoon) or feverfew, and those of *Anthemis parthenoides*, De Cand., or the *Matricaria parthenoides*, Desf. (*Journ. de Pharm.*, Mai, 1859, p. 347.) For the peculiar character by which these two flowers may be distinguished from the chamomile, see *Pyrethrum Parthenium* in Part III.

Properties. Chamomile flowers, as usually found in the shops, are large, almost spherical, of a dull-white colour, a fragrant odour, and a warmish, bitter, aromatic taste. When fresh, their smell is much stronger, and was fancied by the ancients to resemble that of the apple. Hence the name *chamæmelum* (χαμαι on the ground, and μηλόν an apple); and it is somewhat singular that the Spanish name *manzanilla* (a little apple) has a similar signification. The flowers impart their odour and taste to water and alcohol, the former of which, at the boiling temperature, extracts nearly one-fourth of their weight. They are said to contain a volatile oil, a bitter principle, resin, gum, a small quantity of tannin, and various salts. The first two are probably their active ingredients. (See *Oleum Anthemidis.*) A volatile acid, in minute proportion, has been obtained from them by Schendler, said to resemble, if it be not identical with valerianic acid. An examination of the flowers has recently been made by M. Camboulises, who discovered a wax-like substance, soluble in ether, a little chlorophyll, quercitrin, a bitter crystallizable acid supposed to be the same as that discovered by M. Pattone in the flowers of A. arvensis, an oil, and glucose, with silica and salts of potassa, lime, and magnesia. He failed to find the alkaloid discovered by M. Pattone in the flowers of A. arvensis (see *note* on p. 131). (*Journ. de Pharm.*, 4e sér., xiv. p. 337.)

Medical Properties and Uses. Chamomile is a mild tonic, in small doses acceptable and corroborant to the stomach, in large doses capable of acting as an emetic. In cold infusion it is often advantageously used in cases of enfeebled digestion, whether occurring as an original affection, or consequent upon some acute disease. It is especially applicable to that condition of general debility, with languid appetite, which often attends convalescence from idiopathic fevers. As a febrifuge it formerly enjoyed much reputation, and was employed in intermittents and remittents; but we have remedies so much more efficient, that it is now seldom used in this capacity. The tepid infusion is very often given to promote the operation of emetics, or to assist the stomach in relieving itself when oppressed by its contents. The flowers are sometimes applied externally in the form of fomentation, in cases of irritation or inflammation of the abdominal viscera, and as a gentle incitant in flabby, ill-conditioned ulcers. The dose of the powder as a tonic is from half a drachm to a drachm three or four times a day, or more frequently. The infusion is usually preferred. The decoction and extract cannot exert the full influence of the medicine; as the volatile oil is driven off at the boiling temperature.

Off. Prep. Extractum Anthemidis, *Br.;* Infusum Anthemidis. W.

ANTIMONIUM.

Antimony.

Stibium, *Lat.;* Antimoine, *Fr.;* Antimon, Spiessglanz, *Germ.;* Antimonio, *Span., Ital.*

Metallic antimony, sometimes called *regulus of antimony*, is not officinal in the British or United States Pharmacopœias; but, as it enters into the composition of a number of important pharmaceutical preparations, we have thought it proper to notice it under a distinct head.

Antimony exists in nature, 1. uncombined; 2. as an oxide; 3. as a tersulphuret; and 4. as a sulphuretted oxide. It is found principally in France and Germany; but has been discovered also in the British province of New Brunswick.

Extraction. All the antimony of commerce is extracted from the native tersulphuret. The ore is first separated from its gangue by fusion. It is then reduced to powder, and placed on the floor of a reverberatory furnace, where it is subjected

to a gentle heat, being constantly stirred with an iron rake. This process of roasting is known to be completed, when the matter is brought to the state of a dull grayish-white powder, called *antimony ash.* By this treatment the antimony is partly teroxidized, and partly converted into antimonious acid; while nearly all the sulphur is dissipated in the form of sulphurous acid gas; a portion of tersulphuret, however, remains undecomposed. The matter is then mixed with charcoal impregnated with a concentrated solution of carbonate of sodium, and the mixture heated in crucibles, in a melting furnace. The charcoal reduces the teroxide of antimony, while the alkali unites with the undecomposed tersulphuret, and forms melted scoriæ, which cover the reduced metal, and diminish its loss by volatilization.

The purest commercial antimony is not entirely free from foreign metals, chiefly iron, lead, and arsenic. M. Lefort purifies it for the purposes of pharmacy, by gradually adding twenty-five parts of the metal, in fine powder, to fifty parts of nitric acid, by the action of which the antimony is precipitated as antimonious acid, while the foreign metals remain in solution. The precipitate is then thoroughly washed with water, containing a hundredth part of nitric acid, drained completely, mixed with three or four parts of powdered sugar, and reduced to the metallic state by being heated to redness in a Hessian crucible. (*Journ. de Pharm.*, Août, 1855, p. 93.)

Antimony is imported into the United States principally from France, packed in casks. A portion is also shipped from Trieste, from Holland, and occasionally from Cadiz. The Spanish antimony is generally in the form of pigs; the French, in circular cakes of about ten inches in diameter, flat on one side and convex on the other; the English, in cones. The French is most esteemed.

Properties, &c. The time of the discovery of antimony is not known; but Basil Valentine was the first to describe the method of obtaining it, in his work entitled *Currus Triumphalis Antimonii*, published towards the end of the fifteenth century. It is a brittle, brilliant metal, ordinarily of a lamellated texture, of a silver-white colour when pure, but bluish-white as it occurs in commerce. When rubbed between the fingers, it imparts a sensible odour. Its equivalent number is 129, symbol Sb, sp. gr. 6·7, and fusing point 810°, or about a red heat. Recent experiments of Schneider, confirmed by Weber, make the eq. of antimony 120·2; but we shall adhere to 129, until the new number is fully confirmed. On cooling after fusion, antimony assumes an appearance on the surface bearing some resemblance to a fern leaf. When strongly heated, it burns with the emission of white vapours, consisting of teroxide, formerly called *argentine flowers of antimony.* A small portion, being fused, and then thrown upon a flat surface, divides into numerous globules, which burn rapidly as they move along. It forms three combinations with oxygen; one oxide—teroxide of antimony, and two acids—antimonious and antimonic acids. The teroxide contains three, antimonious acid four, and antimonic acid five eqs. of oxygen, combined with one of the metal. In addition to these, a *suboxide* is said to exist, which, according to Marchand, has a composition represented by the formula Sb_3O_4. The teroxide will be noticed under the head of *Antimonii Oxidum. Antimonic acid* is a lemon-coloured powder, which may be prepared by oxidizing the metal by digestion in nitric acid, and then driving off the excess of the acid by a heat not exceeding 600°. When exposed to a red heat, it parts with oxygen, and is converted into *antimonious acid.* This is a white powder, and, though medicinally inert, frequently forms a large proportion of the preparation called antimonial powder. (See *Pulvis Antimonialis.*)

Antimony is officinal in the following states of combination.

I. Sulphuretted.

Antimonii Sulphuretum, *U. S.;* Antimonium Nigrum, *Br.* — *Sulphuret of Antimony; Black Antimony.* (*Prepared Sulphuret of Antimony, Br.* 1864.)

Antimonium Sulphuratum, *U. S., Br.* — *Sulphurated Antimony.*

Antimonii Oxysulphuretum, *U. S.* — *Oxysulphuret of Antimony. Kermes Mineral.*

II. Oxidized.

Teroxide. Antimonii Oxidum, *U. S., Br.* — *Oxide of Antimony.*

Teroxide mixed with phosphate of calcium. Pulvis Antimonialis, *Br.*—*Antimonial Powder.*

III. COMBINED WITH CHLORINE.

Liquor Antimonii Chloridi, *Br.*—*Solution of Chloride of Antimony.*

IV. IN SALINE COMBINATION.

Antimonii et Potassii Tartras, *U. S.;* Antimonium Tartaratum, *Br.*—*Tartrate of Antimony and Potassium. Tartarated Antimony. Tartar Emetic.*

Unguentum Antimonii, *U. S.;* Unguentum Antimonii Tartarati, *Br.*—*Ointment of Antimony. Ointment of Tartarated Antimony.*

Vinum Antimonii, *U. S.;* Vinum Antimoniale, *Br.*—*Wine of Antimony. Antimonial Wine.*

The antimonial preparations are active in proportion to their solubility in the gastric juice. According to Mialhe, those antimonials which contain the hydrated teroxide, or are easily converted into it, are most active. Hence metallic antimony in fine powder, and tartar emetic act with energy. The teroxide is much more active when prepared in the moist than in the dry way. According to Serullas, all the antimonial preparations, except tartar emetic and butter or terchloride of antimony, contain a minute proportion of arsenic. Tartar emetic is an exception, because it separates entirely, in the act of crystallizing, from any minute portion of arsenic in the materials from which it is prepared; the poisonous metal being left behind in the mother-water of the process. B.

ANTIMONII SULPHURETUM. *U. S.*

Sulphuret of Antimony.

Native tersulphuret of antimony, purified by fusion. *U. S.*

Off. Syn. ANTIMONIUM NIGRUM. *Black Antimony.* (*Prepared Sulphuret of Antimony.* Br. 1864.) Native sulphide of antimony, SbS_3, purified from siliceous matter by fusion, and afterwards reduced to fine powder. *Br.*

Artificial sulphuret of antimony; Antimoine sulfuré, *Fr.;* Schwefelantimon, Schwefelspiessglanz, *Germ.;* Solfuro d'antimonio, *Ital.;* Antimonio crudo, *Span.*

Preparation, &c. The sulphuret of antimony of the Pharmacopœias is obtained from the native sulphuret, called *antimony ore,* by different processes of purification; the following being an outline of that generally pursued. The ore is placed in melting pots in a circular reverberatory furnace, and these are made to connect, by means of curved earthen tubes, with the receiving pots, situated outside the furnace. This arrangement affords facilities for removing the residue of the operation, and allows of the collection of the melted sulphuret without interrupting the fire, and, consequently, without loss of time or fuel. In the U. S. Pharmacopœia it is directed to be melted in order to purify it from infusible substances; in the British to be reduced to fine powder, to fit it for pharmaceutic use. In order to bring it to this state, it should be submitted to the process of levigation. (See *Creta Præparata.*)

Properties, &c. Sulphuret of antimony is mostly prepared in France and Germany. It is called, in commerce, antimony, or *crude antimony,* and occurs in fused conical masses, denominated loaves. These are dark gray externally, and exhibit internally, when broken, a brilliant steel-gray colour, and a striated crystalline texture. Their goodness depends upon their compactness and weight, and the largeness and distinctness of the fibres. The quality of the sulphuret cannot well be judged of, except in mass; hence it ought never to be bought in powder. It is entirely soluble in muriatic acid, by the aid of heat, with the evolution of sulphuretted hydrogen. The muriatic solution, when added to water, is decomposed with the production of a white powder (*oxychloride of antimony*). If the muriatic acid should have dissolved some lead or copper, the filtered solution, after the precipitation of the white powder, will give a dark-coloured precipitate with sulphuretted hydrogen; but if these metals should be absent, it will yield, with the same test, an orange-coloured precipitate, derived from a small quantity of antimony, not thrown down by the water. Arsenic, which is often present in considerable quantities, may be detected by the usual tests for that metal. (See *Acidum Arseniosum.*)

Composition. The officinal sulphuret of antimony is a tersulphuret, consisting of one eq. of antimony 129, and three of sulphur 48 = 177.

When prepared by pulverization and levigation, it is in the form of an insoluble powder, without taste or smell, usually of a dull blackish colour, but reddish-brown, when perfectly pure. By exposure to the air, it absorbs, according to Buchner, a portion of oxygen, and becomes partially converted into teroxide.

Medical Properties and Uses. This preparation is very uncertain in its operation; being sometimes without effect, at other times, if it meet with acid in the stomach, acting with violence by vomiting and purging. The effects attributed to it are those of a diaphoretic and alterative; and the principal diseases in which it has been used are scrofula, glandular obstructions, cutaneous diseases, and chronic rheumatism. It is not employed by physicians in the United States; its use in this country being confined to veterinary practice. The dose is from ten to thirty grains, given in powder or bolus.

Off. Prep. Antimonii Oxidum, *U. S.;* Antimonii Oxysulphuretum, *U. S.;* Antimonium Sulphuratum; Liquor Antimonii Chloridi, *Br.* B.

APOCYNUM ANDROSÆMIFOLIUM. *U. S. Secondary.*

Dog's-Bane.

The root of Apocynum androsæmifolium. *U. S.*

APOCYNUM. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Apocynaceæ.

Gen. Ch. Calyx very small, five-cleft, persistent. *Corolla* campanulate, half five-cleft, lobes revolute, furnished at the base with five dentoid glands alternating with the stamens. *Anthers* connivent, sagittate, cohering to the stigma by the middle. *Style* obsolete. *Stigma* thick and acute. *Follicles* long and linear. *Seed* comose. *Nuttall.*

Apocynum androsæmifolium. Willd. *Sp. Plant.* i. 1259; Bigelow, *Am. Med. Bot.* ii. 148. Dog's-bane is an indigenous, perennial, herbaceous plant, from three to six feet in height, and abounding in a milky juice, which exudes when the plant is wounded. The stem is erect, smooth, simple below, branched above, usually red on the side exposed to the sun, and covered with a tough fibrous bark. The leaves are opposite, petiolate, ovate, acute, entire, smooth on both sides, and two or three inches long. The flowers are white, tinged with red, and grow in loose, nodding, terminal or axillary cymes. The peduncles have very small acute bractes. The tube of the corolla is longer than the calyx, and its border spreading. The fruit consists of a pair of long, linear, acute follicles, containing numerous imbricated seeds, attached to a central receptacle, and each furnished with a long seed-down.

The plant flourishes in all parts of the United States from Canada to the Carolinas. It is found along fences and the skirts of woods, and flowers in June and July. The root is the part employed.

This is large, and, like other parts of the plant, contains a milky juice. Its taste is unpleasant and intensely bitter. Dr. Bigelow inferred from his experiments that it contained bitter extractive, a red colouring matter soluble in water and not in alcohol, caoutchouc, and volatile oil. He states that its activity is diminished and eventually destroyed by keeping.

Medical Properties. The powder of the recently dried root acts as an emetic in the dose of thirty grains, and is said to be sometimes employed by practitioners in the country for this purpose. By Dr. Zollickoffer it was considered a useful tonic, in doses of from ten to twenty grains. Dr. Lannon, of Ohio, has found it useful in dyspepsia, and states that in small doses it is laxative, and in large probably cathartic. He recommends the recently dried root in the form of infusion or decoction. (*Proceed. of the Am. Pharm. Assoc.*, A.D. 1858, p. 72.) It is among the remedies employed by the Indians in lues venerea. Dr. John F. Mettauer, of Virginia, has found it, in scrofula, the safest and most valuable aperient in our possession; having given it in the form of tincture in cases attended with debility, and in that of infusion, when the strength is not materially impaired. The tincture he prepares

in the proportion of four ounces of the bruised root and a drachm and a half of coriander to half a pint of diluted alcohol, and gives in the dose of from one to three fluidrachms night and morning; the infusion, by macerating for an hour four ounces of the root in a pint of boiling water, to be given in the dose of from two to four fluidrachms, repeated as often. (*Bost. M. and S. Journ.*, Oct. 17, 1867, p. 231.)

W.

APOCYNUM CANNABINUM. *U.S. Secondary.*

Indian Hemp.

The root of Apocynum cannabinum. *U.S.*

APOCYNUM. See APOCYNUM ANDROSÆMIFOLIUM.

Apocynum cannabinum. Willd. *Sp. Plant.* i. 1259; Knapp, *Am. Med. Rev.* iii. 197. In general appearance and character, this species bears a close resemblance to the preceding. The stems are herbaceous, erect, branching, of a brown colour, and two or three feet in height; the leaves are opposite, oblong-ovate, acute at both ends, and somewhat downy beneath; the cymes are paniculate, many-flowered, and pubescent; the corolla is small and greenish, with a tube not longer than the calyx, and an erect border; the internal parts of the flower are pinkish or purple. The plant grows in similar situations with *A. androsæmifolium*, flowers about the same period, and bears a similar fruit. It abounds in a milky juice, and has a tough fibrous bark, which, by maceration, affords a substitute for hemp. From this circumstance its common name was derived.

The root, which is the officinal part, is horizontal, five or six feet in length, about one-third of an inch thick, dividing near the end into branches which terminate abruptly, of a yellowish-brown colour when young, but dark-chestnut when old, of a strong odour, and a nauseous, somewhat acrid, permanently bitter taste. The internal or ligneous portion is yellowish-white, and less bitter than the exterior or cortical part. The fresh root, when wounded, emits a milky juice, which concretes into a substance resembling caoutchouc. In the dried state, it is brittle and readily pulverized, affording a powder like that of ipecacuanha. Dr. Knapp found it to contain a bitter principle, extractive, tannin, gallic acid, resin, wax, caoutchouc, fecula, lignin, and a peculiar active principle which he proposed to call *apocynin*. (*Am. Med. Review*, iii. 197.) Dr. Griscom, by a subsequent analysis, obtained similar results, with the addition of gum. The root yields its virtues to water and alcohol, but, according to Dr. Griscom, most readily to the former.

Medical Properties and Uses. Indian hemp is powerfully emetic and cathartic, sometimes diuretic, and, like other emetic substances, promotes diaphoresis and expectoration. It produces much nausea, diminishes the frequency of the pulse, and appears to induce drowsiness independently of the exhaustion consequent upon vomiting. The disease in which it has been found most beneficial is dropsy. An aggravated case of ascites, under the care of the late Dr. Joseph Parrish, was completely cured by the decoction of the plant, which acted as a powerful hydragogue cathartic. Dr. Knapp also found it useful in a case of dropsy. Other instances of its efficacy in this complaint have been published by Dr. Griscom, of New York. (*Am. Journ. Med. Sciences*, xii. 55.) Dr. R. S. Cauthorn, of Richmond, Va., has employed the bark of the root successfully in several cases of intermittent fever, and considers it scarcely inferior in antiperiodic power to quinia. He gave from four to six grains, in the form of pill, every two or three hours, augmenting the dose to three times the quantity.* From fifteen to thirty grains of the powdered root will generally produce copious vomiting and purging. The decoction is a more convenient form for administration. It may be prepared by boiling half an ounce of the dried root in a pint and a half of water to a pint, of which from one to two fluidounces may be given twice or thrice daily, or more frequently. The watery extract, in doses of three or four grains three times a day, will generally act on the bowels.

*In a paper published in the *Va. Monthly Stethoscope and Med. Reporter* (i. 7), Dr. Cauthorn ascribes these effects to Asclepias Syriaca; but, in a subsequent communication to the *Va. Med. Journ.* (ix. 425), he informs us that the plant employed was really the Apocynum cannabinum, and that he had been led into the error by the common name of milk-weed attached to both plants. (*Note to the twelfth edition.*)

AQUA. *U.S., Br.*

Water.

Natural water in the purest attainable state. *U.S.* Natural water, the purest that can be obtained, cleared, if necessary, by filtration. *Br.*

"Υδωρ, *Gr.;* Eau, *Fr.;* Wasser, *Germ.;* Acqua, *Ital.;* Agua, *Span.*

Water has always been included in the Materia Medica of the U. S. Pharmacopœia, on account of its great importance as a medical and pharmaceutical agent. It was not admitted into the officinal lists of the British Pharmacopœias until 1839, when it was first recognised by the Edinburgh College. It is more or less concerned in almost all the changes which take place in inorganic matter, and is essential to the growth and existence of living beings, whether animal or vegetable. In treating of a substance of such diversified agency, our limits will allow of a sketch only of its properties and modifications. We shall speak of it under the several heads of *pure water*, *common water*, and *mineral waters*.

Pure Water. Water, in a pure state, is a transparent liquid, without colour, taste, or smell. Its sp. gr. is assumed to be unity, and forms the term of comparison for that of solids and liquids. A cubic inch of it, at the temp. of 60°, weighs very nearly 252·5 grains. It is compressible to a small extent, as was proved first by Canton, and afterwards, in an incontestable manner, by Perkins. Reduced in temp. to 32°, it becomes a solid or ice, with the sp. gr. 0·9175 (Dufour, *Comptes Rendus*, Juin, 1860); and raised to 212°, an elastic fluid called steam. In the latter state its bulk is increased nearly 1700 fold, and its sp. gr. so far lessened as not to be much more than half that of atmospheric air. At the temp. of about 39° its density is at the maximum; and consequently, setting out from that point, it is increased in bulk by being either heated or cooled. It has the power of dissolving more or less of all gases, including common air, the constituents of which are always present in natural water. It uniformly exists in the atmosphere, in the form of invisible vapour, even in the driest weather.

Water consists of one eq. of hydrogen 1, and one of oxygen 8 = 9; or, in volumes, of one volume of hydrogen and half a volume of oxygen condensed into one volume of aqueous vapour or steam. On these data, it is easy to calculate the sp. gr. of steam; for its density will be 0·0689 (sp. gr. of hydrogen) + 0·5512 (half the sp. gr. of oxygen) = 0·6201.

Common Water. By reason of its extensive solvent powers, water, in its natural state, must be more or less contaminated with foreign matter. Thus, it becomes variously impregnated, according to the nature of the strata through which it percolates. When the foreign substances present are in so small an amount as not materially to alter its taste and other sensible qualities, it constitutes the different varieties of *common water*.

There are almost innumerable shades of difference in common water, as obtained from different localities and sources; but all its varieties may be conveniently arranged under the two heads of soft and hard. A *soft water* is one which contains but inconsiderable impurities, and which, when used in washing, forms a lather with soap. By a *hard water* is understood a variety of water which contains calcareous or magnesian salts, or other impurities, through which it curdles soap, and is unfit for domestic purposes. Tincture of soap is a convenient test for ascertaining the quality of water. In distilled water it produces no effect; in soft water, only a slight opalescence; but in hard water, a milky appearance. The milkiness is due to the formation of an insoluble compound between the oily acids of the soap and the lime or magnesia of the foreign salt.

The most usual foreign substances in common water, besides oxygen and nitrogen, and matters held in a state of mechanical suspension, are carbonic acid, sulphate and carbonate of calcium, and chloride of sodium (common salt). Carbonic acid is detected by lime-water, which produces a precipitate before the water is boiled, but not afterwards, as ebullition drives off this acid. The presence of sulphate of calcium is shown by precipitates being produced by nitrate of barium, and, after ebullition,

by oxalate of ammonium. The former test shows the presence of sulphuric acid, and the latter, after boiling the water, indicates lime not held in solution by carbonic acid. Carbonate of calcium, when held in solution by an excess of carbonic acid, may be detected by boiling the water, which causes it to precipitate; but, even after ebullition and filtration, the water will retain enough carbonate of calcium to give a precipitate with acetate of lead; carbonate of calcium being itself to a minute extent soluble in water. Nitrate of silver will produce a precipitate, if any soluble chloride be present; and, ordinarily, the one present may be assumed to be common salt. Arsenic in minute quantity has been found in water used as drink. At Whitbeck, in Cumberland, England, the inhabitants employ, both as drink and for culinary purposes, a water holding enough arsenic in solution to be quite sensible to tests, without any known injurious consequences. (*Chem. News*, Aug. 25, 1860, p. 128.)

Dr. Clark has proposed to purify hard water, when the hardness arises from bicarbonate of calcium, by a process which he calls *liming*. This consists in adding to the water sufficient lime-water to convert the bicarbonate into the very sparingly soluble carbonate. This procedure renders the water soft, and gets rid of all the lime, except that in the minute portion of carbonate dissolved. The merit of this process consists chiefly, not in the removal of lime, but in preventing the formation of organic matters, principally confervæ, the decomposition of which renders the water offensive and unwholesome. Dr. Clark's process has been for some time in successful operation on the water obtained by boring, at the Plumstead water-works, near Woolwich. (*Pharm. Journ. and Trans.*, June, 1856.) River water containing the usual amount of calcareous matter, if allowed to stagnate in open reservoirs, in the summer, will become contaminated with myriads of microscopic plants and animals. This change is prevented, according to Dr. Clark, by his peculiar treatment, which deprives the living organism of the nutriment, derived from loosely combined carbonic acid.

The oxygen and nitrogen present in natural waters are not usually in the same proportion as in atmospheric air; the oxygen in atmospheric air amounting to about 20 per cent. in volume, while the usual gaseous mixture, expelled from fresh water by boiling, contains about 32 per cent.

Common water is also divided into varieties according to its source. Thus we have rain, snow, spring, river, well, lake, and marsh water.

Rain and *snow waters* are the purest kinds of natural water. Rain water, to be obtained as pure as possible, must be collected in large vessels in the open fields, at a distance from houses, and some time after the rain has commenced falling; otherwise it will be contaminated with the dust which floats in the atmosphere, and with other impurities derived from roofs. The rain water of large cities contains nitrogenized organic matter, as shown by the odour produced by burning the residue left after the water has been evaporated.

Rain water ordinarily contains atmospheric air, and, according to Liebig, a little nitric acid, the amount of which is increased when the rain descends during a storm. M. Chabrier states as the result of his observations, that rain water contains either nitrous or nitric acid, the one or the other predominating according to the condition of the weather; the nitrous acid being relatively in excess in mild weather, but the nitric when the rain was attended with tempestuous winds. (*Journ. de Pharm.*, Janv. 1872, p. 42.) According to an analysis, made by M. Martin, of rain water which fell at Marseilles during a violent storm, 1000 parts by weight contained 0·004 of chlorine and 0·003 of ammonia. Not a trace of iodine or of nitric acid was discovered. Boussingault has ascertained that the rain which falls in towns contains considerably more ammonia than that which falls in the country. Thus the rain of Paris was found by him to contain three or four parts of ammonia per million; while that collected in a mountainous region, contained about four-fifths of one part only in a million. The average results of Mr. J. B. Lawes and Dr. J. H. Gilbert give one part of ammonia to the million of rain water. (*Chem. Gaz.*, Nov. 1, 1854.) Snow water has a peculiar taste, which was supposed to depend on the presence of air more oxygenous than that of the atmosphere; but in point of fact it contains no air, and this accounts for its vapid taste. Both rain and snow water are sufficiently pure for employment in most chemical operations.

Spring water (aqua fontana) depends entirely for its quality on the strata through which it flows; being purest when it passes through sand or gravel. It almost always contains a trace of common salt, and generally other impurities, which vary according to the locality of the spring.

River water (aqua fluvialis) is, generally speaking, less impregnated with saline matter than spring water, because made up in considerable part of rains; while its volume bears a larger proportion to the surface of its bed. It is, however, much more apt to have mechanically suspended in it insoluble matters, of a vegetable and earthy nature, which impair its transparency.

Well water, like that from springs, is liable to contain various impurities. As a general rule, the purity of the water of a well will be in proportion to its depth and the constancy with which it is used. Well water in large cities always contains a large amount of impurity, both organic and inorganic. Dr. R. D. Thomson found 147·6 grs., per Imperial gallon, of impurity in a well in London. From the organic matter he extracted much nitric acid and ammonia, evidently the product of animal excretions. (*Pharm. Journ. and Trans.*, July, 1856, p. 27.) The presence of nitrates in water prevents the formation of organic beings, which cannot be detected by the microscope, even after it has been long kept. *Artesian* or *overflowing wells*, from their great depth, generally afford a pure water.

Lake water cannot be characterized as having any invariable qualities. That of most of the lakes in the United States is pure and wholesome.

Marsh water is generally stagnant, and contains vegetable remains undergoing decomposition. It is unwholesome, and ought never to be used for medicinal purposes.

Common waters are apt to contain various organic matters in solution, not only substances of the nature of *ulmin* or *gein*, but many others, both solid and gaseous, which have not been well determined. Among them are living organized microscopic beings, both vegetable and animal, which often have an injurious influence on the health, and sometimes give rise to special diseases. As an example may be mentioned the extremely pernicious effects of swamp water on the health of the troops, encamped in its vicinity, during the late war; a severe and obstinate diarrhœa, which often resisted treatment for months, being among the most frequent. From the researches of Prof. Aug. Vogel, of Munich, it appears that when inorganic and organic matters exist at the same time in water, the proportion of the two jointly increases with the depth of the water, while that of the organic matters by themselves diminishes with the depth; so that the deeper the water the purer it will be in reference to these substances. (*Neues Repertorium für Pharm.*, xv. 488, A. D. 1866.) In order to ascertain whether the amount of organic matter exceeds the minute quantity usually present in good water, Dupasquier has proposed chloride of gold as a test. From one to two fluidounces of the water to be tested is put into a small flask, and a few drops of solution of chloride of gold, free from excess of muriatic acid, are added, so as to give the water a slightly yellow tint. The liquid is then boiled. If the water contain the ordinary proportion of organic matter, the yellow tint will remain unchanged; but if its quantity be greater than this, the liquid will at first become brownish, and afterwards violet or bluish, in consequence of the reduction of the gold. Organic matter is also detected by its decolourizing effect on a solution of permanganate of potassium.* Water rendered impure and discoloured by organic im-

* It may become desirable in certain cases to determine the quantity of these organic matters in solution; and various modes of accomplishing this object have been proposed, but as yet none perfectly satisfactory. One of the readiest of these methods is the use of permanganate of potassium referred to in the text. By adding gradually a solution of permanganate of potassium, of known strength, to the contaminated liquid until the solution ceases to be decolorized, the quantity of that salt consumed in the process may be determined, and thus the quantity of oxygen, and approximatively the amount of organic matter oxidized. Various other methods have been proposed; as 1. by incineration; 2. the process of Messrs. Wankyn, Chapman, and Smith, which determines the product of ammonia during distillation with caustic potassa, by which the quantity of nitrogenous matter is approximatively ascertained; especially important, as it is this kind of impurity that is most noxious; and 3. the more complicated processes of Dr. Frankland, which determine the quantity of nitrogen of immediate organic origin, as distinct from that which may result from any nitrates or nitrites that may be present, and with this also the quantity of carbon exclusive of that derived from the mineral carbonates. From the want of space, we must content ourselves with referring to articles

pregnation, or the presence of animalcula, is freed from its impurities, partially at least, by the presence of a coil of bright iron wire, or admixture with sesquioxide of iron, and subsequent filtration. It is proposed by M. Scheerer that such waters should be treated with solution of sulphate of sesquioxide of iron, which precipitates the organic matter; but care must be taken to use only so much of the salt as is strictly necessary for the purpose. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 394.) Another method has been patented by Mr. Alfred Bird, of Birmingham, consisting in the use of neutral sulphate of aluminium, by which the carbonate of calcium, the presence of which favours the growth of organized beings through the food afforded by its carbonic acid, is converted into sulphate of calcium; while the organic matter subsides, combined with alumina. (*Chem. News*, Aug. 3, 1866.) The boiling of water contaminated with organic ferments, or other microscopic living bodies, before using it for drink or mixed with food, should always be carried into effect, when the use of such water is unavoidable. Filtration no doubt is to a certain degree effectual in ridding water of these poisonous agents, and will prove still more advantageous if in connection with charcoal, magnesia, &c. For an account of different filters for this purpose, consult the *London Lancet* (Jan. 12, March 23, April 13 and 27, 1867, pp. 58, 371, 473, and 526). For an elaborate paper on the examination of water for organic matter by R. Angus Smith, in which this matter is considered under various heads, as vegetable and animal, recent and old, decomposed or putrid, &c., see the *Chemical News* (June 1, 1869; and following numbers).

The term *Aqua*, in the U.S. and Br. Pharmacopœias, may be considered as designating any natural water of good quality. A good water may be known by its being limpid and inodorous. It answers well for cooking, and does not curdle soap. Upon the addition of nitrate of barium, nitrate of silver, or oxalate of ammonium, its transparency is but slightly affected; and, upon being evaporated to dryness, it leaves but an inconsiderable residue.

Water should never be kept in leaden cisterns, on account of the risk of its dissolving a small portion of lead. This risk is greater in proportion to the softness and purity of the water; for it is found that the presence of a minute proportion of saline matter, as for example of sulphate of calcium, protects the water from the slightest metallic impregnation. The chlorides are not protective; as they give rise to chloride of lead, which is slightly soluble. The protection has been ascribed to an insoluble film on the surface of the lead, formed by the decomposition of the saline matter. Upon this principle is based a plan of protection by Dr. Schwartz, of Breslau, who proposes to fill leaden pipes through which water is conducted with a strong solution of an alkaline sulphide, which forms a perfectly insoluble coating of sulphide (sulphuret) of lead, said to be quite impermeable by the water afterwards introduced. (*Chem. News*, Sept. 26, 1863, p. 157.) A coating of zinc has been employed for protecting the surface of iron pipes and reservoirs against the action of water, but has failed. Experiment has shown that the water becomes impregnated with the salts of both metals. (*Ibid.*, Ap. 5, 1862, p. 188.)*

The *Schuylkill water*, introduced into Philadelphia, possesses all the characteristics

on the subject in the *Pharm. Journ. and Trans.* (Dec. 1867, p. 293, and Jan. 1868, p. 335); and the *Chem. News* (Nov. 29, 1867, p. 280).—*Note to the thirteenth edition.*

In reference to the operation of permanganate of potassium on organic impurities in water, it seems to have been determined that its immediate action is only on the lifeless decomposing and putrid ingredients, and that upon living matter it is slow, lasting hours and even days before being completed. Hence its value as a test has been denied; but as the decomposing or putrescent ingredients are those which render those waters unhealthy, it would appear that, though defective merely as a test of the quantity of organic matters, its utility as a disinfectant is real and great. (*Chem. News*, April 3, 1868, p. 166.)—*Note to the fourteenth edition.*

* Experiments by M. Roux, pharmaceutist of the marine at Rochefort, made by order of the naval authorities, have satisfactorily shown that reservoirs of iron coated with zinc are attacked with great facility by water contained in them, which becomes more or less impregnated with both metals in the state of oxides and salts, and especially with those of zinc, to such a degree as to render such vessels improper, as recipients of water for drinking. Of the different kinds of water tried, distilled water deprived as far as possible of atmospheric air produced least effect; next in degree of action was spring water; still more energetic was distilled water containing carbonic acid furnished by the earthy bicarbonates of the water submitted to distillation; and more powerful than all was river water containing a certain proportion of common salt. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 99, A.D. 1865.)—*Note to the thirteenth edition.*

of a good water, except that it is occasionally turbid after heavy rains. It contains, on an average, in a wine gallon, according to an analysis by Prof. M. H. Boyè, of Philadelphia, 4·42 grains of solid matter, nearly one-half of which is carbonate of calcium, with only a trace of organic matter. Since this analysis, however, the saline matter in Schuylkill water has somewhat changed; the sulphuric acid from the coal mines above having caused a substitution of sulphate for carbonate of calcium, and thereby rendered the water secure from poisonous impregnation by lead. It is perfectly free from lead, even after standing in leaden pipes for thirty-six hours. (*Prof. E. N. Horsford.*) The solid matter in the same quantity of the *Delaware water* at Philadelphia, is 3·53 grains, a little over one-third of which is carbonate of calcium. (*Henry Wurtz.*) The *Croton water* of New York is also a good water. It contains 10·93 grs. of solid matter to the gallon. Brackish or hard water ought never to be employed in compounding prescriptions. For some pharmaceutical purposes, no natural water is sufficiently pure; and hence the necessity of resorting to distillation. (See *Aqua Destillata.*)

Matters mechanically suspended in a natural water may be removed by filtration through sand. On a large scale they may be separated by causing the water to percolate a bed of gravel and sand. Rest, causing subsidence, effects the same purpose, but in a less perfect manner, and requires time.

Mineral Waters. When natural spring waters are so far impregnated with foreign substances as to have a decided taste, and a peculiar operation on the economy, they are called *mineral waters.* These are conveniently arranged under the heads of *carbonated*, *sulphuretted*, *chalybeate*, and *saline.*

1. *Carbonated waters* are characterized by containing an excess of carbonic acid, which gives them a sparkling appearance, and the power of reddening litmus paper. These waters frequently contain the carbonates of calcium, magnesium, and iron, which are held in solution by the excess of carbonic acid. The waters of Seltzer, Spa, and Pyrmont in Europe, and of the sweet springs in Virginia, belong to this class.

2. *Sulphuretted waters* are such as contain sulphuretted hydrogen, and are distinguished by the peculiar fetid smell of that gas, and by yielding a brown precipitate with the salts of lead or silver. Examples of this kind are the waters of Aix la Chapelle and Harrogate in Europe, and those of the white, red, and salt sulphur springs in Virginia.

3. *Chalybeate waters* are characterized by a strong inky taste, and by striking a black colour with the infusion of galls, and a blue one with ferrocyanide of potassium. The iron is generally in the state of carbonate of the protoxide, held in solution by excess of carbonic acid. By standing, the carbonic acid is given off; and the protoxide, by absorbing oxygen, is precipitated as a hydrated sesquioxide of an ochreous colour. The principal chalybeate waters are those of Tunbridge and Brighton in England, of Wiesbaden in Germany, and of Bedford, Pittsburg, and Brandywine in the United States. The sediments of many of the chalybeate springs of Germany have been ascertained by Walchner to contain both arsenic and copper in minute quantities. These results have been confirmed by Dr. H. Will, who finds in some of these springs a minute proportion of tin, lead, and antimony, in addition to the arsenic and copper. In three springs Will found the ratio of the sesquioxide of iron to the other metals to be, on an average, as 48 to 1. According to M. Lassaigne, the arsenical impregnation exerts no poisonous action on the inferior animals, a result which he ascribes to the antidotal power of the iron. The mineral water of Mont Dore, in France, was found by Thenard to contain arseniate of sodium in the proportion of about one-fifteen-thousandth of a grain to two pints.

4. *Saline waters* are those, the predominant properties of which depend upon saline impregnation. The salts most usually present are sulphates and carbonates of sodium, calcium, and magnesium, and the chlorides of sodium, calcium, and magnesium. Potassa is occasionally present, and lithia has been detected by Berzelius in the spring of Carlsbad, and other salt springs of Germany. Cæsia and rubidia have also been detected in certain mineral waters. Bromine is found in the saline at Theodorshalle, in Germany, as also in the salt wells of western Pennsylvania. The mineral springs at Saratoga contain a small proportion of iodine and bromine. The principal saline waters are those of Seidlitz in Bohemia, Cheltenham

and Bath in England, and Harrodsburg and Saratoga in the United States. To these may be added the water of the ocean.

We subjoin a summary view of the composition of most of the mineral waters enumerated under the foregoing heads.

1. CARBONATED. *Seltzer.* In a wine pint. Carbonic acid 17 cubic inches. *Solid contents;*—carbonate of sodium 4 grs.; carbonate of magnesium 5; carbonate of calcium 3; chloride of sodium 17. Total 29 grs. (*Bergmann.*)

Spa. In a wine pint. Carbonic acid 13 cubic inches. *Solid contents;*—carbonate of sodium 1·5 grs.; carbonate of magnesium 4·5; carbonate of calcium 1·5; chloride of sodium 0·2; oxide of iron 0·6. Total 8·3 grs. (*Bergmann.*)

Pyrmont. In a wine pint. Carbonic acid 26 cubic inches. *Solid contents;*—carbonate of magnesium 10 grs.; carbonate of calcium 4·5; sulphate of magnesium 5·5; sulphate of calcium 8·5; chloride of sodium 1·5; oxide of iron 0·6. Total 30·6 grs. (*Bergmann.*)

Vichy. Grand-Grille spring. In 1000 parts by weight. Water 992·572; carbonic acid 0·983; carbonate of sodium 4·971; carbonate of calcium 0·349; carbonate of magnesium 0·084; carbonate of iron 0·012; chloride of sodium 0·570; sulphate of sodium 0·472; silica 0·073. (*Longchamp.*)

Gettysburg Mineral Spring. This spring, situated near the town of Gettysburg, Pa., is distinguished by containing lithia among its constituents. Analyzed by Prof. Mayer, it was found to contain, in an Imperial gallon, the following solid contents; viz. of bicarbonate of sodium and bicarbonate of lithium, jointly, 46·05 Troy grains; bicarbonate of potassium a trace; bicarbonate of magnesium 76·05 grs.; bicarbonate of calcium 81·00; bicarbonate of iron a trace; sulphate of calcium 53·20 grs.; silica 10·00 grs.; and traces of chlorides and phosphates. (*Dr. J. Bell. Med. and Surg. Reporter*, Sept. 28, 1867, p. 262.)*

2. SULPHURETTED. *Aix la Chapelle.* In a wine pint. Sulphuretted hydrogen 5·5 cubic inches. *Solid contents;*—carbonate of sodium 12 grs.; carbonate of calcium 4·75; chloride of sodium 5. Total 21·75 grs. (*Bergmann.*)

Harrogate old sulphur well. Sp. gr. 1·01113; temp. 48·2°. In an Imperial gallon. *Gaseous contents;*—carbonic acid 22·03 cubic inches; carburetted hydrogen 5·84; sulphuretted hydrogen 5·31; nitrogen 2·91. Total 36·09 cubic inches. *Solid contents;*—sulphate of calcium 0·181 grs.; carbonate of calcium 12·365; chloride of calcium 81·735; chloride of magnesium 55·693; chloride of potassium 64·701; chloride of sodium 866·180; sulphuret of sodium 15·479; silica 0·246; with traces of fluoride of calcium, bromide and iodide of sodium, ammonia, carbonate of iron, carbonate of manganese, and organic matter. Total 1096·580 grs. (*Hofmann. Pharm. Journ. and Trans.*, xiv. 123.)†

In one of the springs of Harrogate, which he distinguishes as the *strong chalybeate*, Dr. Muspratt found 16·011 grains of *protochloride of iron* and 7·717 of chloride of barium in the Imp. gallon; whereas in another well within the distance of a yard, which he calls the *mild chalybeate*, there is not a trace of either. The protochloride of iron of the former spring renders it, according to Dr. Muspratt, without a parallel. (*Chem. News*, April 27, 1866, p. 203.)

* *Gettysburg Katalysine Water.* The following is a reliable analysis of the now well-known Gettysburg Spring, by Prof. F. A. Genth (of the University of Penn.). One gallon, of 231 cubic inches, contains of the following sulphates, of barium a trace, of strontium 0·004,27 grains, of calcium 0·831,45 grs., of magnesium 6·779,40 grs., of potassium 0·208,36 grs., of sodium 2·467,76 grs.; of chlorides, of sodium 0·657,90 grs., of lithium a trace; of the bicarbonates, of sodium 0·704,57 grs., of calcium 16·408,15 grs., of magnesium 0·542,60 grs., of iron 0·035,85 grs., of manganese 0·006,69 grs., of nickel, cobalt, each, a trace, of copper 0·000,50 grs.; of borate of magnesium 0·034,92; phosphate of calcium 0·006,79; fluoride of calcium 0·009,54; alumina 0·003,80; silicic acid 2·030,75; organic matter with traces of nitric acid, &c., 0·708,70; impurities suspended in the water, as clay, &c., 1·100,69. Total 32·542,72 grains. (*New Remedies*, April, 1873, p. 345.)—*Note to the fourteenth edition.*

† The following are the results of a more recent analysis of the *old Harrogate sulphur well* by Dr. J. Muspratt. In an Imperial gallon. *Gaseous contents;*—carbonic acid 25·55 cubic inches; sulphuretted hydrogen 7·01. *Solid contents;*—carbonate of calcium 10·505 grs.; carbonate of magnesium 2·864; chloride of sodium 862·412; chloride of potassium 69·897; chloride of magnesium 61·769; chloride of calcium 79·878; chloride of barium 4·998; chloride of strontium, chloride of lithium, traces; sulphide of sodium 16·418; iodides, bromides, ammonia, &c., traces. Total 1108·781 grs. (*Chem. News*, Oct. 2, 1868, p. 155.)—*Note to the fourteenth edition.*

White Sulphur. Gaseous contents in a wine gallon;—sulphuretted hydrogen 2·5 cubic inches; carbonic acid 2; oxygen 1·448; nitrogen 3·552. Total 9·5. *Solid contents* in a pint;—sulphate of magnesium 5·588 grs.; sulphate of calcium 7·744; carbonate of calcium 1·150; chloride of calcium 0·204; chloride of sodium 0·180; oxide of iron a trace; loss 0·410. Total 15·276 grs. (*W. B. Rogers.*)

3. CHALYBEATE. *Tunbridge.* In a wine gallon. *Solid contents;*—chloride of sodium 2·46 grs.; chloride of calcium 0·39; chloride of magnesium 0·29; sulphate of calcium 1·41; carbonate of calcium 0·27; oxide of iron 2·22; manganese, vegetable fibre, silica, &c. 0·44; loss 0·13. Total 7·61 grs. (*Scudamore.*)

Brighton. In a wine pint. Carbonic acid 2·5 cubic inches. *Solid contents;*—sulphate of iron 1·80 grs:; sulphate of calcium 4·09; chloride of sodium 1·53; chloride of magnesium 0·75; silica 0·14; loss 0·19. Total 8·5 grs. (*Marcet.*)

Cheltenham (*chalybeate*). In a wine pint. *Gaseous contents;*—carbonic acid 2·5 cubic inches. *Solid contents;*—carbonate of sodium 0·5 grs.; sulphate of sodium 22·7; sulphate of magnesium 6; sulphate of calcium 2·5; chloride of sodium 41·3; oxide of iron 0·8. Total 73·8 grs. (*Brande and Parkes.*)

Bedford. In a wine pint. Carbonic acid not estimated. *Solid contents;*—carbonate of calcium 2·120 grs.; sulphate of calcium 11·274; sulphate of magnesium 3·974; sulphates of aluminium and sesquioxide of iron 1·280; sulphate of sodium 3·092; chloride of sodium 0·343; free sulphuric acid [?] 0·128; silica and organic matter a trace. Total 22·211 grs. (*J. Cheston Morris. Med. Exam.*, June, 1852.)

Sharon (*chalybeate*). *Gaseous contents* in a wine gallon;—sulphhydric acid gas [sulphuretted hydrogen] 0·7702 cubic inches. *Solid contents* in a gallon;—bicarbonate of magnesium 15·1148 grains; sulphate of calcium 63·8024; sulphate of magnesium 8·1546; protosulphate of iron 1·4040; sulphate of sodium 3·7401; sulphate of potassium a trace; organic matter 28·48. This analysis was of water which had been kept several months, and there was a precipitate of sulphide of iron in the vessel, showing that the fresh water must have contained more of this metal than that obtained upon analysis. (*Maisch. Am. J. of Pharm.*, March, 1861, p. 105.)

Rockbridge alum spring. In a wine gallon. Carbonic acid 7·536 grs. *Solid contents;*—sulphate of potassium 1·765 grs.; sulphate of calcium 3·263; sulphate of magnesium 1·763; protoxide of iron 4·863; alumina 17·905; crenate of ammonium 0·700; chloride of sodium 1·008; silica 2·840; free sulphuric acid 15·224. Total 49·331. (*Hayes.*) A free acid and free bases are here made to coexist.

Church Hill alum water, Richmond, Va. Sp. gr. 1·0069. In a wine gallon. *Solid contents;*—sulphate of potassium 2·444 grs.; sulphate of sodium 1·943; chloride of sodium 4·627; sulphate of ammonium 0·643; sulphate of calcium 88·836; sulphate of magnesium 86·064; tersulphate of aluminium 72·928; sulphate of protoxide of iron 24·991; tersulphate of sesquioxide of iron 51·270; bisulphate of sesquioxide of iron 83·355; silica 10·429; phosphoric acid a trace. Total 427·530 grs. (*J. C. Booth. Am. Journ. of Pharm.*, May, 1854.)

4. SALINE. *Seidlitz.* In a wine pint. *Solid contents;*—carbonate of magnesium 2·5 grs.; carbonate of calcium 0·8; sulphate of magnesium 180; sulphate of calcium 5; chloride of magnesium 4·5. Total 192·8 grs. (*Bergmann.*)

Cheltenham (*pure saline*). In a wine pint. *Solid contents;*—sulphate of sodium 15 grs.; sulphate of magnesium 11; sulphate of calcium 4·5; chloride of sodium 50. Total 80·5 grs. (*Parkes and Brande.*)

Bath. King's well. Sp. gr. 1·0025; temp. 115°. In an Imperial gallon. *Solid contents;*—carbonate of calcium 8·820 grs.; carbonate of magnesium 0·329; carbonate of iron 1·064; sulphate of calcium 80·052; sulphate of potassium 4·641; sulphate of sodium 19·229; chloride of sodium 12·642; chloride of magnesium 14·581; silica 2·982; with traces of iodine and oxide of manganese. Total 144·34 grs. (*Merck and Galloway. Chem. Gaz.*, 1846, p. 496.)

Balston Spa. Sans Souci spring. In a wine gallon. *Solid contents;*—chloride of sodium 143·733 grs.; bicarbonate of sodium 12·66; bicarbonate of magnesium 39·1; carbonate of calcium 43·407; carbonate of iron 5·95; iodide of sodium 1·3; silica 1. Total 247·15 grs. (*Steel.*)

Saratoga. Iodine spring. In a wine gallon. *Gaseous contents;*—carbonic acid

336 cubic inches; atmospheric air 4. Total 340 cubic inches. *Solid contents;*—chloride of sodium 187 grs.; carbonate of magnesium 75; carbonate of calcium 26; carbonate of sodium 2; carbonate of iron 1; iodine 3·5. Total 294·5 grs. (*Emmons.*)

Saratoga. Pavilion spring. In a wine gallon. *Gaseous contents;*—carbonic acid 359·05 cubic inches; atmospheric air 5·03. Total 364·08 cubic inches. *Solid contents;*—chloride of sodium 187·68 grs.; carbonate of sodium 4·92; carbonate of calcium 52·84; carbonate of magnesium 56·92; carbonate of iron 3·51; sulphate of sodium 1·48; iodide of sodium 2·59; alumina 0·42; silica 1·16; phosphate of calcium 0·19; bromide of potassium a trace. Total 311·71 grs. (*Chilton.*)

Saratoga. Union spring. In a wine gallon. *Gaseous contents;*—carbonic acid 314·16 cubic inches; atmospheric air 4·62. Total 318·78 cubic inches. *Solid contents;*—chloride of sodium 243·620 grs.; carbonate of magnesium 84·265; carbonate of calcium 41·600; carbonate of sodium 12·800; carbonate of iron 5·452; iodide of sodium and iodine 3·600; silica and alumina 1·570; bromide of potassium a trace. Total 392·907 grs. (*J. R. Chilton.*) This spring is now called *Excelsior Rock spring*, having been re-tubed to the depth of 56 feet, of which 11 feet are in the solid rock. The following are given by Messrs. Booth and Garrett, of Philadelphia, as the solid contents in grains of a gallon of the water: of chloride of sodium 375·8996 grs., carbonate of calcium 76·0160, carbonate of magnesium 30·4437, carbonate of sodium 10·3520, silicate of potassium 6·9829, silicate of sodium 3·7672, carbonate of iron 2·8086, sulphate of sodium 1·5563, total 507·8263 grs.

Saratoga. Congress spring. Gaseous contents in 100 cubic inches;—carbonic acid 114 cubic inches. *Solid contents* in a pound Troy;—chloride of ammonium 0·0326 grs.; chloride of potassium 1·6256; chloride of sodium 19·6653; iodide of sodium 0·0046; bromide of sodium 0·1613; carbonate of sodium 0·8261; carbonate of calcium 5·8531; carbonate of magnesium 4·1155; carbonate of strontium 0·0672; carbonate of protoxide of iron 0·0173; carbonate of protoxide of manganese 0·0202; sulphate of potassium 0·1379; nitrate of magnesium 0·1004; alumina 0·0069; silica 0·1112. Total 32·7452 grs. (*Schweitzer.*)

Saratoga. Empire spring. In a U. S. gallon of 231 cubic inches. *Gaseous contents;*—carbonic acid 344·669 cubic inches. *Solid contents;*—chloride of sodium 506·630 grs.; chloride of potassium 4·292; bicarbonate of magnesium 42·953; bicarbonate of calcium 109·656; bicarbonate of lithium 2·080; bicarbonate of sodium 9·022; bicarbonate of barium 0·070; bicarbonate of strontium a trace; bicarbonate of iron 0·793; bromide of sodium 0·266; iodide of sodium 0·006; sulphate of potassium 2·769; phosphate of sodium 0·023; silica 1·458; alumina 0·418; chloride of calcium, biborate of sodium, organic matters, each, a trace. Total 680·436 grains. (*C. F. Chandler and T. A. Cairns, American Chemist*, Sept. 1872.)

Alleghany Spring. Montgom. Co., Va. "In one gallon, 70,000 grains. Sulphate of magnesia 50·884290 grs.; sulphate of lime 115·294022; sulphate of soda 1·717959; sulphate of potassa 3·699081; carbonate of copper 0·000359; carbonate of lead 0·000569; carbonate of zinc 0·001713; carbonate of iron 0·157049; carbonate of manganese 0·060617; carbonate of lime 3·613209; carbonate of magnesia 0·362362; carbonate of strontia 0·060536; carbonate of baryta 0·022404; carbonate of lithia 0·001679; nitrate of magnesia 3·219562; nitrate of ammonia 0·559412; phosphate of alumina 0·025549; silicate of alumina 0·207399; fluoride of calcium 0·022858; chloride of sodium 0·274676; silicic acid 0·882782; crenic acid 0·001921; apocrenic acid 0·000192; other organic matter 1·999121; carbonate of cobalt a trace; teroxide of antimony a trace. Total 183·069321 grains. Solid ingredients by direct evaporation gave 184·072000; half combined carbonic acid 1·885526; free carbonic acid 5·455726*; hydrosulphuric acid 0·001339†. Total amount of ingredients 190·411912 grains." (*Prof. F. A. Genth, of the Univ. of Penna.*)

Sea Water. English Channel. In a thousand grains. Water 964·744 grs.; chloride of sodium 27·059; chloride of potassium 0·765; chloride of magnesium 3·667; bromide of magnesium 0·029; sulphate of magnesium 2·296; sulphate of calcium 1·407; carbonate of calcium 0·033. Total 1000 grs. (*Schweitzer.*) The

* 5·455726 grains of carbonic acid is equal to 11·544067 cubic inches.
† 0·001339 grains of hydrosulphuric acid is equal to 0·000369 cubic inches.

proportion of chloride of sodium is from 36 to 37 parts in 1000 in the ocean, at a distance from land. Its amount is small in the interior of the Baltic. It is perceived that bromine is present in very minute amount; 100 pounds of sea water yielding only 3½ grs. of this element. According to Balard, iodine exists in the water of the Mediterranean; but it has not been detected in the water of the ocean, the bromine being supposed to mask its presence. Besides these ingredients, others are alleged to exist in minute proportion in sea water; as fluorine by Dr. G. Wilson; lead, copper, and silver, by MM. Malaguti, Durocher, and Sarzeau; and iron and manganese by M. Uziglio. Anterior to Wilson's researches, Mr. Middleton and Prof. Silliman, jun. had inferred the existence of fluorine in sea water, from its presence in marine animals. The lead and copper above mentioned, were found in certain fuci only; the silver, in the sea water itself. The presence of silver in sea water has been rendered probable by Mr. F. Field, by a comparative analysis of the same copper sheathing, when new, and after having been on a vessel for many years. The old sheathing was always found to contain more silver than the new (*Chem. Gaz.*, March 2, 1857); and the observations of Mr. Field have been subsequently confirmed by others. Schweitzer's analysis gives a small proportion of carbonate of calcium; but Bibra could not detect any. Dr. John Davy's examinations of sea water show that carbonate of calcium does not exist at a great distance from land, except in very minute proportion; but becomes quite evident in water, taken at a distance of from fifty to a hundred miles from coasts. Boracic acid has been found by Mr. Veatch in the sea water on the coast of California. (See *Am. Journ. of Pharm.*, July, 1860, p. 330.)*

Sea water, filtered, and charged with five times its volume of carbonic acid, forms, according to Pasquier, a gentle purgative, which keeps very well, and is not disagreeable to take. The dose is from half a pint to a pint.

By freezing, sea water is almost entirely freed from saline matter, the ice being nearly pure water. It is obvious that the unfrozen water contains much more than its ordinary proportion of salts; and this is one of the methods of concentrating this and other saline solutions.

Medical Properties of Water. Water is a remedy of great importance. When taken into the stomach, it acts by its temperature, by its bulk, and by being absorbed. When of the temperature of about 60°, it gives no positive sensation either of heat or cold; between 60° and 45°, it creates a cool sensation; and below 45°, a decidedly cold one. Between 60° and 100°, it relaxes the fibres of the stomach, and is apt to produce nausea, particularly if the effect of bulk be added to that of temperature. By its bulk and solvent powers, it allays irritation by diluting the acrid contents of the stomach and bowels, and favouring their final expulsion; and by its absorption, it promotes the secretion of urine and cutaneous transpiration. Indeed, its influence is so great in the latter way, that it may be safely affirmed that sudorifics and diuretics will not produce their proper effect, unless assisted by copious dilution.

* The following analysis of sea water, taken at 2 leagues from Fécamp, on the coast of France, merits special notice from the care with which it was made, and the large quantity operated on. The sp. gr. was 1·026, at 57° F.

Gaseous Contents.	*In one kilog.*	*In one litre.*
	litres.	litres.
Atmospheric air	0·0120	0·0123
Free carbonic acid	traces	traces
" sulphhydric acid	traces	traces
Solid Contents.	grs.	grs.
Chloride of potassium	0·09763	0·10019
" sodium	26·09300	26·78913
" lithium	0·00042	0·00043
" ammonium	0·00178	0·00183
" magnesium	3·19300	3·27700
Iodide of sodium	0·00920	0·00944
Bromide of sodium	0·10605	0·10882
" magnesium	0·03084	0·03163
Sulphate of calcium	0·90170	0·92540
" potassium	0·00919	0·00943

Solid Contents.	*In one kilog.*	*In one litre.*
	grs.	grs.
Sulphate of sodium	2·57250	2·64012
" magnesium	0·32736	0·33597
Phosphate of magnesium	0·00046	0·00047
" , ammoniaco-magnesian	signs	signs
Carbonate of calcium	0·13600	0·13959
" magnesium	traces	traces
" iron	0·00021	0·00021
" manganese	signs	signs
Silicic acid	0·01420	0·01457
Organic matter	signs	signs
Pure water	966·50646	991·91577
Total	1000·00000	1026·30000

(*Journ. de Pharm. et de Chim.*, 4e sér., i. 381, A.D. 1865.) — *Note to the thirteenth edition.*

Water, externally applied as a bath, is also an important remedy. It may act by its own specific effect as a liquid, or as a means of modifying the heat of the body. It acts in the latter way differently, according to the temperature at which it may be applied. When this is above 97°, it constitutes the vapour or hot bath; when between 97° and 85°, the warm bath; between 85° and 65°, the tepid bath; and between 65° and 32°, the cold bath.

The general action of the *vapour bath* is to accelerate the circulation, and produce profuse sweating. It acts locally on the skin, by softening and relaxing its texture. In stiffness of the joints, and in various diseases of the skin, it has often proved beneficial.

The *hot bath*, like the vapour bath, is decidedly stimulant. By its use the pulse becomes full and frequent, the veins turgid, the face flushed, the skin red, and the respiration quickened. If the temperature be high, and the constitution peculiar, its use is not without danger; as it is apt to produce a feeling of suffocation, violent throbbing in the temples, and vertigo with tendency to apoplexy. When it acts favourably, it produces profuse perspiration.

The *warm bath*, though below the animal heat, nevertheless produces a sensation of warmth; as its temperature is above that of the surface. It diminishes the frequency of the pulse, renders the respiration slower, lessens the heat of the body, and relaxes the skin. It cannot, therefore, be deemed a stimulant. By relieving certain diseased actions and states, accompanied by morbid irritability, it often acts as a soothing remedy, producing a disposition to sleep. It is proper in febrile exanthematous diseases, in which the pulse is frequent, the skin hot and dry, and the general condition characterized by restlessness. It is contraindicated in diseases of the head and chest.

The *tepid bath* is not calculated to have much modifying influence on the heat of the body. Its peculiar effects are to soften and cleanse the skin, and to promote insensible perspiration.

The *cold bath* acts differently according to its temperature and manner of application, and the condition of the system to which it is applied. When of low temperature and suddenly applied, it acts primarily as a stimulant, by the sudden and rapid manner in which the caloric is abstracted; next as a tonic, by condensing the living fibres; and finally as a sedative. It is often useful in diseases of relaxation and debility, when practised by affusion or plunging. But it is essential to its efficacy and safety, that the stock of vitality should be sufficient to create, immediately after its use, those feelings of warmth and invigoration, included under the term reaction. Currie used it with advantage, by affusion, in certain febrile diseases, especially typhus and scarlatina. To make it safe, the heat must be steadily above the natural standard, and the patient free from all sense of chilliness, and not in a state of profuse perspiration.

Cold water is frequently applied as a sedative in local inflammations, and as a means of restraining hemorrhage. Its use, however, is inadmissible in inflammations of the chest.

Pharm. Uses. Water is used in a vast number of preparations, either as a menstruum, or as a means for promoting chemical action by its solvent power.

Off. Prep. Aqua Destillata. B.

ARALIA NUDICAULIS *U. S. Secondary.*

False Sarsaparilla.

The root of Aralia nudicaulis. *U. S.*

ARALIA. *Sex. Syst.* Pentandria Pentagynia.—*Nat. Ord.* Araliaceæ.

Gen. Ch. Flowers umbelled. *Calyx* five-toothed, superior. *Petals* five. *Stigma* sessile, subglobose. *Berry* five-celled, five-seeded. *Torrey.*

Aralia nudicaulis. Willd. *Sp. Plant.* i. 1521; Rafinesque, *Med. Flor.* i. 53.

False sarsaparilla, *wild sarsaparilla*, or *small spikenard*, as this plant is variously called, is an indigenous perennial, with one leaf and one flower-stem, springing together from the root, or from a very short stalk, and seldom rising two feet in height.

The leaf, which stands upon a long footstalk, is twice ternate, or once and quinate, with oblong-oval, acuminate leaflets, rounded at the base, serrate on the margin, and smooth on both surfaces. The scape or flower-stem is naked, shorter than the leaf, and terminated by three small umbels, each consisting of from twelve to thirty small yellowish or greenish flowers. The fruit consists of small round berries, about as large as those of the common elder. The plant grows throughout the United States, from Canada to the Carolinas, inhabiting shady and rocky woods, and delighting in a rich soil. It flowers in May and June.

The root, which is the officinal portion, is horizontal, creeping, sometimes several feet in length, about as thick as the little finger, more or less twisted, of a yellowish-brown colour externally, of a fragrant odour, and a warm, aromatic, sweetish taste. It has not been analyzed.

Medical Properties and Uses. False sarsaparilla is a gentle stimulant and diaphoretic, and is thought to have an alterative influence, analogous to that of the root from which it derived its name. It is used in domestic practice, and, by some practitioners in the country, in rheumatic, syphilitic, and cutaneous affections, in the same manner and dose as genuine sarsaparilla. A strong decoction has proved useful as a stimulant to old ulcers.

The root of *Aralia racemosa*, or *American spikenard*, though not officinal, is used for the same purposes as A. nudicaulis, which it is said to resemble in medical properties. Dr. Peck strongly recommends the root of *Aralia hispida*, called in Massachusetts *dwarf elder*, as a diuretic in dropsy. He uses it in the form of decoction, and finds it pleasanter to the taste and more acceptable to the stomach than most other medicines of the same class. (*Am. Journ. of Med. Sci.*, xix. 117.) W.

ARALIA SPINOSA. *U. S. Secondary.*

Aralia.

The bark of Aralia spinosa. *U. S.*

ARALIA. See ARALIA NUDICAULIS.

Aralia spinosa. Willd. *Sp. Plant.* i. 1520. This is an indigenous arborescent shrub, variously called *angelica-tree*, *toothache-tree*, and prickly ash. The last name, however, should be dropped; as it belongs properly to *Xanthoxylum fraxineum*, and if retained might lead to confusion. The stem is erect, simple, from eight to twelve feet high, armed with numerous prickles, and furnished near the top with very large bipinnate or tripinnate leaves, which are also prickly, and are composed of oval, pointed, slightly serrate leaflets. It terminates in an ample panicle, very much branched, and bearing numerous small hemispherical umbels, in each of which are about thirty white flowers.

This species of Aralia is found most abundantly and of the largest growth in the Southern States, where it is said sometimes to attain a height of from thirty to sixty feet. It grows also in the Western States, and as far north as New York. It is sometimes cultivated in the gardens of the North as a curious or ornamental plant. It flourishes in low, fertile woods, and flowers in August and September. The bark, root, and berries are medicinal; but the first only is directed by the Pharmacopœia.

The bark, as in the shops, is usually in small quills or half quills, from two or three lines to half an inch in diameter, thin, fibrous, grayish externally, and armed with prickles or the remains of them, yellowish within, of an odour somewhat aromatic, and a bitterish taste, which becomes slightly acrid on chewing, and leaves a lasting sense of pungency upon the tongue. It yields its virtues to boiling water.

Medical Properties and Uses. The virtues of *Aralia spinosa* are those of a stimulant diaphoretic. According to Elliot, an infusion of the recent bark of the root is emetic and cathartic. The remedy is used in chronic rheumatism and cutaneous eruptions; and in some parts of the South has been employed in syphilis. Pursh states that a vinous or spirituous infusion of the berries is remarkable for relieving rheumatic pains; and a similar tincture is said to be employed in Virginia with advantage in violent colic. The pungency of this tincture has also been found useful in relieving toothache. The bark is most conveniently administered in decoction.

W.

ARGENTUM. *U.S.*

Silver.

Off. Syn. ARGENTUM PURIFICATUM. *Refined Silver.* Pure metallic silver. *Br.*

Argent, *Fr.;* Silber, *Germ.;* Argento, *Ital.;* Plata, *Span.*

Silver is occasionally found in the metallic state, sometimes crystallized, at other times combined with gold, antimony, arsenic, or mercury; but usually it occurs in the state of sulphuret, either pure or mixed with other sulphurets, as those of copper, lead, and antimony. It is sometimes found as a chloride.

The most productive mines of silver are found on this continent, being those of Mexico and Peru, and our own Rocky Mountain territories; the richest in Europe are those of Norway, Hungary, and Transylvania. Mines have been opened and profitably worked in California and Nevada, and there can be little doubt that vast deposits of silver ores exist in the mountainous regions extending northward from Arizona and New Mexico. The principal ore is the sulphuret. The mineral containing silver, which is most disseminated, is argentiferous galena, which is sulphuret of lead, containing a little sulphuret of silver. Argentiferous galena exists in several localities in the United States. A mine of silver was opened, about the year 1841, in Davidson county, N. C. The ore is an argentiferous carbonate of lead, yielding about one-third of its weight of lead, from which from 100 to 400 ounces of silver are extracted per ton. (*Eckfeldt and Du Bois. Manual of Coins.*) Native silver is associated, in small quantities, with the native copper of the Lake Superior region; and a little of it has come into the market. The two metals, though more or less mixed, are yet quite distinct, seldom being alloyed to any considerable extent.

Extraction. Silver is extracted from its ores by two principal processes, *amalgamation* and *cupellation.* At Freyberg, in Saxony, the ore, which is principally the sulphuret, is mixed with a tenth of chloride of sodium, and roasted in a reverberatory furnace. The sulphur becomes acidified, and combines with sodium and oxygen, so as to form sulphate of sodium, while the chlorine forms a chloride with the silver. The roasted mass is then reduced to very fine powder, mixed with half its weight of mercury, one-third of its weight of water, and about a seventeenth of iron in flat pieces, and subjected, for sixteen or eighteen hours, to constant agitation in barrels turned by machinery. The chlorine combines with the iron, and remains in solution as chloride of iron; while the silver forms an amalgam with the mercury. The amalgam is then subjected to pressure in leathern bags, through the pores of which the excess of mercury passes, a solid amalgam being left behind. This is then subjected to heat in a distillatory apparatus, by means of which the mercury is separated from the silver, which is left in a porous mass. In Peru and Mexico the process is similar to that above given, common salt and mercury being used; but slaked lime and sulphuret of iron are also employed, with an effect which is not very obvious.

When argentiferous galenas are worked for the silver they contain, they are first reduced, and the argentiferous lead obtained is fused on a large, oval, shallow vessel called a *test*, and exposed to the blast of a bellows, whereby the lead is oxidized, half vitrified, and driven off the test in scales, in the form of *litharge.* The operation being continued on successive portions of argentiferous lead, the whole of the lead is separated, and the silver, not being oxidizable, accumulates on the test as a brilliant fused mass, until its amount is sufficient to be removed. The time required for the separation is much abridged by the process of Mr. Pattinson, of Newcastle, England. This consists in allowing the melted alloy to cool slowly, and separating the crystals which first form, consisting mainly of lead, by means of a perforated ladle. The residue is a very fusible alloy of lead and silver, in which the latter metal is in large proportion, and from which it can be easily separated by cupellation or other means. (*Brande and Taylor.*)

Properties. Silver is a white metal, very brilliant, tenacious, malleable, and ductile. In malleability and ductility, it is inferior only to gold. It is harder than gold, but softer than copper. Its equivalent number is 108, symbol Ag, and sp. gr. about 10·4.

It forms but one well characterized oxide, which is a protoxide. Exposed to a full red heat, it enters into fusion, and exhibits a brilliant appearance. It is not oxidized in the air, but contracts a superficial tarnish of sulphuret of silver by the action of sulphuretted hydrogen in the atmosphere; from which it may be freed by washing it with a strong solution of cyanide of potassium, and, as soon as it becomes bright, washing it with water and drying it. (*Chem. News*, Jan. 5, 1866, p. 12.) It is entirely soluble in diluted nitric acid. If any gold be present, it will remain undissolved as a dark-coloured powder. From the nitric solution, the whole of the silver may be thrown down by chloride of sodium, as a white precipitate of chloride of silver, characterized by being completely soluble in ammonia. If the remaining solution contain copper or lead, it will be precipitated or discoloured by sulphuretted hydrogen. "The solution, deprived of silver by means of chloride of sodium, and filtered, is not coloured, *or but slightly so*, and is not precipitated by hydrosulphuric acid." *U. S.* "If ammonia be added in excess to a solution of the metal in nitric acid, the resulting fluid exhibits neither colour nor turbidity" (*Br.*); proving the absence of copper, lead, and other metals.

Pharm. Uses. The only officinal preparations containing silver are the *oxide*, *nitrate*, and *cyanide*. The *chloride* will be noticed in the *third part* of this work.

Off. Prep. Argenti Nitras. B.

ARMORACIÆ RADIX. *Br.*

Horse-radish Root.

The fresh root of Cochlearia Armoracia. *Br.*

Armoracia, Br. 1864; Raifort sauvage, *Fr.;* Meerrettig, *Germ.;* Rafano rusticano, *Ital.;* Rabano rusticano, *Span.*

Cochlearia. *Sex. Syst.* Tetradynamia Siliculosa.—*Nat. Ord.* Brassicaceæ or Cruciferæ.

Gen. Ch. Silicula emarginate, turgid, scabrous, with gibbous, obtuse valves. *Willd.*

Cochlearia Armoracia. Willd. *Sp. Plant.* iii. 451; Woodv. *Med. Bot.* p. 400, t. 145. The root of this plant is perennial, sending up numerous very large leaves, from the midst of which a round, smooth, erect, branching stem rises two or three feet in height. The radical leaves are lance-shaped, waved, scalloped on the edges, sometimes pinnatifid, and stand upon strong footstalks. Those of the stem are much smaller, without footstalks, sometimes divided at the edges, sometimes almost entire. The flowers are numerous, white, peduncled, and form thick terminal clusters. The calyx has four ovate, deciduous leaves, and the corolla an equal number of obovate petals, twice as long as the calyx, and inserted by narrow claws. The pod is small, elliptical, crowned with the persistent stigma, and divided into two cells, each containing from four to six seeds.

The horse-radish is a native of western Europe, growing wild on the sides of ditches, and in other moist situations. It is cultivated for culinary purposes in most civilized countries, and is said to have become naturalized in some parts of the United States. Its flowers appear in June.

The root, which is officinal in its fresh state, is long, conical at top, then nearly cylindrical for some inches, at last tapering, whitish externally, very white within, fleshy, of a strong pungent odour when scraped or bruised, and of a hot, biting, somewhat sweetish, and sometimes bitterish taste. Its virtues are imparted to water and alcohol. They depend upon a *volatile oil*, which is dissipated by drying; the root becoming at first sweetish, and ultimately insipid and quite inert. Its acrimony is also destroyed by boiling. The oil may be obtained by distillation with water. It is colourless or pale-yellow, heavier than water, very volatile, excessively pungent, acrid, and corrosive, exciting inflammation and even vesication when applied to the skin. Hubatka considers it as identical with the volatile oil of mustard. (*Journ. de Pharm.*, 3e sér., v. 42.) According to Gutret, only six parts of it are obtained from 10,000 of the root. Besides this principle, the fresh root contains, according to the same chemist, a bitter resin in minute quantity, sugar, extractive, gum, starch, albumen, acetic acid, acetate, and sulphate of calcium, water, and lignin. From obser-

vations made by F. L. Winckler, it may be inferred that *myronic acid* exists in the root combined with potassa, and that it is from the reaction between this acid, *myrosine*, also existing in the root, and water, that the volatile oil is produced, in the same manner as oil of mustard from mustard seed. (See *Sinapis.*) Horse-radish, when distilled with alcohol, yields none of the oil. (*Journ. für Prakt. Pharm.*, xviii. 89.) The root may be kept for some time without material injury, if buried in sand in a cool place.

It is said that if, to the powder of the dried root, which has become apparently inert, the emulsion of white mustard seed containing myrosine be added, it reacquires its original irritant properties; so that it is the myrosine and not the myronate of potassium which is injured by drying. Hence the powdered root may be added with advantage to mustard in preparing cataplasms, pediluvia, &c. (*Journ. de Pharm. et de Chim.*, xxvii. 268.)

Medical Properties and Uses. Horse-radish is highly stimulant, exciting the stomach when swallowed, and promoting the secretions, especially that of urine. Externally, it is rubefacient. Its chief use is as a condiment to promote appetite and invigorate digestion; but it is also occasionally employed as a medicine, particularly in dropsy attended with enfeebled digestion and general debility. It has, moreover, been recommended in palsy and chronic rheumatism, both as an internal and external remedy; and in scorbutic affections is highly esteemed. Cullen found advantage in cases of hoarseness, from the use of a syrup prepared from an infusion of horse-radish and sugar, and slowly swallowed in the quantity of one or two teaspoonfuls, repeated occasionally. The root may be given in the dose of half a drachm or more, grated or cut into small pieces.

Off. Prep. Spiritus Armoraciæ Compositus, *Br.* W.

ARNICA. *U. S.*

Arnica.

The flowers of Arnica montana. *U. S.*

Off. Syn. ARNICÆ RADIX. *Arnica Root.* The dried rhizome and rootlets of Arnica montana, *Br.*

Leopard's-bane, *U. S.* 1850; Arnique, *Fr.;* Berg Wolverly, Gemeines ächtes Fallkraut, *Germ.;* Arnica montana, *Ital., Span.*

ARNICA. *Sex. Syst.* Syngenesia Superflua.—*Nat. Ord.* Compositæ Senecionideæ. *De Cand.* Asteraceæ. *Lindley.*

Gen. Ch. Calyx with equal leaflets in a double row. *Seed-down* hairy, sessile. *Seeds* of the disk and ray furnished with seed-down. *Receptacle* hairy. *Hayne.*

Arnica montana. Willd. *Sp. Plant.* iii. 2106; Woodv. *Med. Bot.* p. 41, t. 17. This is a perennial, herbaceous plant, having a woody, brownish, horizontal root, from one to three inches long, and two or three lines thick, ending abruptly, and sending forth numerous slender fibres of the same colour. The stem is about a foot high, cylindrical, striated, hairy, and terminating in one, two, or three peduncles, each bearing a flower. The radical leaves are ovate, entire, ciliated, and obtuse; those of the stem, which usually consist of two opposite pairs, are lance-shaped. Both are of a bright-green colour, and somewhat pubescent on their upper surface. The flowers are very large, and of a fine orange-yellow colour. The calyx is greenish, imbricated, with lanceolate scales. The ray consists of about fourteen ligulate florets, twice as long as the calyx, striated, three-toothed, and hairy at the base; the disk, of tubular florets, with a five-lobed margin.

This plant is a native of the mountainous districts of Europe and Siberia, and is found, according to Nuttall, in the northern regions of this continent, west of the Mississippi. It has been introduced into England, and might no doubt be cultivated in this country. Its transference from the secondary to the primary catalogue of the U.S. Pharmacopœia, indicates that it is more used with us than formerly. The flowers, leaves, and root are employed; but the flowers are usually preferred.

Properties. The whole plant, when fresh, has a strong, disagreeable odour, which is apt to excite sneezing, and is diminished by drying. The taste is acrid, bitterish,

and durable. The dried root is cylindrical, contorted, and marked by scars from the insertion of the leaves. Water extracts its virtues. Chevallier and Lassaigne discovered, in the flowers, gallic acid, gum, albumen, yellow colouring matter, an odorous resin, and a bitter principle which they considered identical with *cytisin*, discovered by them in the seeds of the laburnum-tree (*Cytisus Laburnum*), which are possessed of poisonous properties. (See *Lond. Med. Times and Gaz.*, Nov. 1856, p. 446.) Cytisin is yellow, of a bitter and nauseous taste, deliquescent, readily soluble in water and diluted alcohol, but with difficulty in strong alcohol, and insoluble in ether. In the dose of five grains it is powerfully emetic and cathartic; and it has been supposed to be the active principle of the plant. The flowers also contain a small proportion of a blue volatile oil. Pfaff obtained from the root a volatile oil, an acrid resin, extractive, gum, and lignin. Mr. Wm. Bastick, of London, has separated an organic alkali from the flowers, and names it *arnicina*. It is solid, slightly bitter, but not acrid, of the odour of castor, slightly soluble in water, and much more soluble in alcohol and ether. (*Pharm. Journ. and Trans.*, x. 389.)* The alkaloid, however, appears to have been previously obtained by M. Lebourdais by the charcoal process. (See *An. Journ. of Pharm.*, xxiii. p. 243.)

Medical Properties and Uses. Leopard's-bane is a stimulant, directed with peculiar energy to the brain and whole nervous system, as manifested by the resulting headache, spasmodic contractions of the limbs, and difficulty of respiration. It acts also as an irritant to the stomach and bowels, often producing an emetic and cathartic effect, and is said by Bergius to be diuretic, diaphoretic, and emmenagogue. It is capable of acting as a poison in over-doses, causing burning in the stomach, violent abdominal pains, intense headache, and great nervous disturbance. A case of tetanic spasm of one side, and ultimate death under its use, is on record; but there is reason to doubt whether arnica was the real cause of the fatal issue. (*Ann. de Thérap.*, 1854, p. 46.) It is much used by the Germans, who prescribe the flowers and root with advantage in amaurosis, paralysis, and other nervous affections. It is said to prove useful in that disordered condition which succeeds concussion of the brain from falls, blows, &c.; and from this circumstance has received the title of *panacea lapsorum*. It has also been recommended in chronic catarrh of the old, intermittent fever and its sequelæ, dysentery, diarrhœa, nephritis, gout, rheumatism, passive hemorrhages, dropsy, chlorosis, amenorrhœa, and various other complaints, in most of which it seems to have been empirically prescribed. It is peculiarly useful in diseases attended with a debilitated or typhoid state of the system. Dr. T. C. Miller has found it a very valuable remedy in enteric or typhoid fever. (*Penins. Med. Journ.*, Sept. 1859, p. 382.) The powdered flowers and leaves are employed as a sternutatory; and the inhabitants of Savoy and the Vosges are said to substitute them for tobacco. They may be given in substance or infusion. The dose of the powder is from five to twenty grains frequently repeated. The infusion may be prepared by digesting an ounce in a pint of water, of which from half a fluidounce to a fluidounce may be given every two or three hours. It should always be strained through linen, in order to separate the fine fibres, which might irritate the throat. The poisonous properties of the plant are said to be best counteracted by the free use of vinegar or other dilute vegetable acid; but this is very doubtful; and, at all events, the stomach should be first thoroughly emptied. A tincture prepared from the flowers has come into use in this country as a domestic remedy in sprains, bruises, &c., and is now among the U.S. officinals. It is employed externally.

Off. Prep. of the Flowers. Extractum Arnicæ Alcoholicum, *U.S.;* Tinctura Arnicæ, *U.S.*

Off. Prep. of the Root. Tinctura Arnicæ, *Br.* W.

*Mr. Bastick obtained the alkaloid by the following process. The flowers were macerated with alcohol acidulated with sulphuric acid; the tincture was filtered, and treated with lime until it evinced an alkaline reaction; the liquid was then filtered, and the filtrate treated with sulphuric acid in slight excess; the acid solution was filtered and concentrated by evaporation; to the residue a little water was added, the liquid was evaporated until all the alcohol was driven off, and was then again filtered; the filtered liquor was saturated with carbonate of potassium, and, after filtration, was mixed with a considerable excess of that salt; finally, the liquid was agitated with successive portions of ether until this fluid ceased to dissolve anything, and the ethereal solution obtained was left to spontaneous evaporation. Arnicina remained. (*Note to the ninth edition.*)

ARSENICUM. *U. S.*

Arsenic.

Arsenic, *Fr.*; Arsenik, *Germ.*; Arsenico, *Ital., Span.*

This metal was introduced into the U. S. and Dublin Pharmacopœias of 1850, for the purpose of being used to form the iodide of arsenic, and the solution of iodide of arsenic and mercury, two new officinals of those works. It has been retained in the Materia Medica of the U. S. Pharmacopœia, but was rejected by the compilers of the British. The Dublin College gave the following formula.

"Take of White Oxide of Arsenic of Commerce two drachms [*Dub. weight*]. Place the Oxide at the sealed end of a hard German glass tube, of about half an inch in diameter and eighteen inches long, and, having covered it with about eight inches of dry and coarsely pulverized charcoal, and raised the portion of the tube containing the charcoal to a red heat, let a few ignited coals be placed beneath the Oxide, so as to effect its slow sublimation. When this has been accomplished, the metallic arsenic will be found attached to the interior of the tube at its distant or cool extremity.

"In conducting this process, the furnace used in the performance of an organic analysis should be employed, and the fuel should be ignited charcoal. It will be proper also to connect the open extremity of the tube with a flue, for the purpose of preventing the possible escape into the apartment of arsenical vapours; and, with the view of keeping it from being plugged by the metal, to introduce occasionally into it, as the sublimation proceeds, an iron wire through a cork, fixed (but not air-tight) in its open extremity."

In the above process, the white oxide (arsenious acid) is reduced by the agency of ignited charcoal, which attracts the oxygen of the acid, and revives the metal. On the large scale, metallic arsenic is generally obtained by heating arsenical pyrites ($FeAs,FeS_2$) in earthen tubes; when the metal sublimes, and two eqs. of protosulphuret of iron are left.

Properties. Arsenic is a brittle, crystalline metal, of a steel-gray colour, and possessing much brilliancy when recently broken or sublimed. Exposed to the air, its surface becomes dull and blackish. Its texture is granular, and sometimes a little scaly. Rubbed on the hands, it communicates a peculiar odour; but it is devoid of taste. Its sp. gr. is about 5·8 (5·88, *U. S.*) When heated to about 356°, it sublimes without fusing, giving rise to white vapours having a garlicky odour. Its equivalent number is 75. It forms two combinations with oxygen, both having acid properties, called arsenious and arsenic acids, and three with sulphur, namely, bisulphuret of arsenic or realgar; tersulphuret or orpiment, corresponding in composition with arsenious acid; and quintosulphuret, corresponding with arsenic acid. (See *Acidum Arseniosum;* also *realgar* and *orpiment* in the *third part* of this work.) *Arsenic acid* is obtained by distilling a mixture of twelve parts of nitric and one of muriatic acid off from four parts of arsenious acid, until the whole acquires the consistence of a thin syrup. The liquid is then poured into a porcelain dish, and evaporated at a moderate heat. Suddenly the arsenic acid, in the anhydrous state, concretes into an opaque white mass, which should be transferred, while warm, to a well-stopped bottle. Arsenic acid is white, solid, deliquescent, and soluble in six parts of cold and two of boiling water. It forms several hydrates, corresponding to those of phosphoric acid, to which it bears a close analogy. With nitrate of silver it gives a brick-red precipitate of arseniate of silver. As a poison it is even more virulent than arsenious acid. It consists of one eq. of arsenic and five of oxygen (AsO_5).

Arsenic is much diffused. Besides being present in a great many minerals, it has been detected, in minute proportion, in the earth of graveyards by Orfila; in certain soils and mineral waters by M. Walchner; in the ashes of various plants by M. Stein; and in various kinds of mineral coal, as also in the incrustation formed in the boiler of a sea-going steamer, by M. Daubrée.

Arsenic is officinal:—

I. IN THE METALLIC STATE.

Arsenicum, *U. S.*—*Arsenic.*

II. Combined with oxygen.
Acidum Arseniosum, *U. S.*, *Br.*—*Arsenious Acid.*

III. Combined with iodine.
Arsenici Iodidum, *U. S.*—*Iodide of Arsenic.*

IV. Combined with iodine and mercury.
Liquor Arsenici et Hydrargyri Iodidi, *U. S.*—*Solution of Iodide of Arsenic and Mercury. Donovan's Solution.*

V. In saline combination.
Ferri Arsenias, *Br.*—*Arseniate of Iron.*
Liquor Arsenici Hydrochloricus, *Br.*—*Hydrochloric Solution of Arsenic.*
Liquor Potassii Arsenitis, *U. S.*; Liquor Arsenicalis, *Br.*—*Solution of Arsenite of Potassium. Arsenical Solution. Fowler's Solution.*
Sodii Arsenias, *U. S.*; Sodæ Arsenias, *Br.*—*Arseniate of Soda.*
Liquor Sodii Arseniatis, *U. S.*, Liquor Sodæ Arseniatis, *Br.*—*Solution of Arseniate of Sodium.* B.

ASARUM. *U. S. Secondary.*

Wild Ginger. Canada Snakeroot.

The root of Asarum Canadense. *U. S.*

Asarum. *Sex. Syst.* Dodecandria Monogynia.—*Nat. Ord.* Aristolochiaceæ.

Gen. Ch. Calyx three or four cleft, sitting on the germen. *Corolla* none. *Capsule* coriaceous, crowned. *Willd.*

Asarum Canadense. Willd. *Sp. Plant.* ii. 838; Bigelow, *Am. Med. Bot.* i. 149; Barton, *Med. Bot.* ii. 85. This species of Asarum very closely resembles *A. Europæum* or asarabacca, in appearance and botanical character. It has a long, creeping, jointed, fleshy, yellowish root or rhizoma, furnished with radicles of a similar colour. The stem is very short, dividing, before it emerges from the ground, into two long round hairy leafstalks, each of which bears a broad kidney-shaped leaf, pubescent on both surfaces, of a rich shining light-green above, veined and pale or bluish beneath. A single flower stands in the fork of the stem, upon a hairy pendulous peduncle. The flower is often concealed by the loose soil or decayed vegetable matter; so that the leaves with their petioles are the only parts that appear. There is no corolla. The calyx is very woolly, divided into three broad, concave, acuminate segments, with the ends reflexed, of a deep brownish-purple colour on the inside, and of a dull-purple inclining to greenish externally. The filaments, which are twelve in number, and of unequal length, stand upon the germ, and rise with a slender point above the anthers attached to them. Near the divisions of the calyx are three filamentous bodies, which may be considered as nectaries. The pistil consists of a somewhat hexagonal germ, and a conical grooved style, surmounted by six revolute stigmas. The capsule is six-celled, coriaceous, and crowned with the adhering calyx.

Canada snakeroot, or *wild ginger*, is an indigenous plant, inhabiting woods and shady places from Canada to the Carolinas. Its flowering period is from April to July. All parts of the plant have a grateful aromatic odour, which is most powerful in the root. This is the officinal portion.

As we have seen it in the shops, it is in long more or less contorted pieces, from the thickness of a straw to that of a goose-quill, brownish and wrinkled externally, whitish within, hard and brittle, and frequently furnished with short fibres. Its taste is agreeably aromatic and slightly bitter, said to be intermediate between that of ginger and serpentaria, but in our opinion bearing a closer resemblance to that of cardamom. The taste of the petioles, which usually accompany the root, is more bitter and less aromatic.

Among its constituents, according to Dr. Bigelow, are a light-coloured, pungent, and fragrant volatile oil, a reddish bitter resinous matter, starch, and gum; in addition to which Mr. Rushton found fatty matter, chlorophyll, and salts of potassa, lime, and iron. Mr. Procter found the resin to be acrid as well as bitter, and without aromatic properties. The root imparts its virtues to alcohol, and less perfectly to water.

Medical Properties and Uses. Canada snakeroot is an aromatic stimulant tonic, with diaphoretic properties, applicable to similar cases with serpentaria, which it resembles in its effects. It is said to be sometimes used by the country people as a substitute for ginger. Dr. J. R. Black, of Indiana, has found it to be diuretic, and has used it with extraordinary success in two cases of dropsy with albuminous urine. He gave it in decoction, made with four ounces of the root and two pints of water, in the dose of a fluidounce every four hours, till its effect was produced. (*N. Y. Journ. of Med.*, xxxii. 289.) From the close botanical analogy of the plant with the European Asarum, it might be supposed, like that, to possess emetic and cathartic properties; but such does not appear to be the case, at least with the dried root. It would form an elegant adjuvant to tonic infusions and decoctions. It may be given in powder or tincture. The dose in substance is twenty or thirty grains. W.

ASCLEPIAS INCARNATA. *U.S. Secondary.*

Flesh-coloured Asclepias.

The root of Asclepias incarnata. *U. S.*

ASCLEPIAS. See ASCLEPIAS TUBEROSA.

Asclepias incarnata. Willd. *Sp. Plant.* i. 1267. This species has an erect downy stem, branched above, two or three feet high, and furnished with opposite, nearly sessile, lanceolate, somewhat downy leaves. The flowers are red, sweet-scented, and disposed in numerous crowded erect umbels, which are generally in pairs. The nectary is entire, with its horn exserted. In one variety the flowers are white.

The plant grows in all parts of the United States, preferring a wet soil, and flowering from June to August. Upon being wounded it emits a milky juice. The root is the officinal portion. Its properties are probably similar to those of *A. Syriaca;* but they have not, so far as we know, been fully tested. Dr. Griffith states that it has been employed by several physicians, who speak of it as a useful emetic and cathartic. (*Journ. of the Phil. Col. of Pharm.*, iv. 283.) Dr. Tully, of New Haven, has found it useful in catarrh, asthma, rheumatism, syphilis, and worms. W.

ASCLEPIAS SYRIACA. *U.S. Secondary.*

Common Silk-weed.

The root of Asclepias Syriaca (Linn.) Asclepias cornuti (Decaisne in *Prodrom.* D.C.) *U. S.*

ASCLEPIAS. See ASCLEPIAS TUBEROSA.

A. Syriaca. Willd. *Sp. Plant.* i. 1265. *A. Cornuti* (Decaisne, *Gray's Manual*, p. 351). *Common Silk-weed. Common Milk-weed.* The silk-weed has simple stems, from three to five feet high, with opposite, lanceolate-oblong, petiolate leaves, downy on their under surface. The flowers are large, of a pale-purple colour, sweet-scented, and arranged in two or three nodding umbels. The nectary is bidentate. The pod or follicle is covered with sharp prickles, and contains a large quantity of silky seed-down, which has been used as a substitute for fur in the manufacture of hats, and for feathers in beds and pillows.

This species of Asclepias is very common in the United States, growing in sandy fields, on the roadsides, and on the banks of streams, from New England to Virginia. It flowers in July and August. Like the preceding species, it gives out a white juice when wounded, and has hence received the name of *milk-weed*, by which it is frequently called. This juice has a faint smell, a sub-acrid taste, and an acid reaction. According to Shultz, 80 parts of it contain 69 of water, 3·5 of a wax-like fatty matter, 5 of caoutchouc, 0·5 of gum, 1 of sugar with salts of acetic acid, and 1 of other salts. (*Pharm. Central Blatt*, 1844, p. 302.) Dr. C. List has found the chief solid ingredient of the juice to be a peculiar crystalline substance, of a resinous character, closely allied to lactucone, and which he proposes to call *asclepione.* To obtain it, the juice is coagulated by heat, filtered so as to separate the liquid portion, and then digested with ether, which dissolves the asclepione, and yields it by

evaporation. To purify it, the residue must be treated repeatedly with anhydrous ether, which leaves another substance undissolved. It is white, crystalline, tasteless, inodorous, fusible, insoluble in water and alcohol, soluble in ether, oil of turpentine, and concentrated acetic acid. A strong hot solution of potassa does not affect it. Its constituents are carbon, hydrogen, and oxygen, and its formula $C_{40}H_{34}O_6$. (List, *Liebig's Annalen*, Jan. 1849.)

Medical Properties and Uses. Dr. Richardson, of Massachusetts, found the root possessed of anodyne properties. He gave it with advantage to an asthmatic patient, and in a case of typhus fever attended with catarrh. In both instances it appeared to promote expectoration, and to relieve pain, cough, and dyspnœa. He gave a drachm of the powdered bark of the root, in divided doses, during the day, and employed it also in strong infusion. In a letter to one of the authors, dated Jan. 22d, 1850, Dr. A. E. Thomas, of Rocky Spring, Mississippi, stated that he had employed the root in scrofula with great success, and in dyspepsia with advantage. He found it cathartic and alterative, but observed no anodyne property. He was induced to try it by having noticed that it was much used by the planters in scrofula and other diseases, and by the recommendation of Dr. McLean, of Kentucky, who had employed it in scrofula for twenty years, with the most satisfactory results. In a letter subsequently received from Dr. McLean himself, this account of the virtues of the asclepias root has been confirmed. Dr. McLean has also found it an excellent alterative in hepatic affections; but he seems to be of the opinion that the root he employed was from a different species of asclepias, and one not described in this Dispensatory. Mention may here be made of another indigenous species of Asclepias, *A. verticillata* (*Gray's Manual*, p. 354), which has reputation in some parts of the Southern States as a remedy in snakebites and the bites of venomous insects. It is given in the form of a saturated decoction of the fresh plant (root, stem, and leaves), of which three gills are said to have been taken at a draught, with the effect of producing an anodyne and sudorific effect, followed by a gentle sleep. (See *Va. Med. Journ.*, Dec. 1858, p. 458.) W.

ASCLEPIAS TUBEROSA. *U.S. Secondary.*

Butterfly-weed.

The root of Asclepias tuberosa. *U.S.*

Syn. ASCLEPIAS. *U.S.* 1860.

ASCLEPIAS. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Asclepiadaceæ.

Gen. Ch. Calyx small, five-parted. *Corolla* rotate, five-parted, mostly reflexed. *Staminal crown* (or nectary) simple, five-leaved; leaflets opposite the anthers, with a subulate averted process at the base. *Stigmas* with the five angles (corpuscles) opening by longitudinal chinks. *Pollinia* five distinct pairs. *Torrey.*

Several species of Asclepias, besides A. tuberosa, have been employed medicinally; and two of these, *A. Syriaca* and *A. incarnata*, have been always recognised in the Secondary Catalogue of the U.S. Pharmacopœia until they were, injudiciously we think, discharged at the revision of that work in 1860. They were, however, restored in the late revision, and now hold their original place.

Asclepias tuberosa. Willd. *Sp. Plant.* i. 1273; Bigelow, *Am. Med. Bot.* ii. 59; Barton, *Med. Bot.* i. 239. The root of the butterfly-weed or *pleurisy-root* is perennial, and gives origin to numerous stems, which are erect, ascending, or procumbent, round, hairy, of a green or reddish colour, branching at the top, and about three feet in height. The leaves are scattered, oblong-lanceolate, very hairy, of a rich, deep-green colour on their upper surface, paler beneath, and supported usually on short footstalks. They differ, however, somewhat in shape according to the variety of the plant. In the variety with decumbent stems, they are almost linear, and in another variety cordate. The flowers are of a beautiful reddish-orange colour, and disposed in terminal or lateral corymbose umbels. The fruit is an erect lanceolate follicle, with flat ovate seeds connected to a longitudinal receptacle by long silky hairs.

This plant differs from other species of Asclepias in not emitting a milky juice

when wounded. It is indigenous, growing throughout the United States from Massachusetts to Georgia, and as far west as Texas, and, when in full bloom, in June and July, having a splendid appearance. It is most abundant in the Southern States. The root is the only part used in medicine.

This is large, irregularly tuberous, branched, often somewhat fusiform, fleshy, externally brown, internally white and striated, and, in the recent state, of a sub-acrid, nauseous taste. When dried, it is easily pulverized; and its taste is bitter, but not otherwise unpleasant. Mr. E. Rhoads discovered in it a peculiar principle, which he obtained by treating the cold infusion with tannic acid, mixing the precipitate, previously washed and expressed, with litharge, drying the mixture and exhausting it with hot alcohol, and finally decolorizing and evaporating the alcoholic liquor. The product was a yellowish-white powder, having the taste of the root, soluble in ether, and much less readily so in water, from which it was precipitated by tannic acid. Mr. Rhoads also found evidence of the existence in the root of tannic and gallic acids, albumen, pectin, gum, starch, a resin soluble and another insoluble in ether, fixed oil, a volatile odorous fatty matter, and various salts, besides from 30 to 35 per cent. of lignin. (*Am. Journ. of Pharm.*, xxxiii. 492.)

Medical Properties and Uses. The root of Asclepias tuberosa is diaphoretic and expectorant, without being stimulant. In large doses it is often also cathartic. Dr. Pawling, of Norristown, Pa., found it always, when freely given, to diminish the volume and activity of the pulse, while it produced copious diaphoresis (*Am. Journ. of Pharm.*, xxxiii. 496); and Dr. Goodrake, of Clinton, Illin., considers it, from his experience, slightly sedative and astringent. (*Trans. of Illinois State Med. Soc.*, A. D. 1857.) In the Southern States it has long been employed by regular practitioners in catarrh, pneumonia, pleurisy, consumption, and other pectoral affections; and appears to be decidedly useful, if applied in the early stage, or, after sufficient depletion, when the complaint is already formed. Its popular name of *pleurisy-root* expresses the estimation in which it is held as a remedy in that disease. It has also been useful in diarrhœa, dysentery, and acute and chronic rheumatism. Dr. Lockwood speaks highly of its efficacy in promoting the eruption in exanthematous fevers. (*Buffalo Med. Journ.*, March, 1848.) Much testimony might be advanced in proof of its possessing considerable diaphoretic powers. It is said to be gently tonic, and has been popularly used in pains of the stomach from flatulence and indigestion.

From twenty grains to a drachm of the root in powder may be given several times a day; but as a diaphoretic it is best administered in decoction or infusion, made in the proportion of an ounce to a quart of water, and given in the dose of a teacupful every two or three hours till it operates.* W.

ASSAFŒTIDA. *U. S., Br.*

Assafetida.

A gum-resinous exudation, obtained by incision, from the root of Narthex Assafœtida (Falconer, *Royle's Mat. Med.*) *U. S.* A gum-resin obtained by incision from the living root of Narthex Assafœtida. *Br.*

Assafœtida, *Fr.;* Stinkasant, Teufelsdreck, *Germ.;* Assafetida, *Ital.;* Asafetida, *Span.;* Ungoozeh, *Persian;* Hilteet, *Arab.*

NARTHEX. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Apiaceæ or Umbelliferæ.

Gen. Ch. Umbels compound. *Involucres* none. *Calyx* obsolete. *Fruit* thin, compressed at the back, with a dilated border. *Ridges* three only, dorsal. *Vittæ* one to each dorsal furrow, and two to the laterals. *Albumen*, thin, flat. *Lindley.*

Narthex Assafœtida. Falconer, *Royle's Mat. Med.*, Am. ed., p. 407.—*Ferula*

* *Fluid Extract of Asclepias.* Mr. E. Rhoads prepares a *fluid extract* by moistening sixteen ounces of the powdered root with four fluidounces of a menstruum consisting of three pints of alcohol and a pint and a half of water, packing the mixture into a conical glass percolator, pouring on it the remainder of the menstruum, reserving the twelve fluidounces which first pass, evaporating the residue of the filtered liquor by means of a water-bath to four fluidounces, mixing this with the reserved liquor, and filtering at the end of twenty-four hours. This preparation was found effective by Dr. Pawling, in the dose of a fluidrachm every four hours. (*Note to the twelfth edition.*)

Assafœtida. Willd. *Sp. Plant.* i. 1413; Kœmpfer, *Amœnitat. Exotic.* 535, t. 536. This plant was first described by Kœmpfer, who wrote from actual observation. By him and others after him it was considered as belonging to the genus Ferula; but Dr. Falconer, from a careful examination of the plant in its native site, as well as of specimens cultivated in the Saharunpore Botanic Garden, came to the conclusion that it belongs to a distinct genus, which he denominated Narthex, and which is now generally admitted. The root is perennial, fleshy, tapering, simple or divided, a foot or more in length, about three inches thick at top, where it is invested above the soil with numerous small fibres, dark-gray and transversely corrugated on the outside, internally white, and abounding in an excessively fetid, opaque, milky juice. The leaves, which spring from the root, are numerous, large and spreading, nearly two feet long, light-green above, paler beneath, and of a leathery texture. They are three-parted, with bipinnatifid segments and oblong-lanceolate, obtuse, entire or variously sinuate, decurrent lobes, forming a narrow winged channel on the divisions of the petiole. From the midst of the leaves rises a luxuriant, herbaceous stem, from six to nine feet high, two inches in diameter at the base, simple, erect, round, smooth, striated, solid, and terminating in a large head of compound umbels, with from ten to twenty rays, each surmounted by a roundish partial umbel. The flowers are pale-yellow, and the fruit oval, thin, flat, foliaceous, and reddish-brown. The plant is said to differ, in its leaves and product, in different situations.

It is a native of Persia, Affghanistan, and other neighbouring regions; and flourishes abundantly in the mountainous provinces of Laar and Chorassan, where its juice is collected. Burns, in his travels into Bokhara, states that the young plant is eaten with relish by the people, and that sheep crop it greedily. Some have erroneously supposed that certain species of Ferula contribute to the production of the assafetida of commerce; and *F. Persica* was admitted among its probable sources in the last edition of the Edinburgh Pharmacopœia. This plant grows also in Persia, and has a strong odour of the drug.*

The oldest plants are most productive, and those under four years old are not considered worth cutting. At the season when the leaves begin to fade, the earth is removed from about the top of the root, and the leaves and stem, being twisted off near their base, are thrown with other vegetable matters over the root, in order to protect it from the sun. After some time the summit of the root is cut off transversely, and, the juice which exudes having been scraped off, another thin slice is removed, in order to obtain a fresh surface for exudation. This process is repeated at intervals till the root ceases to afford juice, and perishes. During the whole period of collection, which occupies nearly six weeks, the solar heat is as much as possible excluded. The juice collected from numerous plants is put together, and allowed to harden in the sun. The fruit is said to be sent to India, where it is highly esteemed as a medicine.

Assafetida is brought to this country either from India, whither it is conveyed from Bushire, and down the Indus, or by the route of Great Britain. It sometimes comes in mats, but more frequently in cases, the former containing eighty or ninety, the latter from two hundred to four hundred pounds. It is sometimes also imported in casks.

Properties. As found in the shops, assafetida is in irregular masses, softish when not long exposed, of a yellowish or reddish-brown colour externally, exhibiting when broken an irregular, whitish, somewhat shining surface, which soon becomes red on exposure, and ultimately passes into a dull yellowish-brown. This change of colour is characteristic of assafetida, and is ascribed to the influence of air and light upon its resinous ingredient. The masses appear as if composed of distinct portions agglutinated together, sometimes of white, almost pearly tears, embedded in a darker, softer, and more fetid paste. Occasionally the *tears* are separate, though rarely in the commerce of this country.† They are roundish, oval, or irregular, and generally

* The assafetida plant has been introduced into the European conservatories. On a visit by the author to the Edinburgh Botanical Garden, in September, 1860, in company with Drs. Christison and Balfour, the latter the Superintendent of the garden, an assafetida plant was shown to him which had flowered and borne fruit, but not until it was 14 years old. (*Note to the twelfth edition.*)

† From the account given by Dr. Bellew, who was officially present in the assafetida region, and

flattened, from the size of a pea to that of a large almond, sometimes larger, yellowish or brownish externally and white within, and not unlike ammoniac tears, for which they might be mistaken except for their odour, which, however, is weaker than that of the masses.

The odour of assafetida is alliaceous, extremely fetid, and tenacious; the taste, bitter, acrid, and durable. The effect of time and exposure is to render it more hard and brittle, and to diminish the intensity of its smell and taste, particularly the former. Kœmpfer assures us that one drachm of the fresh juice diffuses a more powerful odour, through a close room, than one hundred pounds of the drug as usually kept in the stores. Assafetida softens by heat without melting, and is of difficult pulverization.* Its sp. gr. is 1·327. (*Berzelius.*) It is inflammable, burning with a clear, lively flame. It yields all its virtues to alcohol, and forms a clear tincture, which becomes milky on the addition of water. Macerated in water it produces a turbid red solution, and, triturated with that fluid, gives a white or pink-coloured milky emulsion of considerable permanence. In 100 parts, Pelletier found 65 parts of resin, 19·44 of gum, 11·66 of bassorin, 3·60 of volatile oil, with traces of supermalate of calcium. Brandes obtained 4·6 parts of volatile oil, 47·25 of a bitter resin soluble in ether, 1·6 of a tasteless resin insoluble in ether, 1·0 of extractive, 19·4 of gum containing traces of potassa and lime united with sulphuric, phosphoric, acetic, and malic acids, 6·4 of bassorin, 6·2 of sulphate of calcium, 3·5 of carbonate of calcium, 0·4 of oxide of iron and alumina, 0·4 of malate of calcium with resin, 6·0 of water, and 4·6 of impurities consisting chiefly of sand and woody fibre. The odour of the gum-resin depends on the *volatile oil*, which may be procured by distillation with water or alcohol. It is lighter than water, colourless when first distilled, but becoming yellow with age, of an exceedingly offensive odour, and of a taste at first flat, but afterwards bitter and acrid. It contains, according to Stenhouse, from 15·75 to 23 per cent. of sulphur. Hlasiwetz considers it a mixture, in variable proportions, of the sulphuret and bisulphuret of a compound radical, consisting of carbon and hydrogen ($C_{12}H_{11}$). A persulphide (persulphuret) of allyl, which is sublimed when oil of mustard is heated with persulphide (persulphuret) of potassium, is said by Wertheim to have an extremely intense odour of assafetida; a fact which justifies the supposition that it may be identical with the oil of that gum-resin. (*Gmelin*, ix. 377.) The oil boils at about 280°, but suffers decomposition, yielding sulphuretted hydrogen. When long exposed to the air it becomes slightly acid, and acquires a somewhat different odour. (*Chem. Gaz.*, No. 178, p. 108.) The volatile oil and bitter resin are the active principles.

Impurities and Adulterations. Assafetida is probably not often purposely adulterated; but it frequently comes of inferior quality, and mixed with various impurities, such as sand and stones. Portions which are very soft, dark-brown or blackish, with few or no tears, and indisposed to assume a red colour when freshly broken, should be rejected. We have been informed that a case seldom comes without more or less of this inferior assafetida, and of many it forms the larger portion. It is sold chiefly for horses. A factitious substance, made of garlic juice and white pitch with a little assafetida, has occurred in commerce.†

had the opportunity of making personal observation, the tears are produced by the concretion of the juice which issues by drops from circular incisions at the top of the root, before this has been removed, while the lumps are from the juice which exudes from the cut surface after the removal of the top. (*Pharm. Journ. and Trans.*, May 1864.)—*Note to the thirteenth edition.*

* In the pharmaceutical preparation of assafetida, it is sometimes very desirable to reduce it to powder. Mr. B. S. Proctor has found that this, and other gum-resins, when incorporated with from 4 to 10 per cent. of magnesia, by first softening them by means of a water-bath, and then stirring them with the earth, become readily pulverizable; and the powder is without the tendency to agglutination which it has when procured without this preliminary preparation. (*Lond. Chem. and Druggist*, April 13, 1863.)—*Note to the twelfth edition.*

† The statement made in the text that assafetida is probably not often purposely adulterated applies only to the drug after it has entered the market. From the accounts given by Dr. Bellew it appears that, at the place of its production, the drug is generally adulterated; the pure juice being mixed, to the extent of from one-fifth to one-third, usually with the flour of wheat or barley, or powdered gypsum. It is only the juice proceeding from the centre of the root top of the newly sprouting plant that is never adulterated; and this is much more costly than the common kind. (*Pharm. Journ. and Trans.*, May, 1864.)—*Note to the thirteenth edition.*

Assafetida is sometimes kept in the powdered state; but this is objectionable; as the drug is thus necessarily weakened by the loss of volatile oil, and is besides rendered more liable to adulteration.

Medical Properties and Uses. The effects of assafetida on the system are those of a moderate stimulant, powerful antispasmodic, efficient expectorant, and feeble laxative. Some consider it also emmenagogue and anthelmintic. Its volatile oil is undoubtedly absorbed; as its peculiar odour may be detected in the breath and the secretions. As an antispasmodic simply, it is employed in the treatment of hysteria, hypochondriasis, convulsions of various kinds, spasm of the stomach and bowels unconnected with inflammation, and in numerous other nervous disorders of a merely functional character. From the union of expectorant with antispasmodic powers, it is highly useful in spasmodic pectoral affections, such as hooping-cough and asthma, and in certain infantile coughs and catarrhs, complicated with nervous disorder, or with a disposition of the system to sink. In catarrhus senilis; in the secondary stages of peripneumonia notha, croup, measles, and catarrh; in pulmonary consumption; in fact, in all cases of disease of the chest in which there is want of due nervous energy, and in which inflammation is absent or has been sufficiently subdued, assafetida may be occasionally prescribed with advantage. In the form of enema, it is useful in cases of inordinate accumulation of air in the bowels, and, in the same form, is most conveniently administered in the hysteric paroxysm, and other kinds of convulsion. Its laxative tendency is generally advantageous, but must sometimes be counteracted by opium. It may often be usefully combined with cathartics in constipation with flatulence.

It appears to have been known in the East from very early ages, and, notwithstanding its repulsive odour, is at present much used in India and Persia as a condiment. Persons soon habituate themselves to its smell, which they even learn to associate pleasantly with the agreeable effects experienced from its internal use. Children with hooping-cough sometimes become fond of it.

The medium dose is ten grains, which may be given in pill or emulsion. (See *Mistura Assafœtidæ.*) The tincture is officinal, and is much used. When given by injection, the gum-resin should be triturated with warm water. From half a drachm to two drachms may be administered at once in this way. It may also sometimes be conveniently given in the form of a suppository, which is now officinal. A syrup has been recommended, in which the fetid odour of the drug is obviated by the use of the infusion of wild cherry bark as the liquid vehicle. (See *Am. Journ. of Pharm.*, Sept. 1871, p. 397.) As assafetida is not apt to affect the brain injuriously, it may be given very freely when not contraindicated by the existence of inflammatory action.

Off. Prep. Emplastrum Assafœtidæ, *U. S.;* Enema Assafœtidæ, *Br.;* Mistura Assafœtidæ, *U. S.;* Pilulæ Aloës et Assafœtidæ; Pilulæ Assafœtidæ, *U. S.;* Pilula Assafœtidæ Composita, *Br.;* Pilulæ Galbani Compositæ, *U. S.;* Spiritus Ammoniæ Fœtidus, *Br.;* Suppositoria Assafœtidæ, *U. S.;* Tinctura Assafœtidæ. W.

AURANTII AMARI CORTEX. *U. S.*

Bitter Orange Peel.

The rind of the fruit of Citrus vulgaris. *U. S.*

Off. Syn. AURANTII CORTEX. *Bitter Orange Peel.* The dried outer part of the rind of the bitter orange, Citrus Bigaradia. *Br.*

AURANTII DULCIS CORTEX. *U. S.*

Sweet Orange Peel.

The rind of the fruit of Citrus Aurantium. *U. S.*

AURANTII FLORES. *U.S.*

Orange Flowers.

The flowers of Citrus Aurantium and of Citrus vulgaris.

Ecorce d'orange, *Fr.;* Pomeranzenschale, *Germ.;* Scorze del frutto dell'arancio, *Ital.;* Corteza de naranja, *Span.*

CITRUS. *Sex. Syst.* Polyadelphia Icosandria.—*Nat. Ord.* Aurantiaceæ.

Gen. Ch. Calyx five-cleft. *Petals* five, oblong. *Anthers* twenty, the filaments united into different parcels. *Berry* nine-celled. *Willd.*

This very interesting genus is composed of small evergreen trees, with ovate or oval-lanceolate, and shining leaves, odoriferous flowers, and fruits which usually combine beauty of colour with a fragrant odour and grateful taste. They are all natives of warm climates. Though the species are not numerous, great diversity exists in the character of the fruit; and many varieties, founded upon this circumstance, are noticed by writers. In the splendid work on the natural history of the *Citrus* by Risso and Poiteau, 169 varieties are described under the eight following heads:—1. sweet oranges, 2. bitter and sour oranges, 3. bergamots, 4. limes, 5. shaddocks, 6. lumes, 7. lemons, and 8. citrons. Of these it is difficult to decide which have just claims to the rank of distinct species, and which must be considered merely as varieties. Those employed in medicine may be arranged in two sets of which the orange, *C. Aurantium*, and the lemon, *C. Medica*, are respectively the types; the former characterized by a winged, the latter by a naked or nearly naked petiole. The form and character of the fruit, though not entirely constant, serve as the basis of subdivisions. *C. Decumana*, which yields the *shaddock*, agrees with *C. Aurantium* in the form of its petiole.

Citrus Aurantium. Willd. *Sp. Plant.* iii. 1427; Woodv. *Med. Bot.* p. 532, t. 188. The orange-tree grows to the height of about fifteen feet. Its stem is rounded, much branched, and covered with a smooth, shining, greenish-brown bark. In the wild state, and before inoculation, it is often furnished with axillary spines. The leaves are ovate, pointed, entire, smooth, and of a shining pale-green colour. When held between the eye and the light, they exhibit numerous small transparent vesicles, filled with volatile oil; and, when rubbed between the fingers, are highly fragrant. Their footstalks are about an inch long, and have wings or lateral appendages. The flowers, which have a delightful odour, are large, white, and attached by short peduncles, singly, or in clusters, to the smallest branches. The calyx is saucer-shaped, with pointed teeth. The petals are oblong, concave, white, and beset with numerous small glands. The filaments are united at their base in three or more distinct portions, and support yellow anthers. The germen is roundish, and bears a cylindrical style, terminated by a globular stigma. The fruit is a spherical berry, often somewhat flattened at its base and apex, rough, of a yellow or orange colour, and divided internally into nine vertical cells, each containing from two to four seeds, surrounded by a pulpy matter. The rind of the fruit consists of a thin exterior layer, abounding in vesicles filled with a fragrant volatile oil, and of an interior one, which is thick, white, fungous, insipid, and inodorous. There are two varieties of *C. Aurantium*, considered by some as distinct species. They differ chiefly in the fruit, which in one is sweet, in the other sour and bitterish. The first retains the original title, the second is called *Citrus vulgaris* by De Candolle, and *C. Bigaradia* by Risso. The Seville orange is the product of the latter.*

This beautiful evergreen, in which the fruit is mingled, in every stage of its growth, with the blossoms and foliage, has been applied to numerous purposes of utility and

* A variety of the orange, called the Mandarin Orange (*Citrus Bigaradia Sinensis* or *C. Bigaradia myrtifolia*), which is probably a native of China, but cultivated lagely in Sicily and the south of Italy, bears a fruit much smaller than the common orange, round but flattened above and below, with a smooth, thin, delicate rind, and a very sweet delicious pulp. A volatile oil is obtained from the rind by expression, of a yellow colour, a very bland agreeable odour, different from that of the orange or lemon, and a not unpleasant taste, like that of the rind. When freed from colouring matter by distillation, it was found by M. S. de Luca to be a pure carbohydrogen, with the formula $C_{20}H_{16}$. (*Journ. de Pharm.*, 3e sér., xxxiii. 52.)—*Note to the twelfth edition.*

ornament. A native of China and India, it was introduced into Europe at a very early period, was transplanted to America soon after its first settlement, and is now found in every civilized country where the climate is favourable. In colder countries, it is one of the most cherished ornaments of the hot-house, though in this situation its beauties are not fully developed, and its fruit does not attain perfection. It flourishes in the most southern portions of our own country, especially near St. Augustine in Florida, where very fine oranges are produced. The tree also grows in the gardens about New Orleans, but is sometimes destroyed by frosty winters. The fruit is brought to us chiefly from the south of Europe and the West Indies. The Havana oranges have the sweetest and most agreeable flavour.

Various parts of the plant are used in medicine. The leaves, which are bitter and aromatic, are employed in some places in the form of infusion as a gently stimulant diaphoretic. They yield by distillation with water a volatile oil, which is said to be often mixed by the distillers with the oils obtained from the flowers and unripe fruit. In regard to polarized light, it has a rotatory power to the left, which is considerably weakened by the prolonged action of heat. (Chautard, *Journ. de Pharm.*, 3e sér., xliv. 28.) The fresh flowers impart to water distilled from them their peculiar fragrance: and the preparation thus obtained is much esteemed in the south of Europe for antispasmodic virtues. (See *Aqua Aurantii Florum*, among the *Preparations.*) The dried flowers are used on the continent of Europe as a gentle nervous stimulant, in the form of infusion, which may be made in the proportion of two drachms to the pint of boiling water, and taken in the dose of a teacupful. The flowers should be dried in the shade, at a temperature between 75° and 95° F. (*Annuaire de Thérap.*, A. D. 1861, p. 59.)

An oil is obtained also from the flowers by distillation, which is called *neroli* in France, and is much used in perfumery, and in the composition of *liqueurs.* It is an ingredient of the famous Cologne water. That obtained from the flowers of the Seville or bitter orange (*C. vulgaris*) is deemed the sweetest. It was introduced into the Edinburgh Pharmacopœia, with the title of *Aurantii Oleum*, to serve for the preparation of orange-flower water. Soubeiran considers this oil rather as a product of the distillation than as pre-existing in the flowers. The fact may thus be explained, that orange-flower water, made by dissolving even the finest neroli in water, has not the precise odour of that procured by distillation from the flowers. Pure neroli has a rotating power to the right, in this respect differing from the oil of the leaves. (*Chautard.*)

The fruit is applied to several purposes. Small unripe oranges, about the size of a cherry or less, previously dried, and rendered smooth by a turning lathe, are sometimes employed to maintain the discharge from issues. They are preferred to peas on account of their agreeable odour, and by some are thought to swell less with the moisture; but this is denied by others, and it is asserted that they require to be renewed at the end of twenty-four hours. These fruits are sometimes kept in the shops under the name of *orange berries.* They are of a grayish or greenish-brown colour, fragrant odour, and bitter taste, and are said to be used for flavouring cordials. A volatile oil is obtained from them by distillation, known to the French by the name of *essence de petit grain*, and employed for similar purposes with that of the flowers. The oil, however, which now goes by this name, is said to be distilled from the leaves, and those of the bitter orange yield the best. The oils from the unripe and the ripe fruit have a rotating power to the right, the latter much greater than the former; and this property might serve to distinguish them from the oil of the leaves.* Several of the oils from the Aurantiaceæ deposit a crystalline substance, differing from camphor. (*Chautard.*) The juice of the Seville orange is sour and bitterish, and forms with water a refreshing and grateful drink in febrile diseases. It is employed in the

*Prof. Procter, while in Italy, was informed that the oils of oranges and lemons were prepared in Calabria and Sicily in three ways: 1. by scraping off the exterior part of the rind and submitting it to expression; 2. by putting the scrapings into hot water, depressing the pulp beneath, and skimming off the oil as it rises; 3. by distillation. Prof. Procter also states, on the authority of Mr. John A. Dix, of New York, that the best Sicily orange oil is procured by dexterous compression, within a cask, of the fresh rind by the hand, the oil being driven out in jets. (*Am. Journ. of Pharm.*, Jan. 1868, p. 27.)—*Note to the thirteenth edition.*

same manner as lemon-juice, which it resembles in containing citric acid, though in much smaller proportion. The sweet orange is more pleasant to the taste, and is extensively used as a light refrigerant article of diet in inflammatory diseases, care being taken to reject the membranous portion. The rind both of the sweet and bitter varieties is directed by the U. S. Pharmacopœia, the bitter only by the British. With the latter the outer portion is that considered officinal; as the inner is destitute of activity, and by its affinity for moisture renders the peel liable to become mouldy. The best mode of separating the outer rind, when its desiccation and preservation are desired, is to pare it from the orange in narrow strips with a sharp knife, as we pare an apple. When the object is to apply the fresh rind to certain pharmaceutic purposes, as to the preparation of the *confection of orange peel*, it is best separated by a grater. The dried peel, sold in the shops, is usually that of the Seville orange, and is brought chiefly from the Mediterranean.

Properties. Orange peel has a grateful aromatic odour, and a warm bitter taste, which depend upon the volatile oil contained in its vesicles. The rind of the Seville orange is much more bitter than that of the other variety. Both yield their sensible properties to water and alcohol. The oil may be obtained by expression from the fresh grated rind, or by distillation with water. It is imported into the United States in tinned copper cans. It has properties resembling those of the oil of lemons, but spoils more rapidly on exposure to the air, acquiring a terebinthinate odour. The perfumers use it in the preparation of Cologne water, and for other purposes; and it is also employed by the confectioners. According to Dr. Imbert-Gourbeyre, they who are much exposed to the inhalation of the oil of bitter oranges are apt to be affected with cutaneous eruptions, and various nervous disorders; as headache, tinnitus aurium, oppression of the chest, gastralgia, want of sleep, and even muscular spasm. He thinks that the oils of the Aurantiaceæ have much resemblance to camphor in their effects. (*Chem. Pharm. Cent. Blatt*, Feb. 1854, p. 128.)

Medical Properties and Uses. Bitter orange peel is a mild tonic, carminative, and stomachic; the sweet is simply aromatic; but neither is much used alone. They are chiefly employed to communicate a pleasant flavour to other medicines, to correct their nauseating properties, and to assist their stimulant impression upon the stomach. They are a frequent and useful addition to bitter infusions and decoctions, as those of gentian, quassia, columbo, and especially Peruvian bark. It is obviously improper to subject orange peel to long boiling; as the volatile oil, on which its virtues chiefly depend, is thus driven off. The dose in substance is from half a drachm to a drachm three times a day. Large quantities are sometimes productive of mischief, especially in children, in whom violent colic and even convulsions are sometimes induced by it. We have known the case of a child, in which death resulted from eating the rind of an orange.

When orange peel is used simply for its agreeable flavour, the rind of the sweet orange is preferable; as a tonic, that of the Seville orange.

Off. Prep. of Bitter Orange Peel. Infusum Aurantii, *Br.;* Infusum Aurantii Compositum, *Br.;* Infusum Gentianæ Comp.; Mistura Gentianæ, *Br.;* Spiritus Armoraciæ Comp., *Br.;* Tinctura Aurantii; Tinct. Cinchonæ Comp.; Tinct. Gentianæ Comp.

Off. Prep. of Sweet Orange Peel. Confectio Aurantii Corticis, *U. S.;* Syrupus Aurantii Corticis, *U. S.*

Off. Prep. of the Flowers. Aqua Aurantii Florum, *U. S.* W.

AVENÆ FARINA. *U. S.*

Oatmeal.

The meal prepared from the seeds of Avena sativa. *U. S.*

Farine d'avoine, *Fr.;* Hafermehl, *Germ.;* Farina dell'avena, *Ital.;* Harina de avena, *Span.*

AVENA. *Sex. Syst.* Triandria Digynia.—*Nat. Ord.* Gramineæ.

Gen. Ch. Calyx two-valved, many-flowered, with a twisted awn on the back. *Willd.*

Avena sativa. Willd. *Sp. Plant.* i. 446. The common oat is so well known that a minute description would be superfluous. It is specifically distinguished by its

"loose panicle, its two-seeded glumes, and its smooth seeds, one of which is awned." It was known to the ancients, and is now cultivated in all civilized countries; but its original locality has not been satisfactorily ascertained. It grows wild in Sicily, and is said to have been seen by Anson in the Island of Juan Fernandez on the coast of Chili.

This grain, though cultivated chiefly for horses, is very nourishing, and is largely consumed as food by the inhabitants of Scotland, the North of Ireland, Brittany, and some other countries. A decoction is said to possess decided diuretic properties, and to be useful in dropsy. (*Lond. Med. Times and Gaz.*, Sept. 1854, p. 263.) The seeds deprived of their husks are called *groats*, but are little used in this country. It is only the meal, prepared by grinding the seeds, that is kept in our shops.

Oatmeal contains, according to Vogel, in 100 parts, 59 of starch, 4·30 of a grayish substance resembling rather coagulated albumen than gluten, 8·25 of sugar and a bitter principle, 2·50 of gum, 2 of fixed oil, and 23·95 of fibrous matter including loss. An elaborate analysis of oats deprived of the husk, made by Professor J. P. Norton, of Yale College, gave as the average of four varieties of the grain, 65·11 per cent. of starch, 2·24 of sugar, 2·23 of gum, 6·55 of oil, 16·51 of a nitrogenous body analogous to casein, though differing from it in some respects, 1·42 of albumen, 1·68 of gluten, 2·17 of epidermis, and 2·09 of alkaline salts, with allowance for loss and error. Professor Norton thinks there may have been some error in the proportion of the nitrogenous compounds, in consequence of the difficulty of separating them from starch; and concludes, from the quantity of nitrogen obtained by ultimate analysis, that these compounds must amount to at least 8 per cent. (*Am. Journ. of Sci. and Arts*, 2d ser., iii. 330.) Oatmeal has no smell, is very slightly but not unpleasantly bitter, and yields most of its nutritive matter readily to boiling water.

Gruel made with oatmeal affords a nutritious, bland, and easily digested aliment, admirably adapted to inflammatory diseases; and, from its somewhat laxative tendency, preferable in certain cases to the purely mucilaginous or amylaceous preparations. It is often administered after brisk cathartics, in order to render them easier, and at the same time more efficient in their action. It is sometimes also used in the form of enema; and the meal, boiled with water into a thick paste, forms an excellent emollient cataplasm. *Oatmeal gruel* may be prepared by boiling an ounce of the meal with three pints of water to a quart, straining the decoction, allowing it to stand till it cools, and then pouring off the clear liquor from the sediment. Sugar and lemon-juice may be added to improve its flavour; and raisins are not unfrequently boiled with the meal and water for the same purpose. W.

AZEDARACH. *U.S. Secondary.*

Azedarach.

The bark of the root of Melia Azedarach. *U.S.*

Melia. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Meliaceæ.

Gen. Ch. Calyx five-toothed. *Petals* five. *Nectary* cylindrical, toothed, bearing the *anthers* in the throat. *Drupe* with a five-celled nut. *Willd.*

Melia Azedarach. Willd. *Sp. Plant.* ii. 558; Michaux, *N. Am. Sylv.* iii. 4. This is a beautiful tree, thirty or forty feet high, with a trunk fifteen or twenty inches in diameter. When alone, it attains less elevation, and spreads out into a capacious summit. Its leaves are large and doubly pinnate, consisting of smooth, acuminate, denticulate, dark-green leaflets, disposed in pairs with an odd one at the end. The flowers are of a lilac colour, delightfully fragrant, and in beautiful axillary clusters near the ends of the branches. The fruit is a round drupe, about as large as a cherry, and yellowish when ripe.

This species of Melia is variously called *pride of India*, *pride of China*, and *common bead-tree*. It is a native of Syria, Persia, and the north of India, and is cultivated as an ornament in different parts of the world. It is abundant in our Southern States, where it adorns the streets of cities, and the environs of dwellings, and has even become naturalized. North of Virginia it does not flourish, though small trees

may sometimes be seen in sheltered situations. It flowers early in the spring. The fruit is sweetish, and, though said by some to be poisonous, is eaten by children without inconvenience, and is reputed to be powerfully vermifuge. But the bark of the root is chiefly employed. It is preferred recent, and is scarcely to be found in the shops at the North. It has a bitter, nauseous taste, and yields its virtues to boiling water.

Medical Properties and Uses. This bark is cathartic and emetic, and in large doses is said to produce narcotic effects similar to those of spigelia, especially if gathered at the season when the sap is mounting. It is considered in the Southern States an efficient anthelmintic, and appears to enjoy, in some places, an equal degree of confidence with the pinkroot. It is thought also to be useful in those infantile remittents which resemble verminose fevers, without being dependent on the presence of worms. The form of decoction is usually preferred. A quart of water is boiled with four ounces of the fresh bark to a pint, of which the dose for a child is a tablespoonful every two or three hours, till it affects the stomach or bowels. Another plan is to give a dose morning and evening for several successive days, and then to administer an active cathartic. W.

BALSAMUM PERUVIANUM. *U.S., Br.*

Balsam of Peru.

An empyreumatic liquid balsam obtained from Myrospermum Peruiferum (*De Candolle*). *U. S.* A balsam obtained from Myroxylon Pereiræ, *Klotzsch. Br.*

Baume de Peru, *Fr.;* Peruvianischer Balsam, *Germ.;* Balsamo del Peru, *Ital.;* Balsamo negro, *Span.*

Myrospermum. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Leguminosæ. *De Cand.*

Gen. Ch. Calyx campanulate, five-toothed, persistent. *Petals* five, the upper one largest. *Stamens* ten, free. *Ovary* stipitate, oblong, membranous, with from two to six ovules; the style originating near the apex, filiform, lateral. *Legume* with the stalk naked at the base, broadly winged above, samaroid, indehiscent, one-celled, one or two seeded, laterally somewhat pointed by the style. *Seed* covered over with balsamic juice. *Cotyledons* thick, flat. *De Candolle.*

Most botanists agree in uniting the genera *Myroxylon* and *Toluifera* of Linnæus, and *Myrospermum* of Jacquin, into one, and follow De Candolle in adopting the last-mentioned title. Klotzsch, of Berlin, however, asserts the distinctness of the genera *Myroxylon* and *Myrospermum*, and attaches the Peru balsam tree to the former. (*Bonplandia*, Sept. 15, 1857, p. 274.) Besides the officinal species, there are others which possess medical virtues, and have been more or less employed. The pod of *M. frutescens* (Jacq.), growing in Trinidad, is popularly used in that island as a carminative, and externally, in the form of tincture, as a lotion in rheumatic pains; and a small quantity of balsamic juice is obtained by incisions in the stem, not distinguishable from balsam of Tolu. (*Pharm. Journ. and Trans.*, Sept. 1862, p. 108.) Another species is known in Paraguay under the name of *quino-quino*, the bark of which is used, in powder and decoction, as a remedy in wounds and ulcers; and from the trunk of which a juice is obtained, which in its concrete state closely resembles dried balsam of Peru. (*Ibid.*, Oct. 1862, p. 183.) In relation to the particular species which yields the balsam now under consideration, there has been much uncertainty. After the death of Linnæus, specimens of a plant were sent to the younger Linnæus by Mutis, from New Granada, which was said by this botanist to yield the balsam of Peru. A description of the plant was published in the *Supplementum Plantarum* with the name of *Myroxylon Peruiferum;* and pharmacologists have generally referred the balsam to it. But considerable doubt has existed as to the identity of the species; nor have these doubts been satisfactorily settled up to the present time. Specimens of a plant were received by Dr. Pereira from Central America, which, there is no reason to doubt, is the real source of Peruvian balsam. Upon comparing these with the specimen of Mutis's plant, preserved in the Herbarium of the Linnæan Society, he found a sufficiently close resemblance

in the leaves; but unfortunately this specimen is not perfect, and a certain conclusion did not seem to be attainable. A species of Myrospermum was described by Ruiz, in his Quinologia, as the true Peruvian balsam plant, which he believed to be identical with Myroxylon Peruiferum of Linn., and named accordingly. But this identity is denied by Kunth and De Candolle, who consider Ruiz's plant to be the *Myrospermum pubescens.* (*Prodrom.* ii. 95.) Lambert, in his *Illustrations of the genus Cinchona*, translated the description of Ruiz, and gave a figure of the plant (p. 97); but, according to Dr. Pereira, he drew the figure from Pavon's specimens contained in the British Museum, which were not those of Ruiz's plant, and were marked in Pavon's own handwriting *Myroxylon balsamiferum.* With this figure the real plant corresponds most closely; and it would appear, therefore, not to be the *M. Peruiferum* of Ruiz, the *M. pubescens* of Kunth and De Candolle. More recently, Prof. Carson, of the University of Pennsylvania, received from Central America a specimen, in leaf and flower, of the true Peruvian balsam tree, which he described and figured in the *Am. Journ. of Pharm.* for July, 1860 (p. 297). From a comparison of this specimen with the description of Pereira's plant, and with that by Willdenow, in the 4th edition of the Species Plantarum, of the M. Peruiferum of the younger Linnæus, he concluded that the three plants were identical, and that the balsam is in fact, as originally supposed, the product of the Myroxylon Peruiferum of Linn., the Myrospermum Peruiferum of Kunth and De Candolle. In the uncertainty which exists upon this subject, we shall give a brief account of the plant described and figured by Pereira, with the designation of "Myrospermum of *Sonsonate*," leaving its proper botanical place to be determined by further observation. After all the above mutations in the botanical history of the balsam, it appears to Professor Baillon, who read a note on the subject before the late Scientific Congress at Lyons, that we should return to the nomenclature of Linnæus; no sufficient reasons existing for the formation of the new genera; so that the balsams should be referred to plants of the genus Toluifera; the Tolu balsam to *T. balsamum*, and the Peru to *T. Peruiferum.* (*Pharm. Journ.*, Nov. 1873, p. 382.)

The Myrospermum of Sonsonate, for which Dr. Royle proposes the name of *Myrospermum Pereiræ*, in honour of the late Dr. Pereira (*Manual of Mat. Med.*, 2d ed., p. 414), the *Myroxylon Pereiræ* of Klotzsch (*Br.*), is a handsome tree, with a straight, round, lofty stem, a smooth ash-coloured bark, and spreading branches at the top. The leaves are alternate, petiolate, and unequally pinnate. The leaflets are from five to eleven, shortly petiolate, oblong, oval-oblong, or ovate, about three inches long by somewhat less than an inch and a half in breadth, rounded at the base, and contracting abruptly at top into an emarginate point. When held up to the light, they exhibit, in lines parallel with the primary veins, beautiful rounded and linear pellucid spots. The common and partial petioles and midribs are smooth to the naked eye, but, when examined with a microscope, are found to be furnished with short hairs. The fruit, including the winged footstalks, varies from two to four inches in length. At its peduncular extremity it is rounded or slightly tapering; at the top enlarged, rounded, and swollen, with a small point at the side. The mesocarp, or main investment of the fruit, is fibrous, and contains in distinct receptacles a balsamic juice, which is most abundant in two long receptacles or vittæ, one upon each side. A gum-resin exudes spontaneously in small quantities from the trunk of the tree, which, though containing, besides gum and resin, a small proportion of volatile oil, is wholly distinct from the proper balsam, and yields no cinnamic acid. (Attfield, *Pharm. Journ.*, Dec. 1863, p. 248.)

This tree grows in Central America, in the State of San Salvador, upon the Pacific Coast. Dr. Charles Dorat, in a letter to Professor Carson, states that it is never found at a greater height on the mountains than one thousand feet, that it begins to be productive after five years, and continues to yield for thirty years or more, and that the aroma of its flowers is perceived at the distance of one hundred yards. (*Am. Journ. of Pharm.*, xxxii. 303.) The balsam is collected from it exclusively by the aborigines, within a small district denominated the Balsam Coast, extending from Acajutla to Port Libertad. Incisions are made into the bark, which is slightly burned, so as to cause the juice to flow. Previously to the incisions, according to Dr.

Dorat, the bark is beaten on four sides of the trunk, so as to separate it from the wood without breaking it; intermediate strips being left sound, in order not to destroy the life of the tree. Cuts are then made in the bruised bark, and the exuding balsam set on fire. Fifteen days after this operation the juice begins to flow freely. It is received on cotton or woollen rags inserted into the apertures, which, after saturation, are removed and replaced by others. When sufficient is collected, the rags are boiled in water in large jars, and the liquid allowed to stand; whereupon the water rises to the top, and is poured off, leaving the balsam, which is put into calabashes or bladders. (*Pharm. Journ. and Trans.*, xi. 205.)* It is then taken for sale to the neighbouring town of Sonsonate, where it is purified by subsidence and straining, and put into jars for exportation. The annual average produce is said to be about 25,000 pounds.

Seeds of the Peru balsam tree, sent to Ceylon and the W. India islands of Jamaica and Trinidad, have proved fruitful, and young plants derived from them are growing vigorously; so that, at no great distance in the future, commerce will cease to depend for its supplies upon Central America. (*Pharm. Journ. and Trans.*, 2d ser., vi. 441, Feb. 1865.)

A substance called *white balsam* is procured from the fruit by expression. This has been confounded by some with the balsam of Tolu, but is wholly distinct. It is of a semifluid or soft-solid consistence, somewhat granular, and, on standing, separates into a white resinous crystalline deposit, and a superior translucent more fluid portion. The smell, though quite distinct from that of the balsam of Tolu and Peru, is not disagreeable. Dr. Stenhouse has obtained from it a peculiar resinous body, readily crystallizable, and remarkably indifferent in its chemical affinities, which he denominates *myroxocarpin*. (*Pharm. Journ. and Trans.*, x. 290.) Dr. Dorat, however, denies that the white balsam is produced by the same tree, or in the same vicinity.

Another substance obtained from the same tree, and much used in Central America, is a tincture of the fruit, made by digesting it in rum. It is called *balsamito* by the inhabitants, and is said to be stimulant, anthelmintic, and diuretic. It is also used as an external application to gangrenous or indolent ulcers, and as a wash to the face to remove freckles. According to Dr. Dorat, the balsamito is not the tincture, but an alcoholic extract of the young fruit. Neither this nor the white balsam reaches the markets of this country.

The balsam of Peru was named from its place of exportation; and it was long thought to be a product of Peru. It is now shipped partly from the Pacific Coast, and partly from the Balize or other Atlantic ports, whither it is brought across the country. It was Guibourt who first made known the fact of its exclusive production in Central America. As imported it is usually in tin canisters, with a whitish scum on its surface, and more or less deposit, which is dissolved with the aid of heat.

The balsam is said to be adulterated in Europe with castor oil, copaiba, &c. (*Pharm. Journ. and Trans.*, xii. 549); and a factitious substance has been sold in this country for the genuine balsam, prepared by dissolving balsam of Tolu in alcohol. This may be distinguished by taking fire readily, and burning with a blue flame. (*N. Y. Journ. of Pharm.*, i. 133.) It would, moreover, undergo diminution in volume when mixed with water, which is not the case with the genuine balsam. (*Br.*) A method of detecting castor oil, proposed by Dr. Wagner, is to expose a small portion of the suspected balsam to distillation until somewhat more than one-half has passed, to shake the distillate with baryta-water, to remove by means of a pipette the layer of oil floating on the surface, and to shake this with a concentrated solution of bisulphite of sodium. If castor oil be present, the liquid will immediately become a crystalline mass. (*Am. Journ. of Pharm.*, xxx. 570, from *Annal. der Chem. und Pharm.*)

*In a communication to the *Pharmaceutical Journal* (Dec. 1863, p. 241), Mr. Daniel Hanbury published an extract of a letter from Dr. Dorat, giving an account of a somewhat modified process for collecting the balsam. After the bruising of the bark as described in the text, fire is applied to the beaten bark, which becomes charred, and, after eight days, falls off in places, or is removed; and the rags are spread on the bare wood, and allowed to remain till saturated. They are then treated as above stated. (*Note to the twelfth edition.*)

Properties. Balsam of Peru is viscid like syrup or honey, of a dark reddish-brown colour, a fragrant odour, and a warm bitterish taste, leaving when swallowed a burning or prickling sensation in the throat. Its sp. gr. is from 1·14 to 1·16. When exposed to flame it takes fire, diffusing a white smoke and fragrant odour. Containing resin, volatile oil, and both benzoic and cinnamic acids, it is properly considered a balsam, though probably somewhat altered by heat. Alcohol entirely dissolves it, taking up one part in five. (*Br.*) Boiling water extracts the acid. From 1000 parts of the balsam, Stolze obtained 24 parts of a brown nearly insoluble resinous matter, 207 of resin readily soluble, 690 of oil, 64 of benzoic acid, 6 of extractive matter, and a small proportion of water. The oil he considers to be of a peculiar nature, differing from the volatile, the fixed, and the empyreumatic oils. Frémy gives the following views of the composition of the balsam. The acid is *cinnamic* and not benzoic acid. The oily substance is named by him *cinnamein*. It is decomposed by caustic potassa into cinnamic acid, which unites with the alkali, and a light oily fluid called *peruvin*. The resin is a hydrate of cinnamein, and increases at the expense of the latter principle as the balsam hardens. Cinnamein often holds in solution a crystalline substance called *metacinnamein*, isomeric with hydruret of *cinnamyl*, and by its oxidation producing cinnamic acid. When none exists in the balsam, it is presumed to have been wholly converted into that acid.

M. K. Kraut gives the following results of the fractional distillation of the essential oil of the balsam. The oil separates into three parts. The first, small in amount, distils at near 200° C. It is *benzylic alcohol* ($C_{14}H_8O_2$), with traces of foreign matter. Oxidized by chromic acid, it is transformed into benzoic acid. The second product, which constitutes most of the essence, boils at about 300°. It is an ether, the *benzoic ether* of the benzylic alcohol ($C_{14}H_6O_4$, benzoic acid, $+ C_{14}H_8O_2$, benzylic alcohol,— $H_2O_2 = C_{28}H_{12}O_4$, benzoic ether). The third compound boils at nearly the same temperature as mercury; and, according to M. Kraut, is the *cinnamic ether* of benzylic alcohol ($C_{18}H_8O_4$, cinnamic acid, $+ C_{14}H_8O_2$, benzylic alcohol, $— H_2O_2 = C_{32}H_{14}O_4$, cinnamic ether). The balsam contains free cinnamic acid and a little free benzoic acid. (*Journ. de Pharm.*, Janv. 1870, p. 90.)

Medical Properties and Uses. This balsam is a warm stimulating tonic and expectorant, and has been recommended in chronic catarrhs, certain forms of asthma, phthisis, and other pectoral complaints attended with debility. It has also been used in gonorrhœa, leucorrhœa, amenorrhœa, chronic rheumatism, and palsy. At present, however, it is little employed by American physicians. As an external application it has been found beneficial in chronic indolent ulcers. The dose is half a fluidrachm. It is best administered diffused in water by means of sugar and the yolk of eggs or gum arabic. W.

BALSAMUM TOLUTANUM. *U.S., Br.*

Balsam of Tolu.

A semi-liquid balsam obtained from Myrospermum Toluiferum (*De Candolle*). *U.S.* A balsam obtained from Myroxylon Toluifera. *Br.*

Baume de Tolu, *Fr.;* Tolubalsam, *Germ.;* Balsamo del Tolu, *Ital.;* Balsamo de Tolu, *Span.*

MYROSPERMUM. See BALSAMUM PERUVIANUM.

For a long time the tree from which this balsam is derived retained the name of *Toluifera Balsamum*, given to it by Linnæus; but it is now admitted that the genus *Toluifera* was formed upon insufficient grounds; and botanists agree in referring the Tolu balsam tree to the genus *Myroxylon*, or, as it was afterwards named, *Myrospermum*. Ruiz, one of the authors of the Flora Peruviana, considered it identical with *Myroxylon Peruiferum;* but M. Achille Richard determined that it was a distinct species, and gave it the appropriate specific name of *Toluiferum*, which is now recognised by the Pharmacopœias. Sprengel and Humboldt also consider it a distinct species of Myroxylon. According to Richard, who had an opportunity of examining specimens brought from South America by Humboldt, the leaflets of *M. Peruiferum* are thick, coriaceous, acute, blunt at the apex, and all equal in size; while those of *M. Toluiferum* are thin, membranous, obovate, with a lengthened and acu-

minate apex, and the terminal one is longest. *M. Peruiferum* is found in Peru and the southern parts of New Granada; *M. Toluiferum* grows in New Granada, and abounds especially in the neighbourhood of Tolu. The wood of the latter species, according to Humboldt, is of a deep-red colour, has a delightful balsamic odour, and is much used for building. Mr. John Weir, who visited the country of the Tolu balsam tree, found it growing abundantly in the mountainous region on the Magdalena river, near the towns of Plato and Las Mercedes, but at a considerable distance from the stream. The average height of the trees is seventy feet, the trunk sometimes more than two feet in diameter at a yard from the ground, and the height to the first branches 40 feet, so that it was necessary to fell the tree in order to obtain the leaves and fruit. (*Pharm. Journ. and Trans.*, July, 1864, p. 61.) As before stated, Prof. Baillon goes back to the Toluifera of Linn., and proposes to name the Peru balsam the *Toluifera Peruiferum*. (See *page* 165.)

The balsam is procured by making incisions in the trunk quite through the bark. The juice is received in small calabash cups, which are inserted in slight excavations beneath the point of two vertical incisions meeting at the lower end; and Mr. Weir has seen as many as twenty cups at a time on one tree. The collectors go from tree to tree, emptying the cups into flasks of raw hide. In these skin vessels the juice is taken to the different ports on the river, where it is transferred to tin cans. (Weir, *Ibid.*) It is brought from Carthagena in calabashes or baked earthen jars, or in tin or glass vessels. G. L. Ulex gives as a test of the purity of the balsam, that, if heated in sulphuric acid, it dissolves without disengagement of sulphurous acid, and yields a cherry-red liquid. (*Archiv. der Pharm.*, Jan. 1853.)

Properties. As first imported, balsam of Tolu has a soft tenacious consistence, which varies considerably with the temperature. By age it becomes hard and brittle like resin. It is shining, translucent, of a reddish or yellowish-brown colour, a highly fragrant odour, and a warm, somewhat sweetish and pungent, but not disagreeable taste. Exposed to heat, it melts, inflames, and diffuses an agreeable odour while burning. It is entirely dissolved by alcohol and the volatile oils. Boiling water extracts its acid. Distilled with water it affords a small proportion of volatile oil; and, if the heat be continued, an acid matter sublimes. Mr. Hatchett states that, when dissolved in the smallest quantity of solution of potassa, it loses its own characteristic odour, and acquires that of the clove pink. Its ingredients are resin, cinnamic acid, and volatile oil, the proportions of which vary in different specimens. The acid was formerly thought to be benzoic; but was proved by Frémy to be the cinnamic. The existence of the former acid in the balsam was denied by that chemist; and, though Deville subsequently obtained benzoic acid from it, yet, according to Kopp, this did not pre-exist in the balsam, but resulted from changes produced in the resin by heat, or the reaction of strong alkaline solutions. The pure volatile oil is a carbohydrogen ($C_{10}H_8$), which is denominated by Kopp *tolene*. According to the same chemist, the resinous matter is of two kinds, one very soluble in alcohol, the other but slightly so. (*Journ. de Pharm.*, 3e sér., xi. 426.) Guibourt observed that the balsam contains more acid, and is less odorous in the solid form; and thinks that the acid is increased at the expense of the oil. Trommsdorff obtained 88 per cent. of resin, 12 of acid, and only 0·2 of volatile oil. According to Mr. Heaver, the balsam yields by distillation about one-eighth of its weight of pure cinnamic acid. The acid distils over in the form of a heavy oil, which condenses into a white crystalline mass. It may be freed from empyreumatic oil by pressure in bibulous paper, and subsequent solution in boiling water, which deposits it in minute colourless crystals, upon cooling. (*Am. Journ. of Pharm.*, xv. 77.) According to Frémy, this balsam is closely analogous in constitution to the balsam of Peru, being composed of cinnamein, cinnamic acid, and resin.

Medical Properties and Uses. Balsam of Tolu is a stimulant tonic, with a peculiar tendency to the pulmonary organs. It is given with some advantage in chronic catarrh and other pectoral complaints, in which a gently stimulating expectorant is demanded; but should not be prescribed until after the reduction of inflammatory action. Independently of its medical virtues, its agreeable flavour renders it a popular ingredient in expectorant mixtures. Old and obstinate coughs are said to be some-

times greatly relieved by the inhalation of the vapour, proceeding from an ethereal solution of this balsam. From ten to thirty grains may be given at a dose, and frequently repeated. The best form of administration is that of emulsion, made by triturating the balsam with mucilage and loaf sugar, and afterwards with water.

Off. Prep. Syrupus Tolutanus, *Br.;* Tinctura Benzoini Composita; Tinctura Tolutana. W.

BARIUM.

Barium.

This is the metallic radical of the earth baryta, and the basis of two officinal compounds. It was first obtained in 1808 by Sir H. Davy, who describes it as a difficultly fusible metal, of a dark-gray colour, effervescing violently with water, and considerably heavier than sulphuric acid. Its eq. is 68·7, and symbol Ba. When exposed to the air, it instantly becomes covered with a crust of baryta, and when gently heated, burns with a deep-red light. The only officinal compounds of barium are the chloride, and the carbonate of the protoxide (baryta).

Baryta may be obtained from the native carbonate by intense ignition with carbonaceous matter; or from the native sulphate, by ignition with charcoal, which converts it into sulphuret of barium, subsequent solution of the sulphuret in nitric acid, and strong ignition of the nitrate formed to dissipate the acid. As thus obtained, it is an anhydrous solid, caustic, alkaline, difficultly fusible, and of a grayish-white colour. Its sp. gr. is about 4. It acts on the animal economy as a poison. When sprinkled with water it slakes like lime, becomes hot, and is reduced to the state of a white pulverulent hydrate, containing one eq. of water. The same hydrate is formed in mass, when the anhydrous earth is made into a paste with water, and exposed to a red heat in a platinum crucible. The excess of water is expelled, and the hydrate, undergoing fusion, may be poured out and allowed to congeal. Baryta dissolves in water, and forms the reagent called *baryta-water.* A boiling saturated solution, as it cools, yields crystals of baryta, containing much water of crystallization.

An economical process for obtaining baryta in crystals has been published by Dr. Mohr, of Coblentz. It consists in adding to a boiling solution of caustic soda an equivalent quantity of chloride of barium and nitrate of barium. In consequence of the usual impurities in caustic soda, a precipitate is formed of some carbonate and sulphate of barium, which is easily separated by subsidence from the solution of caustic baryta, kept hot. This, when clear, is drawn off by a syphon, and put in a suitable covered vessel to cool and crystallize; when the whole liquid is often converted into a mass of acicular crystals. (*Pharm. Journ. and Trans.*, Dec. 1856.)

Baryta consists of one eq. of barium 68·7, and one of oxygen 8 = 76·7. Its symbol is, therefore, BaO. B.

BARII CARBONAS. *U.S.*

Carbonate of Barium.

Barytæ Carbonas, *U. S.* 1860; Carbonate de baryte, *Fr.;* Kohlensaurer Baryt, *Germ.;* Barite carbonate, *Ital.;* Carbonato de barito, *Span.*

The officinal carbonate of barium is the native carbonate, a rare mineral, discovered in 1783 by Dr. Withering, in honour of whom it is called *Witherite.* It is found in Sweden and Scotland, but most abundantly in the lead mines of the north of England. It occurs usually in grayish, or pale yellowish-gray, fibrous masses, but sometimes crystallized. Its sp. gr. varies from 4·2 to 4·4. It is generally translucent, but sometimes opaque. It effervesces with acids, and, before the blowpipe, melts into a white enamel without losing its carbonic acid. It consists of one eq. of acid 22, and one of baryta 76·7 = 98·7. It is distinguished from the carbonate of strontium, with which it is most liable to be confounded, by its greater specific gravity, and by the absence of a reddish flame upon the burning of alcohol impregnated with its muriatic solution. If strontia be present, the reddish flame will detect it.

When pure, carbonate of barium is entirely soluble in muriatic acid. Any sulphate of barium present is left undissolved. If neither ammonia nor sulphuretted hydrogen produces discoloration or a precipitate in the muriatic solution, the absence of alumina, iron, copper, and lead is shown. Lime may be detected by adding an excess of sulphuric acid, which will throw down the baryta as a sulphate, and afterwards testing the clear liquid with carbonate of sodium, which, if lime be present, will produce a precipitate of carbonate of calcium.

Carbonate of barium acts as a poison on the animal economy. Its only officinal use is to prepare chloride of barium.

Off. Prep. Barii Chloridum, *U. S.;* Liquor Barii Chloridi, *U. S.* B.

BARII SULPHAS.

Sulphate of Barium.

Barytæ sulphas; Sulphate of baryta; Heavy spar, Baroselenite; Sulfate de baryte, *Fr.;* Schwefelsaurer Baryt, *Germ.;* Barite sulfata, *Ital.*

The native sulphate of barium is used in pharmacy with the same view as the native carbonate; namely, to obtain chloride of barium. The U. S. Pharmacopœia directs for this purpose the carbonate; but, as the sulphate may be used more economically, and is, in fact, generally employed in the preparation of chloride of barium, we retain it here, though not recognised as officinal.

Sulphate of barium is a heavy, lamellar, brittle mineral, varying in sp. gr. from 4·4 to 4·6. It is generally translucent, but sometimes transparent or opaque, and its ordinary colour is white or flesh-red. When crystallized, it is usually in very flat rhombic prisms. Before the blowpipe it strongly decrepitates, and melts into a white enamel, which, in the course of ten or twelve hours, falls to powder. It is thus partially converted into sulphuret of barium, and, if applied to the tongue, will give a taste like that of putrid eggs, arising from the formation of sulphuretted hydrogen. It consists of one eq. of acid 40, and one of baryta 76·7 = 116·7.

This salt, on account of its great insolubility, is not poisonous. Ground to fine powder, it is sometimes mixed with white lead, but impairs the quality of that pigment. The artificial sulphate of barium, under the name of *permanent white* or *blancfix*, is much used in the arts as a water colour. It is made from both the native sulphate and native carbonate. It forms a dazzling white colour, unalterable by light, heat, air, or sulphuretted hydrogen. It is used by the manufacturers of paper hangings, and for mixing with other colours, the tone of which it does not impair. (*Chem. Gaz.*, Feb. 1, 1857.) B.

BELÆ FRUCTUS. *Br.*

Bael Fruit.

The dried half-ripe fruit of Ægle Marmelos. *Br.*

This is a newly introduced officinal of the British Pharmacopœia, little known as yet in Great Britain, and scarcely at all in the United States; and probably sanctioned by the British Council out of complaisance to practitioners in the E. Indies, who are said to have used it with advantage. It is the unripe fruit of the *Ægle Marmelos* of De Candolle, belonging to the *Aurantiaceæ*, and with the following generic character. "*Flowers* bi-sexual. *Petals* 4-5, patent. *Stamens* 30-40, with distinct filaments, and linear-oblong anthers. *Ovary* 8-15 celled, with numerous ovules in each cell. *Style* very short and thick. *Stigma* capitate. *Fruit* baccate, with a hard rind, 8-15 celled, the cells 6-10 seeded. *Seed* with a woolly coat, covered with a slimy liquid." (*Wight & Arnott.*)

This species of Ægle, sometimes called the *Bengal quince*, is a rather large tree, with an erect stem, and few and irregular branches, covered with an ash-coloured bark, and furnished in general with strong, very sharp, axillary thorns, single or in pairs. The leaves are ternate, with oblong-lanceolate, crenulated, slightly dotted leaflets, of which the terminal is largest. The flowers are large, white, and in small, terminal or axillary panicles. The fruit is a berry, of about the size of a large orange,

somewhat spherical, but flattened at the base, and depressed at the insertion of the stem, with a hard smooth shell, and from 10 to 15 cells, containing besides the seeds a large quantity of exceedingly tenacious mucilage, which, when dried, is hard and transparent. The tree is a native of Hindostan and of further India. It is figured in the *Pharm. Journ. and Trans.* (Octob. 1850, p. 166), from which we have taken the foregoing account.

Several parts of the tree are used in India. The ripe fruit is described as fragrant, and of a delicious flavour; and a sort of sherbet prepared from it is deemed useful in febrile affections. The mucilage about the seeds is applied to various purposes in the arts, in connection with its viscid properties. The rind is used in dyeing. The flowers are deemed refrigerant by the native physicians. The fresh leaves yield by expression a bitterish and somewhat pungent juice, which, diluted with water, is occasionally used in the early stage of catarrhal and other fevers. The bark of the stem and root is thought to possess febrifuge properties. But it is the unripe or half-ripe fruit that is chiefly employed, and is the part recognised by the Br. Pharmacopœia.

Properties. The dried fruit is imported into England in vertical slices, or in broken pieces consisting of a part of the rind with the adherent pulp and seeds. The "rind is about a line and a half thick, covered with a smooth pale-brown or grayish epidermis, and internally, as well as the dried pulp, brownish-orange, or cherry-red." (*Br.*) When moistened, the pulp becomes mucilaginous. The fruit is astringent to the taste, and yields its virtues to water by maceration or decoction. It was found by Mr. Pollock to contain tannic acid, a concrete essential oil, and a vegetable acid. (*Med. Times and Gaz.*, Feb. 1864, p. 199.)

The difficulty of obtaining bael in England, is said of late to have led to the substitution for it of mangosteen, the fruit of *Garcinia Mangostana.* This is in irregular fragments of the rind, without any adhering pulp. The pieces are convex, three or four lines or more in thickness, externally covered with a smooth, deep reddish-brown, easily separable coating, and internally pale reddish-brown or reddish-yellow, smooth, with projecting vertical lines. (Prof. Bentley, *Pharm. Journ.*, May, 1867, p. 654.)

Medical Properties and Uses. Bael, as the medicine is called in India, or *bela*, as it has been officinally named, is said to possess astringent properties which render it useful in diarrhœa, dysentery with debility of the mucous membrane, and other discases of the bowels with relaxation, which it relieves without inducing constipation. It is much used by some practitioners in India, generally in the form of decoction, made by slowly boiling down a pint of water with two ounces of the dried fruit to four fluidounces. Of this one or two fluidounces are given in acute cases every two or three hours, in chronic cases two or three times a day. A liquid extract is directed in the Br. Pharmacopœia, the dose of which may be one or two fluidrachms. Mr. Waring, of the East India medical service, recommends an extract in the dose of half a drachm or a drachm. (*Med. Times and Gaz.*)

Off. Prep. Extractum Belæ Liquidum, *Br.* W.

BELLADONNÆ FOLIA. *U.S.*, *Br.*

Belladonna Leaves.

Belladonnæ Folium. *U. S.* 1860.

The leaves of Atropa Belladonna. *U. S.* The fresh leaves, with the branches to which they are attached, of *Deadly Nightshade*, Atropa Belladonna; also the leaves separated from the branches and carefully dried; gathered from the wild or cultivated British plants when the fruit has begun to form. *Br.*

BELLADONNÆ RADIX. *U.S.*, *Br.*

Belladonna Root.

The root of Atropa Belladonna from plants more than two years old. *U. S.* The dried root of Atropa Belladonna. *Br.*

Belladone, *Fr.;* Gemeine Tollkirsche, Wolfskirsche, *Germ.;* Belladonna, *Ital.;* Belladona, Belladama, *Span.*

ATROPA. *Sex. Syst.* Petandria Monogynia. — *Nat. Ord.* Solanaceæ.

Gen. Ch. Corolla bell-shaped. *Stamens* distant. *Berry* globular, two-celled. *Willd.*

Atropa Belladonna. Willd. *Sp. Plant.* i. 1017; Woodv. *Med. Bot.* p. 230, t. 82; Carson, *Illust. of Med. Bot.* ii. 19. pl. lxv. The belladonna, or *deadly nightshade*, is an herbaceous perennial, with a fleshy, creeping root, from which rise several erect, round, purplish, branching stems, to the height of about three feet. The leaves, which are attached by short footstalks to the stem, are in pairs of unequal size, oval, pointed, entire, of a dusky green on their upper surface, and paler beneath. The flowers are large, bell-shaped, pendent, of a dull-reddish colour, with solitary peduncles, rising from the axils of the leaves. The fruit is a roundish berry with a longitudinal furrow on each side, at first green, afterwards red, ultimately deep purple, bearing considerable resemblance to a cherry, and containing, in two distinct cells, numerous seeds, and a sweetish violet-coloured juice. The calyx adheres to the base of the fruit.

The plant is a native of Europe, where it grows in shady places, along walls, and amidst rubbish, flowering in June and July, and ripening its fruit in September. It grows vigorously under cultivation in this country, and retains all its activity, as shown by the observations of Mr. Alfred Jones. (*Am. Journ. of Pharm.*, xxiv. 106.) All parts of it are active. The leaves and roots are directed by the United States and British Pharmacopœias; the latter including the young branches, which are probably not less efficient. The leaves should be collected in June or July, when the plant is in flower, the roots in the autumn or early in the spring, and from plants three years old or more. Leaves which have been kept long should not be used, as they undergo change through absorption of atmospheric moisture, emitting ammonia, and probably losing a portion of their active nitrogenous matter. (See *Am. Journ. of Pharm.*, xxvii. 455.)

Properties. The *dried leaves* are of a dull-greenish colour, with a very faint, narcotic odour, and a sweetish, subacrid, slightly nauseous taste. The *root* is long, round, from one to several inches in thickness, branched and fibrous, externally when dried of a reddish-brown colour, internally whitish, of little odour, and a feeble sweetish taste. As to the relative strength of these two parts, M. Hirtz, of Strasburg, has inferred from his experiments that the root yields an extract five times stronger than that obtained from the leaves; but, to determine accurately the point referred to, another element in the calculation is necessary; the relative quantity, namely, of the extracts from the two sources; and this is uncertain. (*Annuaire de Thérap.*, A. D. 1862, p. 22.) Both the leaves and root, as well as all other parts of the plant, impart their active properties to water and alcohol. Brandes rendered it probable that these properties reside in a peculiar alkaline principle, which he supposed to exist in the plant combined with an excess of malic acid, and appropriately named *atropia*. Besides malate of atropia, Brandes found in the dried herb two azotized principles, a green resin (chlorophyll), wax, gum, starch, albumen, lignin, and various salts. The alkaline principle was afterwards detected by M. Runge; and the fact of its existence was established beyond question by Geiger and Hesse, who obtained it from an extract prepared from the stems and leaves of the plant. It was first, however, procured in a state of purity by Mein, a German apothecary, who extracted it from the root. Lübekind has described, under the name of *belladonnin*, a volatile alkaline principle, wholly distinct from atropia, which he obtained from belladonna; but it yet remains to be seen whether this was not a product of the process. (See *Am. Journ. of Pharm.*, xiii. 127.) For the mode of preparing atropia and its properties, see the article ATROPIA in the second part of this work.

The imported belladonna, especially that from Germany, is occasionally adulterated. Prof. J. M. Maisch, in a communication to the *American Journal of Pharmacy* (xxxiv. 126), states that, in different packages of the German drug, he has met with the leaves of Digitalis purpurea, Solanum nigrum and villosum, and Verbascum Thapsus, the leaves, stem, and capsules of Hyoscyamus niger, and various other impurities, not to speak of the flowers and fruit and immature leaves of the belladonna plant itself. The apothecary can have no difficulty in detecting these adulterations, if acquainted with the characters of the genuine leaves. One of the most distinctive

of these is the unequal size of the two leaves constituting each pair. But the plant is so easily cultivated, and grows so vigorously in this country, that all the demand for it might be readily supplied from our own gardens, without the need of recourse to Europe, were a little attention paid to the subject.

Medical Properties and Uses. The action of belladonna is that of a powerful narcotic, possessing also diaphoretic and diuretic properties, and somewhat disposed to operate upon the bowels. Among its first obvious effects, when taken in the usual dose, and continued for some time, are dryness and stricture of the fauces and neighbouring parts, with slight uneasiness and giddiness of the head, and more or less dimness of vision. In medicinal doses, it may also occasion dilatation of the pupil, decided frontal headache, slight delirium, colicky pains and purging, and a scarlet efflorescence on the skin; but this last effect is rare. The practitioner should watch for these symptoms as signs of the activity of the medicine, and should gradually increase the dose till some one of them is experienced in a slight degree, unless the object at which he aims should be previously attained; but, so soon as they occur, the dose should be diminished, or the use of the narcotic suspended for a time.

In large quantities, belladonna produces the most deleterious effects. It is in fact a powerful poison; and many instances are recorded in which it has been taken with fatal consequences. All parts of the plant are poisonous. It is not uncommon, in countries where it grows wild, for children to pick and eat the berries, allured by their fine colour and sweet taste. Soon after the poison has been swallowed, its peculiar influence is experienced in dryness of the mouth and fauces, burning in the throat and stomach, great thirst, difficult deglutition, nausea and ineffectual retching, loss of vision, vertigo, and intoxication or delirium, with violent gestures and sometimes fits of laughter, and followed by coma. The pupil is dilated and insensible to light, the face red and tumid, the mouth and jaws spasmodically affected, the stomach and bowels insusceptible of impressions, in fact the whole nervous system prostrated and paralyzed. A feeble pulse, cold extremities, subsultus tendinum, deep coma or delirium, and sometimes convulsions precede death. Dissection discloses appearances of inflammation in the stomach and intestines; and it is said that the body soon begins to putrefy, swells, and becomes covered with livid spots, while dark blood flows from the mouth, nose, and ears. To obviate the poisonous influence of belladonna, the most effectual method is to evacuate the stomach as speedily as possible, by means of emetics or the stomach-pump, and afterwards to cleanse the bowels by purgatives and enemata. The shocks of an electro-magnetic battery have been found useful in the comatose state. (*N. Y. Journ. of Med.*, N. S., v. 172.) The infusion of galls may be serviceable as an antidote; and, if the experiments of M. Runge can be relied on, lime-water or the alkaline solutions would render the poisonous matter remaining in the stomach inert. Bouchardat recommends the iodureted solution of iodide of potassium: and a case is recorded in which it seems to have been useful. (*Ann. de Therap.*, 1854, p. 14.)*

Dr. Garrod, of London, infers from his experiments that the caustic alkalies have the effect of destroying the activity of the poisonous principle of belladonna, and, consequently, that solution of potassa should never be used, even though very dilute, in prescriptions with this medicine, but may be employed with the hope of some benefit as an antidote, though its influence in this respect would be much limited by the necessity of giving it in small quantities, in consequence of its causticity.

It has been satisfactorily ascertained that the physiological effects of opium are to some extent antagonistic to those of belladonna; and that the preparations of the former may be advantageously employed in poisoning by the latter; especially where there is great nervous excitement. But, in the present state of medical experience

* There has been some difference of opinion as to the effect of belladonna on certain of the lower animals. Dr. W. Ogle states, as the result of his experiments on rabbits, 1. that a middle-aged rabbit may live for at least 6 days exclusively on belladonna; 2. that the animal will tolerate enormous doses of atropia, whether swallowed or injected into the areolar tissue, and that this tolerance is not owing to the non-absorption of the alkaloid; 3. that the tolerance increases with the age; 4. but that dilatation of the pupil is produced at least as readily in the old as in the young. (*Am. Journ. of Med. Sci.*, July, 1867, p. 249.) These conclusions are important, as qualifying materially any inference from experiments on these animals as to the effects of belladonna on the human system. (*Note to the thirteenth edition.*)

on the subject, it would be unsafe to rely on this expedient, to the exclusion of other measures, and especially of a thorough preliminary evacuation of the stomach.

Belladonna has been used as a medicine from early times. The leaves were first employed externally to discuss scirrhous tumours, and heal cancerous and other ill-conditioned ulcers; and were afterwards administered internally for the same purpose. Much evidence of their usefulness in these affections is on record, and even Dr. Cullen spoke in their favour; but this application of the medicine has fallen into disuse. It is now more esteemed in nervous diseases. It has been highly recommended in hooping-cough, in the advanced stages of which it is undoubtedly sometimes beneficial. In neuralgia it is one of the most effectual remedies in our possession; and it may be employed to give relief in other painful affections. Hufeland recommends it in the convulsions dependent on scrofulous irritation. It has been prescribed also in nervous colic, cholera morbus, strangulated hernia, chorea, epilepsy, hydrophobia, tetanus, mania, delirium tremens, paralysis, amaurosis, incontinence of urine, rheumatism, gout, dysmenorrhœa, obstinate intermittents, scarlatina, dropsy, and jaundice; and, in such of these affections as have their seat chiefly in the nervous system, it may sometimes do good. Bretonneau has employed it usefully in the treatment of constipation. It has been recommended as an antaphrodisiac, and is said to have been effectually employed in several cases of strangulated hernia. It has acquired considerable credit as a preventive of scarlatina; an application of the remedy first suggested by the author of the *homœopathic* doctrine; but its efficiency in this way is at best doubtful. Much has been said of it as an antidote to the poisonous effects of opium; and there is no doubt that some of the symptoms are relieved by its use; but it should not be relied on to the exclusion of measures for evacuating the stomach; nor should it be so administered that its greatest stimulant and depressing influences on the brain should coincide with the similar influences of opium.

Applied to the eye, belladonna has the property of dilating the pupil exceedingly, and for this purpose it is employed by oculists previously to the operation for cataract. Dilatation usually comes on in about an hour, is at its greatest height in three or four hours, and continues often for one or two days, or even longer. In cases of partial opacity of the crystalline lens, confined to the centre of that body, vision is temporarily improved by a similar use of the remedy; and it may also be beneficially employed, when, from inflammation of the iris, there is danger of a permanent closure of the pupil. For these purposes, a strong infusion of the plant, or a solution of the extract, may be dropped into the eye, or a little of the extract itself rubbed upon the eyelids. The same application has been recommended in morbid sensibility of the eye. The extract, rubbed upon the areola of the breast, has been found quickly to arrest the secretion of milk; and, upon the abdomen, to relieve the vomiting of pregnancy, and other irritations sympathetic with the gravid uterus. Applied, in the form of a large plaster, above the pubes, it has been found very useful in relieving dysenteric tenesmus, and, as a dressing to a blistered surface over the abdomen, has been known to effect a cure in epidemic cholera; but in such a case much care would be required to prevent its poisonous effects. (*Ann. de Thérap.*, A.D. 1860, p. 49.) The decoction or extract, applied to the neck of the uterus, is asserted to have hastened tedious labour dependent on rigidity of the os tincæ; and spasmodic stricture of the urethra, neck of the bladder, and sphincter ani, anal fissures, and painful uterine affections, have been relieved by the local use of the extract, either smeared upon bougies, or administered by injection. In the latter mode it has relieved strangulated hernia. It is asserted also to be useful in paraphimosis. The inhalation of the vapour from a decoction of the leaves or extract has been recommended in spasmodic asthma. For this purpose, two drachms of the leaves, or fifteen grains of the aqueous extract are employed to the pint of water. Relief is said to have been obtained in phthisis by smoking the leaves, infused when fresh in a strong solution of opium, and then dried.

Belladonna may be given in substance, infusion, or extract. The dose of the powdered leaves is for children from the eighth to the fourth of a grain, for adults one or two grains, repeated daily, or twice a day, and gradually increased till the characteristic effects are experienced. An infusion may be prepared by adding a

scruple of the dried leaves to ten fluidounces of boiling water, of which from one to two fluidounces is the dose for an adult. The extract is generally preferred in the United States. (See *Extractum Belladonnæ.*)

From its quicker action, more uniform strength, and greater cleanliness, *atropia* has been largely substituted for extract of belladonna for local use; and it is also much employed internally. (See *Atropia* in Part II.)

Off. Prep. of the Leaves. Extractum Belladonnæ; Extract. Belladonnæ Alcoholicum, *U. S.;* Tinctura Belladonnæ.

Off. Prep. of the Root. Atropia; Emplastrum Belladonnæ, *U. S.;* Extractum Belladonnæ Radicis Fluidum, *U. S.;* Linimentum Belladonnæ, *Br.* W.

BENZOINUM. *U. S., Br.*

Benzoin.

A solid balsam obtained from Styrax Benzoin, *U. S.* A balsamic resin obtained from Styrax Benzoin. *Br.*

Benjoin, *Fr.;* Benzoe, *Germ.;* Belzoino, *Ital.;* Benjui, *Span.*

The botanical source of benzoin was long uncertain. At one time it was generally supposed in Europe to be derived from the *Laurus Benzoin* of this country. This error was corrected by Linnæus, who, however, committed another, in ascribing the drug to *Croton Benzoë*, a shrub which he afterwards described under the name of *Terminalia Benzoin.* Mr. Dryander was the first who ascertained the true benzoin-tree to be a *Styrax;* and his description, published in the 77th vol. of the London Philosophical Transactions, has been copied by most subsequent writers.

Styrax. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Styraceæ.

Gen. Ch. Calyx inferior. *Corolla* funnel-shaped. *Drupe* two-seeded. *Willd.*

Styrax Benzoin. Willd. *Sp. Plant.* ii. 623; Woodv. *Med. Bot.* p. 294, t. 102. This is a tall tree of quick growth, sending off many strong round branches, covered with a whitish downy bark. Its leaves are alternate, entire, oblong, pointed, smooth above, and downy beneath. The flowers are in compound, axillary clusters, nearly as long as the leaves, and usually hang, all on the same side, upon short slender pedicels.

The benzoin, or *benjamin-tree*, is a native of Sumatra, Java, Borneo, Laos, and Siam. By wounding the bark near the origin of the lower branches, a juice exudes, which hardens upon exposure, and forms the *benzoin* of commerce. A tree is deemed of a proper age to be wounded at six years, when its trunk is about seven or eight inches in diameter. The operation is performed annually, and the product on each occasion from one tree never exceeds three pounds. The juice which first flows is the purest, and affords the whitest and most fragrant benzoin. It is exported chiefly from Bangkok in Siam, and Acheen in Sumatra, and comes into the western markets in large masses packed in chests and casks, and showing externally the impression of the reed mats in which they were originally contained.

Two kinds of benzoin are distinguishable in the market; one consisting chiefly of whitish tears united by a reddish-brown connecting medium, the other of brown or blackish masses without tears. The first is the most valuable, and has been called *benzoë amygdaloides*, from the resemblance of the white grains to fragments of blanched almonds; the second is sometimes called *benzoë in sortis*—benzoin in sorts—and usually contains numerous impurities. Between these two kinds there is every gradation. We have seen specimens consisting of yellowish-white homogeneous fragments, which when broken presented a smooth, white, shining surface. These were no doubt identical in constitution with the tears of the larger masses.

A factitious substance has been sold in our markets for benzoin, consisting of chips of wood agglutinated by a resinous substance, with no benzoic acid, and only a trace of the cinnamic. (J. M. Maisch, *Am. Journ. of Pharm.*, xxxv. 494.)

Properties. Benzoin has a fragrant odour, with very little taste; but, when chewed for some time, leaves a sense of irritation in the mouth and fauces. It breaks with a resinous fracture, and presents a mottled surface of white and brown or reddish-brown; the white spots being smooth and shining, while the remainder, though sometimes shining and even translucent, is usually more or less rough and porous, and

often exhibits impurities. In the inferior kinds, the white spots are very few, or entirely wanting. Benzoin is easily pulverized, and, in the process of being powdered, is apt to excite sneezing. Its sp. gr. is from 1·063 to 1·092. When heated it melts, and emits thick, white, pungent fumes, which excite cough when inhaled, and consist chiefly of benzoic acid. It is wholly soluble, with the exception of impurities, in alcohol, and is precipitated by water from the solution, rendering the liquor milky. It imparts to boiling water a notable proportion of benzoic acid. Lime-water and the alkaline solutions partially dissolve it, forming benzoates, from which the acid may be precipitated by the addition of other acids. Its chief constituents are resin and benzoic acid; and it therefore belongs to the balsams. The white tears and the brownish connecting medium are said by Stolze to contain nearly the same proportion of acid, which, according to Bucholz, is 12·5 per cent., to Stolze, 19·8 per cent. In a more recent examination by Kopp, the white tears were found to contain from 8 to 10 per cent. of acid, and the brown 15 per cent. (*Journ. de Pharm.*, 3e sér., iv. 46.) The resin is of three kinds, one extracted with the benzoic acid by a boiling solution of carbonate of potassium in excess, another dissolved by ether from the residue, and the third affected by neither of these solvents. Besides benzoic acid and resin, the balsam contains a little extractive, and traces of volatile oil. Benzoin retards the oxidation of fatty matters, and thus tends to prevent rancidity.

It appears from recent researches that benzoin, besides its own characteristic acid, often contains also the cinnamic, which is found more especially in the white tears. Indeed, Hermann Aschoff obtained from some benzoin of Sumatra a pure cinnamic acid, without any benzoic; and Messrs. Kolbe and Lautermann, upon examining a specimen of the tears, discovered what they at first supposed to be a peculiar acid, but which, on further investigation, proved to be a mixture of the cinnamic and benzoic acids. Aschoff recommends the following method of detecting cinnamic acid. Boil the benzoin with milk of lime, filter, decompose with muriatic acid, and add either bichromate of potassium with sulphuric acid, or permanganate of potassium, when, if cinnamic acid be present, the odour of oil of bitter almonds will be perceived. The two acids which, when they occur together in benzoin, are said to be always mixed in the same proportion, may be at least partially separated by simple crystallization; their melting points being very different, that of benzoic acid 249° F., and that of the mixed acid, consisting of one part of the cinnamic and two of the benzoic, only 78° F. (*Pharm. Journ.*, Aug. 1863, p. 77.) According to Mr. A. C. Curtis, cinnamein may be obtained by boiling benzoin with twice its bulk of lime in forty parts of water for fifteen or twenty minutes, filtering, cooling, adding muriatic acid, washing the precipitate, and recrystallizing from water acidulated with muriatic acid. (*Am. Journ. of Pharm.*, Nov. 1872, p. 486.)

Medical Properties and Uses. Benzoin is stimulant and expectorant, and was formerly employed in pectoral affections; but, except as an ingredient of the compound tincture of benzoin, it has fallen into disuse. Trousseau and Pidoux recommend strongly its inhalation in chronic laryngitis. Either the air of the chamber may be impregnated with its vapour by placing a small portion upon some live coals, or the patient may inhale the vapour of boiling water to which the balsam has been added. It is employed in pharmacy for the preparation of benzoic acid (see *Acidum Benzoicum*); and the milky liquor resulting from the addition of water to its alcoholic solution is sometimes used as a cosmetic, under the impression that it renders the skin soft. A tincture has been strongly recommended in fissures of the anus. In the East Indies, the balsam is burnt by the Hindoos as a perfume in their temples.*

Off. Prep. Acidum Benzoicum; Adeps Benzoatus, *Br.;* Tinctura Benzoini, *U. S.;* Tinctura Benzoini Composita; Unguentum Benzoini, *U. S.* W.

BERBERIS. *U. S. Secondary.*

Barberry.

The bark of the root of Berberis vulgaris. *U. S.*

Epine-vinette, Vinettier, *Fr.;* Fauerach, gemeiner Sauerdorn, Berberitze, *Germ.;* Berbero, *Ital., Span.*

* A styptic liquid, prepared by a Roman pharmaceutist named *Pagliari*, and kept secret for a

BERBERIS. *Sex. Syst.* Hexandria Monogynia. — *Nat. Ord.* Berberaceæ. *Lindley.* *Gen. Ch. Sepals* six, with interior scales. *Petals* six, with two glands at the base. *Stamens* six, without denticulations. *Pericarp* fleshy, oblong, two to three seeded. *Seeds* erect, oblong, with a crustaceous skin. *Lindley.*

The plants belonging to this genus are shrubs, with the inner bark and wood yellow, and with leaves and berries of a sour taste. Besides the officinal Berberis vulgaris, there are other species of which the products have been medicinally employed. The *Lycium*, or λυκιον of the ancients, highly valued as a local application in affections of the eye and eyelids, and used for various other purposes, is supposed to be the medicine still used in India for the same affections, under the name of *rusot* or *ruswut*. This, according to Dr. Royle, is an extract from the wood or roots of different species of Berberis, as *B. Lycium*, *B. aristata*, &c., growing in Upper India, especially near Lahore. Combined with opium and alum, it is much used, and with great asserted benefit, in both incipient and chronic ophthalmia. It has been employed also by European practitioners for the same purpose, and especially by Mr. Walker of Edinburgh, who found it very efficient. The preparation used by him consisted of equal parts of lycium and burnt alum, with half the quantity of opium, and was applied, mixed with lemon-juice to the consistence of cream, over the eyelids and eyebrows. (J. V. Simpson, *Pharm. Journ.*, xiii. 415.) More recently the remedy has been used by Mr. L. W. Stewart, Surgeon in the Madras army, with highly favourable results, in the treatment of intermittent, remittent, and typhoid fevers, diarrhœa, and dyspepsia. (*Pharm. Journ. and Trans.*, Dec. 1865, p. 303.)

Berberis vulgaris. Gray's *Manual of Botany*, p. 19; Woodv. *Med. Bot.* p. 618, t. 219. This is a native of Europe, but grows wild in waste grounds in the eastern parts of New England, and is sometimes cultivated in gardens on account of its berries. It is a spreading shrub, from four to six feet or more in height, with thorny branches, a light-gray bark, and a fine yellow wood. The leaves are somewhat obovate, with ciliated teeth on their edges, and upon the young shoots three-parted and spiny. The flowers, which are in drooping many-flowered racemes, have yellow entire petals, and are succeeded by oblong scarlet berries. It is a vulgar error to suppose that the vicinity of this plant is injurious to wheat. Under the name of *Berberis Canadensis*, Pursh described an American plant, which grows in hilly districts, from the borders of Canada to the Carolinas, and which is characterized, according to Gray, by its repandly-toothed leaves, with the teeth less bristly pointed, by its few-flowered racemes, its petals notched at the apex, and its oval berries. By Dr. Hooker, however, it is considered a variety of B. vulgaris, from which it differs only in the points mentioned. It is from one to three feet high.

Properties. The *berries*, which grow in loose bunches, are oblong and of a red colour, have a grateful, sour, astringent taste, and contain malic and citric acids. They are refrigerant, astringent, and antiscorbutic, and are used in Europe, in the form of drink, in febrile diseases and diarrhœas. An agreeable syrup is prepared from the juice; and the berries are sometimes preserved for the table. Dr. Graeger found in the ripe fruit, 15·58 per cent. of integuments and seeds, 17·20 of soluble solid constituents, and 67·22 of water. The constituents of the juice in 100 parts

time, has acquired some reputation among the French army surgeons. It is made by boiling, for six hours, eight ounces of tincture of benzoin (containing about two ounces of the balsam), a pound of alum, and ten pounds of water, in a glazed earthen vessel, stirring constantly, and supplying the loss with hot water. The liquor is then strained and kept in stopped bottles. It is limpid, styptic, of an aromatic smell, and said to have the property of causing an instantaneous coagulation of the blood. (See *Am. Journ. of Med. Sci.*, N. S., xxv. 199.) — *Note to the tenth edition.*

M. Meyer, believing that the long boiling in the foregoing process is injurious, if in no other way, by dissipating the benzoic acid, proposes to dispense with it, and has substituted the following formula, which furnishes a product always identical. Take tears of benzoin, 6 grammes (about ℥iss), alcohol at 90° C. 15 grammes; dissolve and add of water 300 grammes, alum 30 grammes; mix and boil till the liquid becomes clear. The liquid should mark 6° on the hydrometer. (*Journ. de Pharm. et de Chim.*, 4e sér., v. 123.)

Fumigating pastiles are made from 16 parts of benzoin, 4 of balsam of Tolu, 4 of yellow saunders, 1 of labdanum, 48 of charcoal, 2 of nitre, 1 of tragacanth, 2 of gum arabic, and 12 of cinnamon-water, by reducing the solid ingredients to powder, and mixing the whole into a plastic mass, which is to be formed into cones, flattened at the base, and dried first in the air, and then in a stove. (Soubeiran, *Trait. de Pharm.*, 3e ed., i. 463.)

of fresh berries, were 5·92 parts of malic acid, 4·67 of sugar, 6·61 of gum, 67·16 water, and 0·06 salts of potassa and lime. (*Am. Journ. of Pharm.*, Jan. 1, 1873, p. 14.) The *root* and *inner bark* have been used for dyeing yellow. The *bark of the root* is the officinal portion. This is grayish on the outside, yellow within, very bitter, and stains the saliva when chewed. Brandes found in 100 parts of the root 6·63 of bitter, yellow extractive, 1·55 of brown colouring matter, 0·35 of gum, 0·20 of starch, 0·10 of cerin, 0·07 of stearin, 0·03 of chlorophyll, 0·55 of a subresin, 55·40 of lignin, and 35·00 of water. The active properties reside in the extractive matter of Brandes, which, however, has subsequently been found to owe its virtues, as well as colouring properties, to a peculiar crystallizable principle, possessed of alkaline properties, and named *berberin*, or more properly *berberina*. This alkaloid appears to have been first discovered, in 1826, in a species of Xanthoxylum, by Chevallier and Pelletan, who, from its colour and taste, named it *xanthopicrite*. Buchner and Herberger, in 1835, found it in Berberis vulgaris, and named it berberin; but none of these chemists were aware of its alkaline properties. Indeed, the substance obtained by them, at least the berberin of Buchner, must have been a native salt of the proper alkaloid, which was not, therefore, procured in a pure state. Subsequently Fleitmann demonstrated its basic character, and published an account of several of its salts. It is not confined to the barberry, but has been found, by various chemists, in several other plants, particularly those combining bitterness and a yellow colour, as in various products of Cocculus palmatus, Hydrastis Canadensis, Xanthoriza apiifolia, Coptis Teeta, Xanthoxylum Clava Herculis, Coscinium fenestratum, and others belonging to the natural families of *Berberaceæ*, *Menispermaceæ*, and *Ranunculaceæ*. Indeed, few if any of the known alkaloids are so widely diffused as this appears to be in the vegetable kingdom.*

Berberina may be obtained most readily from its sulphate. Prof. Procter has given the following process for preparing it, based upon a suggestion of Mr. Merrill, of Cincinnati. The coarsely powdered root is to be exhausted by repeated decoction with boiling water, and the mixed liquids, after filtration, are to be evaporated to a soft extract. This is to be digested several times with stronger alcohol, in the proportion of a pint to half a pound of the root, until exhausted, one-fourth of its bulk of water is to be added to the tincture, and five-sixths of the alcohol to be distilled off. To the residue, while still hot, sulphuric acid is to be added in excess, and the liquid allowed to cool. The sulphate of berberin is deposited in crystals, and having been purified by recrystallization, is to be decomposed by the addition, in excess, to its solution in boiling water, of freshly precipitated protoxide of lead, the solution being kept hot until the decomposition is completed. This may be known by the absence of a precipitate when acetate of lead is added to a drop of the clear liquid. The liquid is then to be filtered, and set aside to crystallize. Thus obtained, berberina is in the form of a yellow powder, which, under the microscope, appears to consist of groups of minute, acicular crystals. It has a bitter taste, is soluble in about 100 parts of cold water, still less soluble in cold alcohol, freely soluble in both these liquids when hot, and insoluble in ether. It forms salts of difficult solubility with muriatic and sulphuric acids, and is distinguished by being copiously precipitated by the former acid from its cold watery solution in the form of crystals of the muriate. It is freely dissolved by acetic acid, which forms with it a readily soluble salt. (*Am. Journ. of Pharm.*, Jan. 1864, p. 10.) Its formula is, according to Fleitmann, $C_{42}H_{18}NO_9$, but, on the more recent authority of Perrins, $C_{40}H_{17}NO_8$. (*Pharm. Journ.*, April, 1863, p. 464.) The *muriate of berberina*, which is the salt that has attracted most notice, may be readily obtained by using muriatic instead of sulphuric acid in the above process, and purifying the precipitate by solution in hot alcohol, and subsequent refrigeration. It is in fine acicular crystals, of a bright-yellow colour, and intensely bitter taste, very slightly soluble in cold water, to which, however, it imparts a deep-yellow colour, slightly soluble also in cold alcohol, but dissolved in large proportion by both liquids when hot. By concentrated nitric acid both this salt and its base are decomposed, with the production of a dark-red colour, and the escape of nitrous fumes.

* For a list of all the plants from which it has been obtained, see a paper by J. Dyson Perrins, contained in the *Am. Journ. of Pharm.* (Sept. 1863, p. 456).

Besides berberina, another alkaloid has been discovered in the root of the barberry, for which the name of *vinetina*, derived from the French name of the plant, has been proposed. *Oxycanthin* and *berbina* are other, though less appropriate names, which have been applied to this principle. To procure it, the mother-liquor of berberina is precipitated by carbonate of sodium, the precipitate treated with dilute muriatic acid, and the liquid filtered and precipitated by ammonia. The impure alkaloid thus obtained may be purified by washing with water, drying, exhausting with ether, evaporating, dissolving the residue in dilute muriatic acid, and finally precipitating by ammonia. Vinetina is a white amorphous powder, crystallizable from its alcoholic and ethereal solutions, purely bitter, fusible unchanged at 283° F., insoluble or but slightly soluble in water, sparingly dissolved by cold but freely by hot alcohol and ether, and freely soluble in alcohol. It forms soluble salts with the acids, and its muriate is white. When deprived of one eq. of water at 212°, it has the formula $C_{32}H_{23}NO_{11}$. (*Am. Journ. of Pharm.*, xxxiii. 455.)

Medical Properties. Barberry is in small doses tonic, in larger cathartic, and was formerly given in jaundice, in which, though probably originally employed on account of its yellow colour, it may be useful, when the influence of a gentle tonic and laxative is required. It may be used in the form of decoction. There can be little doubt that its alkaloid berberina, from its extensive diffusion in plants used in medicine, is possessed of valuable remedial properties, and capable of advantageous application in many diseases. It would be desirable to test thoroughly its antiperiodic properties. Piorry considered them as superior to those of quinia, and found it of great benefit in miasmatic fevers. (*Lancet*, Oct. 5, 1872, p. 498.) It may be used in the form of the muriate, of which the dose is stated at from one to ten grains, according to the effect desired. Should it come into extensive use, it would be more conveniently obtained from the root of our native Hydrastis Canadensis, which yields it very copiously. W.

BISMUTHUM. *U.S., Br.*

Bismuth.

Commercial bismuth of good quality. *U.S.* A crystalline metal. As met with in commerce it is generally impure. *Br.*

Etain de glace, Bismuth, *Fr.;* Wissmuth, *Germ.;* Bismutte, *Ital.;* Bismut, *Span.*

Bismuth occurs usually in the metallic state, occasionally as a sulphuret, and rarely as an oxide. It is found principally in Saxony. It occurs also in Cornwall, and has been found at Monroe, in Connecticut, and in Archer county, Texas. (*Amer. Journ. of Pharm.*, May, 1871, p. 228.) It has recently been discovered largely in South Australia, whence a quantity of it has been sent into commerce. (*Pharm. Journ. and Trans.*, Aug. 1867, p. 95.) It is obtained almost entirely from native bismuth, which is heated by means of wood or charcoal, whereby the metal is fused and separated from its gangue. Nearly all the bismuth of commerce comes from Saxony.

Bismuth was first distinguished as a metal by Agricola in 1520. Before that period it was confounded with lead. It is a brittle, pulverizable, brilliant metal, of a crystalline texture, and of a white colour with a slight reddish tint. Its crystals are in the form of cubes. It undergoes but a slight tarnish in the air. Its sp. gr. is 9·8, melting point 507° (*Brande and Taylor*), eq. number 213, and symbol Bi. When impure bismuth solidifies after fusion, globules of the metal, nearly pure, are thrown up from the mass. This takes place when the metal contains as much as 50 per cent. of impurity. The same phenomenon does not occur when pure bismuth is melted. (*R. Schneider.*) At a high temperature, in close vessels, bismuth volatilizes, and may be distilled over. When heated in the open air to a full red heat, it takes fire, and burns with a faint blue flame, forming an oxide of a yellow colour. This is the *teroxide*, and consists of one eq. of bismuth 213, and three of oxygen 24 = 237. There is another compound of bismuth and oxygen, consisting of one eq. of the former and five eqs. of the latter, which, having acid properties, is called *bismuthic acid*, BiO_5. It is obtained in the form of a hydrate by boiling nitrate of bismuth in solution of potassa, washing the precipitate, and mixing it while moist with solu-

tion of potassa into which chlorine is passed. A mixture of teroxide and bismuthic acid is precipitated, from which the former is separated by digestion with nitric acid. The hydrated acid remaining, when washed and dried, is in the form of a red powder, which gives up its water at 266°, and at a higher heat loses oxygen. Bismuth is acted on feebly by muriatic acid, but violently by nitric acid, which dissolves it with a copious extrication of red fumes. Sulphuric acid, when cold, has no action on it, but at a boiling heat effects its solution with the extrication of sulphurous acid. As it occurs in commerce, it is generally contaminated with other metals, among which is arsenic in minute quantity, and sometimes a very small proportion of thallium. It may be purified from all contaminating metals by dissolving the bismuth of commerce in diluted nitric acid, precipitating the clear solution by adding it to water, and reducing the white powder thus obtained with black flux. The same precipitate is obtained by adding ammonia to the nitric solution; if the supernatant liquor is blue, the presence of copper is indicated; if the precipitate is yellowish, iron is present.

Pharmaceutical Uses, &c. Bismuth is not used in medicine in an uncombined state, but is employed pharmaceutically to obtain the subcarbonate and subnitrate of bismuth, the only medicinal preparations formed from this metal. In the arts it is used to form a white paint for the complexion, called *pearl white;* and as an ingredient of the best pewter.

Off. Prep. Bismuthi Subcarbonas, *U. S.;* Bismuthi Subnitras, *U. S.;* Bismuthum Purificatum, *Br.* B.

BRAYERA. *U. S., Secondary.*

Koosso.

The flowers and unripe fruit of Brayera anthelmintica. *U. S.*

Off. Syn. CUSSO. *Kousso.* The flowers and tops of Brayera anthelmintica. *Br.* BRAYERA. *Nat. Ord.* Rosaceæ.

Gen. Ch. "*Calyx* with the tube bibracteolate at the base, turbinate; throat internally constricted by a membranous ring; the limb with two series of segments, each five in number, the outer much larger. *Petals* five, inserted in the throat of the calyx, small, linear. *Stamens* from 15 to 20, inserted with the petals. *Filaments* free, unequal. *Anthers* bilocular, dehiscing longitudinally. *Carpels* two at the bottom of the calyx, free, unilocular, containing one or two pendulous ovules. *Styles* terminal, exserted from the throat of the calyx, thickened upward. *Stigmas* subpeltate, dilated, crenate, oblong." The flowers are said to be dicœcious; though the male have well-developed carpels.

Brayera anthelmintica. Kunth; De Cand. *Prodrom.* ii. 580; Pereira, *Mat. Med.*, 3d ed., ii. 1818.—*Hagenia Abyssinica.* Lamarck.—*Banksia Abyssinica.* Bruce. This is a tree about 20 feet high, growing on the table-land of Abyssinia, at an elevation of not less than six or seven thousand feet. The branches exhibit circular cicatrices, left by the fallen leaves. These are crowded near the ends of the branches, large, pinnate, sheathing at the base, with opposite, lanceolate, serrate leaflets, villose at the margin, and nerved beneath. The flowers are tinged with purple, pedicelled, with an involucre of four roundish, oblong, obtuse, membranous bractes, and are arranged in fours, upon hairy, flexuous, bracteate peduncles, with alternate branches. They are small and of a greenish colour, becoming purple. These and the unripe fruit are the parts of the plant employed. The petals are apt to be wanting in the dried flowers. They are brought from Abyssinia packed in boxes. The Abyssinian name of the medicine has been variously spelled by European writers kosso, kousso, cusso, cosso, &c.; but that at the head of this article is deemed the most appropriate English title, as it indicates the proper pronunciation of the word.

Properties. The dried flowers are in unbroken though compressed clusters. The general colour of the mass is greenish-yellow. As the medicine, from its high price, is apt to be adulterated, it should be procured in the unpowdered state, in which the botanical characters of the flower will sufficiently test its genuineness. It has a fragrant balsamic odour; and the taste, little perceptible at first, becomes in a short time somewhat acrid and disagreeable. Analyzed by Wittstein, it was found to con-

tain, in 100 parts, 1·44 of fatty matter and chlorophyll, 2·02 of wax, 6·25 of bitter acrid resin, 0·77 of tasteless resin, 1·08 of sugar, 7·22 of gum, 24·40 of tannic acid, 40·97 of lignin, 15·71 of ashes, with 0·14 parts loss. To Clemens Willing it yielded a small quantity of volatile oil, having the odour of the flowers, much extractive, tannic acid colouring iron green, a crystallizable acid, and a resin with a bitter and astringent taste and the odour of the oil. (*Chem. Cent. Blatt*, Marz 31, 1855, p. 224.) In which of these constituents the virtues of the medicine reside remained undetermined. Claims for this honour have been presented on the part of the *koossine* of Signor Pavesi, of Mortara, in Piedmont, and they would appear to have been recently confirmed.

Since the publication of the immediately preceding edition of this work (13th) the composition of koosso has been investigated by Dr. C. Bedall, of Munich, who determined that the koossine or tæniine of Pavesi is identical with the bitter acrid resin of Wittstein. It may be obtained by treating koosso repeatedly with alcohol to which hydrate of lime has been added; the residue is boiled with water; the liquids are mixed, filtered, and distilled; and the residue treated with acetic acid, which precipitates the koossine in a white flocculent form, soon becoming denser and resin-like, and, on drying, yellowish, or, at a higher temperature, brown. The product is 3 per cent. In bulk, koossine has an odour like that of Russian leather, a persistent bitter and acrid taste, a yellowish or yellowish-white colour, and an indistinct crystalline appearance under the microscope. It is very sparingly soluble in water, but freely so in alcohol, ether, and alkaline solutions. Its empirical formula is $C_{26}H_{22}O_5$. (*Am. Journ. of Pharm.*, Sept. 1872, p. 394.)

Medical Properties. Koosso is highly valued in Abyssinia as a vermifuge. Bruce speaks of it in his travels, and gives a figure of the plant. Dr. Brayer, a French physician, practising in Constantinople, employed the medicine effectively, and published a treatise on it at Paris, so long ago as 1823. It was in his honour that Kunth adopted his generic title of the plant. Much attention has recently been attracted to this medicine; and trials made with it have proved that it has extraordinary efficacy in the destruction and expulsion of the tapeworm. Its effects, when taken internally, are not very striking. In the ordinary dose it sometimes produces heat of stomach, nausea, and even vomiting, and shows a tendency to act on the bowels, though this effect is not always produced. It appears to operate exclusively as a poison to the worms; and has been found equally effectual in both kinds of tapeworm. The high price demanded for it has tended very much to restrict the use of the remedy; but, should the demand continue, it will no doubt be supplied at a reasonable cost, as it is brought by caravans from Abyssinia into Egypt; and the monopoly which was at first the cause of its expensiveness cannot be long maintained. The medicine is taken in the morning upon an empty stomach, a light meal having been made the preceding evening. A previous evacuation of the bowels is also recommended. The flowers are given in the form of powder, mixed with half a pint of warm water; the mixture being allowed to stand for fifteen minutes, then stirred up, and taken in two or three draughts at short intervals. The medicine may be preceded and followed by lemonade. The medium dose for an adult is half an ounce, which may be diminished one-third for a child of 12 years, one-half for one of 6, and two-thirds for one of 3. Should the medicine not act on the bowels in three or four hours, a brisk cathartic should be administered. One dose is said to be sufficient to destroy the worm. Should the quantity mentioned not prove effectual, it may be increased to an ounce or more.

For the last few years, the principle koossine has been considerably used in Germany, and the following conclusions have been arrived at by Dr. Bedall, whose investigation into its nature, &c., have been before referred to. Koossine is the only active principle of koosso, and should be used preferably. It is one of the best tæniafuges; two scruples being sufficient to discharge the worm; and, taken in 2 or 4 powders, usually agrees with the patient; only exceptionally causing transient nausea and vomiting. (*Am. Journ. of Pharm.*)

Off. Prep. Infusum Cusso, *Br.* W.

BROMINIUM. *U.S.*

Bromine.

Off. Syn. BROMUM. *Bromine.* A liquid non-metallic element, obtained from sea-water, and from saline springs. *Br.*

Brome, *Fr.;* Brom, *Germ.;* Bromo, *Ital.*

Bromine is an elementary body, possessing many analogies to chlorine and iodine. It was discovered in 1826 by M. Balard, of Montpellier, in the bittern of sea-salt works, in which it exists as a bromide of magnesium. Since then it has been found in the waters of the ocean, in certain marine animals and vegetables, in various aquatic plants, as the water-cress, in numerous salt springs, and, in two instances, in the mineral kingdom — in an ore of zinc, and in the cadmium of Silesia. It has also been detected by M. Mène in the coal-gas liquor of the Paris gas works. In the United States it was first obtained by Professor Silliman, who found it in the bittern of the salt works at Salina, in the State of New York. It was discovered in the salt wells, near Freeport, Pa., by Dr. David Alter, who has been engaged for several years in manufacturing it on a large scale. The bittern of the salt wells of that locality contains the bromine combined with sodium and magnesium, and affords an average product of nine drachms of bromine to the gallon; though the yield of different wells varies greatly. Bromine has been detected also in the waters of the Saratoga springs. Minute quantities of this, as well as of chlorine and iodine, may be detected in any mixture by means of spectrum analysis. For the method employed for this purpose by Alex. Mitscherlich, see *Chem. News* (Nov. 24, 1865, p. 243).

Preparation. Bromine is obtained from bittern, rich in this element, on the same principle that chlorine is procured from chloride of sodium; that is, by the action of diluted sulphuric acid and deutoxide of manganese. As manufactured near Freeport, the reaction takes place with the bromides of sodium and magnesium, with the result of forming a residue, consisting of the sulphates of sodium and magnesium, mixed with sulphate of manganese. The distillation should be performed at a gentle heat, by means of a water-bath, into a refrigerated receiver containing water. We are informed by Dr. Thomas Magill, of Allegheny Co., Pa., that Dr. Alter first heats the bittern in an iron boiler, and then introduces it hot into the retort, thus facilitating the process.

The bittern of the salt works of Schoenbeck, in Germany, which contains only seven-tenths of one part of bromine in 1000 parts, is subjected to several successive operations, whereby the solution is reduced in bulk, and so far purified as to contain chiefly the bromide and chloride of magnesium. The chlorine is separated in the form of muriatic acid gas, by heating the liquid with sulphuric acid, at a temperature not exceeding 259°; the sulphates are crystallized out; and the bromine is evolved in the usual manner by sulphuric acid and deutoxide of manganese. The last operation, occupying six hours, is performed in a leaden still, of sufficient capacity to contain a charge of 84 pounds of the concentrated bittern, 60 or 70 pounds of weak sulphuric acid from the leaden chambers, and 40 pounds of deutoxide of manganese. The product is 4 pounds of bromine. (Moritz Herman, *Journ. de Pharm.*, Janv. 1854.)

Bromine has also been obtained from sea-weeds by carbonizing them, lixiviating the carbonaceous residue, and then separating the ingredients, among which are iodine and bromine. For the particulars of the process, see *Chem. News* (July 6, 1866, p. 2).

Properties. Bromine is a volatile liquid, of a dark-red colour when viewed in mass, but hyacinth-red in thin layers. Its taste is very caustic, and its smell strong and disagreeable, having some resemblance to that of chlorine.* Its density is very nearly 3 (2·966, *Br.*). At 4° (12°, *Baumhauer*)† below zero it becomes a hard, brittle, crystalline solid, having a dark leaden colour, and a lustre nearly metallic. It

*Inhaled in the form of vapour it produces intense irritation, and endangers asphyxia through spasm of the glottis. A case which had nearly proved fatal occurred under the notice of G. P. Duffield, Ph. D., of Detroit, and was apparently saved by throwing steam sufficiently cooled into the larynx. (*Am. Journ. of Pharm.*, July, 1868, p. 288.) — *Note to the thirteenth edition.*

† See *Am. Journ. of Pharm.*, Oct. 1872, p. 452. The higher degree usually given in chemical works is ascribed by Baumhauer to the presence of water in the bromine examined. (*Note to the fourteenth edition.*)

boils at about 117°, forming a reddish vapour resembling that of nitrous acid, and of the sp. gr. 5·39. It evaporates readily, a single drop being sufficient to fill a large flask with its peculiar vapour. Shaken with solution of soda in slight excess it becomes colourless, and, if now coloured again by a little bromine, does not assume a blue colour on the addition of a cold solution of starch (*Br.*); thus showing the absence of iodine.

Bromine is sparingly soluble in water, to which it communicates an orange colour, more soluble in alcohol, and still more so in ether.* By the aid, however, of bromide of potassium, it may be dissolved to any desirable extent in water. Its alcoholic and ethereal solutions lose their colour in a few days, and become acid from the generation of hydrobromic acid. It bleaches vegetable substances like chlorine, destroys the colour of sulphate of indigo, and decomposes organic matters. Its combination with starch has a yellow colour. It corrodes the skin and gives it a deep-yellow stain. Bromine is intermediate in its affinities between chlorine and iodine; since its combinations are decomposed by chlorine, while, in its turn, it decomposes those of iodine. Its eq. number is 78·4 (80, *Dumas*), and its symbol Br. It forms acids with both oxygen and hydrogen, called bromic and hydrobromic acids, which are analogous in properties and composition to the corresponding acids of chlorine and iodine. It combines also with chlorine, forming chloride of bromine, which probably has the formula $BrCl_5$. This is prepared by passing chlorine through bromine, and condensing the vapours at a low temperature. It is a reddish-yellow liquid, very volatile, soluble in water, and having a penetrating odour and disagreeable taste.

Commercial bromine sometimes contains as much as 6 or 8 per cent. of *bromide of carbon*, as ascertained by M. Poselger. He discovered the impurity by submitting some bromine to distillation, during the progress of which the boiling point rose to 248°. The residuary liquid at this temperature was colourless, and when freed from a little bromine, proved to be bromide of carbon as an oily, aromatic liquid.†

In testing for bromine in mineral or saline waters, the water is evaporated in order to crystallize most of the salts. The solution, after having been filtered, is placed in a narrow tube, and a few drops of strong chlorine-water are added. If this addition produces an orange colour, bromine is present. The water examined, in order that the test may succeed, must be free from organic matter, and the chlorine not be added in excess. Bromine may be detected in marine vegetables by carbonizing them in a covered crucible, exhausting the charcoal, previously pulverized, with boiling distilled water, precipitating any alkaline sulphuret present in the solution by sulphate of zinc, and then adding successively a few drops of nitric acid and a portion of ether, shaking the whole together. If bromine be present, it will be set free and dissolve in the ether, to which it will communicate an orange colour. (*Dupasquier.*) According to Reynoso, a more delicate test is furnished by oxidized water, which liberates bromine from its compounds, without reacting on it when free. The mode of proceeding is as follows. Put a piece of the deutoxide of barium in a test-tube, and add successively distilled water, pure muriatic acid and ether. The materials are here present for generating oxidized water; and so soon as bubbles are seen to rise to the surface, the substance suspected to contain bromine is added, and the whole shaken together. If a bromide be present, the muriatic will give rise to hy-

* *Bromine-water a test for carbolic acid.* M. Landolt recommends this as very delicate. Bromine-water, added in excess to a very dilute solution of carbolic (phenic) acid, produces a yellowish-white, flocculent precipitate of tri-bromated carbolic acid. Even a 43,700th of crystallized acid causes a decided turbidness. To determine that the precipitate is really carbolic acid, submit it in a test-tube to the action of amalgam of sodium and water, with a quick and steady agitation. Then pour a little of the liquid into a small capsule, and add dilute sulphuric acid. If there be carbolic acid, its peculiar odour will be perceived. (*Journ. de Pharm.*, Janv. 1873, p. 86.)—*Note to the fourteenth edition.*

† It is stated by T. L. Phipson, Ph. D., that he has found in commercial bromine, accounted pure, a notable amount of cyanogen, and that it may be detected as follows.—Take of iron filings and bromine, of each half an ounce; add to the filings 2 or 2·5 ounces of water; introduce the bromine very gradually, stirring steadily; filter rapidly while warm from the reaction; and put the filtered liquid in a partially closed bottle. In the course of some hours a deposit of ferricyanide of iron (Berlin blue) will have formed, and may be collected on a filter. In the course of two days, the whole of the cyanogen will be deposited. In the samples of bromine thus examined he had found from 0·5 to 1 per cent. of cyanogen. (*Chem. News*, Aug. 1, 1873, p. 51.)—*Note to the fourteenth edition.*

drobromic acid; and the oxidized water, acting on this, will set free the bromine, which will dissolve in the ether, and give it a yellow tint.

Medical Properties. Bromine, from its analogy to iodine, was early tried as a remedy, and the result has demonstrated its value as a therapeutic agent. It acts like iodine as an alterative, and probably also as a stimulant to the lymphatic system, thereby promoting absorption. It has been employed in bronchocele, scrofulous tumours and ulcers, secondary and tertiary syphilis, amenorrhœa, diphtheric affections, chronic diseases of the skin, and hypertrophy of the ventricles. Magendie recommends it in cases in which iodine does not operate with sufficient activity, or has lost its effect by habit. The form in which it is employed is aqueous solution, the dose of which, containing one part of bromine to forty of distilled water, is about six drops taken several times a day.* Locally it is powerfully irritant, and in its concentrated state even caustic. When used as a wash for ulcers, from ten to forty minims may be added to a pint of water. Bromine has been found by Dr. Goldsmith, Surgeon of the U. S. Volunteers, extremely efficacious as a local remedy in hospital gangrene, being applied either pure or dissolved in water; and the same remedy, dissolved in water, with the aid of bromide of potassium, in the proportion of from 15 to 40 drops to the fluidounce, has produced very good effects in erysipelas. (See *Am. Med. Times*, June 20, 1863.) Of the compounds of bromine, the bromides of potassium, ammonium, iron, and mercury have been chiefly used. Some of them have been found to exercise a remarkable influence in allaying nervous irritation, and are now much employed for that purpose. See these titles respectively in the different parts of this work. The *chloride of bromine* has been used in cancer by Landolfi, of Naples, both externally as a caustic and internally. The caustic was usually formed of equal parts of the chlorides of bromine, zinc, gold, and antimony, made into a paste with flour. To assist the local treatment, he gave a pill, composed of the tenth of a drop of chloride of bromine, half a grain of extract of hemlock, and a grain of phellandrium seed, daily, for two months, and twice a day for two months more. (*Arch. Gén.*, Mai, 1855, p. 609.) A committee of the Paris Academy of Sciences, consisting of M. Broca and others, having practically examined the method of Landolfi in the hospitals, reported decidedly against it, not only as inefficacious, but as sometimes positively injurious. (*Gaz. Hebdom. de Méd. et Chir.*, Mai 9, 1856.)

Dr. J. Lawrence Smith, of Louisville, Ky., proposes the following as a convenient formula for a solution of bromine. Dissolve 160 grains of bromide of potassium in two fluidounces of water, add one troyounce of bromine, and, stirring diligently, pour in sufficient water to make the solution measure four fluidounces. The solution should be kept in accurately stopped bottles. This is a suitable preparation for application to hospital gangrene, and may be diluted to any desirable extent with water. (*Am. Journ. of Pharm.*, May, 1863, p. 202.)

Bromine, in an over-dose, acts as an irritant poison. The best antidote, according to Mr. Alfred Smee, is ammonia. A case of poisoning by this substance, which proved fatal in seven hours and a half, is related by Dr. J. R. Snell, of Long Island, N. Y. The amount swallowed was about an ounce, and the symptoms generally were those produced by the irritant poisons: such as violent inflammation of the lips, mouth, tongue, and œsophagus, with incessant burning pain, followed, in two hours and a half, by prostration, which soon ended in death. (*New York Journ. of Med.*, Sept. 1850.)

Bromine is extensively used in the art of the daguerreotypist.

Off. Prep. Ammonii Bromidum; Potassii Bromidum. B.

BUCHU. *U. S.*

Buchu.

The leaves of Barosma crenata, and of other species of Barosma. *U. S.*

* This is a very small dose, originally taken from Pereira's Materia Medica; and much more has been given with impunity. M. Pourché, of Montpellier, gave six drops of bromine in three ounces of distilled water three times in 24 hours. (*Trousseau and Pidoux.*) A safe and efficient dose would probably be two or three drops, largely diluted with distilled water, and gradually increased if necessary. (*Note to the thirteenth edition.*)

Off. Syn. BUCHU FOLIA. The dried leaves of Barosma betulina, Barosma crenulata, and Barosma serratifolia. *Br.*

This medicine consists of the leaves of different plants growing at the Cape of Good Hope, formerly ranked in the genus *Diosma*, but transferred by botanists to *Barosma*, so named from the strong odour of the leaves (βαρυς and οσμη). *B. crenata* (*B. betulina*, Br.), *B. crenulata*, and *B. serratifolia* are described by Lindley as medicinal species. The leaves of these and other Barosmas, and of some *Agathosmas*, are collected by the Hottentots, who value them on account of their odour, and, under the name of *bookoo* or *buchu*, rub them, in the state of powder, upon their greasy bodies.

Barosma. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Rutaceæ.

Gen. Ch. Calyx five-cleft or five-parted. Disk lining the bottom of the calyx, generally with a short scarcely prominent rim. *Petals* five, with short claws. *Filaments* ten; the five opposite the petals sterile, petaloid; the other five longer, subulate. *Style* as long as the petals. *Stigma* minute, five-lobed. *Fruit* composed of five cocci, covered with granular dots at the back. These plants are small shrubs, with opposite leaves and peduncled flowers. *Lindley.*

Barosma crenata. Lindley, *Flor. Med.* p. 213.—*Diosma crenata.* De Cand. *Prodrom.* i. 714; Woodv. *Med. Bot.*, 3d ed., v. 52. This is a slender shrub, with smooth somewhat angular branches, of a purplish colour. The leaves are opposite, ovate or obovate, acute, serrated and glandular at the edge, coriaceous, and full of small pellucid dots on the under surface. The flowers are white or of a reddish tint, and stand solitarily at the end of short, lateral leafy shoots.

Properties. The leaves, as found in the shops, are from three-quarters of an inch to an inch long, from three to five lines broad, elliptical, lanceolate-ovate or obovate, sometimes slightly pointed, sometimes blunt at the apex, very finely notched and glandular at the edges, smooth and of a green colour on the upper surface, dotted and paler beneath, and of a firm consistence. Their odour is strong, diffusive, and somewhat aromatic; their taste bitterish, and analogous to that of mint. These properties will distinguish them from senna, with which they might be confounded upon a careless inspection. They are sometimes mixed with portions of the stalks and fruit. Cadet de Grassicourt found them to contain, in 1000 parts, 6·65 parts of a light, brownish-yellow, and highly odorous volatile oil, 211·7 of gum, 51·7 of extractive, 11 of chlorophyll, and 21·51 of resin. Water and alcohol extract their virtues, which probably depend on the volatile oil and extractive. The latter is precipitated by infusion of galls.

The foregoing description of buchu leaves applies to the drug, as first seen by the author many years ago, when the chief product imported was probably that of B. crenulata, more or less mixed with the leaves of B. crenata. The first of these has now in great measure disappeared from our market, the importations consisting either of the leaves of B. crenata or B. serratifolia, in distinct parcels. The following is a concise description of the three different kinds of leaf. The leaves of *B. crenata* (*short buchu* or *round buchu*, as it is called in commerce) are "about three-quarters of an inch long, obovate, with a recurved truncated apex, and sharp, cartilaginous, spreading teeth;" those of *B. crenulata*, of *medium size*, "are about an inch long, oval-lanceolate, obtuse, minutely crenated, and five-nerved;" those of *B. serratifolia*, or *long buchu*, "are from an inch to an inch and a half long, linear-lanceolate, tapering to each end, sharply and firmly serrated, three-nerved" (*Br.*). The last-mentioned leaves are also of more delicate structure than the others. Of the three species, the short-leaved was found by Mr. P. W. Bedford to yield an average of 1·21 per cent. of volatile oil; while the long-leaved, though more highly valued in the market, gave only 0·66 per cent., showing their great inferiority in strength. (*Proceed. of the Am. Pharm. Association*, A. D. 1863, p. 211.)

Medical Properties and Uses. Buchu is gently stimulant, with a peculiar tendency to the urinary organs, producing diuresis, and, like all similar medicines, exciting diaphoresis when circumstances favour this effect. The Hottentots have long used it in a variety of diseases. From these rude practitioners the remedy was borrowed by the resident English and Dutch physicians, by whose recommendation it

was employed in Europe, and has come into general use. It is given chiefly in complaints of the urinary organs, such as gravel, chronic catarrh of the bladder, morbid irritation of the bladder and urethra, disease of the prostate, and retention or incontinence of urine from a loss of tone in the parts concerned in its evacuation. It has also been recommended in dyspepsia, chronic rheumatism, cutaneous affections, and dropsy. From twenty to thirty grains of the powder may be given two or three times a day. The leaves are also used in infusion, in the proportion of an ounce to a pint of boiling water, of which the dose is one or two fluidounces. A tincture has been employed as a stimulant embrocation in local pains. There is an officinal fluid extract, of which the dose is half a fluidrachm.

Off. Prep. Extractum Buchu Fluidum, *U. S.;* Infusum Buchu; Tinctura Buchu, *Br.* W.

CADMIUM. *U. S.*

Cadmium.

This metal was introduced into the present U. S. Pharmacopœia, because used in the preparation of sulphate of cadmium. It is associated with zinc in its ores, and, being more volatile than that metal, comes over with the first portions of it distilled in the process for obtaining it. (See *Zincum.*) The cadmium is separated by dissolving the mixed metal in dilute sulphuric acid, precipitating the sulphuret by sulphuretted hydrogen, treating the precipitate with muriatic acid, and again precipitating with carbonate of ammonium. The carbonate of cadmium thus obtained, after being washed and dried, is mixed with charcoal, and exposed to a dull-red heat in an earthen retort, when the reduced metal distils over.

Properties. Cadmium is a white metal, resembling tin, but somewhat heavier and more tenacious. Like that metal, it crackles when bent. Its sp. gr. is 8·7, melting point about 440°, point of volatilization 480° (*Guy*), 320° C. (*Riemsdyk*)* equivalent 55·8, and symbol Cd. It is little affected by the air, but, when heated, combines with an eq. of oxygen, forming a reddish-brown or orange-coloured oxide, CaO, which combines with the acids to form salts. From its saline solutions the oxide is precipitated by the alkalies in the form of a white hydrate. Cadmium also combines with chlorine, iodine, bromine, and sulphur, in equivalent proportions. It is distinguished by forming a colourless solution with nitric acid, from which sulphuretted hydrogen or hydrosulphate of ammonium precipitates a lemon-yellow sulphuret, insoluble in an excess of the reagent, or in potassa or ammonia, and not volatilized at a red heat. Potassa produces a white precipitate insoluble in an excess, and ammonia a similar precipitate soluble in an excess of the precipitant. Zinc precipitates cadmium in the metallic state. "A neutral solution of the metal in nitric acid, after having been fully precipitated by carbonate of sodium in slight excess, yields a filtrate which is not affected by hydrosulphate of ammonium." (*U. S.*) This proves the absence of arsenic.

Medical Uses. According to Prof. Simpson, of Edinburgh, cadmium resembles antimony in its effects on the system. Dr. Garrod considers the metal, in this respect, more closely allied to zinc. In over-doses its salts appear to act as corrosive poisons. Three cases are recorded in which serious consequences resulted from inhaling the powdered carbonate, while used in polishing silver. The chief symptoms were constriction of the throat, embarrassed respiration, vomiting and purging, giddiness, and painful spasms. (*Annuaire de Thérap.*, A. D. 1859, p. 229.) Experiments by Dr. Wilh. Marmé demonstrate that the sulphuret of cadmium is not poisonous, but that all its compounds soluble in water or in diluted acids at the heat of the body are so; and they all operate in an analogous manner, locally as powerful irritants, and internally producing giddiness, vomiting, purging, slowness of pulse and respiration, prostration, loss of consciousness, and spasms. (*Neues Repertorium*, A. D. 1867, xvi. 303.) It is chiefly, if not exclusively, for external application that the preparations of this metal are used. Two of them have especially engaged attention; the iodide and sulphate. The latter is among the *Preparations* in the U. S. Pharmacopœia,

* Dr. A. von Riemsdyk, of the Netherland Mint, at Utrecht. (*Am. Journ. of Pharm.*, Sept. 1869, p. 424.)

and will be treated of in the *second part* of this work. (See *Cadmii Sulphas.*) The former will be noticed here.

Off. Prep. Cadmii Iodidum, *Br.;* Cadmii Sulphas, *U. S.;* Unguentum Cadmii Iodidi, *Br.* B.

CADMII IODIDUM. *Br.*

Iodide of Cadmium.

Iodide of cadmium (CdI) may be prepared by mixing iodine and filings of cadmium in a moist state. It is soluble in water and alcohol, and may be crystallized from either solution in large, white, transparent crystals, in the form of six-sided tables, of a pearly lustre. These are permanent in the air, melt at about 600° F. forming an amber-coloured liquid, and give off violet vapours at a dull-red heat. The salt is freely soluble in water and in alcohol, and the solution has an acid reaction. The Br. Pharmacopœia gives the following tests. The aqueous solution gives a yellow precipitate with sulphuretted hydrogen or sulphide of ammonium, insoluble in excess of the sulphide; and a white gelatinous precipitate with excess of solution of potash, the filtrate from which is unaffected by sulphide of ammonium. Ten grains dissolved in water gives with an excess of nitrate of silver a precipitate which, washed with water and afterwards with half an ounce of water of ammonia, and dried, weighs 12·5 grains.

Iodide of cadmium was introduced as an external remedy by Dr. A. B. Garrod, of London. He has employed it, with good effects, in the form of ointment, made of one part of the iodide to eight of lard, as a local application by friction to enlarged scrofulous glands, nodes, chronic inflammations of joints, certain cutaneous diseases, and chilblains. The ointment is soft and white, readily yields its iodine for absorption, and is preferable to the corresponding ointment of iodide of lead, the use of which endangers lead poisoning. (*Pharm. Journ. and Trans.*, Nov. 1857, p. 260.) B.

CAFFEA. *U. S.*

Coffee.

The seed of Coffea Arabica, *U. S.*

Café, *Fr.;* Kaffee, *Germ.;* Caffé, *Ital.;* Café, *Span.;* Bun, *Arabic;* Copi cotta, *Cingalese;* Kaeva, *Malay.*

Coffea. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Cinchonaceæ. *Lindley.*

Gen. Ch. "*Calyx* with a small, 4-5 toothed limb. *Corolla* tubular, funnel-shaped, with a 4-5 parted spreading limb. *Stamens* 4-5, inserted in the middle of the upper part of the tube, exserted or enclosed. *Style* bifid at the apex. *Berry* umbilicate, naked or crowned with the calyx, containing two seeds enclosed in a parchment-like putamen." *Lindley.*

Coffea Arabica. Linn. *Sp. Plant.* 245; *Bot. Mag.*, t. 1303. The coffee plant is a small tree, from fifteen to thirty feet in height. The branches are opposite, the lower spreading, the upper somewhat declining, and gradually diminishing in length, as they ascend, so as to form a pyramidal summit, which is covered with green foliage throughout the year. The leaves are opposite, upon short footstalks, oblong-ovate, acuminate, entire, wavy, four or five inches long, smooth and shining, of a dark-green colour on their upper surface, paler beneath, and accompanied with a pair of small pointed stipules. The flowers are white, with an odour not unlike that of the jasmine, and stand in groups in the axils of the upper leaves. The calyx is very small, the corolla salverform, with a nearly cylindrical tube, and a flat border divided into five lanceolate, pointed segments. The stamens project above the tube. The fruit, which is inferior, is a roundish berry, umbilicate at top, at first green, then red, and ultimately dark purple. It is about as large as a cherry, and contains two seeds surrounded by a paper-like membrane, and enclosed in a yellowish pulpy matter. These seeds, divested of their coverings, constitute coffee.

This tree is a native of Southern Arabia and Abyssinia, and probably pervades Africa about the same parallel of latitude, as it is found growing wild at Liberia, on

the western coast of the continent. It is cultivated in various parts of the world where the temperature is sufficiently elevated and uniform. Considerable attention has long been paid to its culture in its native country, particularly in Yemen, in the vicinity of Mocha, from which the demands of commerce were at first almost exclusively supplied. About the year 1690, it was introduced by the Dutch into Java, and in 1718, into their colony of Surinam. Soon after this latter period, the French succeeded in introducing it into their West India Islands, Cayenne, and the Isles of France and Bourbon; and it has subsequently made its way into the other West India Islands, various parts of tropical America, Hindostan, and Ceylon.

The tree is raised from the seeds, which are sown in a soil properly prepared, and, germinating in less than a month, produce plants which, at the end of the year, are large enough to be transplanted. These are then set out in rows at suitable distances, and in three or four years begin to bear fruit. It is customary to top the trees at this age, in order to prevent their attaining an inconvenient height, and to increase the number of the fruit-bearing branches. It is said that they continue productive for 30 or 40 years. Though almost always covered with flowers and fruit, they yield most largely at two seasons, and thus afford two harvests during the year. Various methods are employed for freeing the seeds from their coverings; but that considered the best is, by means of machinery, to remove the fleshy portion of the fruit, leaving the seeds surrounded only by their papyraceous envelope, from which they are afterwards separated by drying, and by the action of peeling and winnowing mills.

The character of coffee varies considerably with the climate and mode of culture. Consequently, several varieties exist in commerce, named usually from the sources from which they are derived. The *Mocha Coffee*, which is in small roundish grains, takes precedence of all others. The *Java Coffee* is highly esteemed in this country; but our chief supplies are derived from the West Indies and South America. Some good coffee has been brought from Liberia. Coffee improves by age, losing a portion of its strength, and acquiring a more agreeable flavour. It is said to be much better when allowed to ripen perfectly on the tree, than as usually collected. The grains should be hard, and should readily sink in water. When soft, light, black or dark-coloured, or musty, they are inferior.

Properties: Coffee has a faint, peculiar odour, and a slightly sweetish, somewhat austere taste. An analysis by M. Payen gives for its constituents, in 100 parts, 34 of cellulose, 12 of hygroscopic water, 10 to 13 of fatty matter, 15·5 of glucose, with dextrin and a vegetable acid, 10 of legumin, 3·5 of *chlorogenate of potassium and caffein*, 3 of a nitrogenous body, 0·8 of free caffein, 0·001 of concrete volatile oil, 0·002 of fluid volatile oil, and 6·697 of mineral substances. (*Journ. de Pharm.*, 3e sér., x. 266.) Pfaff recognised, in the precipitate produced by acetate of lead with the decoction of coffee, two peculiar principles, one resembling tannin, called *caffeo-tannic acid*, and the other an acid, called by him *caffeic acid*. The latter is thought to be identical with the chlorogenic acid of Payen. When strongly heated, it emits the odour of roasted coffee, and is supposed to be the principle to which the flavour of coffee as a drink is owing. A remarkable property of caffeic acid is that, when acted on by sulphuric acid and binoxide of manganese, it is converted into kinone, being in this respect analogous to kinic acid. The *sugar* of coffee is probably neither glucose as supposed by Payen, nor cane-sugar as stated by Rochleder, but peculiar; for, when the coffee is roasted, it does not answer to Trommer's test for glucose. (*Pharm. Journ.*, xvi. 526–8.) Caffeo-tannic acid has been ascertained by Klasiwetz to be a glucoside, resolvable into glucose and a peculiar crystallizable acid, $C_{18}H_8O_8$, named by him caffeic acid (*Journ. de Pharm. et de Chim.*, Oct. 1867, p. 307), and which may be obtained from coffee, by boiling a solution of the extract with caustic potassa, treating the resulting liquid with sulphuric acid in excess, and extracting the caffeic acid with ether, which yields it somewhat impure by evaporation. (*Ibid.*, January, 1868, p. 75.) Another acid, named *viridic acid*, has been obtained by M. Cech from coffee, by bruising the grains, removing the fat by boiling etherized alcohol, and exposing the residue, moistened from time to time, to the air. In a few days the matter assumes a green colour from the formation of *viridiate of calcium*, which will yield the acid to alcohol mixed with acetic acid. (*Ibid.*, Oct. 1867, p. 318.)

Caffein (*Caffeia*) was first discovered by Runge, and afterwards by Robiquet. According to Payen, it exists in coffee partly free, partly as a double salt, consisting of *chlorogenic acid*, combined with potassa and caffein. It may be obtained in the following manner. Exhaust bruised coffee by two successive portions of boiling water, unite the infusions, add acetate of lead in order to precipitate various principles accompanying the caffein, filter, decompose the excess of acetate of lead in the filtered liquor by sulphuretted hydrogen, concentrate by evaporation, and neutralize with ammonia. The caffein is deposited in crystals upon cooling, and may be purified by redissolving in water, treating with animal charcoal, and evaporating. H. J. Versmann, of Lubeck, recommends the following process as more economical. Powdered coffee, mixed with one-fifth of its weight of slaked lime, is exhausted, by means of percolation, with alcohol of 0·863; the tincture is distilled to separate the alcohol; the residue is rinsed out of the still with warm water, and the supernatant oil separated; the liquid is evaporated so as to solidify on cooling; and the crystalline mass thus obtained, having been expressed and dried by pressure in bibulous paper, is purified by solution in water with animal charcoal, and recrystallization. (*Chem. Gaz.*, Feb. 1852, p. 67.) H. Leuchsenring obtains caffein by availing himself of its property of subliming unchanged by heat. He precipitates a concentrated decoction of coffee by a weak solution of acetate of lead, filters, evaporates to dryness, mixes the residue with sand, and sublimes as in Mohr's process for procuring benzoic acid. (*Am. Journ. of Pharm.*, xxxii. 25.) Still another method, proposed by Vogel, is to treat coffee, ground to powder, with benzine, which dissolves the caffein and an oily substance, to separate the benzine by distillation, to treat the residue with boiling water which dissolves the caffein, and deposits it in a crystalline form, after filtration and concentration. (*Journ. de Pharm.*, 3e sér., xxxv. 436.) The proportion of caffein in coffee may be stated at from 0·75 to 1·0 per cent. (*Pharm. Journ.*, xvi. 527.) Caffein crystallizes, by the cooling of its concentrated solution, in opaque, silky, flexible needles, by slow and spontaneous evaporation, in long transparent prisms. It has a feebly bitter and disagreeable taste, is soluble in water, alcohol, and ether, melts when exposed to heat, and at a higher temperature sublimes, without residue, in needles analogous to those formed by benzoic acid. It is precipitated from its aqueous solution by no reagent except tannic acid and solution of iodide of potassium and mercury. When this solution, made by saturating iodide of potassium with red oxide of mercury, is added to a solution of caffein, a precipitate is produced, which soon takes the form of white, shining, acicular crystals. This reaction is proposed as a test of caffein by Prof. Dellfs; for, though the same solution will precipitate the other alkaloids, the product is always amorphous. (*Chem. Gaz.*, Feb. 15, 1855.) It is stated by M. Schwazenback that, if chlorine-water with caffein is evaporated, a red residue is obtained, which becomes yellow at a higher temperature, and is restored to its original red colour by a drop of solution of ammonia. This is proposed as a delicate test of caffein. (*Journ. de Pharm.*, 3e sér., xxxix. 232.) Caffein is remarkable for containing a larger proportion of nitrogen than almost any other proximate vegetable principle, in this respect equalling some of the most highly animalized products. The present views of its composition are represented by the formula $C_{16}H_{10}N_4O_4$; and it is believed to be identical with theïn, or the peculiar principle of tea. Notwithstanding its large proportion of nitrogen, caffein is indisposed to putrefaction.

Coffee undergoes considerable change during the roasting process. It swells up very much, acquiring almost double its original volume, while it loses from 15 to 20 per cent. of its weight. (*Pharm. Cent. Blatt*, Oct. 1850, p. 687.) It acquires, at the same time, a peculiar odour entirely different from that of the unroasted grains, and a decidedly bitter taste. A volatile oil is developed during the process, and, according to Chenevix, a portion of tannin. The *caffein* does not appear to undergo material change, as, according to Garot, it may be extracted unaltered from the roasted coffee. The excellence of the flavour of roasted coffee depends much upon the manner in which the process is conducted, and the extent to which it is carried. It should be performed in a covered vessel, over a moderate fire, and the grains should be kept in constant motion. When they have acquired a chestnut-brown colour, the

process should cease. If too long continued, it renders the coffee bitter and acrid, or, by reducing it to charcoal, deprives it entirely of flavour. When much roasted, it loses a portion of caffein, which sublimes; while, if but slightly roasted, it loses none: yet ordinary coffee for drinking, prepared by percolation, contains rather more caffein when prepared from strongly roasted than from slightly roasted coffee, because more easily extracted from the former. (Herman Aubert. See *Am. Journ. of Pharm.*, March, 1873, p. 121.) The coffee should not be burnt long before it is used, and should not be kept in the ground state.

Medical and Economical Uses. More attention has been paid to the effects of coffee on the system in the roasted than in the crude state. Unroasted coffee has been employed by Dr. Grindel, of Russia, in intermittent fever; and the practice has been followed by others; but the success, though considerable, has not been such as to lead to the conclusion that this medicine would answer as a substitute for quinia. It was given in powder, in the dose of a scruple every hour; in decoction, prepared by boiling an ounce with eighteen ounces of water down to six; or in extract, in the dose of from four to eight grains.

The action of coffee is directed chiefly to the nervous system. When swallowed it produces a warming cordial impression on the stomach, quickly followed by a diffused agreeable nervous excitement, which extends itself to the cerebral functions, giving rise to increased vigour of imagination and intellect, without any subsequent confusion or stupor such as characterizes the action of narcotic medicines. Indeed, one of its most extraordinary effects is a disposition to wakefulness, which continues for several hours after it has been taken. It is even capable of resisting, to a certain extent, the intoxicating and soporific influence of alcohol and opium, and may sometimes be advantageously employed for this purpose. It also moderately excites the circulatory system, and stimulates the digestive function. A cup of coffee, taken after a hearty meal, will often relieve the sense of oppression so apt to be experienced, and enable the stomach to perform its office with comparative facility. The exhilarating effects of coffee, united with its delicious flavour when suitably qualified by cream and sugar, have given rise to its habitual employment as an article of diet. Its use for this purpose has prevailed from time immemorial in Persia and Arabia. In 1517 it was introduced by the Turks into Constantinople, whence it was carried to France and England about the middle of the succeeding century, and has since gradually made its way into almost universal use. It cannot be supposed that a substance, capable of acting so energetically upon the system, should be entirely destitute of deleterious properties. Accordingly, if taken in large quantities, it leaves, after its first effects, a degree of nervous derangement or depression equivalent to the previous excitement; and its habitual immoderate employment is well known very greatly to injure the tone of the stomach, and frequently to occasion troublesome dyspeptic and nervous affections. This result is peculiarly apt to take place in individuals of susceptible nervous systems, and in those of sedentary habits. We have repeatedly known patients, who have long suffered with headache and vertigo, to get rid of them by abstaining from coffee.

In the treatment of disease, coffee has been less employed than might have been expected from its effects upon the system. There can be no doubt that it may be advantageously used in various nervous disorders. In a tendency to stupor or lethargy dependent on deficient energy of the brain, without congestion or inflammation, it would be found useful by stimulating the cerebral functions. In light nervous headaches, and even in sick headache not caused by the presence of offending matter in the stomach, it often proves temporarily useful. It has acquired much reputation as a palliative in the paroxysms of spasmodic asthma, and has been recommended in hooping-cough, and in hysterical affections. The Egyptians are said to have formerly employed it as a remedy in amenorrhœa. Hayne informs us that, in a case of violent spasmodic disease, attended with short breath, palpitation of the heart, and a pulse so much increased in frequency that it could scarcely be counted, immediate relief was obtained from a cup of coffee, after the most powerful antispasmodics had been used in vain for several hours. It has been given, with supposed advantage, in strangulated hernia. Cases have been recorded, in which its free exhibition in that

affection has been successful; in one instance, at least, after the fruitless employment of other remedies. (*Med. Times and Gaz.*, Jany. 1869, p. 18.) By the late Dr. Dewees it was highly recommended in cholera infantum. It is said also to have been used successfully in obstinate chronic diarrhœa; and the late Dr. Chapman, of Philadelphia, found it highly useful in calculous nephritis. Under the impression of its diuretic powers, it has been recommended in dropsy. We have heard of its effectual use in croup. Dr. Wallace, of Belfast, Ireland, has found it, in strong decoction, successful in many cases of cholera. (*Ann. de Thérap.*, 1867, p. 60.) In acute inflammatory affections it is contraindicated. It should be given in cases of poisoning from opium, after the evacuation of the stomach, or when from any cause such evacuation is not effected.

Roasted coffee is said to have the effect of destroying offensive and noxious effluvia from decomposing animal and vegetable substances, and therefore to be capable of beneficial application as a disinfecting and deodorizing agent. The powder of the grains should be roasted until it becomes dark-brown, and then sprinkled, or placed in plates, in the infected place.

Coffee is usually prepared in this country by boiling the roasted grains, previously ground into a coarse powder, in water for a short time, and then clarifying by the white of an egg. Some prefer the infusion, made by a process similar to that of percolation. It has more of the aroma of the coffee than the decoction, with less of its bitterness. The proper proportion for forming the infusion for medical use is an ounce to a pint of boiling water, of which a cupful may be given warm for a dose, and repeated, if necessary. A *syrup of coffee* is prepared by Dorvault in the following manner. Treat a pound of ground roasted coffee by percolation with boiling water until two pints have passed. Evaporate eight pounds of simple syrup to six, add the infusion, and strain. Two tablespoonfuls of this syrup may be added to a cup of hot water or milk. It is also used with carbonic acid water.

Caffein, though undoubtedly one of the active principles of coffee, is not exactly identical with it in effects. Precise and reliable information as to its physiological action and therapeutic application is yet wanting. Lehmann found it, in doses of from two to ten grains, to produce great disturbance of the nervous and circulatory systems. Introduced directly into the circulation, in the lower animals, such as cats, rabbits, and dogs, in doses of three-quarters of a grain or more, by Drs. Stuhlmann and Falek, it caused death, preceded by purging, vomiting of food, tonic and clonic spasms, and prostration; but no useful reliable inference can be drawn from these results. (*Ranking's Abstract*, xxix. 286.) Herman Aubert found it to produce tetanus when injected into the veins of the lower animals; 1·8 gr. producing the effect in rabbits, and 3 grs. in cats and dogs. Occasionally it produced palsy of the hind legs in rabbits. It quickens the action of the heart, but lessens its force; a result which M. Aubert ascribes to stimulation of the cardiac ganglia with diminution of the heart's tone. (*Am. Journ. of Pharm., ut supra.*) By Botkin it is said to diminish the frequency of the cardiac contractions, and rapidly to increase the quantity of the urine, while the desire to urinate is augmented, and heat is felt in the passage of it. Patients, however, soon become habituated to it. (*Ann. de Thérap.*, 1867, p. 60.) M. Aubert states that an ordinary cup of coffee contains about 1·5 or 1·8 grains of caffein, and a cup of tea about the same. It has been used remedially both uncombined, and in the state of salt. Prof. H. F. Campbell, of Georgia, found it apparently very useful, given by enema, in a case of poisoning by opium, in the advanced stage, when the patient could no longer swallow. He injected twenty grains in infusion of coffee. The patient recovered; but in a second case, though some favourable effects seemed to be produced, the patient ultimately succumbed. (See *Am. J. of Med. Sci.*, July and Oct. 1860, pp. 282 and 570.) In the form of *citrate of caffein*, made by dissolving caffein in a solution of citric acid with a gentle heat, and evaporating carefully, it has been recommended, as a remedy and preventive in sick headache, in the dose of a grain every hour, before and during the paroxysm. Two or three grains during the twenty-four hours is recommended under ordinary circumstances. (*Botkin.*)

The *arseniate* has been given as an antiperiodic; but the arsenic is no doubt the main therapeutic agent in this case.

The *leaves* of the coffee plant possess properties analogous to those of the fruit, and are extensively used, in the form of infusion, as a beverage, in the vicinity of Padang, in the island of Sumatra. An account of their employment was published in the *Singapore Free Press* by Mr. N. M. Ward, of Padang. Previously to this, Dr. John Gardener, of London, had proposed to introduce them into use in Europe, and is stated to have taken out a patent for the mode of preparing them. A specimen examined by Dr. Stenhouse has been found to contain caffein in larger proportion than the coffee-bean, and also caffeic acid. Mr. Ward states that, in Sumatra, the leaves are prepared for use by moderately roasting them, and then powdering them coarsely by rubbing in the hands. The powder is made into an infusion like common tea. The taste is said to be like that of tea and coffee combined. (*Pharm. Journ.*, xii. 443, and xiii. 207 and 382.) W.

CALAMUS. *U. S. Secondary.*

Sweet Flag.

The rhizoma of Acorus Calamus. *U. S.*

Acorus vrai, Acorus odorant, *Fr.;* Kalmuswurzel, *Germ.;* Calamo aromatico, *Ital., Span.*

ACORUS. *Sex. Syst.* Hexandria Monogynia.—*Nat. Ord.* Acoraceæ.

Gen. Ch. Spadix cylindrical, covered with florets. *Corolla* six-petaled, naked. *Style* none. *Capsule* three-celled. *Willd.*

Acorus Calamus. Willd. *Sp. Plant.* ii. 199; Barton, *Med. Bot.* ii. 63. The sweet flag, or calamus, has a perennial, horizontal, jointed, somewhat compressed root (rhizome), from half an inch to an inch thick, sometimes several feet in length, sending off numerous round and yellowish or whitish radicles from its base, and bunches of brown fibres resembling coarse hair from its joints, internally white and spongy, externally whitish with a tinge of green, variegated with triangular stains of light brown and rose colour. The leaves are all radical, sheathing at the base, long, sword-shaped, smooth, green above, but, near their origin from the root, of a red colour variegated with green and white. The scape or flower-stem resembles the leaves, but is longer, and from one side, near the middle of its length, sends out a cylindrical spadix, tapering at each end, about two inches in length, and crowded with greenish-yellow flowers. These are without calyx, and have six small, concave, membranous, truncated petals. The fruit is an oblong capsule, divided into three cells, and containing numerous oval seeds.

This is an indigenous plant, growing throughout the United States, in low, wet, swampy places, and along the sides of ditches and streams, and flowering in May and June. It is also a native of Europe and Western Asia; and a variety is found in India. The European plant differs slightly from the American. The leaves as well as root have an aromatic odour; but the latter only is employed. It should be collected late in the autumn, or in the spring. After removal from the ground, the roots are washed, freed from their fibres, and dried with a moderate heat. By the process of drying they lose nearly one-half their diameter, but are improved in odour and taste.

Properties. The roots, as kept in the shops, are in pieces of various length, somewhat flattened, externally wrinkled and of a yellowish-brown colour, and presenting on their under surface numerous minute circular spots, indicating the points at which the radicles were inserted. Their texture is light and spongy, their colour internally whitish or yellowish-white, and their fracture short and rough. A variety imported from Germany consists exclusively of the interior portion of the root. The pieces are usually long, slender, irregularly quadrangular, and of a grayish-white colour.

The odour of calamus is strong and fragrant; its taste warm, bitterish, pungent, and aromatic. Its active principles are taken up by boiling water. From 100 parts of the fresh root of the European plant, Trommsdorff obtained 0·1 of volatile oil, 2·3 of soft resin, 3·3 of extractive with a little chloride of potassium, 5·5 of gum with some phosphate of potassium, 1·6 of starch analogous to inulin, 21·5 of lignin, and 65·7 of water. Sixteen ounces of the dried root afforded to Neumann about two scruples of volatile oil. The oil is at first yellow, but ultimately becomes red,

and has the smell and taste of calamus. The extractive matter has an acrid and sweetish taste. The root is sometimes attacked by worms, and deteriorates by keeping. The India variety is more slender than the European, and has a stronger and more pleasant flavour.

Medical Properties and Uses. Calamus is a stimulant tonic, possessing the ordinary virtues of the aromatics. It may be taken with advantage in pain or uneasiness of the stomach or bowels arising from flatulence, and is a useful adjuvant to tonic or purgative medicines, in cases of torpor or debility of the alimentary canal. It was probably known to the ancients, and is supposed to have been the ἄκορον of the Greeks; but the *calamus aromaticus* of Dioscorides was a different product, having been derived, according to Dr. Royle, from a species of Andropogon. The medicine is at present much neglected, though well calculated to answer as a substitute for more costly aromatics. The dose in substance is from a scruple to a drachm.* An infusion, made in the proportion of an ounce of the root to a pint of boiling water, is sometimes given in the dose of a wineglassful or more. W.

CALCIUM.

Calcium.

This is the peculiar metal of lime, and consequently of all calcareous substances. It was obtained by Dr. Matthiessen, in 1855, in masses of the size of a pea, by the electrolysis, with a Bunsen battery, of chloride of calcium. It is a pale-yellow metal, remarkably glittering when freshly filed. Its fracture is jagged, becoming granular. It is malleable and very ductile. In a dry air it remains unaltered; but it soon tarnishes in a moist one. It melts at a red heat, and afterwards burns with splendour, forming lime. Its eq. number is 20, and symbol Ca. (*Chem. Gaz.*, June 15, 1855.)

Calcium is a very abundant element in nature, existing in the mineral kingdom chiefly as a carbonate, in the form of limestone, marble, chalk, and calcareous spar; and as a phosphate and carbonate in the bones and shells of animals. It is the peculiar metal in the officinals, lime, chloride of calcium, and carbonate, phosphate, and hypochlorite of calcium. B.

CALCII CHLORIDUM. *U.S., Br.*

Chloride of Calcium.

Chloride of calcium prepared by fusion. *U.S.* CaCl. *Br.*

Muriate of lime, Hydrochlorate of lime; Chlorure de calcium, Hydrochlorate de chaux, *Fr.;* Chlorcalcium, Salzsaurer Kalk, *Germ.*

Chloride of calcium consists of chlorine, united with calcium, the metallic radical of lime. It may be readily formed by saturating muriatic acid with chalk or marble, evaporating to dryness, and heating to redness. The muriatic acid, by reacting with the lime, forms chloride of calcium and water, the latter of which is dissipated at a red heat. The Br. Pharmacopœia, after neutralizing the acid with carbonate of calcium, adds a little solution of chlorinated lime and slaked lime, filters, evaporates till the chloride becomes solid, and, instead of igniting the residue, dries it at about 400°.

Properties. In the fused or anhydrous state, as it is directed or understood to be in the U. S. and Br. Pharmacopœias, chloride of calcium is a colourless, slightly translucent, hard and friable solid, of an acrid, bitter, saline taste, extremely deliquescent, very soluble in water, and readily soluble in rectified spirit. On account of its avidity for water, the fused salt is used for drying gases, and for bringing alcohol to its highest degree of concentration. The crystallized salt is also very deliquescent, and has the form of colourless, transparent, striated, six-sided prisms. The

* *A fluid extract of calamus* may be prepared in the same manner as fluid extract of ginger, and given in the dose of from half a fluidrachm to a fluidrachm. From this Prof. Maisch prepares a syrup by rubbing f℥i of the fluid extract with about ℥viii of sugar, exposing the mixture to a moderate heat until all the alcohol has been evaporated, then adding ℥vii of sugar, and half a pint of water, heating to 212°, and straining. (*Am. Journ. of Pharm.*, xxxii. 113.)—*Note to the twelfth edition.*

crystals, on exposure to heat, first dissolve in their water of crystallization, and after this has evaporated, undergo the igneous fusion. With ice or snow they form a powerful frigorific mixture. Solution of chloride of calcium, when pure, yields no precipitate with ammonia, chloride of barium, or ferrocyanide of potassium dissolved in a large quantity of water; evincing the absence of magnesia, sulphuric acid, and iron. It yields white precipitates with nitrate of silver and oxalate of ammonium. *U. S.* The salt evolves no chlorine or hypochlorous acid on the addition of hydrochloric acid, is entirely soluble in twice its weight of water, and is not precipitated by lime-water. *Br.*

Chloride of calcium exists in the water of the ocean and of many springs. It is usually associated with common salt and chloride of magnesium, from which it is separated with difficulty. It consists of one eq. of chlorine 35·5, and one of calcium 20 = 55·5. When crystallized, it contains six eqs. of water = 54.*

Chloride of calcium is used medicinally in solution only. In this state it forms the officinal *Liquor Calcii Chloridi*, under which its medicinal properties are given.

Pharm. Uses. In preparing Acidum Tartaricum, *Br.;* Æther, *Br.;* Æther Fortior, *U. S.;* Æther Purus, *Br.;* Chloroformum, *Br.;* Ferrum Redactum, *Br.*

Off. Prep. Calcis Carbonas Præcipitata, *Br.;* Morphiæ Hydrochloras, *Br.* B.

CALCII HYPOPHOSPHIS. *U. S.*

Hypophosphite of Calcium.

Syn. Calcis Hypophosphis. *Hypophosphite of Lime.*

Attention has been called to the hypophosphites as a class of salts, in consequence of their recommendation by Dr. Churchill, of Paris, in the treatment of phthisis, in which they are thought to be useful by furnishing phosphorus to the tissues. A paper on their mode of preparation and qualities was communicated by Prof. Procter to the *American Journal of Pharmacy* (March, 1858, p. 118), to which we are indebted for much of what follows on the chemistry of the subject. Hypophosphorous acid consists of one eq. of phosphorus and one of oxygen, and always contains two or three eqs. of water. It has a strong affinity for oxygen, and acts therefore as a powerful deoxidizing agent, and carries this property as well as water with it into composition. When heated, it is resolved into phosphuretted hydrogen and phosphoric acid. Its salts are generally soluble in water and deliquescent, and many of them are soluble in alcohol. They are converted into phosphates by heat, with the escape of phosphuretted hydrogen; and some of them are explosive.

Hypophosphite of calcium has attracted most attention, and would meet the views of those who wish to supply phosphate of calcium to the system, as the hypophosphorous acid is converted into the phosphoric by its deoxidizing power. To prepare it Prof. Procter gives the following formula. Slake 4 lbs. avoird. of lime with a gallon of water, add it, in a deep boiler, to 4 gallons of boiling water, and mix thoroughly. To the mixture add a pound avoird. of phosphorus, and continue the boiling, adding hot water from time to time to keep up the measure, until the combination is complete, and phosphuretted hydrogen is no longer evolved. It is necessary that provision should be made for the escape of the gas, which takes fire spontaneously in contact with the air. There are formed in the liquid phosphate and hypophosphite of calcium, the phosphorus having become oxidized at the expense of the water, the hydrogen of which has escaped in combination with another portion of phosphorus, which is therefore lost. The liquid is filtered to separate the insoluble phosphate and residuary lime, then concentrated, and refiltered to separate the car-

* Various useful applications of chloride of calcium, independently of its employment in chemical operations, have been proposed, or carried into effect, of which one is the substitution of its solution for water alone in sprinkling the streets of towns in dry weather; its affinity for moisture being such that much less sprinkling is necessary in order to obtain the desired result; another, its application to the surface of combustible substances, such as wood, by which they are in a considerable degree protected against fire. For the latter purpose it is recommended to add to the solution a portion of milk of lime, which prevents the unpleasant dampness which it would tend to maintain in the surfaces covered with it. (*Neues Repertorium*, xvi. 597.)—*Note to the thirteenth edition.*

bonate of calcium formed by the action of the air on a little lime held in solution, and lastly evaporated till a pellicle appears; after which the salt may be allowed to crystallize by setting the liquid aside, or may be obtained in the granular form by continuing the heat, and stirring. The salt should be introduced into bottles.

Hypophosphite of calcium is white, of a somewhat pearly lustre, and crystallizes in flattened prisms. It has a nauseous bitter taste. It is soluble in 6 parts of cold water, little more so in boiling water, and slightly soluble in diluted, but insoluble in officinal alcohol. Its solubility is increased by the addition of hypophosphorous acid. When heated, it loses no water at the temperature of 300° or less; but at a red heat, it decrepitates, giving off water and evolving phosphuretted hydrogen, which is spontaneously inflammable, and leaving about 80 per cent. of a reddish substance behind. *U. S.* Its formula is CaO,2HO,PO.

As the soluble salts of mercury and silver are reduced by the hypophosphites, they are of course incompatible with it in prescriptions. With the hypophosphite of calcium, all the soluble sulphates and carbonates produce precipitates. As the hypophosphites are insoluble in cod-liver oil, they should be dissolved in syrup before being added to the oil. Prof. Procter prepares a *syrup of hypophosphite of calcium* by dissolving a troyounce of the salt in 9·5 fluidounces of water, then adding 12 troyounces of sugar and dissolving with a gentle heat, and finally adding half a fluidounce of the fluid extract of vanilla. The dose of the syrup is from one to four fluidrachms, three times a day. A compound syrup is prepared by the same writer, containing the hypophosphites of calcium, sodium, potassium, and iron, with hypophosphorous acid, a formula for which will be found in the same communication to which reference has been made above.

The author does not wish to be understood as recommending these remedies in consumption. The weight of testimony appears to him to be opposed to the first favourable impressions; and, though some cases may have seemed to be benefited, yet great care must be taken not to allow a reliance on the hypophosphites to interfere with the use of remedies known to be efficient, as cod-liver oil, and supporting measures generally. But though of doubtful efficacy in phthisis, the hypophosphites may be valuable remedies in other affections, and would seem to be indicated in cases in which there may be defect of nutrition of the nerve-centres, of which phosphorus forms an important constituent; and Dr. J. D. Brown, of the Albany City Hospital, has found them highly useful in diseases attended with the loss of nerve power, and complaints of infancy connected with the scrofulous diathesis, and defect in the osseous system. (*Boston Med. and Surg. Journ.*, Dec. 21, 1865, p. 412.) The dose of either of the hypophosphites is from ten to thirty grains, three times a day. W.

CALX. *U. S., Br.*

Lime.

Lime recently prepared by calcination. *U. S.* An alkaline earth, CaO, with some impurities, obtained by calcining chalk or limestone so as to expel carbonic acid. *Br.*

Quicklime; Chaux, Chaux vive, *Fr.;* Kalk, *Germ.;* Calce, *Ital.;* Calviva, *Span.*

Lime, which is ranked among the alkaline earths, is a very important pharmaceutical agent, and forms the principal ingredient in several standard preparations. It is a very abundant natural production. It is never found pure, but mostly combined with acids; as with carbonic acid in chalk, marble, calcareous spar, limestone, and shells; with sulphuric acid in the different kinds of gypsum; with phosphoric acid in the bones of animals; and with silica in a great variety of minerals.

Preparation. Lime is prepared by calcining, by a strong heat, some form of the native carbonate. The carbonic acid is thus expelled, and the lime remains. When the lime is intended for nice chemical operations, it should be obtained from pure white marble, or oyster shells. For the purpose of the arts it is procured from common limestone, by calcining it in kilns of peculiar construction. When obtained in this way it is generally impure, being of a grayish colour, and containing alumina, silica, sesquioxide of iron, and occasionally a little magnesia and oxide of manganese.

The officinal lime of the United States and British Pharmacopœias is the lime of

commerce, and therefore impure. It may be obtained purer by exposing pure white marble, broken into small fragments, in a covered crucible, to a full red heat for three hours, or till the residuum, when slaked and suspended in water, no longer effervesces on the addition of muriatic acid.

Properties. Lime is a grayish-white solid, having a strong caustic, alkaline taste, and the sp. gr. 2·3. It is very refractory in the fire, having been fused only by the compound blowpipe of Dr. Hare. Exposed to the air, it absorbs moisture and carbonic acid, and falls into a white powder. On account of its liability to change by being kept, lime intended for pharmaceutical purposes should be recently prepared. It acts upon vegetables colours like an alkali. Upon the addition of water, it cracks and falls into powder, with the evolution of heat, forming hydrate of lime. In this state lime dissolves freely in syrup. If it dissolve in muriatic acid without effervescence, the fact shows the absence of carbonic acid, and that the lime has been well calcined. If any silica be present, it will remain undissolved. If the solution give no precipitate with ammonia, the absence of iron and alumina is shown.

Lime is but sparingly soluble in water, requiring at 60° about seven hundred times its weight of that liquid for complete solution. Contrary to the general law, it is less soluble in hot than in cold water. The solution is called lime-water. (See *Liquor Calcis.*) When lime in excess is mixed with water, so as to form a thick liquid, the mixture is called *milk of lime.*

Lime is the protoxide of calcium, and consists of one eq. of calcium 20, and one of oxygen 8 = 28. (See *Calcium.*) It is distinguished from the other alkaline earths by forming a very deliquescent salt (*chloride of calcium*) by reaction with muriatic acid, and a sparingly soluble one with sulphuric acid. All acids, acidulous, ammoniacal, and metallic salts, borates, alkaline carbonates, and astringent vegetable infusions are incompatible with it.

Medical Properties. Lime acts externally as an escharotic, and was formerly applied to ill-conditioned ulcers. The *lime ointment* of Spender is made by incorporating four parts of washed slaked lime with one part of fresh lard and three parts of olive oil, previously warmed together. Mixed with potassa, lime forms an officinal caustic. (See *Potassa cum Calce.*) As an internal remedy, it is always administered in solution. (See *Liquor Calcis.*)

Pharm. Uses. In preparing Æther Fortior, *U. S.;* Ammonii Valerianas, *U. S.;* Aquæ Ammoniæ, *U. S.;* Liquor Potassæ, *U. S.;* Liquor Sodæ, *U. S.;* Quiniæ Sulphas, *U. S.;* Santoninum, *U. S.;* Spiritus Ammoniæ, *U. S.;* Strychnia, *U. S.;* Sulphur Præcipitatum, *U. S.*

Off. Prep. Calcis Hydras, *Br.;* Liquor Calcis, *U. S.;* Potassa cum Calce, *U. S.* B.

CALX CHLORINATA. *U. S.*

Chlorinated Lime.

A compound resulting from the action of chlorine on hydrate of calcium, and containing at least twenty-five per cent. of Chlorine. *U. S.*

Off. Syn. CALX CHLORATA. *Chlorinated Lime.* A product obtained by exposing slaked lime to the action of chlorine gas so long as the latter is absorbed. *Br.*

CHLORIDE OF LIME, *U. S.*, Hypochlorite of lime or calcium, Oxymuriate of lime or calcium, Bleaching powder; Calcis chloridum, Calcii hypochloris, *Lat.;* Chlorure de chaux, *Fr.;* Chlorkalk, *Germ.;* Cloruro di calce, *Ital.*

This compound was originally prepared and brought into notice as a bleaching agent, in 1798, by Tennant of Glasgow. Subsequently it was found to have valuable properties as a medicine and disinfectant; and, accordingly, it has been introduced into the United States and British Pharmacopœias.

The following is an outline of the process for preparing chlorinated lime on the large scale. An oblong-square chamber is constructed, generally of siliceous sandstone, the joints being secured by a cement of pitch, rosin, and dry gypsum. At one end it is furnished with an air-tight door, and on each side with a glass window, to enable the operator to inspect the process during its progress. The slaked or hydrated lime is sifted, and placed on wooden trays eight or ten feet long, two broad,

and one inch deep. These are piled within the chamber to a height of five or six feet on cross-bars, by which they are kept about an inch asunder, in order to favour the circulation of the gas over the lime. The chlorine is generated in a leaden vessel nearly spherical, the lower portion of which is surrounded with an iron case, leaving an interstice two inches wide, intended to receive the steam for the purpose of producing the requisite heat. In the leaden vessel are five apertures. The first is in the centre of the top, and receives a tube which descends nearly to the bottom, and through which a vertical stirrer passes, intended to mix the materials, and furnished, at the lower end, with horizontal cross-bars of iron, or of wood sheathed with lead. The second is for the introduction of the common salt and manganese. The third admits a syphon-shaped funnel, through which the sulphuric acid is introduced. The fourth is connected with a pipe to lead off the chlorine. The fifth, which is near the bottom, receives a discharge pipe, passing through the iron case, and intended for drawing off the residuum of the operation. The pipe leading off the chlorine terminates, under water, in a leaden chest or cylinder, where the gas is washed from muriatic acid. From this intermediate vessel the chlorine finally passes, by means of a pretty large leaden pipe, through the ceiling of the chamber containing the lime. The process of impregnation generally lasts four days, this time being necessary to form a good bleaching powder. If it be hastened, heat will be generated, which will favour the production of chloride of calcium, with a proportional diminution of chloride of lime.

The proportions of the materials generally adopted are 10 cwt. of common salt, mixed with from 10 to 14 cwt. of deutoxide of manganese: to which are added, in successive portions, from 12 to 14 cwt. of strong sulphuric acid, diluted before being used until its sp. gr. is about 1·65, which is accomplished by adding about one-third of its weight of water. In factories in which sulphuric acid is also made, the acid intended for this process is brought to the sp. gr. 1·65 only, whereby the expense of further concentration is saved.

Properties. Chlorinated lime is a dry, or but slightly moist, grayish-white pulverulent substance, having an acrid, hot, bitter, astringent taste, and an odour resembling that of chlorine. It possesses powerful bleaching properties. When perfectly saturated with chlorine, it dissolves almost entirely in water; but, as ordinarily prepared, a large proportion is insoluble, consisting of hydrate of lime. "It is wholly dissolved by dilute muriatic acid, with the escape of chlorine." *U. S.* When exposed to heat, it gives off oxygen, and some chlorine, and is converted into chloride of calcium. It is incompatible with the mineral acids, carbonic acids, and the alkaline carbonates. The acids evolve chlorine copiously, and the alkaline carbonates cause a precipitate of carbonate of calcium. (See *Liquor Sodæ Chlorinatæ.*)*

Chlorinated lime is an oxidizing agent, the oxygen being derived from water, the hydrogen of which unites with the chlorine to form muriatic acid. It has a powerful action on organic matter, converting sugar, starch, cotton, linen, and similar substances into formic acid, which unites with the lime. (*W. Bastick.*) It also acts energetically on the volatile oils, including oil of turpentine, producing chloroform. (J. Chautart, *Journ. de Pharm.*, Mars, 1855.)

* Chlorinated lime is constantly becoming weaker on exposure, giving off chlorine or hypochlorous acid, probably through the influence of the atmospheric carbonic acid, which sets them free by combining with the lime. But it would seem that, even when closely confined, it sometimes at least gives off gaseous matter, as we have an account of a well-stopped bottle containing it having been broken by a violent explosion, without any peculiar exposure to heat. (See *Am. Journ. of Pharm.*, Jan. 1861, p. 72.) M. Barreswil has found that the subjection of chlorinated lime to strong pressure greatly diminishes the tendency to decomposition. It is rendered in this way as hard as a stone, and may be kept long without undergoing change. (*Chem. News*, No. 58, p. 33.)

Under the following conditions, it is stated by C. Schrader that good chlorinated lime may be prepared which will long retain its strength. 1. The lime used must be free from iron and alumina; but the hydrate may contain from 6 to 12 per cent. of moisture without injury. 2. The chlorine must be brought slowly in contact with the hydrate. 3. When the hydrate of lime is oversaturated with chlorine, decomposition speedily ensues. Hence the hydrate and the muriatic acid employed must be in due proportion, to be determined by practice. 4. To ensure complete saturation, there should be free chlorine in the apparatus at the close of the process. By attending to these precautions, it is said that a product may be obtained, with from 33 to 35 per cent. of chlorine, and losing its strength only at the rate of 3 or 4 per cent. a year. (*Ibid.*, Aug. 15, 1863, p. 78.) — *Note to the twelfth edition.*

Composition. According to Dr. Ure, bleaching powder consists of hydrate of lime and chlorine, united in variable proportions, not correspondent to equivalent quantities. According to Brande, Grouvelle, and Phillips, the compound obtained when chlorine ceases to be absorbed consists of one eq. of chlorine and two of hydrate of lime, resolvable, by water, into one eq. of hydrated chloride of lime which dissolves, and one of hydrate of lime which is left. Dr. Thomson, however, asserts that the compound has been so much improved in quality, that good samples consist of single equivalents of lime and chlorine, and are almost entirely soluble in water. Its ultimate constituents, exclusive of the elements of water, may, therefore, be considered to be one eq. of calcium, one of oxygen, and one of chlorine. Three views may be taken of the manner in which these elements are united to form the bleaching powder. The first makes it a chloride of lime, CaO,Cl; the second, oxychloride of calcium, $Ca\left\{\begin{matrix}O\\Cl;\end{matrix}\right.$ and the third hypochlorite of calcium with chloride of calcium, $CaO,ClO + CaCl$, formed by doubling the equivalents of the elements present.

The simplest view of the nature of bleaching powder is that which supposes it to be a compound of chlorine and lime. The view which makes it a hypochlorite with chloride of calcium is that of Balard, and is supported by the fact that the compound smells of hypochlorous acid. But if it contain chloride of calcium, it ought to deliquesce; unless it can be shown that the metallic chloride is in such a state of combination as to prevent this result. The second view, that it is an oxychloride, which assimilates its nature to that of the deutoxide of calcium, is held by Millon. According to this chemist, the quantity of chlorine, taken up by a metallic protoxide, is regulated by the nature of its peroxide. The peroxide of calcium is a deutoxide, (CaO_2); and Millon contends that, in forming bleaching powder, the lime takes up but one eq. of chlorine, corresponding to the second eq. of oxygen in the deutoxide, thus generating the compound $Ca\left\{\begin{matrix}O\\Cl.\end{matrix}\right.$ Again, the peroxide of potassium is represented by KO_3, and Millon states that the bleaching compound which potassa (KO) forms with chlorine is $K\left\{\begin{matrix}O\\Cl_2.\end{matrix}\right.$ If further observation should show that the number of equivalents of chlorine, necessary to convert a protoxide into a bleaching compound, is always equal to the number of eqs. of oxygen required to convert it into a peroxide, the fact will go far to prove the correctness of Millon's views.

On the supposition that the bleaching powder is a hypochlorite of calcium with chloride of calcium, the mode of its formation is thus explained. Two eqs. of chlorine, by uniting separately with the elements of one eq. of lime, form one eq. of chloride of calcium, and one of hypochlorous acid; the latter of which combines with an additional eq. of lime, to form hypochlorite of calcium.

M. Fresenius, having submitted chlorinated lime to the action of successive portions of water, noticed that the first portions dissolved out nearly all the free chloride of calcium, with very little hypochlorite of calcium, while in the subsequent operations the two salts were dissolved in regular proportion. From this fact he inferred that either the chloride of calcium and hypochlorite of calcium were combined, or that water decomposed the chlorinated lime into them. His views as to the composition of the bleaching powder, deduced from this observation and from various experiments, are that it consists of hypochlorite of calcium, combined with chloride of calcium $CaO,ClO + CaCl$, of free chloride of calcium $CaCl$, of hydrated lime CaO,HO, and of combined water. (*Chem. Gaz.*, Aug. 30, 1862.)

Impurities and Tests. Chlorinated lime may contain a great excess of lime, from imperfect impregnation with the gas. This defect will be shown by the large proportion insoluble in water. If it contain much chloride of calcium, it will be quite moist, which is always a sign of inferior quality. When long and insecurely kept, it deteriorates from the gradual formation of chloride of calcium and carbonate of calcium. Several methods have been proposed for determining its bleaching power, which depends solely on the proportion of loosely combined chlorine. Walter proposed to add a solution of the bleaching powder to a standard solution of sulphate of indigo, in order to ascertain its decolorizing power; but the objection to this test

is that the indigo of commerce is very variable in its amount of colouring matter. Dr. Ure has proposed muriatic acid to disengage the chlorine over mercury; but this test is liable to the fallacy that it will disengage carbonic acid as well as chlorine; and it has been shown, by some unpublished experiments of Prof. Procter of this city, that the amount of disengaged gaseous matter is not in proportion to the decolorizing power. Dalton recommended, as a test, to add a solution of the bleaching powder to one of the sulphate of protoxide of iron, slightly acidulated with muriatic or sulphuric acid, until the odour of chlorine is perceived. Chlorine is not disengaged until the iron is sesquioxidized, and the stronger the bleaching powder, the sooner will this be accomplished. A more delicate way of ascertaining when all the iron is sesquioxidized, is to test a drop of the liquid with one of a solution of ferridcyanide of potassium (red prussiate of potassa). So long as any protoxide of iron remains in the liquid, this salt will occasion a blue precipitate (*Turnbull's Prussian blue*), but not afterwards. This test for chlorinated lime was adopted in the U.S. Pharmacopœia of 1850, and is applied as follows. "When 40 grains of it, triturated with a fluidounce of distilled water, are well shaken with a solution of 78 grains of crystallized sulphate of protoxide of iron, and 10 drops of sulphuric acid in two fluidounces of distilled water, a liquid is formed which does not yield a blue precipitate with ferridcyanide of potassium. It is wholly dissolved by dilute muriatic acid with the escape of chlorine. Its solution quickly destroys vegetable colours." *U. S.* The chlorinated lime of the U.S. Pharmacopœia is directed to contain at least 25 per cent. of chlorine. If it be to this extent chlorinated, 40 grains will contain enough chlorine to cause the sesquioxidation of all the protoxide of iron in 78 grains of crystallized sulphate of iron; but, if impregnated with chlorine to a less extent, some of the protoxide will remain unchanged, and, consequently, a blue precipitate will be formed with the ferridcyanide. According to Wittstein and Claude, however, the test of sulphate of iron is not reliable.

The following is the test given in the British Pharmacopœia. "Ten grains mixed with thirty grains of iodide of potassium, and dissolved in four fluidounces of water, produce, when acidulated with two fluidrachms of hydrochloric acid, a reddish solution, which requires for the discharge of its colour at least 850 grain-measures of *the volumetric solution of hyposulphite of soda*, corresponding to 30 per cent. of chlorine liberated by hydrochloric acid." In this process iodine is separated by the chlorine in equivalent quantity, and imparts colour to the liquid, which is removed by the hyposulphite of sodium, by forming colourless compounds with the iodine; and the quantity required for this purpose measures the quantity of iodine, and consequently that of the chlorine present in the chlorinated solution. (See *Hyposulphite of Sodium.*)

Medical Properties and Uses. Chlorinated lime, externally applied, is a desiccant and disinfectant, and has been used with advantage in solution, as an application to ill-conditioned ulcers, burns, chilblains, and cutaneous eruptions, especially itch, as a gargle in putrid sorethroat; and as a wash for the mouth to disinfect the breath, and for ulcerated gums. Internally, it is stimulant and astringent. It has been employed by Dr. Reid in the epidemic typhoid fever of Ireland; by the same practitioner in dysentery, both by the mouth and injection, with the effect of correcting the fetor, and improving the appearance of the stools; by Cima, both internally and externally, in scrofula; and by Dr. Varlez, of Brussels, in ophthalmia. Dr. Pereira has used a weak solution very successfully in the purulent ophthalmia of infants. In the febrile cases, Dr. Reid found it to render the tongue cleaner and moister, to check diarrhœa, and induce sleep. The dose internally is from three to six grains, dissolved in one or two fluidounces of water, filtered and sweetened with syrup. It should never be given in pills. As it occurs of variable quality, and must be used in solution more or less dilute, according to the particular purpose to which it is to be applied, it is impossible to give any very precise directions for its strength as an external remedy. From one to four drachms of the powder added to a pint of water, and the solution filtered, will form a liquid within the limits of strength ordinarily required. For the cure of itch, M. Derheims has recommended a much stronger solution — three ounces of the chloride to a pint of water, the solution being filtered,

and applied several times a day as a lotion, or constantly by wet cloths. When applied to ulcers, their surface may be covered with lint dipped in the solution. When used as an ointment, to be rubbed upon scrofulous enlargements of the lymphatic glands, this may be made of a drachm of the chloride to an ounce of lard. Chlorinated lime is less eligible for some purposes than the solution of chlorinated soda. (See *Liquor Sodæ Chlorinatæ.*)

In consequence of its powers as a disinfectant, chlorinated lime is a very important compound in its application to medical police. It possesses the property of preventing or arresting animal and vegetable putrefaction, and, perhaps, of destroying pestilential and infectious miasms. It may be used with advantage for preserving bodies from exhaling an unpleasant odour, before interment, in the summer season. In juridical exhumations its use is indispensable; as it effectually removes the disgusting and insupportable fetor of the corpse. The mode in which it is applied, in these cases, is to envelop the body with a sheet completely wet with a solution, made by adding about a pound of the chloride to a bucketful of water. It is employed also for disinfecting dissecting rooms, privies, common sewers, docks, and other places with offensive effluvia. In destroying contagion and infection, it appears to be highly useful; and hospitals, alms-houses, jails, ships, &c., may be purified by it. In short, all places deemed infectious from having been the receptacle of disease, may be more or less disinfected by its use, after having undergone the ordinary cleansing.

Chlorinated lime acts exclusively by its chlorine, which, being loosely combined, is disengaged by the slightest affinities. All acids, even the carbonic, disengage it; and, as this acid is a product of animal and vegetable decomposition, noxious effluvia furnish the means, to a certain extent, of their own disinfection. But the stronger acids disengage the chlorine far more readily, and, among these, sulphuric acid is the most convenient. Accordingly, the powder may be dissolved in a very dilute solution of this acid; or a small quantity of the acid may be added to an aqueous solution ready formed, if a more copious evolution of chlorine be desired than that which takes place from the mere action of the carbonic acid of the atmosphere.

Chlorinated lime may be advantageously applied to the purpose of purifying offensive water, a property which makes it invaluable on long voyages. When used for this purpose, from one to two ounces of the chloride may be mixed with about sixty-five gallons of the water. The water must afterwards be exposed for some time to the air, and allowed to settle, before it is fit to drink.

Strong insecticide properties have been ascribed to chlorinated lime. Hence it is recommended to sprinkle it on vegetables, flowers, fruit-trees, &c., which are apt to be attacked by worms and insects.

Off. Prep. Chloroformum, *Br.;* Liquor Calcis Chloratæ. *Br.;* Liquor Sodæ Chlorinatæ, *U.S.;* Vapor Chlori, *Br.* B.

CALUMBA. *U.S.*

Columbo.

The root of Jateorrhiza palmata (*Miers*), Cocculus palmatus (*De Candolle*); and of Jateorrhiza Calumba (*Miers*), Cocculus palmatus (*Wallich, Catal.* non D.C.). *U.S.*

Off. Syn. CALUMBÆ RADIX. *Calumba Root.* The root, cut transversely and dried, of Jateorrhiza Calumba, *Miers;* Cocculus palmatus, *non D.C.; Steph. and Church. Med. Bot.*, plate 160. *Br.*

Colomba, *U.S.* 1850; Colombo, *Fr.;* Columbowurzel, *Germ.;* Columba, *Ital.;* Raiz de Columbo, *Span.;* Kalumbo, *Port.;* Calumb, *Mozambique.*

The columbo plant was long but imperfectly known. Flowering specimens of a plant gathered by Commerson, about the year 1770, in the garden of M. Poivre in the Isle of France, and sent to Europe with that botanist's collection, were examined by Lamarck, and described under the name of *Menispermum palmatum.* But its original locality was unknown, and it was only conjectured to be the source of columbo. In the year 1805, M. Forten, while engaged in purchasing the drug in Mozambique, obtained possession of a living offset of the root, which, being taken to Madras, and planted in the garden of Dr. Anderson, produced a male plant, which

was figured and described by Dr. Berry. From the drawing thus made, the plant was referred to the natural family of the Menispermeæ; but, as the female flowers were wanting, some difficulty was experienced in fixing its precise botanical position. De Candolle, who probably had the opportunity of examining Commerson's specimens, gave its generic and specific character; but confessed that he was not acquainted with the structure of the female flower and fruit. This desideratum, however, was supplied by ample drawings sent to England by Mr. Telfair, of Mauritius, made from plants which were propagated from roots obtained by Captain Owen in 1825, while prosecuting his survey of the eastern coast of Africa. The genus *Cocculus*, in which the plant is now placed, was separated by De Candolle from *Menispermum*, and includes those species which have six stamens, while the Menispermum is limited to those with twelve or more.

More recently, Mr. J. Miers, on examination of the male and female flowers as well as of the seeds, came to the conclusion that they presented peculiarities which justified the establishment of a new genus, which he named *Jateorrhiza*, from the medicinal properties of the root. "The plants of this genus, natives of intertropical Africa, are all climbers, distinguished by a very peculiar habit, having very large deeply-lobed leaves, upon very long petioles, and clothed with long strigose hairs; their inflorescence is in long slender racemes; the fruit is a drupe containing a putamen covered with a dense hairy coating imbedded in the fleshy mesoderm."* (*Ann. and Mag. of Nat. Hist.*, Feb. 1864.) From the statements of Mr. Miers it appears, moreover, that the species described by De Candolle under the name of Cocculus palmatus, is different from that cultivated in the Botanical Garden at Calcutta, which appears in Wallich's Catalogue under the same name of Cocculus palmatus; two species having, as appears, been confounded together. This new species is described by Mr. Miers under the name of Jateorrhiza Calumba, and is asserted by him to be the true columbo plant. The claim is admitted by Prof. Bentley, of London, and the species is recognised in the last edition of the British Pharmacopœia. But upon what grounds it is assumed to be the exclusive source of the drug has not been satisfactorily shown. Both species grow in the same neighbourhood, and both are described from specimens originating in that neighbourhood, and asserted to have been derived from plants yielding the columbo of commerce. Why, therefore, the root should be ascribed exclusively to either is not obvious. It is by no means improbable that the drug is obtained indifferently from both; and it is not, therefore, needful, while admitting the claims of the new species, to reject the old one. The French Codex, recently published, still ascribes the root to the Cocculus palmatus of De Candolle.

Cocculus. *Sex. Syst.* Dioecia Hexandria. — *Nat. Ord.* Menispermaceæ.

Gen. Ch. Sepals and Petals ternate, usually in 2, rarely in 3 rows. *Stamens* six, distinct, opposite the petals. *Drupes* berried, 1-6, generally oblique, reniform, somewhat compressed, one-seeded. *Cotyledons* distant. *De Cand.*

Cocculus palmatus. De Cand., *Syst. Veg.* i. 523; Woodv. *Med. Bot.*, 3d ed., v. 21; Hooker, *Curtis's Bot. Mag.*, Nos. 2970, 2971. *Jateorrhiza palmata.* Miers, *Annals and Mag. of Nat. Hist.*, Feb. 1864, p. 183. This is a climbing plant, with a perennial root, consisting of several fasciculated, fusiform, somewhat curved, and descending tubers, as thick as an infant's arm. The stems, of which one or two proceed from the same root, are twining, simple in the male plant, branched in the female, round, hairy, and about as thick as the little finger. The leaves, which stand

* The following is the generic character given by Mr. Miers of his Jateorrhiza abbreviated. "Flores dioici. Masc. *Sepala* 6, ovata, 2-seriata, exteriora paulo minora. *Petala* 6, ovata, sepalis paulo breviora, apice truncata, lateribus introflexis stamina tegentia. *Stamina* 6, petalis opposita et subæquilonga; *filamenta* carnosa, apice valde tumida, rugulosa punctata, subito refracta, et extrorsum antherifera; *antheræ* globoso 4 lobæ, rima horizontali 2-valvatim hiantes. Fœm. *Sepala* ut in masc. *Petala* cuneato-obovata, crassiuscula, apice emarginata, lateribus introflexis stamina volventia. *Stamina* 6, sterilia, petalis dimidio breviora. *Ovaria* 3, libera, erecta, oblonga, gibba, extus dense glanduloso-pilosa, gynæcio sub 3-gono imposita, 1-locularia; *ovulo* unico. *Stylus* brevis, crassus, subexcentricus. *Stigma* 3-partitum, laciniis 2-3 fidis, reflexis. *Drupæ* 3, abortu pauciores, ovatæ, carnosæ, 1-spermæ; *putamen* ovatum, dorso convexum, tuberculatum, pilis fibrillosis creberrime indutum, ventre læve." (*Annals and Magaz. of Nat. Hist.*, Feb. 1864, p. 132.)— *Note to the thirteenth edition.*

on rounded, glandular hairy footstalks, are alternate, distant, cordate, with three, five, or seven entire, acuminate, wavy, somewhat hairy lobes, and as many nerves, each running into one of the lobes. The flowers are small and inconspicuous, and arranged in solitary axillary racemes, which, in the male plant, are compound, in the female, simple, and in both, shorter than the leaves.

Jateorrhiza Calumba. Miers. Br. Pharm. — *Cocculus palmatus.* Wallich, non De Cand. — *Menispermum Columba.* Roxb. *Flor. Ind.* This species is characterized by "rounded, angularly striate, roughly pilose branches; broadly orbicular, sinuously lobed leaves, with rounded sinuses; the lobes being 5 in number, broadly ovate, acute, mucronately acuminate; the basal deeply divaricate and hence broadly cordate; 7 to 9 nerved, opaque above, on both sides furnished with short, adpressed, somewhat curved, reddish hairs, beneath, pale, strongly reticulate with prominent nerves and veins; the petiole somewhat slender, striate, tortuous, and roughly glandular; the racemes axillary, solitary or many; the rachis greatly elongated, striate, bristly, with elongated, smooth, divaricate, almost capillary, subflexuous, few-flowered branches; the flowers sessile, and almost without bractes." (*Miers.*)

These plants are natives of Mozambique, on the south-eastern coast of Africa, where they grow wild in great abundance in the thick forests extending from the sea many miles into the interior. They are not cultivated. The root is dug up in March, when dry weather prevails. From the base of the root numerous fusiform offsets proceed, less fibrous and woody than the parent stock. These offsets are separated and cut into transverse slices, which are dried in the shade. The old root is rejected.

Columbo is a staple export of the Portuguese from their dominions in the south-east of Africa. It is taken to India, and thence distributed. It was formerly supposed to be a product of Ceylon, and to have derived its name from Colombo, a city of that island, from which it was thought to be exported. It is possible that, when the Portuguese were in possession of Ceylon, Colombo may have been the entrepot for the drug brought from Africa, and thus have given origin to its name. Some, however, consider a more probable derivation to be from the word *calumb*, which is said to be the Mozambique name for the root. Dr. Christison has been misinformed in relation to the cultivation of the true columbo plant in this country. (*Dispensatory*, Am. ed., p. 304.)

Properties. The root, as it reaches us, is in flat circular or oval pieces, from the eighth of an inch to near an inch in thickness, and from one to two inches in diameter. Along with these are sometimes a few cylindrical pieces an inch or two in length. The cortical portion is thick, of a bright-yellow, slightly greenish colour internally, but covered with a brownish, wrinkled epidermis. The interior or medullary portion, which is readily distinguishable from the cortical, is light, spongy, yellowish, usually more or less shrunk, so that the pieces are thinnest in the centre; and is often marked with concentric circles and radiating lines. Those pieces are to be preferred which have the brightest colour, are most compact and uniform, and least worm-eaten. The odour of columbo is slightly aromatic. The taste is very bitter, that of the cortical much more so than that of the central portion, which is somewhat mucilaginous. The root is easily pulverized. The powder is greenish, becoming browner with age, and deepening when moistened. As it attracts moisture from the air, and is apt to undergo decomposition, it should be prepared in small quantities.

M. Planche analyzed columbo in 1811, and found it to contain an azotized substance, probably albumen, in large quantity, a bitter yellow substance not precipitated by metallic salts, and one-third of its weight of starch. He obtained also a small proportion of volatile oil, salts of lime and potassa, oxide of iron, and silica. Wittstock, of Berlin, afterwards isolated a peculiar crystallizable principle, which he called *colombin*. This crystallizes in beautiful transparent quadrilateral prisms, is without smell, and is extremely bitter. It is but very slightly soluble in water, alcohol, or ether, at ordinary temperatures, and yet imparts to these fluids a strongly bitter taste. It is more soluble in boiling alcohol, which deposits it upon cooling. The best solvent is dilute acetic acid. It is taken up by alkaline solutions, from which it is precipitated by acids. It has neither acid nor alkaline properties, and its alcoholic

and acetic solutions are not affected by the metallic salts, or the infusion of galls. It is obtained by exhausting columbo by means of alcohol of the sp. gr. 0·835, distilling off three-quarters of the alcohol, allowing the residue to stand for some days till crystals are deposited, and lastly treating these crystals with alcohol and animal charcoal. The mother-waters still contain a considerable quantity of colombin, which may be separated by evaporating with coarsely powdered glass to dryness, exhausting the residue with ether, distilling off the ether, treating the residue with boiling acetic acid, and evaporating the solution to crystallization.

From the researches of Dr. Bödeker it appears that another bitter principle exists in columbo, which corresponds in composition and chemical relations with *berberina*, the active principle of *Berberis vulgaris*, and is assumed to be identical with that substance. It was obtained by exhausting columbo with alcohol of 0·889, distilling off the alcohol, allowing the residual liquor to stand for three days so as to deposit the colombin, evaporating the supernatant liquid together with the aqueous washings of the colombin to dryness, exhausting the residue with boiling alcohol of 0·863, treating the solution thus obtained as the former one, submitting the residue to the action of boiling water, filtering and adding muriatic acid, collecting the precipitate thus formed on a filter, drying it with bibulous paper, and finally, in order to separate adhering acid, dissolving it in alcohol, and precipitating with ether. The result was an imperfectly crystalline, bright-yellow powder, of a disagreeable, bitter taste, supposed to be *muriate of berberina*. It is stated that berberina is present in columbo in much larger proportion than colombin, and, being freely soluble in hot water and alcohol, while colombin is but slightly so, is probably more largely extracted in the ordinary liquid preparations of the root. (*Am. Journ. of Pharm.*, xx. 322.) It is thought that berberina exists in columbo combined with a peculiar acid denominated *columbic acid;* and that, while the colombin occurs in the cells of the root in a crystalline state, the columbate of berberina is deposited in the thickening layers of the cell-membranes. (*Chem. Gaz.*, vii. 150.) It is probable that the bitter yellow principle of Planche either was berberina or contained it.

There can be little doubt that both colombin and berberina contribute to the remedial effects of columbo. The virtues of the root are extracted by boiling water and by alcohol. Precipitates are produced with the infusion and tincture by infusion of galls, and solutions of acetate and subacetate of lead; but the bitterness is not affected.

Adulterations. It is said that the root of *white bryony*, tinged yellow with the tincture of columbo, has sometimes been fraudulently substituted for the genuine root; but the adulteration is too gross to deceive those acquainted with the characters of either of these drugs. American columbo, which is the root of *Frasera Walteri*, is said to have been sold in some parts of Europe for the genuine. Independently of the sensible differences between the two roots (see *Frasera*), M. Stolze of Halle states that, while the tincture of columbo remains unaffected by the sulphate or sesquichloride of iron, and gives a dirty-gray precipitate with tincture of galls, the tincture of frasera acquires a dark-green colour with the former reagent, and is not affected by the latter. (*Duncan.*) Under the name of *columbo wood*, or *false columbo*, the wood of *Coscinium fenestratum*, a plant of the family of Menispermaceæ, growing in Ceylon, has been imported into England, and offered for sale in the drug market. (*Pharm. Journ.*, x. 321, and xii. 185.)

Medical Properties and Uses. Columbo is among the most useful of the mild tonics. Without astringency, with very little stimulating power, and generally acceptable to the stomach, it answers admirably as a remedy in simple dyspepsia, and in the debility of convalescence, especially when the alimentary canal is left enfeebled. Hence, it is often prescribed in the declining stages of remittent fever, dysentery, diarrhœa, cholera morbus, and cholera infantum. The absence of irritating properties renders it also an appropriate tonic in the hectic fever of phthisis, and kindred affections. It has been highly recommended in vomiting, unconnected with inflammation of the stomach, as in the sickness of pregnant women. It is frequently administered in combination with other tonics, aromatics, mild cathartics, and antacids. The remedy which we have found most effectual in the permanent cure of a

disposition to the accumulation of flatus in the bowels, is an infusion made with half an ounce of columbo, half an ounce of ginger, a drachm of senna, and a pint of boiling water, and given in the dose of a wineglassful three times a day. Columbo is much used by the natives of Mozambique in dysentery and other diseases. (*Berry.*) It was first introduced to the notice of the profession in Europe by François Redi, in the year 1685. It is most commonly prescribed in the state of infusion. (See *Infusum Calumbæ.*) The dose of the powder is from ten to thirty grains, and may be repeated three or four times a day. It is frequently combined with powdered ginger, subcarbonate of iron, and rhubarb.

Off. Prep. Extractum Calumbæ, *Br.;* Extract. Calumbæ Fluidum, *U. S.;* Infusum Calumbæ; Mistura Ferri Aromatica, *Br.;* Tinctura Calumbæ. W.

CAMPHORA. *U. S., Br.*

Camphor.

A peculiar concrete substance derived from Camphora officinarum (Nees, *Laurin.* 88), and purified by sublimation. *U. S.* A concrete volatile oil, obtained from the wood of Camphora officinarum; imported in the crude state from China and Japan, and purified by sublimation. *Br.*

Camphre, *Fr.;* Kampher, *Germ.;* Canfora, *Ital.;* Alcanfor, *Span.*

The name of camphor has been applied to various concrete, white, odorous, volatile products, found in different aromatic plants, and resulting probably from chemical change in their volatile oil. But commercial camphor is derived exclusively from two plants, the *Camphora officinarum* of Nees or *Laurus Camphora* of Linnæus, and the *Dryobalanops Camphora;* the former of which yields our officinal camphor, the latter a product much valued in the East, but unknown in the commerce of this country and of Europe. A considerable quantity of camphor, said to be identical with the officinal, was a few years since obtained upon the Tenasserim Coast, in further India, by subliming the tops of an annual plant, abundant in that region, and thought to be a species of Blumia. This product, however, has not been introduced into general commerce. (*Am. Journ. of Pharm.*, xvi. 56.) The Rev. Mr. Mason, an American missionary in Burmah, states, in a letter to Mr. Vaux, of Philadelphia, that the Chinese settlers informed him that the same plant abounds in China, and that camphor is procured from it there. (*Proceed. of the Acad. of Nat. Sci. of Phil.*, May 13, 1851, p. 201.) The following observations apply to the officinal camphor.

Camphora. *Sex. Syst.* Enneandria Monogynia.—*Nat. Ord.* Lauraceæ.

Gen. Ch. Flowers hermaphrodite, panicled, naked. *Calyx* six-cleft, papery, with a deciduous limb. *Fertile stamens* nine, in three rows; the inner with two-stalked, compressed glands at the base; anthers four-celled; the outer turned inwards, the inner outwards. Three *sterile stamens* shaped like the first, placed in a whorl alternating with the stamens of the second row; three others stalked, with an ovate glandular head. *Fruit* placed on the obconical base of the calyx. *Leaves* triple-nerved, glandular in the axils of the principal veins. Leaf buds scaly. (Lindley, *Flora Medica*, 332.)

Among the species composing the genus Laurus of Linn., such striking differences have been observed in the structure of the flower and fruit, that botanists have been induced to arrange them in new genera. The camphor, cinnamon, and sassafras trees have been separated from the proper laurels by Nees, and made the type of distinct genera, which have been adopted by most recent writers, and may be considered as well established.

Camphora officinarum. Nees, *Laurin.* 88; Carson, *Illust. of Med. Bot.* ii. 29, pl. lxxiv.—*Laurus Camphora.* Willd. *Sp. Plant.* ii. 478; Woodv. *Med. Bot.* p. 681, t. 236. The camphor-tree is an evergreen of considerable size, having the aspect of the linden, with a trunk straight below, but divided above into many branches, which are covered with a smooth, greenish bark. Its leaves, which stand alternately upon long footstalks, are ovate-lanceolate, entire, smooth and shining, ribbed, of a bright yellowish-green colour on their upper surface, paler on the under, and two or three

inches in length. The flowers are small, white, pediceled, and collected in clusters, which are supported by long axillary peduncles. The fruit is a red berry, resembling that of the cinnamon. The tree is a native of China, Japan, and other parts of eastern Asia. It has been introduced into the botanical gardens of Europe, and is occasionally met with in our own conservatories.*

The leaves have when bruised the odour of camphor, which is diffused through all parts of the plant, and is obtained from the root, trunk, and branches by sublimation. The process is not precisely the same in all places. The following is said to be the one pursued in Japan. The parts mentioned, particularly the roots and smaller branches, are cut into chips, which are placed with a little water in large iron vessels, surmounted by earthen capitals, furnished with a lining of rice-straw. A moderate heat is then applied, and the camphor, volatilized by the steam, rises into the capital, where it is condensed upon the straw. In China the comminuted plant is said to be first boiled with water until the camphor adheres to the stick used in stirring, when the strained liquor is allowed to cool; and the camphor which concretes, being alternated with layers of earth, is submitted to sublimation. In the Island of Formosa, where the camphor-tree abounds, the chips are heated in an iron pot, surmounted by another, and the product of the sublimation is introduced into large vats, with holes in the bottom, through which an oil escapes called *camphor-oil*, much used by the Chinese for medical purposes, and samples of which have been sent to Europe. The camphor, thus drained, is packed in bags and exported. (*Pharm. Journ.*, Dec. 1863, p. 280.)

Commercial History. Camphor, in the *crude* state, is brought to this country chiefly from Canton. It comes also from Batavia, Singapore, Calcutta, and frequently from London. All of it is probably derived originally from China and Japan. Two commercial varieties are found in the market. The cheapest and most abundant is the *Chinese camphor*, most of which is produced in the Island of Formosa, and thence taken to Canton. It comes in chests lined with lead, each containing about 130 pounds. It is in small grains or granular masses, of a dirty-white colour, and frequently mixed with impurities. It has occurred in commerce adulterated with muriate of ammonia. The other variety is variously called *Japan*, *Dutch*, or *tub* camphor, the first name being derived from the place of its origin, the second from the people through whom it was introduced into commerce, and the third from the recipient in which it is often contained. It has usually come from Batavia, to which port it was taken from Japan. Like the former variety, it is in grains or granular masses; but the grains are larger and of a pinkish colour, and there are fewer impurities, so that it yields a larger product when refined.

Crude camphor, as brought from the East, is never found in the shop of the apothecary. It must be refined before it can be used for medicinal purposes. The process for refining camphor was first practised in Europe by the Venetians, who probably derived it from the Chinese. It was afterwards transferred to the Dutch, who long enjoyed a monopoly of this business; and it is only within a few years that the process has been generally known. It is now practised largely in this country, and the camphor refined in our domestic establishments is equal to any formerly imported. Crude camphor is mixed with about one-fiftieth of quicklime, and exposed, in an iron vessel placed in a sand-bath, to a gradually increasing heat, by which it is melted, and ultimately converted into vapour, which condenses in a suitable recipient.† Refined in this manner, it is usually in the form of large circular cakes,

* The camphor-tree sometimes attains a great age and an enormous size. A tree seen by Kämpfer, in Japan, in 1691, with a trunk 36 feet in circumference, was in the year 1826 described by Siebold as having a circumference of 50 feet. (*Japan as it was and is*, by R. Hildreth. Boston, 1855, p. 337.) The author has seen a large tree growing in the open air at Naples, and has no doubt that it might be readily, and perhaps profitably cultivated in the southern parts of our own country, and especially in California.

† We are informed that the process is conducted in the following manner in the laboratories of Philadelphia. The vessels in which the camphor is put are of cast-iron, circular, from 12 to 15 inches or more in diameter, and four inches deep, with perpendicular sides, and a ledge at top, on which the cover rests. This consists of sheet-iron, with a hole through the centre about an inch in diameter, over which a small hollow cone of sheet-iron is placed loosely. The crude camphor mixed with the lime, the object of which is said to be to combine with the moisture present, which

one or two inches thick, slightly convex on one side and concave on the other, and perforated in the centre.

Properties. Camphor has a peculiar, strong, penetrating, fragrant odour; and a bitter, pungent taste, with a slight sense of coolness. It is beautifully white and pellucid, somewhat unctuous to the touch, brittle, and yet possessed of a tenacity which renders its reduction to a fine powder very difficult, unless its cohesion be overcome by the addition of a minute proportion of alcohol, or other volatile liquid for which it has an affinity. It may be obtained in powder also by precipitating the tincture with water, or by grating and afterwards sifting it.* The fracture of camphor is shining, and its texture crystalline. Its sp. gr. varies from 0·9857 to 0·996. When thrown in small fragments upon water, it assumes singular circulatory movements, which cease upon the addition of a drop of oil; and this property has been applied to the detection of grease in liquids, a very small proportion of which is sufficient to prevent the movements. Its volatility is so great that, even at ordinary temperatures, it is wholly dissipated if left exposed to the air. When it is confined in bottles, the vapour condenses on the inner surface, and, in large bottles partially filled, sometimes forms, after long standing, large and beautiful crystals. It melts at 288° F., boils at 400°, and, in close vessels, sublimes unchanged. When allowed to concrete slowly from the state of vapour, it assumes the form of hexagonal plates. It is not altered by air and light. It readily takes fire, burning with a brilliant flame, with much smoke, and without residue. Water triturated with camphor dissolves, according to Berzelius, not more than 1000th part; which, however, is sufficient to impart a decided odour and taste to the solvent. By the intervention of sugar or magnesia, a much larger proportion is dissolved. (See *Aqua Camphoræ.*) Carbonic acid increases the solvent power of water, as also does the spirit of nitrous ether. Ordinary alcohol will take up 75 per cent. of its weight of camphor, which is precipitated upon the addition of water. Berzelius states that 100 parts of alcohol, of the sp. gr. 0·806, dissolve 120 parts at 50° F. It is soluble without change in ether, the volatile and fixed oils, strong acetic acid, and diluted mineral acids, and is extremely soluble in chloroform. By strong sulphuric and nitric acids it is decomposed; the former carbonizing and converting it into artificial tannin, the latter, with the aid of repeated distillation, into *camphoric acid.* Alkalies produce very little effect upon it. Resins unite with it, forming a soft tenacious mass, in which the odour of the camphor is sometimes almost extinguished, and frequently diminished; and a similar softening effect results when it is triturated with the concrete oils.† Exposed to a

interferes with the due solidification of the camphor vapour, is placed in the iron vessels described, of which from 20 to 50 are arranged in a long sand-bath. Heat is then applied until the camphor melts, after which it is kept as nearly uniform as possible, so that the vaporization may take place regularly, without violent ebullition. The vapour condenses on the lower surface of the lid; and care is taken, by the occasional removal of the iron cone, and clearing of the opening by means of a knife, to allow the escape of any accidental excess of the vapour. They who desire to see minute details as to the mode of refining camphor practised in France, are referred to an article by M. Emile Perret, pharmacian at Moret, in the *Journ. de Pharm. et de Chimie* (Fev. 1868, p. 124).—*Note to the ninth and thirteenth editions.*

* But the powder thus formed is apt to aggregate on keeping. To obviate this it is recommended to rub it up with a minute proportion of carbonate of magnesium, from 10 to 20 grains to the ounce: or, as suggested by the late Mr. Henry F. Fish, of New York, by pouring an alcoholic solution of camphor into water in which carbonate of magnesium is suspended; the proportion employed being 16 ounces of camphor to a drachm of the carbonate, suspended in a gallon of water. The powder is allowed to settle on a filter. (*Am. Journ. of Pharm.*, Nov. 1870, p. 506.) Another method of accomplishing the same object, proposed by Mr. John C. Lowd, is to sublime camphor from a retort into a large chamber, and collect the powder. (*Ibid.*, March, 1872, p. 112.)—*Note to the fourteenth edition.*

† As this property of camphor may have a bearing, injuriously or otherwise, on pharmaceutical processes, it is desirable that the operator, as well as prescriber, should be aware of the degree of effect produced by different resinous substances which may be mixed with it. M. Planche has found that mixtures, formed by triturating powdered camphor with powdered *dragon's blood, guaiac, assafetida,* and *galbanum,* assume, and preserve indefinitely the pilular consistence; with *benzoin, tolu, ammoniac,* and *mastic,* though at first of a pilular consistence, afterwards become soft by exposure to the air; with *sagapenum* and *animé,* assume a permanently semi-liquid form: with *olibanum, opopanax, gamboge, euphorbium, bdellium, myrrh,* and *amber,* remain pulverulent though somewhat grumous; and with *tacamahac, resin of jalap, sandarac,* and *resinoid matter of cinchona,* preserve the form of powder indefinitely. The same experimenter observed that camphor loses its odour entirely when mixed with *assafetida, galbanum, sagapenum, animé,* and *tolu;* retains a feeble odour with *dragon's blood, olibanum, mastic, benzoin, opopanax, tacamahac, guaiac,* and *ammoniac;*

strong heat, in close vessels, camphor is resolved into a volatile oil and charcoal. It is closely analogous in character to the essential oils; and is thought to consist of a radical called *camphene* united with oxygen. Camphene, which is represented by pure oil of turpentine, is composed of twenty eqs. of carbon and sixteen of hydrogen ($C_{20}H_{16}$). With two eqs. of oxygen it forms camphor, with eight eqs. of the same element, hydrated camphoric acid, and with one eq. of hydrochloric acid, artificial camphor.* Camphor, dehydrated by means of chloride of zinc, is said to yield a hydrocarbon $C_{20}H_{14}$, at first considered identical with the *cymene* obtained from the oil of chamomile, but determined by Fittig and Ferber to be not identical though isomeric with that principle. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 157.)

Genuine camphor is said to be sometimes adulterated with the artificial, which may be detected by the action of ammonia upon its alcoholic solution, causing a flocculent precipitate, which does not redissolve, and the quantity of which is proportionate to

while with the other resinous substances above mentioned, it either has its odour increased, or retains it without material change. (*Journ. de Pharm.*, xxiv. 226.)

In mixing camphor with other substances in the form of powder, it is best first to pulverize the camphor with the aid of a little alcohol, then to pulverize the other substances together, and lastly to mix the two powders gently; much rubbing with the pestle having the effect of consolidating the granules of the camphor. (*Procter.*)

* *Sumatra Camphor. Borneo Camphor. Dryobalanops Camphor. Camphol.* It has long been known that a variety of camphor is produced in the islands of Sumatra and Borneo, by a forest tree, which remained until a recent period undetermined. It was at length, however, described by Colebrook, and is now recognised in systematic works as *Dryobalanops Camphora*, or *D. aromatica*. It is a very large tree, often exceeding one hundred feet in height, with a trunk six or seven feet in diameter, and ranking among the tallest and largest trees in India.* It is found in Sumatra and Borneo, and is abundant on the N. W. coast of the former island. The camphor exists in concrete masses, which occupy longitudinal cavities or fissures in the heart of the tree, from a foot to a foot and a half long, at certain distances apart. The younger trees are generally less productive than the old. The only method of ascertaining whether a tree contains camphor is by incision. A party proceeds through the forest, wounding the trees, till they find one which will answer their purpose; and hundreds may be examined before this object is attained. When discovered, the tree is felled and cut into logs, which are then split, and the camphor removed by means of sharp-pointed instruments. It is stated that the masses are sometimes as thick as a man's arm; and that the product of a middling-sized tree is nearly eleven pounds; of a large one double that quantity. The trees which have been wounded and left standing often produce camphor seven or eight years afterwards. Mrs. Ida Pfeiffer states, in her *Second Journey round the World* (Am. ed. p. 183), that the camphor is also found in a concrete state under the bark, and is swept down with long brooms. The Dryobalanops yields also a fragrant straw-coloured liquid, called in the East Indies *oil of camphor*, and highly valued as an external application in rheumatism and other painful affections. It is said to be found in trees too young to produce camphor, and is supposed to constitute the first stage in the development of this substance; as it occupies the cavities in the trunk which are afterwards filled with the camphor. It has been stated to hold a large portion of this principle in solution, and to yield an inferior variety by artificial concretion; but this was not true of a specimen in the possession of Dr. Christison. A specimen examined by Professor Procter deposited a small quantity of the camphor at a temperature near the zero of Fahrenheit. By the action of nitric acid, it may be combined with oxygen, and converted into camphor of the same character as that deposited by refrigeration. The whole tree is pervaded more or less by the camphor or the oil. The wood retains a fragrant smell, and, being on this account less liable to the attacks of insects, is highly esteemed for carpenter's work. The camphor wood-chests, occasionally brought to this country from the East Indies, are probably made out of the wood of the Dryobalanops.

It has been supposed that this variety of camphor is occasionally brought into the markets of Europe and America; but this is a mistake; as the whole produce of the islands is engrossed by the Chinese, by whom it is so highly valued that it commands at Canton, according to Mr. Crawford, seventy-eight times, according to Mr. Reeves, one hundred times the price of ordinary camphor. A specimen in our possession, which was sent to this country from Canton as a curiosity, and kindly presented to us by Dr. Joseph Carson, is in tabular plates of the size of a finger nail or smaller, of a foliaceous crystalline texture, white, somewhat translucent, of an odour analogous to that of common camphor, and yet decidedly distinct, and less agreeable. It has also a camphorous taste. It is more compact and brittle than ordinary camphor; and, though the pieces will often float for a time when thrown on water, yet they sink when thoroughly moistened, and deprived of adhering air. According to Dr. Christison, its sp. gr. is 1009. It is easily pulverized without the addition of alcohol. It is, moreover, much less disposed to rise in vapour, and to condense on the inside of the bottle containing it. Like ordinary camphor, it is fusible, volatilizable, very slightly soluble in water, and freely soluble in alcohol and in ether. Dr. Gregory considers it as the bihydrate of camphene ($C_{20}H_{18}O_2$).

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* For a particular description of this tree, see a paper by Dr. W. H. De Vriese, of Leyden, in the *American Journal of Pharm.* (xxiv. 329), taken from Hooker's Journal of Botany. In this paper it is stated on the authority of Dr. Junghuhn, who witnessed the process of collection, that the camphor is deposited in very small quantities, in minute fissures between the fibres, from which it is scraped off by small splinters of wood, or by the nail; and the thickest and oldest trees seldom yield more than two ounces. This account as to the productiveness of the tree differs greatly from that of Colebrook, as stated in the note above. (*Note to the tenth edition.*)

that of the artificial product in any mixture of the two. (*Am. Journ. of Pharm.*, xxxiv. 189.) As a means of distinguishing natural from the artificial camphor resulting from the reaction between oil of turpentine and muriatic acid, Mr. J. W. Bailey recommends that a drop of alcohol, holding a little of the camphor to be tested in solution, be allowed to evaporate on the slide of a microscope. The crystals then formed produce with polarized light beautiful colours, when of natural camphor, but not when of the artificial. (*Neues Repertorium*, xvi. 763, A. D. 1867.)

Medical Properties and Uses. Camphor does not seem to have been known to the ancient Greeks and Romans. Europe probably derived it from the Arabians, by whom it was employed as a refrigerant. Much difference of opinion has prevailed as to its mode of action; some maintaining its immediate sedative influence, others considering it as a direct and decided stimulant. Its operation appears to be primarily and chiefly directed to the cerebral and nervous systems; and the circulation, though usually affected to a greater or less extent, is probably involved, for the most part, through the brain. It acts, also, to a certain extent, as a direct irritant of the mucous membranes with which it is brought into contact, and may thus in some measure secondarily excite the pulse. The effects of the medicine vary with the quantity administered. In moderate doses it produces, in health, mental exhilaration, increased heat of skin, and occasional diaphoresis. The pulse is usually increased in fulness, but little, if at all, in force or frequency. According to the experiments of certain Italian physicians, it has a tendency to the urinary and genital organs, producing a burning sensation along the urethra, and exciting voluptuous dreams (*N. Am. Med. and Surg. Journ.*, ix. 442); and these experiments have been confirmed by the observations of Dr. Reynolds in a case of poisoning by camphor (*Brit. Am. Journ. of Med.*, June, 1846). Cullen, however, states that he has employed it fifty times, even in large doses, without having ever observed any effect upon the urinary passages. By many it is believed to calm irritation of the urinary and genital apparatus, and to possess antaphrodisiac properties. In its primary operation it allays nervous disorder, quiets restlessness, and produces a general placidity of feeling, and is thus highly useful in certain forms of disease attended with derangement of the nervous functions. In larger doses, it displays a more decided action on the brain, producing more or less giddiness and mental confusion, with a disposition to sleep; and in morbid states of the system, relieving pain, and allaying spasmodic action. In immoderate doses it occasions nausea, vomiting, anxiety, faintness, vertigo, delirium, insensibility, coma, and convulsions, which may end in death. The pulse, under these circumstances, is at first reduced in frequency and force (Alexander, *Experimental Essays*, p. 227); but, as the action advances, it sometimes happens that symptoms of strong sanguineous determination to the head become evident in the flushed countenance, inflamed and fiery eyes, and highly excited pulse. (*Quarin.*) In three cases of poisoning by camphor, reported by Schaaf, of Strasburg, the symptoms produced were violent and incessant convulsions, paleness and coolness of the surface, vomiting and frequent micturition, and finally stupor or coma. The patients were children, and the youngest, a girl of about eighteen months, died from the effects of the poison, of which she took about ten grains. (*Monthly Journ. of Med. Sci.*, Oct. 1850, p. 377.) There can be no doubt that camphor is absorbed; as its odour is observed in the breath and perspiration, and according to Dr. Reynolds, in the urine also, though the contrary has been asserted.

By its moderately stimulating powers, its diaphoretic tendency, and its influence over the nervous system, camphor is admirably adapted to the treatment of diseases of a typhoid character, which combine, with the enfeebled condition of the system, a frequent irritated pulse, a dry skin, and much nervous derangement, indicated by restlessness, watchfulness, tremors, subsultus, and low muttering delirium. With a view to its anodyne and narcotic influence, it is also used in diseases of an inflammatory character; as in our ordinary remittents, and the phlegmasiæ, particularly rheumatism, when the increased vascular action is complicated with derangement of the nervous system. In such cases, however, it should not be given until after proper depletion, and even then should be combined with such medicines as may obviate the slight stimulation it produces, and increase its tendency to the skin; as, for instance,

tartarized antimony, ipecacuanha, or nitre. In a great number of spasmodic and nervous disorders, and complaints of irritation, camphor has been extensively employed. The cases of this nature to which experience has proved it to be best adapted, are dysmenorrhœa, puerperal convulsions and other nervous affections of the puerperal state, and certain forms of mania, particularly nymphomania, and that arising from the abuse of spirituous liquors. In some of these cases, advantage may be derived from combining it with opium. Camphor has also been employed internally to allay the strangury produced by cantharides.

It is much used locally as an anodyne, dissolved in alcohol, oil, or acetic acid, and frequently combined with laudanum.* In rheumatic and gouty affections, and various internal spasmodic and inflammatory complaints, it often yields relief in this way. The ardor urinæ of gonorrhœa may be alleviated by injecting an oleaginous solution of camphor into the urethra; and the tenesmus from ascarides and dysentery, by administering the same solution in the form of enema. Twenty or thirty grains of camphor, added to a poultice, and applied to the perineum, allay the chordee which is a painful attendant upon gonorrhœa. Its vapour has been inhaled into the lungs with benefit in asthma and spasmodic cough; and a lump of it held to the nose is said to relieve coryza. It has been employed for the same purpose, and for nervous headache, in the form of powder snuffed up the nostrils. It enters into the composition of certain tooth-powders; but is asserted, when employed in this way, to injure the enamel of the teeth.

Camphor may be given in substance, in the form of bolus or pill, or diffused in water by trituration with various substances. The form of pill is objectionable; as in this state the camphor is with difficulty dissolved in the gastric liquor, and, floating on the top, is apt to excite nausea, or pain and uneasiness at the upper orifice of the stomach. Orfila states that, when given in the solid form, it is capable of producing ulceration in the gastric mucous membrane.† The emulsion is almost always preferred. This is made by rubbing up the camphor with loaf sugar, gum arabic, and water; and the suspension will be rendered more complete and permanent by the addition of a little myrrh. Milk is sometimes used as a vehicle, but is objectionable, from its liability to become speedily sour. The aqueous solution is often employed where only a slight impression is desired. For this purpose, the *Aqua Camphoræ* of the U.S. Pharmacopœia is preferable to the solution made by simply pouring boiling water upon a lump of camphor, which is sometimes prescribed under the name of *camphor tea.* When chloroform is not inadmissible, an elegant preparation may be made by dissolving camphor in that liquid, in the proportion of two drachms of the former to a fluidrachm of the latter, and then mixing the solution with water by the intervention of the yolk of an egg.

The medium dose of camphor is from five to ten grains; but, to meet various indications, it may be diminished to a single grain, or increased to a scruple. The injurious effects of an over-dose are said to be best counteracted, after clearing out the stomach, by the use of opium.

Off. Prep. Aqua Camphoræ; Ceratum Plumbi Subacetatis, *U.S.;* Linimentum Aconiti, *Br.;* Linimentum Belladonnæ, *Br.;* Linimentum Camphoræ; Linimentum Camphoræ Comp., *Br.;* Linimentum Iodi, *Br.;* Linimentum Saponis; Linimentum Sinapis Comp., *Br.;* Linimentum Terebinthinæ, *Br.;* Mistura Chloroformi, *U.S.;* Spiritus Camphoræ; Tinctura Camphoræ Composita, *Br.;* Tinct. Opii Camphorata, *U.S.;* Unguentum Hydrargyri Comp., *Br.;* Unguentum Plumbi Subacetatis Comp., *Br.* W.

* An *ointment of camphor* may be made by heating three parts, in powder, by means of a water-bath, with twelve parts of prepared lard, and stirring the solution thoroughly when it begins to thicken on cooling. (*Pharm. Journ.*, July, 1860, p. 41.) M. Parisel recommends, as affording a better product, that the powdered camphor and the lard should be mixed, at ordinary temperatures, in a thin well-glazed earthen vessel, and allowed to stand for twelve hours, with occasional agitation. The solution of the camphor is effected without apparent liquefaction, each molecule being dissolved in the surrounding molecules of the lard. (*Journ. de Pharm.*, Mai, 1860, p. 362.)—*Note to the twelfth edition.*

† There is some difficulty in making a good pilular mass with powdered camphor. Mr. W. H. Githens states that this difficulty may be obviated by using soap and honey as excipients. (*Am. Journ. of Pharm.*, xxxiii. 206.)—*Note to the twelfth edition.*

CANELLA. *U.S.*

Canella.

The bark of Canella alba. *U.S.*

Off. Syn. CANELLÆ ALBÆ CORTEX. *Canella Alba Bark.* The bark of Canella alba. *Br.*

Canelle blanche, *Fr.;* Weisser Zimmt, Canell, *Germ.;* Canella bianca, *Ital.;* Canela blanca, *Span.*

CANELLA. *Sex. Syst.* Dodecandria Monogynia.—*Nat. Ord.* Meliaceæ. *De Cand.* Canelleæ. *Lindley.*

Gen. Ch. Calyx three-lobed. *Petals* five. *Anthers* sixteen, adhering to an urceolate nectary. *Berry* one-celled with two or four seeds. *Willd.*

Canella alba. Willd. *Sp. Plant.* ii. 851; Woodv. *Med. Bot.* p. 694, t. 237; Carson, *Illust. of Med. Bot.* i. 24, pl. 16. This is the only species of the genus. It is an erect tree, rising sometimes to the height of fifty feet, branching only at the top, and covered with a whitish bark, by which it is easily distinguished from other trees in the woods where it grows. The leaves are alternate, petiolate, oblong, obtuse, entire, of a dark-green colour, thick and shining like those of the laurel, and of a similar odour. The flowers are small, of a violet colour, and grow in clusters upon divided footstalks, at the extremities of the branches. The fruit is an oblong berry, containing one, two, or three black, shining seeds.

Canella alba is a native of Jamaica and other West India islands. The bark of the branches, which is the part employed in medicine, having been removed by an iron instrument, is deprived of its epidermis, and dried in the shade. It comes to us in pieces partially or completely quilled, occasionally somewhat twisted, of various sizes, from a few inches to two feet in length, from half a line to two or even three lines in thickness, and, in the quill, from half an inch to an inch and a half in diameter.

Properties. Canella is of a pale orange-yellow colour externally, yellowish-white on the inner surface, with an aromatic odour somewhat resembling that of cloves, and a warm, bitterish, very pungent taste. It is brittle, breaking with a short fracture, and yielding, when pulverized, a yellowish-white powder. Boiling water extracts nearly one-fourth of its weight; but the infusion, though bitter, has comparatively little of the warmth and pungency of the bark. It yields all its virtues to alcohol, forming a bright-yellow tincture, which is rendered milky by the addition of water. By distillation with water it affords a large proportion of a yellow or reddish, fragrant, and very acrid volatile oil. It contains, moreover, according to the analysis of MM. Petroz and Robinet, mannite, a peculiar very bitter extractive, resin, gum, starch, albumen, and various saline substances. Meyers and Reiche obtained twelve drachms of the volatile oil from ten pounds of the bark. They found it to consist of two distinct oils, one lighter and the other heavier than water. According to the same chemists, the bark contains 8 per cent. of mannite, and yields 6 per cent. of ashes. (See *Am. Journ. of Pharm.*, xvi. 75.) Canella has been sometimes confounded with Winter's bark, from which, however, it differs both in sensible properties and composition. (See *Wintera.*)

Medical Properties and Uses. Canella is possessed of the ordinary properties of the aromatics, acting as a local stimulant and gentle tonic, and producing upon the stomach a warming cordial effect, which renders it useful as an addition to tonic or purgative medicines, in debilitated states of the digestive organs. It is scarcely ever prescribed except in combination. In the West Indies it is employed by the negroes as a condiment, and has some reputation as an antiscorbutic.

Off. Prep. Pulvis Aloës et Canellæ, *U.S.;* Vinum Rhei. W.

CANNA. *U.S.*

Canna.

Syn. Tous les mois. *U.S.*

The fecula from the rhizome of an undetermined species of Canna. *U.S.*

CANNA. *Sex. Syst.* Monandria Monogynia.—*Nat. Ord.* Marantaceæ.

Gen. Ch. Corolla unequal, scarcely lip-shaped in any segment. *Stamens* petaloid, one with half an anther on the edge. *Style* straight, flat, nearly free. *Ovary* three-celled, many-seeded, granular. *Fruit* membranous, three-valved, with a deciduous granular surface. *Lindley.*

It is yet somewhat uncertain from what species of Canna the fecula commonly known by the French name *tous les mois*, and officinally designated *canna*, is derived, though it is generally believed to be C. edulis. The tubers of *Canna Achiras* (Gillies), growing in Central and South America, are said to be used as food in Peru and Chili (Lindley, *Med. and Econom. Bot.* p. 50); and a root or rhizome, closely resembling turmeric, and used by the native Africans at Sierra Leone for dyeing yellow, was found by Dr. Wm. F. Daniell to be the product of a species of Canna, believed to be the *C. speciosa* of Roscoe. (*Pharm. Journ.*, Nov. 1859, p. 258.)

Canna edulis. Lindley, *Flor. Med.* p. 569, figured in *Fl. Med. and Econ.* of the same author, p. 49. This is a tuberous plant, with erect, smooth, purplish stems, from four to six feet high, and invested with sheathing leaves, which are ovate-oblong, tapering towards each end, smooth, and of a deep glaucous green, with purplish edges. The flowers are few, and in compact racemes, of a red and yellow colour. The plant is a native of the West Indies, and is cultivated in the islands of St. Kitts, Trinidad, and perhaps others. The tubers, which are said to be three times larger than the fist, are first rasped, by means of a machine, into a pulp, from which the starch is extracted in the usual manner, by washing and straining, and, after the washings have been allowed to stand, so as to deposit the fecula, decanting the clear liquid. (Pereira, *Mat. Med.*)

Properties. Canna starch is in the form of a light, beautifully white powder, of a shining appearance, very unlike the ordinary forms of fecula. Its granules are said to be larger than those of any other variety of starch in use, being from the 300th to the 200th of an inch in length. Under the microscope they appear ovate or oblong, with numerous regular unequally distant rings; and the circular hylum, which is sometimes double, is usually situated at the smaller extremity. (*Pereira.*) This fecula has the ordinary chemical properties of starch, and forms, when prepared with boiling water, a nutritious and wholesome food for infants and invalids. It may be prepared in the same manner as *arrow-root*, and is said to form even a stiffer jelly with boiling water. (See *Maranta.*) W.

CANNABIS AMERICANA. *U.S.*

American Hemp.

The flowering tops of Cannabis sativa, cultivated in North America. *U.S.*

CANNABIS INDICA. *U.S., Br.*

Indian Hemp.

The flowering tops of the female plant of Cannabis sativa, variety Indica. *U.S.*

The dried flowering tops of the female plants of Cannabis sativa. That which is grown in India, and from which the resin has not been removed, is alone to be employed. *Br.*

CANNABIS. *Sex. Syst.* Dioecia Pentandria.—*Nat. Ord.* Cannabinaceæ.

Gen. Ch. MALE. *Calyx* five-parted. *Stamens* five. FEMALE. *Calyx* one-leaved, rolled up. *Styles* two. *Lindley.*

Cannabis sativa. Linn. *Sp. Plant.* 1457; Griffith, *Med. Bot.* p. 572. Hemp is an annual plant, from four to eight feet or more in height, with an erect, branching angular stem. The leaves are alternate or opposite, on long, lax footstalks, roughish, and digitate with linear-lanceolate, serrated segments. The stipules are subulate. The flowers are axillary; the male in long, branched, drooping racemes; the female in erect simple spikes. The stamens are five, with long pendulous anthers; the pistils two, with long, filiform, glandular stigmas. The fruit is ovate and one-seeded.

The whole plant is covered with a fine pubescence, scarcely visible to the naked eye, and is somewhat viscid to the touch. The hemp plant of India, from which the drug is derived, has been considered by some as a distinct species, and named *Cannabis Indica;* but the most observant botanists, upon comparing it with our cultivated plant, have been unable to discover any specific difference. It is now, therefore, regarded merely as a variety, and is distinguished by the epithet *Indica.* Dr. Pereira states that, in the female plant, the flowers are somewhat more crowded than in the common hemp; but that the male plants in the two varieties are in all respects the same. It is unfortunate that the name of *Indian hemp* has been attached to the medicinal product; as, in the United States, the same name has long been appropriated to *Apocynum cannabinum;* and some confusion has hence arisen.

C. sativa is a native of the Caucasus, Persia, and the hilly regions in the north of India. It is cultivated in many parts of Europe and Asia, and largely in our Western States. It is from the Indian variety exclusively that the medicine was formerly obtained; the heat of the climate in Hindostan apparently favouring the development of its active principle.* But the author, having noticed, in some common hemp cultivated in his own garden, the peculiar narcotic odour and characteristic resinous exudation of the Indian hemp, concluded that American hemp might be medicinally useful; the intense heat of our summers probably developing an activity not to be found in the hemp cultivated in the north of Europe. This suggested the offer of a prize, by our Philosophical Society, to any one who would experimentally determine the question, whether in the affirmative or the negative. Such a prize was accordingly offered, and the consequence was the presentation to the Society of a memoir, which claimed to have proved that our domestic hemp was decidedly energetic, and might be substituted without disadvantage for the imported. The memoir, having been submitted to examination, was decided to have fulfilled the terms of the offer; and the prize was accordingly granted. Dr. H. C. Wood, the author of the memoir, having obtained a parcel of the male plant from Kentucky, made an alcoholic extract of the leaves and tops, and, upon trying it on the system, found it effective in less than a grain, and, having inadvertently taken too large a dose, experienced effects which left no doubt of the powers of the medicine, and of the identity of its influence with that of the Indian plant. The results were so decisive that, at the late revision of our Pharmacopœia, the American plant was unhesitatingly introduced into the materia medica catalogue. The name of Cannabis Americana was adopted, not as expressive of a new species, but merely as a convenient officinal designation to distinguish the hemp cultivated in this country from that imported from India. How far the female tops might have the same effect is left uncertain; but, if we are to judge from analogy with the Indian plant, they would be preferable to the male. (*Proceedings of the Am. Philos. Soc.*, vol. xi., p. 226.)

The seeds, though not now officinal, have been used in medicine. They are about the eighth of an inch long, roundish-ovate, somewhat compressed, of a shining ash-gray colour, inodorous, and of a disagreeable, oily, sweetish taste. They yield by expression a fixed oil, which has the drying property, and is used in the arts. They contain also uncrystallizable sugar and albumen, and when rubbed with water form an emulsion, which may be used advantageously in inflammations of the mucous

* On a visit to the botanical garden of Edinburgh, in the autumn of 1860, the author saw a full-grown specimen of Cannabis sativa, and was surprised to find that it was only about four feet high, had little or no odour, and was scarcely adhesive when handled. If this is the general character of the hemp plant in the north of Europe, it is not surprising that it should be destitute of the medicinal properties of the Indian plant. As cultivated in his own garden in Philadelphia, the plant attains a height usually of six or eight feet, has a decided narcotic odour, and exudes so much of its peculiar resin as to be very adhesive to the fingers. It is highly probable, therefore, that the hemp plant grown in this country might be advantageously used in medicine. On this occasion Dr. Christison informed the author, from information he had received from India, that the plant there cultivated in the hot plains, does not yield hashish satisfactorily; but that this product is chiefly if not exclusively obtained from it in the hilly regions. He said, moreover, that the story of the natives running through the hemp fields, and collecting the resin on their clothing, from which it is afterwards scraped, is, if not quite untrue, at least apocryphal. He had been informed that the real mode of gathering it is to rub the hemp-tops between the hands, and, when the palms and fingers are sufficiently loaded with the resin, to scrape it off. It is possible, however, that different methods may be followed in different localities. (*Note to the twelfth edition.*)

membranes, though without narcotic properties. They are much used as food for birds, which are fond of them. They are generally believed to be in no degree poisonous; but M. Michaud relates the case of a child, in which serious symptoms of narcotic poisoning occurred after taking a certain quantity of them. It is probable that some of the fruit eaten by the child was unripe; as, in this state, it would be more likely to partake of the peculiar qualities of the plant itself. (*Annuaire de Thérap.*, A.D. 1860, p. 159.)

In Hindostan, Persia, and other parts of the East, hemp has long been habitually employed as an intoxicating agent. The parts used are the tops of the plant, and a resinous product obtained from it. The plant is cut after flowering, and formed into bundles from two to four feet long by three inches in diameter, which are sold in the bazaars under the name of *gunjah*. The *hashish* of the Arabs is essentially the same. The name *bang* is given to a mixture of the larger leaves and capsules without the stems. There is on the surface of the plant a resinous exudation to which it owes its clammy feel. Men clothed in leather run through the hemp fields, brushing forcibly against the plants, and thus separating the resin, which is subsequently scraped from their dress, and formed into balls. These are called *churrus*. In these different states of preparation, the hemp is smoked like tobacco, with which it is said to be frequently mixed. An infusion or decoction of the plant is also sometimes used as an exhilarating drink.

The imported *medicinal resin or extract of hemp*, directed by the U. S. Pharmacopœia of 1860, is made by evaporating a tincture of the dried tops. Dr. O'Shaughnessy directs it to be prepared by boiling the tops of the gunjah in alcohol until all the resin is dissolved, and evaporating to dryness by means of a water-bath. Mr. Robertson, of the Calcutta Medical College, prepares it by passing the vapour of boiling alcohol from the boiler of a still into the dried plant contained in a convenient receptacle, and evaporating the condensed liquor by a heat not exceeding 150° F. The Messrs. Smith, of Edinburgh, obtained a purer resin by the following process. Bruised gunjah is digested, first in successive portions of warm water, till the expressed liquid comes away colourless; and afterwards, for two days with a moderate heat, in a solution of carbonate of sodium, containing one part of the salt for two of the dried herb. It is then expressed, washed, dried, and exhausted by percolation with alcohol. The tincture, after being agitated with milk of lime containing one part of the earth for twelve of the gunjah used, is filtered; the lime is precipitated by sulphuric acid; the filtered liquor is agitated with animal charcoal, and again filtered; most of the alcohol is distilled off, and to the residue twice its weight of water is added; the liquor is then allowed to evaporate gradually; and, finally, the resin is washed with fresh water until it ceases to impart a sour or bitter taste to the liquid, and is then dried in thin layers. Thus obtained, it retains the odour and taste of the gunjah, of which 100 pounds yield 6 or 7 of the extract. Much of the commercial extract is very impure, and is but partially soluble in alcohol.

Under the name of *Extractum Cannabis Purificatum*, the U. S. Pharmacopœia of 1860 directed a preparation made by evaporating a tincture of the crude extract, which, from its greater uniformity of strength, was preferable for prescription. The *British Pharmacopœia* directs the Extract of Indian Hemp to be prepared by macerating an avoirdupois pound of the dried tops of the hemp, in coarse powder, in four Imperial pints of rectified spirit, for seven days, then expressing, and evaporating to the proper consistence. From this a tincture is ordered to be prepared. We have also, among the Preparations in the U. S. Pharmacopœia of 1870, two alcoholic extracts directed, one from the American, and the other from the Indian plant; and the former purified extract has been abandoned.

Properties. Fresh hemp has a peculiar narcotic odour, which is said to be capable of producing vertigo, headache, and a species of intoxication. It is much less in the dried tops, which have a feeble bitterish taste. According to Dr. Royle, *churrus* is when pure of a blackish-gray, blackish-green, or dirty olive colour, of a fragrant and narcotic odour, and a slightly warm, bitterish, and acrid taste. Schlesinger found in the leaves a bitter substance, chlorophyll, green resinous extractive, colouring matter, gummy extract, extractive, albumen, lignin, and salts. The plant also

contains volatile oil in very small proportion, which probably has narcotic properties. The resin is probably the active principle, and has received the name of *cannabin*. It is neuter, soluble in alcohol and ether, and separable from the alcoholic solution by water as a white precipitate. According to M. Laneau, of Brussels, it is insoluble in cold alcohol of 80 or 90 per cent., but is soluble in the same liquid heated, in cold absolute alcohol, ether, acetic ether, spirit of nitric ether, muriatic ether, chloroform, and bisulphuret of carbon. (See *Am. Journ. of Pharm.*, xxviii. 362.) Its taste is warm, bitterish, acrid, somewhat balsamic, and its odour fragrant, especially when heated.*

Medical Properties. Extract of hemp is a powerful narcotic, causing exhilaration, intoxication, delirious hallucinations, and, in its subsequent action, drowsiness and stupor, with little effect upon the circulation. It is asserted also to act as a decided aphrodisiac, to increase the appetite, and occasionally to induce the cataleptic state. In over-doses it may produce poisonous effects. In morbid states of the system, it has been found to cause sleep, to allay spasm, to compose nervous inquietude, and to relieve pain. In these respects, it resembles opium; but it differs from that narcotic in not diminishing the appetite, checking the secretions, or constipating the bowels. It is much less certain in its effects; but may sometimes be preferably employed, when opium is contraindicated by its nauseating or constipating effects, or its disposition to produce headache, and to check the bronchial secretion. The complaints in which it has been specially recommended are neuralgia, gout, rheumatism, tetanus, hydrophobia, epidemic cholera, convulsions, chorea, hysteria, mental depression, delirium tremens, insanity, and uterine hemorrhage. It has been found to cure obstinate intermittent fever, given before the paroxysm. Dr. Alexander Christison, of Edinburgh, has found it to have the property of hastening and increasing the contractions of the uterus in delivery, and has employed it with advantage for this purpose. It acts very quickly, and without anæsthetic effect. It appears, however, to exert this influence only in a certain proportion of cases. (*Ed. Month. Journ. of Med. Sci.*, xiii. 117, and xv. 124.) The strength of the extract varies much as found in commerce; and therefore no definite dose can be fixed. When it is of good quality half a grain or a grain will affect the system. The Messrs. Smith found two-thirds of a grain of their extract to produce powerful narcotic effects. In some instances it will be necessary to give as much as ten or twelve grains of the imported extract; and half an ounce of it has been taken without sensible effect. The proper plan is to begin with one-quarter or half a grain, repeated at intervals of two, three, or four hours, and gradually increased until its influence is felt, and the strength of the parcel employed is thus ascertained. Afterwards the dose will be regulated by the ascertained strength; but, should a new parcel be employed, the same caution must be observed as to the commencing dose. A tincture is prepared by dissolving six drachms of the extract in a pint of alcohol. The dose of this, equivalent to a grain of the extract, is about twenty minims, or forty drops. Dr. O'Shaughnessy gave ten drops every half hour in cholera, and a fluidrachm every half hour in tetanus. As the resin is precipitated by water, the tincture should be administered in mucilage or sweetened water. Alarming effects have been produced by over-doses.†

* From the effects on the system of the exhalations from fresh hemp, it was a very probable supposition that the plant owed its medical properties, in part it least, to a volatile principle. By repeated distillation of the same portion of water from relatively large quantities of hemp renewed at each distillation, M. J. Personne obtained a volatile oil, of a stupefying odour, and an action on the system such as to dispose him to think that it was the active principle of the plant. As the water distilled was strongly alkaline, he supposed that this volatile principle might be a new alkaloid; but the alkaline reaction was found to depend on ammonia; and the liquid obtained proved to be a volatile oil, lighter than water, of a deep-amber colour, a strong smell of hemp, and composed of two distinct oils, one colourless, with the formula $C_{36}H_{20}$, the other a hydrate of the first. For the former M. Personne proposes the name of *cannabene*. When this is inhaled, or taken into the stomach, a singular excitement is felt throughout the system, followed by a depression, sometimes amounting to syncope, with hallucinations which are generally disagreeable, but an action on the whole slighter and more fugitive than that of the resin. The pure resin of the Messrs. Smith, M. Personne considers to be complex, depending on volatile principles for its activity, deprived of which at a temperature of about 300° C., it becomes quite inert. (*Journ. de Pharm.*, A.D. 1857, p. 46.)—*Note to the twelfth edition.*

† A preparation of hemp has been recommended as an anodyne liniment in painful affections,

Off. Prep. Extractum Cannabis Americanæ, *U.S.;* Extract. Cannabis Indicæ, *U.S.;* Tinctura Cannabis, *U.S.;* Tinctura Cannabis Indicæ, *Br.* W.

CANTHARIS. *U.S., Br.*

Cantharides. Spanish Flies.

Cantharis vesicatoria, Lytta vesicatoria (*Fabricius*). *U.S.;* Cantharis vesicatoria. *Br.*

Cantharide, *Fr.;* Spanische Fliege, Kantharide, *Germ.;* Cantarelie, *Ital.;* Cantharidas, *Span.*

The term *Cantharis* was employed by the ancient Greek writers to designate many coleopterous insects or beetles. Linnæus gave the title to a genus not including the officinal blistering insect, and placed this in the genus *Meloë*, which, however, has been since divided into several genera. Geoffrey made the Spanish fly (beetle) the prototype of a new one called *Cantharis*, substituting *Cicindela* as the title of the Linnæan genus. Fabricius altered the arrangement of Geoffrey, and substituted *Lytta* for *Cantharis* as the generic name. The former was adopted by the London College, and at one time was in extensive use; but the latter, having been restored by Latreille, is now recognised in the British and American Pharmacopœias, and is universally employed. By this naturalist the vesicating insects were grouped in a small tribe, corresponding very nearly with the Linnæan genus Meloë, and distinguished by the title *Cantharideæ*. This tribe he divided into eleven genera, among which is Cantharis. Two others of these genera, *Meloë* properly so called, and *Mylabris*, have been employed as vesicatories. *Mylabris cichorii* is thought to be one of the insects described by Pliny and Dioscorides under the name of cantharides, and is to this day employed in Italy, Greece, the Levant, and Egypt; and another species, *M. pustulata*, is used for the same purpose in China. Mr. W. R. Warner has found 500 parts of M. cichorii to yield 2·13 parts of cantharidin, which somewhat exceeds the yield of Spanish flies. (*Am. Journ. of Pharm.*, xxviii. 195.) *Meloë proscarabæus* and *M. majalis* have been occasionally substituted for cantharides in Europe, and *M. trianthemæ* is used in the upper provinces of Hindostan. Several species of Cantharis, closely analogous in medical properties, are found in various parts of the world; but *C. vesicatoria* is the only one recognised as officinal in the United States, Great Britain, and France. A second species, *C. vittata*, was introduced into our national Pharmacopœia, but has been discarded, upon insufficient grounds, we think, in the present edition. Of this, and some other indigenous species, notice will be taken at the end of this article. At present we shall confine our observations to *C. vesicatoria.**

Cantharis. *Class* Insecta. *Order* Coleoptera. *Linn.*—*Family* Trachelides. *Tribe* Cantharideæ. *Latreille.*

Gen. Ch. Tarsi entire; *nails* bifid; *head* not produced into a rostrum; *elytra* flexible, covering the whole abdomen, linear, semicylindric; *wings* perfect; *maxillæ* with two membranous *laciniæ*, the external one acute within, subuncinate; *antennæ* longer than the head and thorax, rectilinear; first joint largest, the second transverse, very short; *maxillary palpi* larger at tip. *Say.*

Cantharis vesicatoria. Latreille, *Gen. Crust. et Insect.*, ii. p. 220. This beetle is from six to ten lines in length, by two or three in breadth, and of a beautiful, shining, golden-green colour. The head is large and heart-shaped, bearing two thread-like, black, jointed feelers; the thorax short and quadrilateral; the wing-sheaths long and flexible, covering brownish membranous wings. When alive, the Spanish flies have a strong, penetrating, fetid odour, compared to that of mice, by which swarms of them may be detected at a considerable distance. They attach themselves preferably to certain trees and shrubs, such as the white poplar, privet, ash, elder, and lilac,

made by heating together for five or six hours upon a salt-water bath one part of the bruised tops of Indian hemp and two parts of the oil of hempseed, and then expressing and filtering. (*Journ. de Pharm.*, Mars, 1863, p. 239.)—*Note to the twelfth edition.*

* They who wish to investigate the subject of vesicating insects generally are referred to a very elaborate paper, by M. C. Cooke, in the *Pharmaceutical Journal and Transactions* (Aug. 2, 1871, p. 101, and succeeding numbers). (*Note to the fourteenth edition.*)

upon the leaves of which they feed. They abound most in Spain, Italy, and the south of France; but are found also in all the temperate parts of Europe, and in the west of Asia. In the state of larva, they live in the ground and gnaw the roots of plants. They usually make their appearance in swarms upon the trees in May and June, when they are collected. The time preferred for the purpose is in the morning at sunrise, when they are torpid from the cold of the night, and easily let go their hold. Persons with their faces protected by masks, and their hands with gloves, shake the trees, or beat them with poles; and the insects are received as they fall upon linen cloths spread underneath. They are then plunged into vinegar diluted with water, or exposed in sieves to the vapour of boiling vinegar, and, having been thus deprived of life, are dried either in the sun, or in apartments heated by stoves. This mode of killing the flies by the steam of vinegar is as ancient as the times of Dioscorides and Pliny. In some places they are gathered by smoking the trees with burning brimstone. It has been proposed by M. Lutrand to destroy them by the vapour of chloroform. When perfectly dry, they are introduced into casks or boxes, lined with paper and carefully closed, so as to exclude as much as possible the atmospheric moisture. According to M. Neutwich, the young fly has no vesicating power; and even those half-grown are equally destitute of it. It is only those fully grown which are capable of blistering. (*Pharm. Journ.*, Nov. and Dec. 1870, p. 355.)

Cantharides come chiefly from Spain, Italy, Sicily, and other parts of the Mediterranean. Considerable quantities are also brought from St. Petersburg, derived originally, in all probability, from the southern provinces of Russia, where the insect is very abundant. The Russian flies are most esteemed. They may be distinguished by their greater size, and their colour approaching to that of copper.

Properties. Dried Spanish flies preserve the form and colour, and, to a certain extent, the disagreeable odour of the living insect. They have an acrid, burning, and urinous taste. Their powder is of a grayish-brown colour, interspersed with shining green particles, which are the fragments of the feet, head, and wing-cases. If kept perfectly dry, in well-stopped glass bottles, they retain their activity for a great length of time. A portion which had been preserved by Van Swieten for thirty years, in a glass vessel, was found still to possess vesicating properties. But, exposed to a damp air, they quickly undergo putrefaction; and this change takes place more speedily in the powder. Hence, the insects should either be kept whole, and powdered as they are wanted for use, or, if kept in powder, should be well dried immediately after pulverization, and preserved in air-tight vessels. They should never be purchased in powder, as, independently of the consideration just mentioned, they may in this state be more easily adulterated. But, however carefully managed, cantharides are apt to be attacked by mites, which feed on the interior soft parts of the body, reducing them to powder, while the hard exterior parts are not affected. An idea was at one time prevalent, that the vesicating property of the insect was not injured by the worm, which was supposed to devour only the inactive portion. But this has been proved to be a mistake. M. Farines, an apothecary of Perpignan, has satisfactorily shown that, though the hard parts left by these mites possess some vesicating power, and the powder produced by them still more, yet the sound flies are much stronger than either. Camphor, which has been recommended as a preservative, does not prevent the destructive agency of the worm.* It is stated by M. Farines that, when the flies are destroyed by the vapour of pyroligenous acid, instead of common vinegar, they acquire an odour which contributes to their preservation.

* It appears from the experiments of M. Nivet that, though camphor does not preserve the entire fly from the attacks of the larvæ of the *Anthrenus*, it actually destroys the mites of the Cantharis so often found in the powder, and may, therefore, be introduced with advantage, in small lumps, into bottles containing powdered cantharides. (*Journ. de Pharm.*, xix. 604.) Carbonate of ammonium has also been recommended as a preservative. Pereira has found that a few drops of strong acetic acid, added to the flies, are very effectual. Among the best means of preserving them, whether whole or in powder, is the application of the process of Apert, which consists in exposing them, for half an hour, confined in glass bottles, to the heat of boiling water, which destroys the eggs of the insect, without impairing the virtues of the flies. (*Ibid.*, xxii. 246.) Of course the access of water to the flies should be carefully avoided. Lutrand recommends chloroform as the best preservative that he has tried. (*Journ. de Pharm.*, xviii. 214.) We have little doubt that exposure, in a confined vessel, to the vapour of carbolic acid, would be a perfect protection against all forms of insect life.

Cantharides will bear a very considerable heat without losing the brilliant colour of their elytra; nor is this colour extracted by water, alcohol, ether, or the oils; so that the powder might be deprived of all its active principles, and yet retain the exterior characters unaltered. The wing-cases resist putrefaction for a long time, and the shining particles have been detected in the human stomach months after interment.

So early as 1778, Thouvenel attempted to analyze cantharides, and the attempt was repeated by Dr. Beaupoil in 1803; but no very interesting or valuable result was obtained till 1810, when Robiquet discovered in them a crystalline substance, which proved to be the vesicating principle of the insect, and received the name of *cantharidin*. The constituents, according to Robiquet, are, 1. a green oil, insoluble in water, soluble in alcohol, and inert as a vesicatory; 2. a black matter, soluble in water, insoluble in alcohol, and inert; 3. a yellow viscid matter, soluble in water and alcohol, and without vesicating powers; 4. cantharidin; 5. a fatty matter insoluble in alcohol; 6. phosphates of calcium and magnesium, acetic acid, and in the fresh insect, a small quantity of uric acid. Orfila afterwards discovered a volatile principle, upon which the fetid odour of the fly depends. It is separable by distillation with water. Prof. Dragendorff has found a volatile principle which acts on the system in the same manner as cantharidin. When powdered flies are moistened with water and distilled, the part which passes over, at or below 212°, contains this principle. (*Chem. News*, May 31, 1867.) If, however, the statement of Mr. Guy is correct, that cantharidin sublimes at 212°, there can, we think, be little doubt that the new volatile principle of Dragendorff is cantharidin itself.

Cantharidin is a white substance, in the form of crystalline scales, of a shining micaceous appearance, inodorous, tasteless, almost insoluble in water, and in cold alcohol, but soluble in ether, chloroform, benzole, the oils, and in hot alcohol and acetic acid, which deposit it upon cooling.* It is fusible and volatilizable† by heat without decomposition, and its vapour condenses in acicular crystals. According to MM. Massing and Dragendorff, cantharidin, with the composition $C_{10}H_6O_4$, is capable of combining with two eqs. of water, and thus becomes cantharidic acid $C_{10}H_8O_6$, and in this state forms definite compounds with bases. These may be obtained by heating cantharidin with an alkaline solution. (*Journ. de Pharm. et de Chim.*, Janv. 1868, p. 79.) Cantharidin itself has been found to combine like an acid with the salifiable and earthy bases, forming soluble compounds with potassa, soda, and lithia, salts of very sparing solubility, with baryta, strontia, and lime, and, with magnesia a salt, which, though feebly soluble in water (100 parts of water dissolving only 0·24 of the salt), is much more largely dissolved in cold than in hot water, and in cold than hot alcohol. (For further details on the relation of cantharidin with bases, and on the preparation of its salts with these bases, see *Pharm. Journ.*, Oct. 1873, p. 282.) The most satisfactory test of cantharidin is its vesicating property. It may be obtained by macerating powdered flies in ether for several days; introducing the mixture into a percolation apparatus; adding, after the liquid has ceased to pass, fresh portions of ether, till it comes away nearly colourless; displacing the whole of the menstruum still remaining in the mass by pouring water upon it; distilling the filtered liquor so as to recover the ether; then allowing the residue to cool; and, finally, purifying the cantharidin which is deposited by treating it with boiling alcohol and

* The solubilities of cantharidin have been examined with great care by Professor Procter, with the following results. It is insoluble in water. Cold alcohol dissolves it slightly, hot alcohol freely. It is more soluble in ether, which also dissolves it more freely hot than cold. Chloroform, cold or hot, is its best solvent; and acetone ranks next to it in this respect. Olive oil, at 250° F., dissolves one-twentieth of its weight, and oil of turpentine, boiling hot, one-seventieth; and both deposit the greater portion on cooling. The olive oil solution after deposition vesicates, the terebinthinate does not. Strong acetic, sulphuric, and nitric acids dissolve it, with the aid of heat, and deposit it unchanged on cooling. It is also dissolved by solutions of potassa and soda, and to a small extent by strong solution of ammonia. (*Am. Journ. of Pharm.*, xxiv. 296.)—*Note to the tenth edition.*

Somewhat different results in relation to the solubility of cantharidin have been obtained by M. E. Rowan. Careful examination with distilled water showed that, when agitated for eight days at ordinary temperatures with pure cantharidin, it was capable of dissolving 0·0266 per cent. of that principle; boiling water dissolves 0·297 per cent.; alcohol (boiling at 99 Tralles.) 2·168 per cent. (*Journ. de Pharm.*, Mai, 1873, p. 409).—*Note to the fourteenth edition.*

† As determined by the experiments of Mr. Wm. A. Guy, the subliming heat of isolated cantharidin is 212° F., or the temperature of boiling water. (*Pharm. J. and Trans.*, Feb. 1868, p. 373.) —*Note to the thirteenth edition.*

animal charcoal. Alcohol of 34°, or a mixture of alcohol and ether, may be substituted for the ether itself; but the last-mentioned fluid is preferable, as it dissolves less of the green oil, the separation of which from the cantharidin is the most difficult part of the process. By this plan, M. Thierry obtained, from 1000 parts of powdered flies, 4 parts of pure cantharidin. Notwithstanding the insolubility of this principle in water and cold alcohol, the decoction and tincture of cantharides have the medicinal properties of the insect; and Lewis ascertained that both the aqueous and alcoholic extracts acted as effectually in exciting vesication as the flies themselves, while the residue was in each case inert. Cantharidin consequently exists in the insect, so combined with the yellow matter as to be rendered soluble in water and cold alcohol. It has been found in Cantharis vittata, Mylabris cichorii, and different species of Meloë.* M. Ferrer found cantharidin in all parts of the fly, but somewhat more largely in the soft than the hard parts. (*Journ. de Pharm.*, Oct. 1859, p. 279.)

Adulterations. These are not common. Occasionally other insects are added, purposely, or through carelessness. These may be readily distinguished by their different shape or colour. Flies exhausted of their cantharidin by ether are said to have been substituted for the genuine. An account has been published of considerable quantities of variously coloured glass beads having been found in a parcel of the drug; but this would be too coarse a fraud to be extensively practised. Pereira states that powdered flies are sometimes adulterated with euphorbium.

Medical Properties and Uses. Internally administered, cantharides are a powerful stimulant, with a peculiar direction to the urinary and genital organs. In moderate doses, this medicine sometimes acts as a diuretic, and generally excites some irritation in the urinary passages, which, if its use be persevered in, or the dose increased, often amounts to violent strangury, attended with excruciating pain, and the discharge of bloody urine. In still larger quantities, it produces, in addition to these effects, obstinate and painful priapism, vomiting, bloody stools, severe pains in the whole abdominal region, excessive salivation with a fetid cadaverous breath, hurried respiration, a hard and frequent pulse, burning thirst, exceeding difficulty of deglutition, sometimes a dread of liquids, frightful convulsions, tetanus, delirium, and death. Orfila has known twenty-four grains of the powder to prove fatal. Dissection reveals inflammation and ulceration of the mucous coat of the whole intestinal canal. According to M. Poumet, if the intestines be inflated, dried, cut into pieces, and examined in the sun between two pieces of glass, they will exhibit small shining yellow or green points, strongly contrasting with the matter around them. (*Journ. de Pharm.*, 3e sér., iii. 167.)† The poisonous effects are to be counteracted by emetics, cathartics, bleeding, and opiates by the stomach and rectum. Dr. Mulock, of Dublin, recommends the officinal solution of potassa as an antidote, having found thirty drops given every hour an effectual remedy in strangury from blisters. (*Dub. Quart. Journ.*

* Professor Procter informs us that he has succeeded, by means of chloroform, in isolating cantharidin with great facility. He treats the flies with chloroform by percolation, displacing the last portion by means of alcohol, and allows the resulting solution to evaporate spontaneously. Cantharidin is thus obtained in crystals mixed with the green oil, the greater portion of which may be removed by bibulous paper. The residuary crystals are dissolved in a mixture of ether and alcohol, which, by the spontaneous evaporation of the ether, yields the cantharidin nearly pure. (*Note to the ninth edition.*)

M. Mortreux, having ascertained that cantharidin is insoluble in sulphuret of carbon, proposes to use this fluid for removing the fatty matter associated with the cantharidin crystals obtained by the use of chloroform, as in the foregoing process of Prof. Procter. He employs the same liquid in estimating the proportion of cantharidin, which he has found to be about 20 centigrammes for 40 grammes of the flies, or the half of one per cent. (*Journ. de Pharm. et de Chim.*, 3e sér., xlvi. 33, A. D. 1864.)—*Note to the thirteenth edition.*

Wittstein obtains it by digesting coarsely powdered flies repeatedly with water, straining through linen and expressing, allowing the liquid to settle for a day, separating the supernatant oil, adding a little wood charcoal, evaporating to dryness, treating the residue with sulphuric ether so long as the solution affords a laminated substance on evaporation, evaporating the ethereal solution, treating the residue with cold alcohol of 80 per cent. for one day with frequent shaking, and finally drying the scales. (See *Am. Journ. of Pharm.*, xxviii. 231.) Mr. Williams has obtained it by means of benzole. (*Ibid.*, xxvi. 340.)—*Note to the eleventh edition.*

† Cantharidin may be detected in the body after death from poisoning. M. Dragendorff, contrary to the opinion that cantharidin is so rapidly decomposed in a case of poisoning as to render search for it futile, states that he has succeeded in finding it in the dead body of a cat three months after it had been taken, and is convinced that it might be discovered in the human corpse six months after burial. (*Journ. de Pharm.*, Nov. 1873, p. 443.)—*Note to the fourteenth edition.*

of Med. Sci., N. S., vi. 222.) From the experiments of Schroff it seems that oils somewhat accelerate the poisonous action, probably by dissolving the cantharidin. (See *Am. Journ. of Pharm.*, xxviii. 365.) By experiments upon dogs, M. Thouery, a French apothecary, has satisfied himself that animal charcoal possesses a real antidotal power. (*Journ. de Pharm.*, Janv. 1858, p. 65.) Notwithstanding their exceeding violence, cantharides have been long and beneficially used in medicine. Either these or other vesicating insects appear to have been given by Hippocrates in dropsy and amenorrhœa, in the latter of which complaints, when properly prescribed, they are a highly valuable remedy. In dropsy they sometimes prove useful when the system is in an atonic state, and the vessels of the kidneys feeble. They are also useful in obstinate gleet, leucorrhœa, and seminal weakness; and afford one of the most certain means of relief in incontinence of urine, arising from debility or partial paralysis of the sphincter of the bladder. A case of diabetes is recorded in the *N. Am. Archives* (vol. ii. p. 175), in which recovery took place under the tincture of cantharides. They are used also in certain cutaneous eruptions, especially those of a scaly character, and in chronic eczema. Dr. Erven has employed them in scurvy (*Ann. de Thérap.*, 1845); and they have been found useful, internally administered, in obstinate ulcers. Their unpleasant effects upon the urinary passages are best obviated by the free use of diluent drinks; and, when not consequent upon great abuse of the medicine, may almost always be relieved by an anodyne injection, composed of laudanum with a small quantity of mucilaginous fluid. The dose of Spanish flies is one or two grains of the powder, which may be given twice a day, in the form of pill. The tincture, however, is more frequently employed.

Externally applied, cantharides excite inflammation in the skin, which terminates in a copious secretion of serum under the cuticle. Even thus employed, they not unfrequently give rise to strangury or tenesmus; and this is one of the most troublesome attendants upon their operation. It probably results from the absorption of the active principle of the fly. For various methods employed for obviating strangury from blisters, see *Ceratum Cantharidis.*

The blistering fly may be used either as a rubefacient, or to produce a blister. In the former capacity it is seldom employed, except in low states of disease, where external stimulation is required to support the system; but as an epispastic it is preferred to all other substances.

Blisters are calculated to answer numerous indications. Their local effect is attended with a general excitement, which renders them valuable auxiliaries to internal stimulants in low conditions of disease; and they may sometimes be safely resorted to with this view, when the latter remedies are inadmissible. The powerful impression they make on the system is sufficient, in many instances, to subvert morbid associations, and thus to allow the re-establishment of healthy action. Hence their application to the cure of remittent and intermittent fevers, in which they often prove effectual, when so employed as to be in full operation at the period for the recurrence of the paroxysm. On the principle of revulsion, they are useful in a vast variety of complaints. Drawing both the nervous energy and the circulating fluid to the seat of their immediate action, they relieve irritations and inflammations of internal parts; and are employed for this purpose in every disease attended with these derangements. In such cases, however, arterial excitement should be reduced before the remedy is resorted to. Blisters are also capable of substituting their own action for one of a morbid nature, existing in the part to which they are directly applied. Hence their use in tinea capitis, obstinate herpes, and various cutaneous eruptions. Their local stimulation renders them useful in some cases of threatened gangrene, and in partial paralysis. From the serous discharge they occasion, much good results in erysipelas and various other local inflammations, in the immediate vicinity of which their action can be established; and the effects of an issue may be obtained by the continued application of irritants to the blistered surface. Perhaps the pain produced by blisters may be useful in some cases of nervous excitement or derangement, in which it is desirable to withdraw the attention of the patient from subjects of agitating reflection. On some constitutions they produce a poisonous impression, attended with frequent pulse, dryness of the mouth and fauces, heat

of skin, subsultus tendinum, and even convulsions. What is the precise condition of system in which these effects result, it is impossible to determine. They probably arise from the absorption of the active principle, and depend on individual peculiarities of constitution. In this respect Spanish flies are analogous to mercury; and any argument drawn from this source against the use of the one would equally apply to the other. The general good resulting from their use far overbalances any partial and uncertain evil. For some rules relative to the application of blisters, the reader is referred to the article *Ceratum Cantharidis*, where also will be noticed other blistering preparations from cantharides.

In the United States are several species of Cantharis, which have been employed as substitutes for C. vesicatoria, and found equally efficient; but none of them are now recognised by our national Pharmacopœia; even *C. vittata*, which was at one time officinal, having been discarded. This we regret, as it seems to us that the native products of our country should always be encouraged when shown to be useful. We shall briefly notice all that have been submitted to experiment, and found to possess vesicating powers.

1. *Cantharis vittata.* Latreille, *Gen. Crust. et Insect.;* Durand, *Journ. of Phil. Col. of Pharm.*, ii. 274, fig. 4. The *potato fly* is rather smaller than *C. vesicatoria*, which it resembles in shape. Its length is about six lines. The head is light-red, with dark spots upon the top; the feelers are black; the elytra or wing-cases are black, with a yellow longitudinal stripe in the centre, and with a yellow margin; the thorax is also black, with three yellow lines; and the abdomen and legs, which have the same colour, are covered with a cinereous down. It inhabits chiefly the potato plant, and appears about the end of July or beginning of August, in some seasons very abundantly. It is found on the plant in the morning and evening, but during the heat of the day descends into the soil. The insects are collected by shaking them from the plant into hot water; and are afterwards carefully dried in the sun. They are natives of the Middle and Southern States. This species of Cantharis was first described by Fabricius in the year 1781; and was introduced to the notice of the profession by Dr. Isaac Chapman, of Bucks county, Pennsylvania, who found it equal if not superior to the Spanish fly as a vesicatory. The testimony of Dr. Chapman has been corroborated by that of many other practitioners, some of whom have even gone so far as to assert that the potato fly is not attended with the inconvenience of producing strangury. But this statement has been ascertained to be incorrect; and, as the vesicating property of all these insects probably depends on the same proximate principle, their operation may be considered as identical in other respects. If the potato fly has been found more speedy in its effects than the Cantharis of Spain, the result is perhaps owing to the greater freshness of the former. It may be applied to the same purposes, treated in the same manner, and given in the same dose as the foreign insect. Professor Procter obtained cantharidin from this species; and Mr. W. R. Warner has shown that the proportion of this ingredient is but slightly less than in Spanish flies, the former yielding 1·99, the latter 2·03 parts in 500. (*Am. Journ. of Pharm.*, xxviii. 195.) Professor Leidy, of the University of Pennsylvania, ascertained, by experiment, that the vesicating property of this insect resides in the blood, the eggs, and a peculiar fatty matter of certain accessory glands of the generative apparatus. (*Am. Journ. of Med. Sci.*, Jan. 1860, p. 60.)

2. *Cantharis cinerea.* Latreille, *Gen. Crust. et Insect.;* Durand, *Journ. of the Phil. Col. of Pharm.*, ii. 274, fig. 5. The *ash-coloured cantharis* closely resembles the preceding species in figure and size; but differs from it in colour. The elytra and body are black, without the yellow stripes that characterize C. vittata, and are entirely covered with a short and dense ash-coloured down, which conceals the proper colour of the insect. The feelers are black, and the first and second joints are very large in the male. This species also inhabits the potato plant, and is occasionally found on other plants, as the English bean and wild indigo. It is a native of the Northern and Middle States. Illiger in 1801 discovered its vesicating properties; but Dr. Gorham was the first to call public attention particularly to the subject, and to the fact of its equality in all respects with the potato fly, in a communication addressed, in the year 1808, to the Medical Society of Massachusetts.

3. *Cantharis marginata.* Latreille, *Gen. Crust. et Insect.;* Durand, *Journ. of the Phil. Col. of Pharm.*, ii. 274, fig. 6. This is somewhat larger than *C. vittata*, and of a different shape. The elytra are black with the suture and margin ash-coloured. The head, thorax, and abdomen are black, but nearly covered with an ash-coloured down; and, on the upper part of the abdomen, under the wings, are two longitudinal lines of a bright clay-colour. The insect is usually found, in the latter part of summer, upon different species of *Clematis*, and frequents especially the lower branches which trail along the ground. Professor Woodhouse, of Philadelphia, first ascertained its vesicating properties; but it had previously been described by Fabricius as a native of the Cape of Good Hope. Dr. Harris, of Massachusetts, found it as efficient as any other species.

4. *Cantharis atrata.* Latreille, *Gen. Crust. et Insect.;* Durand, *Journ. of the Phil. Col. of Pharm.*, ii. 274, fig. 7. The *black cantharis* is smaller than the indigenous species already described; but resembles *C. marginata* in figure. Its length is only four or five lines. It is distinguished by its size, and its uniform black colour. It frequents more especially the different species of *Aster* and *Solidago*, though it is found also on *Prunella vulgaris*, *Ambrosia trifida*, and some other plants. Mr. Durand met with considerable numbers of this insect near Philadelphia, in the month of September; and they continued to appear till the middle of October. They are common in the Northern and Middle States, but are not confined exclusively to this country, being found also in Barbary. Drs. Oswood and Harris, of New England, satisfactorily ascertained their vesicating powers. They are probably identical with the insect noticed as vesicatory by Prof. Woodhouse, under the name of *Meloë niger*.

Several other species have been discovered in the United States, but not yet practically employed. Among these are *C. æneas*, a native of Pennsylvania, discovered by Mr. Say; *C. politus* and *C. aszelianus*, inhabiting the Southern States; *C. Nuttalli*, a large and beautiful insect of Missouri, first noticed by Mr. Nuttall, and said to surpass the Spanish fly in magnitude and splendour; and *C. albida*, another large species, found by Mr. Say near the Rocky Mountains. Of these, *C. Nuttalli* (*Lytta Nuttalli*, Say, *Am. Entomol.*, i. 9) bids fair, at some future period, to be an object of importance in the western section of this country. The head is of a deep-greenish colour, with a red spot in front; the thorax is of a golden green; the elytra red or golden purple and somewhat rugose on their outer surface, green and polished beneath; the feet black; the thighs blue or purplish. The exploring party under Colonel Long ascertained the vesicating powers of this insect. It was found in the plains of the Missouri, feeding on a scanty grass. In one spot it was so numerous as to be swept away by bushels, in order that a place might be cleared for encamping. Dr. Geo. H. Horn, in a contribution to the *Medical Zoology* of Prof. Harrison Allen (p. 150), mentions two species as inhabiting California, *C. vulnerata* (Lytta vulnerata, *Horn*), and *C. melœna* (Lytta melœna, *Horn*), which have been proved by many trials, internally and externally, to have all the virtues of the officinal Cantharis.

Off. Prep. Acetum Cantharidis, *Br.;* Ceratum Cantharidis, *U. S.;* Ceratum Extracti Cantharidis, *U. S.;* Charta Cantharidis, *U. S.;* Charta Epispastica, *Br.;* Collodium cum Cantharide, *U. S.;* Emplastrum Calefaciens, *Br.;* Emplastrum Cantharidis, *Br.;* Linimentum Cantharidis, *U. S.;* Liquor Epispasticus, *Br.;* Tinctura Cantharidis; Unguentum Cantharidis, *Br.* W.

CAPSICUM. *U. S.*

Capsicum. Cayenne Pepper.

Syn. Cayenne and African Pepper. *U. S.*

The fruit of Capsicum annuum, Capsicum fastigiatum (*Blum.*), and of other species of Capsicum. *U. S.*

Off. Syn. CAPSICI FRUCTUS. *Capsicum Fruit.* The dried fruit of Capsicum fastigiatum. Imported from Zanzibar, and distinguished in commerce as Guinea Pepper and Pod Pepper. *Br.*

Poivre de Guinée, Poivre d'Inde, *Fr.;* Spanischer Pfeffer, *Germ.;* Pepperone, *Ital.;* Pimiento, *Span.*

CAPSICUM. *Sex. Syst.* Pentandria Monogynia. — *Nat. Ord.* Solanaceæ.

Gen. Ch. Corolla wheel-shaped. *Berry* without juice. *Willd.*

Numerous species of Capsicum, inhabiting the East Indies and tropical America, are enumerated by botanists, the fruit of which, differing simply in the degree of pungency, may be indiscriminately used. *C. baccatum* or bird pepper, and *C. frutescens*, are said to yield most of the Cayenne pepper brought from the West Indies and South America; and Ainslie informs us that the latter is chiefly employed in the East Indies. The Br. Pharmacopœia recognises, as the source of capsicum, *C. fastigiatum*, a species growing in the East Indies, and on the coast of Guinea. The one most extensively cultivated in Europe and this country is *C. annuum*. The first three are shrubby plants, the last is annual and herbaceous.

Capsicum annuum. Willd. *Sp. Plant.* i. 1052; Woodv. *Med. Bot.* p. 226, t. 80.

The stem of the annual capsicum is thick, roundish, smooth, and branching; rises two or three feet in height; and supports ovate, pointed, smooth, entire leaves, which are placed without regular order on long footstalks. The flowers are solitary, white, and stand on long peduncles at the axils of the leaves. The calyx is persistent, tubular, and five-cleft; the corolla, monopetalous and wheel-shaped, with the limb divided into five spreading, pointed, and plaited segments; the filaments, short, tapering, and furnished with oblong anthers; the germen, ovate, supporting a slender style which is longer than the filaments, and terminates in a blunt stigma. The fruit is a pendulous, pod-like berry, light, smooth and shining, of a bright scarlet, orange, or sometimes yellow colour, with two or three cells, containing a dry, loose pulp, and numerous flat, kidney-shaped, whitish seeds.

The plant is a native of the warmer regions of Asia and America, and is cultivated in almost all parts of the world. It is abundantly produced in this country, both for culinary and medicinal purposes. The flowers appear in July and August, and the fruit ripens in October. Several varieties are cultivated in our gardens, differing in the shape of the fruit. The most abundant is probably that with a large irregularly ovate berry, depressed at the extremity, which is much used in the green state for pickling. The medicinal variety is that with long, conical, generally pointed, recurved fruit, usually not thicker than the finger. Sometimes we meet with small, spherical, slightly compressed berries, not greatly exceeding a large cherry in size. When perfectly ripe and dry, the fruit is ground into powder, and brought into market under the name of *red* or *Cayenne* pepper. Our markets are also partly supplied from the West Indies. A variety of capsicum, consisting of very small, conical, pointed, exceedingly pungent berries, less than an inch, is imported from Liberia. It is probably the Capsicum fastigiatum of the British Pharmacopœia. In England the fruit of C. annuum is frequently called *chillies*.

Powdered capsicum is usually of a more or less bright-red colour, which fades upon exposure to light, and ultimately disappears. The colour of the Liberia or African pepper, in powder, is a light-brownish yellow. The odour is peculiar and somewhat aromatic, stronger in the recent than in the dried fruit. The taste is bitterish, acrid, and burning, producing a fiery sensation in the mouth, which continues for a long time. The pungency appears to depend on a peculiar principle, which was obtained, though not in a perfectly isolated state, by Braconnot, and named *capsicin*. The fruit, freed from the seeds, was submitted to the action of alcohol, and the resulting tincture evaporated. During the evaporation a red-coloured wax separated, and the residuary liquor by further evaporation afforded an extract, from which ether dissolved the capsicin. This was obtained by evaporating the ether. It resembles an oil or soft resin, is of a yellowish-brown or reddish-brown colour, and, when tasted, though at first balsamic, soon causes an insupportably hot and pungent impression over the whole interior of the mouth. Exposed to heat it melts, and at a higher temperature emits fumes, which, even in very small quantity, excite coughing and sneezing. It is slightly soluble in water and vinegar, and very soluble in alcohol, ether, oil of turpentine, and the caustic alkalies, which it renders reddish-brown. It constitutes, according to Braconnot, 1·9 per cent. of the fruit.* The

* The capsicin of Braconnot, though containing the active principle of capsicum, was shown by Professor Procter to be itself a complex substance. By treating its alcoholic solution with subacetate of lead, he obtained an abundant precipitate, which, when washed with alcohol, proved to be quite tasteless, while the liquid from which it had been precipitated yielded, on evaporation, a

other ingredients, as ascertained by the same chemist, are colouring matter, an azotized substance, gum, pectic acid (probably pectin), and saline matters. Red oxide of lead is sometimes added to the powdered capsicum sold in Europe. It may be detected by digesting the suspected powder in diluted nitric acid, filtering, and adding a solution of sulphate of sodium, which will throw down a white precipitate if there be any oxide of lead present. Capsicum is said to be sometimes adulterated with coloured sawdust. It is occasionally attacked by insects.

Medical Properties and Uses. Cayenne pepper is a powerful stimulant, producing when swallowed a sense of heat in the stomach, and a general glow over the body, without any narcotic effect. Its influence over the circulation, though considerable, is not in proportion to its local action. It is much employed as a condiment, and proves highly useful in correcting the flatulent tendency of certain vegetables, and aiding their digestion. Hence the advantage derived from it by the natives of tropical climates, who live chiefly on vegetable food. In the East Indies it has been used from time immemorial. From a passage in the works of Pliny, it appears to have been known to the Romans. As a medicine it is useful in cases of enfeebled and languid stomach, and is occasionally prescribed in dyspepsia and atonic gout, particularly when attended with much flatulence, or occurring in persons of intemperate habits. It has also been given as a stimulant in palsy and certain lethargic affections. To the sulphate of quinia it forms an excellent addition in some cases of intermittents, in which there is a great want of gastric susceptibility. Upon the same principle of rousing the susceptibility of the stomach, it may prove useful in low forms of fever, as an adjuvant to tonic or stimulant medicines. Its most important application, however, is to the treatment of malignant sorethroat and scarlet fever, in which it is used both internally and as a gargle. The following formula was employed in malignant scarlatina, with great advantage, in the West Indies, where this application of the remedy originated. Two tablespoonfuls of the powdered pepper, with a teaspoonful of common salt, are infused for an hour in a pint of boiling liquid, composed of equal parts of water and vinegar. This is strained when cool through a fine linen cloth, and given in the dose of a tablespoonful every half hour. The same preparation is also used as a gargle. It is, however, only to the worst cases that the remedy is applied so energetically. In milder cases of scarlatina, with inflamed or ulcerated throat, much relief and positive advantage often follow the employment of the pepper in a more diluted state. Capsicum has been advantageously used in sea-sickness, in the dose of a teaspoonful, given in some convenient vehicle on the first occurrence of nausea. It is thought also to have been beneficial in hemorrhoidal affections. It has long been used as a stomachic stimulant in the enfeebled digestion of drunkards, and has been recommended in delirium tremens, in which, when taken early it is said sometimes to produce sleep, and thus to cut short the disease. (Dr. Lyons, *Med. Press and Circ.*, April 18, 1866.)

brownish substance much more pungent than the capsicin itself. Mr. F. V. Heydenreich, by treating the liquid just referred to with hydrosulphuric acid to separate the lead, filtering, and boiling to drive off the acetic and hydrosulphuric acids, obtained an amber-coloured oily substance, which, when purified by solution in alcohol, treatment with animal charcoal, filtration, and exposure to spontaneous evaporation, became of a light lemon-yellow colour, and presented the following properties. It had the aspect of an oil, rather more viscid than olive oil, was lighter than water, with the odour and intensely hot taste of capsicum, became nearly solid at 0° F., and very fluid when heated, without any tendency to crystallize in the former case, and at a high heat gave off very irritating fumes. It was very soluble in ether, chloroform, and alcohol of 0·809, and soluble in 80 parts of officinal alcohol, and appeared to be saponifiable. From his experiments, Mr. Heydenreich concluded that the capsicin, thus purified, consists of two oils, differing in colour and solubility in alcohol, and represents the virtues of capsicum in their most concentrated state. Mr. David Preston has subsequently examined into the subject, and concludes that the pungency of capsicum resides in a fixed oil; but, as nitric acid destroys the pungency of the oil, without otherwise affecting it, is disposed to think that the active principle is not the oil itself, but a distinct substance contained in it, which has not been isolated, and the nature of which remains undetermined. (*Am. Journ. of Pharm.*, May, 1865, p. 165.)—*Note to the twelfth and thirteenth editions.*

M. Felletar assures us that the capsicum fruit contains an alkaloid analogous to that of conium. It is only necessary to heat an extract of capsicum to render sensible the odour of this alkaloid; but the author does not present us with a satisfactory method of preparing it. (*Journ. de Pharm.*, Avril, 1870, p. 347, from *Zeitschrift für Chemie*, iv. 666.) See also *Am. Journ. of Pharm.*, Sept. 1869, p. 432, in which may be seen Dr. Felletar's method of rendering the alkaloid sensible, and partially isolating it. (*Note to the fourteenth edition.*)

Applied externally, Cayenne pepper is a powerful rubefacient, very useful in local rheumatism, and in low forms of disease, where a stimulant impression upon the surface is demanded. It has the advantage of acting speedily without endangering vesication. It may be applied in the form of cataplasm, or more conveniently and efficiently as a lotion, mixed with heated spirit. The powder or tincture, brought into contact with a relaxed uvula, often acts very beneficially. The tincture has also been used advantageously in chilblain. The ethereal extract (*Oleoresina Capsici, U. S.*) is powerfully rubefacient.

The dose of the powder is from five to ten grains, which is most conveniently given in the form of pill. Of an infusion prepared by adding two drachms to half a pint of boiling water, the dose is half a fluidounce. A gargle may be prepared by infusing half a drachm of the powder in a pint of boiling water, or by adding half a fluidounce of the tincture to eight fluidounces of rose-water.

Off. Prep. Infusum Capsici, *U. S.;* Oleoresina Capsici, *U. S.;* Tinctura Capsici.

W.

CARBO.

Carbon.

Pure charcoal; Carbone, *Fr., Ital.;* Kohlenstoff, *Germ.;* Carbon, *Span.*

Carbon is an element of great importance, and very extensively diffused in nature. It exists in large quantity in the mineral kingdom, and is the most abundant constituent of animal and vegetable matter. In the crystallized state it constitutes the diamond; and, more or less pure, it forms the substances called plumbago, graphite, or black lead, anthracite, bituminous coal coke, animal charcoal, and vegetable charcoal. Combined with oxygen it forms *carbonic acid*, which is a constituent of the atmosphere, and present in many natural waters, especially those which have an effervescing quality. United with oxygen and a base it forms the carbonates, among others *carbonate of calcium*, which is one of the most abundant minerals. There are three allotropic conditions of carbon, represented respectively by the diamond, graphite, and charcoal.

The *diamond* is found principally in India and Brazil. Several diamonds have been found in the gold region of Georgia. This gem is perfectly transparent, and the hardest and most brilliant substance in nature. Its sp. gr. is about 3·5. It is fixed and unalterable in the fire, provided air be excluded; but is combustible in air or oxygen, the product being the same as when charcoal is burned, namely, carbonic acid.

Next to diamond, plumbago and anthracite are the purest natural forms of carbon. *Plumbago* is the substance of which black-lead crucibles and pencils are made. It is found in greatest purity in the mine of Borrowdale, in England; but it also occurs very pure in this country, especially near Bustleton, in Pennsylvania. It was formerly supposed to be a carburet of iron; but, in very pure specimens, it is nearly free from iron, which must, therefore, be deemed an accidental impurity. *Anthracite* occurs in different parts of the world, but particularly in the United States. *Bituminous coal* is a form of the carbonaceous principle, in which the carbon is associated with volatile matter of a bituminous nature. When this is driven off by the process of charring, as in the manufacture of coal gas, a kind of mineral charcoal, called *coke*, is obtained, very useful in the arts as a fuel. When peat is charred, it is converted into *peat charcoal*, which forms a cheap disinfectant and deodorizer, applicable to the purification of hospitals, dissecting rooms, factories, privies, &c.

Carbon may be obtained in a state approaching to purity by several processes. One method is to expose lampblack to a full red heat in a close vessel. It may also be obtained, in a very pure state, by passing the vapour of volatile oils through an ignited porcelain tube; whereby the hydrogen and oxygen of the oil will be dissipated, and the charcoal left in the tube. A pure charcoal is procured by exposing sugar, or other vegetable substances which leave no ashes when burnt, to ignition in close vessels.

Properties. Carbon, in its uncrystallized state, is an insoluble, infusible solid,

generally of a black colour, and without taste or smell. It burns when sufficiently heated, uniting with the oxygen of the air, and generating carbonic acid gas. Its sp. gr. in the solid state, apart from its pores when in mass, is 3·5; but with the pores included, it is only 0·44. It is a very unalterable and indestructible substance, and has great power in resisting and correcting putrefaction in other bodies. When properly prepared, it possesses the property of destroying the colouring and odorous principles of most liquids. (See *Carbo Animalis.*) Its other physical properties differ according to its source, and peculiar state of aggregation. Its equivalent number is 6, and its symbol C. As a chemical element it enjoys a very extensive range of combination. It forms several compounds with oxygen, the principal of which are carbonic oxide, and carbonic and oxalic acids. With hydrogen it forms a number of compounds, called *carbohydrogens*, of which the most interesting, excluding hypothetical radicals, are light carburetted hydrogen or fire-damp, olefiant gas, the light and concrete oils of wine, and certain non-oxygenous volatile oils. With nitrogen it constitutes cyanogen, the compound radical of hydrocyanic or prussic acid; and united in minute proportion with iron it forms steel.

In the foam of anthracite, carbon has recently been used, with great supposed success, by Dr. A. Dyes, in diseases attended with a disordered state of the alimentary canal, as intestinal worms, catarrhal spasm of the stomach and gastric pains from affections of the liver and spleen, in chlorosis, in the splenic enlargement of intermittents, in scurvy, and scrofulous complaints. (*B. and F. Med.-chir. Rev.*, Jan. 1866, p. 239; from *Schmidt's Jahrbuch.*)

To notice all the forms of the carbonaceous principle would be out of place in this work. We shall, therefore, restrict ourselves to the consideration of those which are officinal, namely, *animal charcoal* and *wood charcoal.* B.

CARBO ANIMALIS. *U. S., Br.*

Animal Charcoal.

Charcoal prepared from bone. *U. S.* The residue of bones, which have been exposed to a red heat without access of the air. *Br.*

Bone black, *Br.;* Charbon animal, *Fr.;* Thierische Kohle, *Germ.;* Carbone Animale, *Ital.;* Carbon Animal, *Span.*

The animal charcoal employed in pharmacy and the arts, is usually obtained from bones, by subjecting them to a red heat in close vessels. The residue of the ignition is a black matter, which, when reduced to powder, forms *bone-black*, sometimes incorrectly called *ivory-black.* Ivory by carbonization will furnish a black, which, on account of its fineness and intensely black colour, is more esteemed than the ordinary bone-black; but it is much more expensive.

In manufacturing bone-black, the bones, first boiled in water to separate the fat, are subjected to destructive distillation in iron cylinders, connected with vessels which receive the ammoniacal liquor, called *bone-spirit;* this being a secondary product of the operation. When the bone-spirit ceases to come over, the residue is charred bone, or bone-black. Bone consists of animal matter with phosphate and carbonate of calcium. From a new arrangement of the elements of the animal matter, the nitrogen and hydrogen, united as ammonia, and a part of the charcoal, in the form of carbonic acid, distil over; while the remainder of the charcoal is left in the cylinder, intermingled with the calcareous salts. M. Deiss, of Paris, proposes bisulphuret of carbon as a solvent for the fat of bones; as it furnishes a larger and better product of fat, and renders the bones fitter for producing a good bone-black. (*Chem. Gaz.*, April 1, 1856.) This form of animal charcoal necessarily contains phosphate and carbonate of calcium.

Properties. Animal charcoal, in the form of bone-black, is a black powder, possessing a slightly alkaline and bitterish taste, and having a general resemblance to powdered vegetable charcoal. It is, however, more dense and less combustible than vegetable charcoal; from which, moreover, it may be distinguished by burning a small portion of it on a red-hot iron, when it will leave a residuum imperfectly acted on by sulphuric acid; whereas the ashes from vegetable charcoal readily dissolve in this acid, forming a bitterish solution.

Animal charcoal by no means necessarily possesses the decolorizing property; as this depends upon its peculiar state of aggregation. If a piece of pure animal matter is carbonized, it usually enters into fusion, and from the gaseous matter which is extricated, becomes porous and cellular. The charcoal formed has generally a metallic lustre, and a colour resembling that of black lead. It has, however, little or no decolorizing power, even though finely pulverized.

The decolorizing power of vegetable charcoal was first noticed by Lowitz, of St. Petersburg; and that of animal charcoal, by Figuier, of Montpellier, in 1811. In 1822 the subject was ably investigated by Bussy, Payen, and Desfosses. The power is generally communicated to charcoal by igniting it in close vessels, but not always The kind of charcoal, for example, obtained from substances which undergo fusion during carbonization scarcely possesses the property, even though it may be afterwards finely pulverized. The property in question is possessed to a certain extent by wood charcoal; but is developed in it in a much greater degree by burning it with some chemical substance, which may have the effect of reducing it to an extreme degree of fineness. The most powerful of all the charcoals for discharging colours are those obtained from certain animal matters, such as dried blood, hair, &c., by first carbonizing them in connection with carbonate of potassium, and then washing the product with water. Charcoal, thus prepared, seems to be reduced to a state of extremely minute division, and is, therefore, very porous. The next most powerful decolorizing charcoal is *bone-black*, in which the separation of the carbonaceous particles is effected by the phosphate of calcium present in the bone. Vegetable substances also may be made to yield a good charcoal for destroying colour, provided, before carbonization, they be well comminuted, and mixed with pumice stone, chalk, flint, or other similar substance in a pulverized state.

It results from the foregoing facts that the decolorizing power of charcoal depends upon a peculiar mode of aggregation of its particles, the leading character of which is that they are isolated from one another, and thus enabled to present a greater extent of surface. It is on this principle that certain chemical substances act in developing the property in question, when they are ignited, in a state of intimate mixture, with the substance to be charred. Thus, it is perceived that there is no necessary connection between the animal charcoal and the decolorizing power. Bone-black, for instance, has this property, not because it is an animal charcoal, but because, in consequence of the phosphate of calcium present in the bone, the favourable state of aggregation is imparted.*

The following table, abridged from one drawn up by Bussy, denotes the relative decolorizing power of different charcoals.

KINDS OF CHARCOAL.	Decolorizing power on Syrup.	Decolorizing power on Indigo.
Bone-black,	1	1
Bone charcoal treated with an acid,	1·6	1·8
Lampblack, not ignited,	3.3	4
Charcoal from acetate of potassium,	4·4	5·6
Blood ignited with phosphate of calcium,	10	12
Lampblack ignited with carbonate of potassium,	10·6	12.2
Blood ignited with chalk,	11	18
White of egg ignited with carbonate of potassium,	15·5	34
Glue ignited with carbonate of potassium,	15·5	36
Bone charcoal, formed from bone deprived of phosphate of calcium by an acid, and subsequently ignited with carbonate of potassium,	20	45
Blood ignited with carbonate of potassium,	20	50

E. Filhol has shown that charcoal is not the only decolorizing agent; but that many substances, such as iron reduced by hydrogen, sulphur, arsenic, deutoxide of

* Dr. Stenhouse divides decolorizing charcoals into three classes. First, pure charcoals, which, being in a state of minute division, decolorize by their porosity alone. Second, those which, like aluminized charcoal and artificial bone-black, decolorize solely by the bases they contain, acting as mordants. Third, those which, like bone-black, decolorize, partly by the mineral matter, and partly by the minutely divided charcoal they contain. (*Pharm. Journ.*, Jan. 1857, p. 366.)—*Note to the eleventh edition.*

manganese, sulphate and artificial sulphuret of lead, possess the same property. The property varies not only in different substances in relation to the same colouring matter, but in the same substance in respect to different colouring matters. (*Chem. Gaz.*, April 15, 1852.)

In order to determine the commercial value of animal charcoal, M. Corenwinder has proposed to ascertain its power of absorbing lime from a solution of saccharate of lime of determinate strength. The value is in proportion to the absorbing power of the charcoal. A given weight of the charcoal to be tested is left in contact, for an hour, with a given volume of the solution of the saccharate, taken in excess. The liquid is then filtered, and a small measure of it saturated with dilute sulphuric acid of known strength. The less the acid necessary for this purpose, the greater the amount of lime absorbed, and the better the animal charcoal. (See *Chem. Gaz.*, Jan. 1, 1854, p. 16.)

Spent animal charcoal, which has been used by the sugar refiners, may have its decolorizing power restored by calcination, which destroys the organic matters that have become fixed in it; and it is stated that it may be submitted to this process twenty times before becoming unfit for use. According to Pelouze, the same object may be accomplished by subjecting it to a weak solution of carbonate of potassium or of sodium. In removing the colouring matter, the alkaline solution becomes yellow. After its action the animal charcoal must be carefully washed, first with boiling water, and afterwards with acidulated water. But a process devised by MM. Leplay and Cuisinier is probably more effectual. The charcoal, without being removed from the cylinders, is thoroughly washed, treated by steam to remove viscous substances, and then percolated, successively, 1. by a weak alkaline solution, which removes salts and some colouring matters, 2. by weak muriatic acid, which, in removing a certain amount of salts of lime, liberates colouring matter, 3. again with a weak alkaline solution to carry off the remaining colouring matter; and 4. lastly by a solution of biphosphate of calcium, by which the decolorizing power of the charcoal is restored. (Dr. F. C. Calvert, *Am. Journ. of Pharm.*, July, 1865, p. 263; from *Chem. News.*)

Animal charcoal is capable of taking the bitter principles from infusions and tinctures, and iodine from liquids which contain it in solution. Its power, however, of acting on solutions and chemical compounds is much more decided in its purified state, as shown by both Warington and Weppen. In this state, it takes a number of salts from their aqueous solutions, and even converts chromate of potassium into the carbonate. (See *Carbo Animalis Purificatus.*)

Bone-black consists of about 90 per cent. of phosphate and carbonate of calcium, and 10 per cent. of charcoal.

Pharmaceutical Uses, &c. Animal charcoal is used in pharmacy for decolorizing vegetable principles, such as gallic acid, quinia, morphia, veratria, &c., and in the arts, principally for clarifying syrups in sugar refining, and for depriving spirits distilled from grain of the peculiar volatile oil, called *fusel oil*, which imparts to them an unpleasant smell and taste, as first distilled. The manner in which it is used as a decolorizer is to mix it with the substance to be decolorized, and to allow the mixture to stand for some time. The charcoal unites with the colouring matter, and the solution by filtration is obtained white and transparent. Its use, however, in decolorizing the organic alkalies and other vegetable principles, no doubt causes a loss by absorption; since it has been shown by the experiments of M. Lebourdais, mentioned under the head of purified animal charcoal, that several of these principles may be obtained by the sole action of charcoal. For most pharmaceutical operations, and for use as an antidote, animal charcoal must be purified by muriatic acid from phosphate and carbonate of calcium. (See *Carbo Animalis Purificatus.*) In the U. S. formula for sulphate of quinia, however, it is employed without purification. (See *Quiniæ Sulphas.*) According to Guthe, a German chemist, bone charcoal, without purification, is to be preferred as a decolorizer, in all cases in which the calcareous salts exert no injurious effect.

Pharm. Uses. In preparing Cinchoniæ Sulphas, *U. S.*; Morphia, *U. S.*; Quiniæ Sulphas, *U. S.*; Santoninum, *U. S.*

Off. Prep. Carbo Animalis Purificatus. B.

CARBO LIGNI. *U.S., Br.*

Charcoal.

Charcoal prepared from wood. *U.S.* Wood charred by exposure to a red heat without access of air. *Br.*

Vegetable charcoal; Charbon de bois, *Fr.;* Holzkohle, *Germ.;* Carbone di legno, *Ital.;* Carbon de lena, *Span.*

Preparation on the Large Scale. Billets of wood are piled in a conical form, and covered with earth and sod to prevent the free access of air; several holes being left at the bottom, and one at the top of the pile, in order to produce a draught to commence the combustion. The wood is then kindled from the bottom. In a little while the hole at the top is closed, and, after the ignition is found to have pervaded the whole pile, those at the bottom are stopped also. The combustion taking place with a smothered flame, the volatile portions of the wood, consisting of hydrogen and oxygen, are dissipated; while the carbon, in the form of charcoal, is left.

In this process for the carbonization of wood, all the volatile products are dissipated; and a portion of the charcoal itself is lost by combustion. Wood, thus carbonized, yields not more than 17 or 18 per cent. of charcoal. A better method is to char the wood in iron cylinders, when it yields from 22 to 23 parts in 100 of excellent charcoal; and, at the same time, the means are afforded for collecting the volatile products, consisting of pyroligneous acid, empyreumatic oil, and tar. This process for obtaining charcoal has been described under another head. (See *Acidum Aceticum.*) A method of preparing charcoal by subjecting wood to over-heated steam has been invented by M. Violette. When the temperature of the steam is 572°, the wood is converted into a peculiar charcoal, called *red charcoal*, which is intermediate in its qualities between wood and ordinary charcoal. When the temperature is lower, the carbonization is incomplete; when higher, the product is black charcoal. The steam process yields a uniform charcoal for a given temperature, which may be easily regulated, and a product about double that obtained in closed cylinders. Charcoal, prepared in closed cylinders, yields ten times as much ash as that ordinarily made. Charcoal contains *carbon*, in proportion to the temperature at which it is formed; varying from 65 per cent. when made at 482°, to 80 per cent. at 752°. The gaseous matter present is always inversely as the temperature of carbonization. Thus, for charcoal made at 572°, it is one-third of its weight; at 662°, one-fourth. (*Journ. de Pharm.*, Juillet, 1851, p. 35.)

Mr. E. C. C. Stanford has called attention to a variety of vegetable charcoal, obtained by charring a species of sea-weed, *Laminaria digitata*, gathered on the shores of the Hebrides, which, although, on account of the large proportion of carbonate of calcium contained in it (20 per cent.), unfit for use in refining sugar, possesses more of the deodorizing and decolorizing power than animal charcoal itself, which, with the exception referred to, it closely resembles in chemical composition. (*Pharm. Journ. and Trans.*, Oct. 1867, p. 186.)

Preparation for Medicinal Use. M. Belloc recommends charcoal for this purpose to be obtained from poplar shoots, cut at the time the sap rises, and deprived of their bark. The carbonization should be performed in cast-iron vessels at a red-white heat. The product is a light and brilliant charcoal, which must be purified by being macerated for three or four days in water, frequently renewed. It is then dried, powdered, and placed in bottles, which should be well stopped. The charcoal most esteemed in Philadelphia, for medicinal purposes, is that prepared by the Messrs. Dupont, near Wilmington, Delaware, for the manufacture of gunpowder. It is made from young willow shoots of two or three years' growth.

Properties. Charcoal is a black, shining, brittle, porous substance, tasteless and inodorous, and insoluble in water. It is a good conductor of electricity, but a bad one of heat. It possesses the remarkable property of absorbing many times its own bulk of certain gases. When exposed to the air after ignition, it increases rapidly in weight, absorbing from 12 to 14 per cent. of moisture. As ordinarily prepared, it contains the incombustible part of the wood amounting to 1 or 2 per cent., which

is left as ashes when the charcoal is burned. These may be removed by digesting the charcoal in diluted muriatic acid, and afterwards washing it thoroughly with boiling water.

Medical Properties, &c. Powdered charcoal is disinfectant and absorbent. It is employed with advantage in diarrhœa as an absorbent, and in dyspepsia with fetid breath and eructations. It was given in dysentery by the late Dr. Robert Jackson, who found it to have the effect of soothing the patient, and improving the character and consistence of the stools. It is also useful, in the form of injection, in putrid discharges from the uterus. M. Belloc recommends it strongly in gastralgia, and especially pyrosis, in which, if it fails to remove the disease, it abates the pain, nausea, and vomiting; and his observations have been confirmed by a committee of the French Academy of Medicine. As a remedy in obstinate constipation, Dr. Daniel, of Savannah, speaks of it in high terms. He also found it useful in the nausea and constipation of pregnancy. On the other hand, some practitioners have found charcoal to confine the bowels. Dr. Wilson, of New Zealand, speaks highly of it in the diarrhœa of measles, and in epidemic cholera. Dr. Newman recommends it as a dressing to wounds and ulcers. Mr. Wormald, of St. Bartholomew's Hospital, has made a useful application of the disinfecting power of dry charcoal, in what he calls the *charcoal quilt.* This consists of two sheets of cotton wadding, quilted together in small segments, with a tolerably thick layer of powdered charcoal between them. The quilts, thus prepared, may be of any size, so as to fit a gangrenous sore or stump. Its use as an ingredient of poultices is noticed under *Cataplasma Carbonis.* Several of its varieties are used as tooth-powder. Those generally preferred are the charcoals of the cocoa-nut shell and of bread. It is said that charcoal proves useful in preserving the teeth by absorbing the acid sometimes morbidly present in the mucus of the mouth. The dose of charcoal varies from one to four teaspoonfuls or more. Dr. Daniel gave it in his case of constipation in doses of a tablespoonful, repeated every half hour.

For internal use charcoal is preferred by some in the *granular form.* Mr. W. Lascelles Scott employs the following method of preparing it. He prefers the wood of the box, willow, or linden, which, after being charred, should be allowed to cool out of contact with air, then boiled for some time in dilute muriatic acid, and afterwards, having been thoroughly washed with pure water, in a little weak ammonia. The fragments are again ignited, and then quickly powdered, and passed through a sieve of 80 or 100 apertures to the inch. Nine pounds of this powder are mixed with one pound of pure sugar passed through a 30 sieve, and 4 ounces of gum arabic in impalpable powder. The whole is then moistened with a few ounces of warm distilled water, to which have been added an ounce and a quarter of tincture of benzoin, and a little mucilage. The mass is now granulated on flat steam pans, in the usual manner, at a temperature of 215° or 225°. When perfectly dry it is sifted, and secured in well-stopped bottles. (*Chem. News*, Oct. 18, 1867, p. 204.)

Schönbein has observed the power of charcoal to absorb chlorine, iodine, and bromine, both in the gaseous or vaporous state, and in aqueous solution. He has also noticed its deoxidizing effects, when shaken with certain salts of peroxides, reducing them to salts of protoxides. The power of charcoal to precipitate gold and other metals on its surface has long been known.

Charcoal has been employed with good effect, as a deodorizer, in dissecting rooms, placed in open pans through the room. It has the advantage over the chlorides that it has no smell. When it loses its effect, it requires merely to be recalcined. Water for long voyages is kept sweet by having a little powdered charcoal added to each cask.

Dr. Stenhouse has devised a process for combining alumina with common vegetable charcoal, forming what he calls *aluminized charcoal*, which is an economical substitute for purified animal charcoal, and equally efficacious as a decolorizer. It is prepared by digesting finely powdered charcoal with sufficient of the solution of sulphate of aluminium to give an impregnation of 7·5 per cent. of alumina. The whole is evaporated to dryness, and ignited in a covered Hessian crucible, until the water and acid have been dissipated. Aluminized charcoal is perfectly black, though thoroughly impregnated with anhydrous alumina, and only requires to be carefully

pulverized to be ready for use. (*Pharm. Journ.*, Jan. 1857, p. 364.) On similar principles, Dr. Stenhouse prepares his *artificial bone-black*, by impregnating powdered wood charcoal with 7·5 per cent. of phosphate of calcium, by digesting it in a solution of this salt in muriatic acid, evaporating to dryness, and igniting in covered vessels. This charcoal decolorizes well, but can be used only for neutral solutions.

Charcoal may act either as an oxidizer or deoxidizer; and these contrary powers seem to depend upon its having for oxygen a medium affinity, which enables it to take that element from some bodies, and to yield it to others. Thus, it is known to reduce several oxides; while, on the other hand, it powerfully oxidizes animal matter. The bodies of two dogs having been laid in an open box on a bed of charcoal, a few inches deep, and covered by the same material, were kept by Mr. John Turnbull, of Glasgow, for six months in his laboratory, without emitting any perceptible effluvium; and, when they were examined at the end of this time, scarcely anything remained but the bones. Dr. Stenhouse, who relates this experiment, has confirmed it by observations of his own, and believes that the animal matter thus treated, undergoes putrefaction; though the products, by their rapid oxidation, are prevented from contaminating the air. He, therefore, considers charcoal not to be antiseptic, but the very opposite. (*Chem. Gaz.*, April, 1854, p. 132.)

The study of the absorbent and oxidizing properties of charcoal has led Dr. Stenhouse to apply it to the purpose of preventing the access of noxious effluvia to the lungs in respiration. This object he proposes to effect by covering the nose and mouth with what he calls the *charcoal respirator*. The instrument consists of a layer of coarsely powdered charcoal, a quarter of an inch thick, between two sheets of silvered wire gauze, covered with thin woollen cloth, by means of which the temperature of the inspired air is greatly increased. The frame is made of thin sheet copper; but the edges of lead padded and lined with velvet so as to fit the lower part of the face. Dr. Stenhouse considers his respirator to act as an air filter, and to be peculiarly adapted to protect the wearer against infectious diseases. (*Pharm. Journ.*, Jan. 1855, p. 328.) This instrument must not be confounded with Jeffrey's wire ventilator, which is intended solely to warm the air before entering the lungs.

Pharm. Uses. In the preparation of Acidum Sulphurosum; Potassii Bromidum, *Br.*; Potassii Iodidum.

Off. Prep. Cataplasma Carbonis, *Br.* B.

CARDAMOMUM. *U.S.*, *Br.*

Cardamom.

The fruit of Elettaria Cardamomum (Maton, *Act. Linn.*, 254). *U.S.* CARDAMOMS. The dried capsules of the Malabar Cardamom, Elettaria Cardamomum. The seeds are best kept in their pericarps, from which they should be separated when required for use, the pericarpial coats being rejected. *Br.*

Petit Cardamome, *Fr.*; Kleine Cardamomen, *Germ.*; Cardamomo minore, *Ital.*; Cardamomo menor, *Span.*; Ebil, *Arab.*; Kakelah seghar, *Persian*; Capalaga, *Malay*; Gujaratii elachi, *Hindoost.*

The subject of Cardamom has been involved in some confusion and uncertainty, both in its commercial and botanical relations. The name has been applied to the aromatic capsules of various Indian plants belonging to the family of Scitamineæ. Three varieties have long been designated by the several titles of the *lesser*, *middle*, and *larger—cardamomum minus*, *medium*, and *majus*; but these terms have been used differently by different writers, so that their precise signification remains doubtful. To the late Dr. Pereira we are mainly indebted for the clearing up of this confusion. It is well known that the *lesser cardamom* of most writers is the variety recognised by the Pharmacopœias, and generally kept in the shops. The other varieties, though circulating to a greater or less extent in European and Indian commerce, are little known in this country.* The following remarks have reference exclusively to the genuine Malabar or officinal cardamom.

* The following is a sketch of the non-officinal cardamoms, chiefly from Pereira.

1. *Ceylon Cardamom.* This has been denominated variously *cardamomum medium*, *cardamomum majus*, and *cardamomum longum*, and is sometimes termed in English commerce *wild cardamom.* It

Linnæus confounded, under the name of *Amomum Cardamomum*, two different vegetables—the genuine plant of Malabar, and another growing in Java. These were separated by Willdenow, who conferred on the former Sonnerat's title of *Amomum repens*, while he retained the original name for the latter, though not the true cardamom plant. In the tenth volume of the Linn. Transactions, A. D. 1811, Mr. White, a British Army Surgeon in India, published a very minute description of the Malabar plant, which he had enjoyed frequent opportunities of examining in its

is the *large cardamom* of Guibourt. In the East it is sometimes called *grains of Paradise;* but it is distinct from the product known with us by that name. It is derived from a plant cultivated in Candy, in the Island of Ceylon, which belongs to the same genus as that producing the officinal cardamom, and is designated by Sir James Edward Smith *Elettaria major*. This plant was described by Pereira in the *Pharmaceutical Journal and Transactions* (ii. 388). The fruit is a lanceolate-oblong, acutely triangular capsule, somewhat curved, about an inch and a half long and four lines broad, with flat and ribbed sides, tough and coriaceous, brownish or yellow ash-coloured, having frequently at one end the long, cylindrical, three-lobed calyx, and at the other the fruit-stalk. It is three-celled, and contains angular, rugged, yellowish-red seeds, of a peculiar fragrant odour and spicy taste. Its effects are analogous to those of the officinal cardamom.

2. *Round Cardamom.* This is probably the Ἄμωμον of Dioscorides, and the *Amomi uva* of Pliny, and is believed to be the fruit of *Amomum Cardamomum* (Willd.), growing in Sumatra, Java, and other East India islands. The capsules are usually smaller than a cherry, roundish or somewhat ovate, with three convex sides, more or less striated longitudinally, yellowish or brownish-white, and sometimes reddish, with brown, angular, cuneiform, shrivelled seeds, which have a spicy camphorous flavour. They are sometimes, though rarely, met with connected in their native clusters, constituting the *amomum racemosum*, or *amome en grappes* of the French. They are similar in medicinal properties to the officinal, but are seldom used except in the southern parts of Europe.

3. *Java Cardamom.* The plant producing this variety is supposed to be the *Amomum maximum* of Roxburgh, growing in Java and other Malay islands, and said to be cultivated in the mountains of Nepaul. The product of the latter site is called *Nepaul* or *Bengal cardamoms* in the East. The capsules are oval, or oval-oblong, often somewhat ovate, from eight to fifteen lines long, and from four to eight broad, usually flattened on one side and convex on the other, sometimes curved, three-valved, and occasionally imperfectly three-lobed, of a dirty grayish-brown colour, and coarse fibrous appearance. They are strongly ribbed, and, when soaked in water, exhibit from nine to thirteen ragged membranous wings, which distinguish them from all other varieties. The seeds have a feebly aromatic taste and smell. This variety of cardamom affords but a very small proportion of volatile oil, is altogether of inferior quality, and, when imported into London, is usually sent to the continent.

4. *Madagascar Cardamom.* This is the *Cardamomum majus* of Geiger and some others, and is thought to be the fruit of *Amomum angustifolium* of Sonnerat, growing in marshy grounds in Madagascar. The capsule is ovate, pointed, flattened on one side, striated, with a broad circular scar at the bottom, surrounded by an elevated, notched, corrugated margin. The seeds have an aromatic flavour analogous to that of officinal cardamom.

5. *Grains of Paradise. Grana Paradisi.* Under this name and that of *Guinea grains*, and *Malegueta* or *Mallaguetta pepper*, are kept in the shops small seeds of a round or ovate form, often angular, and somewhat cuneiform, minutely rough, brown externally, white within, of a feebly aromatic odour when rubbed between the fingers, and of a strongly hot and peppery taste. Two kinds of them are known in the English market, one larger, plumper, and more warty, with a short conical projecting tuft of pale fibres on the umbilicus; the other smaller and smoother, and without the fibrous tuft. The latter are the most common. It is probable that one of the varieties is produced by *Amomum Grana Paradisi* of Sir J. E. Smith, and the other by Roscoe's *Amomum Melegueta*. (Pereira's *Mat. Med.*, 3d ed., p. 1134.) Dr. W. F. Daniell, who has published (*Pharm. Journ. and Trans.*, xiv. 312 and 356) an elaborate paper on the Amoma of Western Africa, states that the true Mallaguetta pepper is obtained exclusively from varieties of the same species, to which belong the *Amomum Grana Paradisi* of Afzelius, and the *A. Melegueta* of Roscoe; while the *A. Grana Paradisi* of Sir J. E. Smith is a different plant, and yields a different product. These grains are imported from Guinea, and other parts of the western coast of Africa. Similar grains are taken to England from Demarara, where they are obtained from a plant cultivated by the negroes, supposed to have been brought from Afrjca, and believed by Dr. Pereira to be the *Amomum Melegueta* of Roscoe. (*Ibid.*, vi. 412.) At the international exhibition of 1862, at London, the author noticed a specimen of similar grains, under the name of grains of Paradise, sent from the island of Trinidad. Their effects on the system are analogous to those of pepper; but they are seldom used except in veterinary practice, and to give artificial strength to spirits, wine, beer, and vinegar. In the same journal (ii. 443), Dr. Pereira points out seven distinct scitamineous fruits, to which the name of grains of Paradise has been applied by different authors.

Other products of different Scitamineæ, which have received the name of cardamom, are described by Pereira; but the above are all that are known in commerce, or likely to be brought into our drug markets.

In the *Pharm. Journ. and Trans.* (xiv. 352), and in the same journal for October, 1861 (p. 207), and for September, 1862 (p. 110), are papers by Mr. Daniel Hanbury on some rare kinds of cardamom of Siam, Cochin-China, Tonquin, and China, in which new information is given on varieties already known, and others are noticed which appear hitherto to have escaped the attention of European writers; but as these are of little practical interest to American pharmaceutists, we must content ourselves with referring those who wish to investigate especially the subject of the cardamoms and analogous products to the sources of information alluded to.

native state. From this description, Dr. Maton inferred that the plant, according to Roscoe's arrangement of the Scitamineæ, could not be considered an *Amomum;* and, as he was unable to attach it to any other known genus, he proposed to construct a new one with the name of *Elettaria*, derived from *elettari* or *elatari*, the Malabar name of this vegetable. Sir James Smith afterwards suggested the propriety of naming the new genus *Matonia*, in honour of Dr. Maton; and the latter title, having been adopted by Roscoe, obtained a place in former editions of the London and U. S. Pharmacopœias. The celebrated Dr. Roxburgh described the Malabar cardamom plant as an *Alpinia*, with the specific name *Cardamomum*. As doubts were entertained of the necessity for the new genus proposed by Maton, Roxburgh was followed in the London and U. S. Pharmacopœias, and the fruit was referred to Alpinia Cardamomum. This decision, however, has been revised in the latest editions of the U. S. and British Pharmacopœias, in which the plant is entitled Elettaria Cardamomum. Finally Roscoe has arranged it with the abandoned genus *Renealmia* of Linnæus, which he has restored.

ELETTARIA. *Sex. Syst.* Monandria Monogynia. — *Nat. Ord.* Scitamineæ. *Brown.* Zingiberaceæ. *Lindley.*

Gen. Ch. Corolla with the tube filiform and the inner limb one-lipped. *Anther* naked. *Capsule* often berried, three-celled, three-valved. *Seeds* numerous, arillate. *Blume.*

Elettaria Cardamomum. Maton. — *Alpinia Cardamomum.* Roxburgh. — *Amomum Repens.* Sonnerat; Willd. *Sp. Plant.* i. 9. — *Renealmia Cardamomum.* Roscoe, *Monandrous Plants.* Figured in *Linn. Trans.* x. 248, and Carson's *Illust. of Med. Bot.* ii. 55. The Cardamom plant has a tuberous horizontal root or rhizome, furnished with numerous fibres, and sending up from eight to twenty erect, simple, smooth, green and shining, perennial stems, which rise from six to twelve feet in height, and bear alternate sheathing leaves. These are from nine inches to two feet long, from one to five inches broad, elliptical-lanceolate, pointed, entire, smooth and dark-green on the upper surface, glossy and pale sea-green beneath, with strong midribs, and short footstalks. The flower-stalk proceeds from the base of the stem, and lies upon the ground, with the flowers arranged in a panicle. The calyx is monophyllous, tubular, and toothed at the margin; the corolla monophyllous and funnel-shaped, with the inferior border unilabiate, three-lobed, and spurred at the base. The fruit is a three-celled capsule, containing many seeds.

This valuable plant is a native of the mountains of Malabar, where it springs up spontaneously in the forests after the removal of the undergrowth. From time immemorial, great numbers of the natives have derived a livelihood from its cultivation. It begins to yield fruit at the end of the fourth year, and continues to bear for several years afterwards. The capsules when ripe are picked from the fruit stems, dried over a gentle fire, and separated by rubbing with the hands from the footstalks and adhering calyx.

Thus prepared, they are ovate-oblong, from three to ten lines long, from two to four thick, three-sided with rounded angles, obtusely pointed at both ends, longitudinally wrinkled, and of a yellowish-white colour. The seeds which they contain are small, angular, irregular, rough as if embossed upon their surface, of a brown colour, easily reduced to powder, and thus separable from the capsular covering, which, though slightly aromatic, is much less so than the seeds, and should be rejected when the medicine is administered. The seeds constitute about 74 parts per cent. by weight. According to Pereira, three varieties are distinguished in commerce: — 1. the *shorts*, from three to six lines long, from two to three broad, browner and more coarsely ribbed, and more highly esteemed than the others; 2. the *long-longs*, from seven lines to an inch in length by two or three lines in breadth, elongated, and somewhat acuminate; and 3. the *short-longs*, which are somewhat shorter and less pointed than the second variety. The odour of cardamom is fragrant, the taste warm, slightly pungent, and highly aromatic. These properties are extracted by water and alcohol, but more readily by the latter. They depend on a volatile oil, which rises with water in distillation. The seeds contain, according to Trommsdorff, 4·6 per cent. of volatile oil, 10·4 of fixed oil, 2·5 of a salt of potassa mixed with a colouring prin-

ciple, 3·0 of starch, 1·8 of azotized mucilage, 0·4 of yellow colouring matter, and 77·3 of ligneous fibre. The volatile oil is colourless, of an agreeable and very penetrating odour, and of a strong, aromatic, burning, camphorous, and bitterish taste. Its sp. gr. is 0·945. It cannot be kept long without undergoing change, and finally, even though excluded from the air, loses its peculiar odour and taste. If ether be made to percolate through the powdered seeds, and the liquor obtained be deprived of the ether, a light greenish-brown fluid remains, consisting almost exclusively of the volatile and fixed oils. It has the odour of cardamom, and keeps better than the oil obtained by distillation. (*Am. Journ. of Pharm.*, xxi. 116.) The seeds should be powdered only when wanted for use; as they retain their aromatic properties best while in the capsules.

Cardamoms are not often adulterated; but an instance has been mentioned by Mr. G. W. Kennedy, as having occurred under his own observation, in which orange seeds and unroasted grains of coffee were mixed with the cardamoms to the extent of nearly 4 per cent. (*Am. Journ. of Pharm.*, Sept. 1872, p. 389.)

Medical Properties and Uses. Cardamom is a warm and grateful aromatic, less heating and stimulating than some others belonging to the class, and very useful as an adjuvant or corrective of cordial, tonic, and purgative medicines. Throughout the East Indies it is largely consumed as a condiment. It was known to the ancients, and derived its name from the Greek language. In this country it is employed chiefly as an ingredient in compound preparations.

Off. Prep. Extractum Colocynthidis Compositum; Pulvis Aromaticus, *U. S.;* Pulvis Cinnamomi Comp., *Br.;* Pulvis Cretæ Aromaticus, *Br.;* Tinctura Cardamomi, *U. S.;* Tinct. Cardamomi Comp.; Tinct. Gentianæ Comp.; Tinct. Rhei; Vinum Aloës.

W.

CAROTA. *U. S. Secondary.*

Carrot Seed.

The fruit of Daucus Carota. *U. S.*

Carotte, *Fr.;* Gemeine Mohre, Gelbe Rübe, *Germ.;* Carota, *Ital.;* Lanahoria, *Span.*

Daucus. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Umbelliferæ or Apiaceæ.

Gen. Ch. Corolla somewhat rayed. *Florets* of the disk abortive. Fruit hispid with hairs. *Willd.*

Daucus Carota. Willd. *Sp. Plant.* i. 1389; Woodv. *Med. Bot.* p. 130, t. 50. The *wild carrot* has a biennial spindle-shaped root, and an annual, round, furrowed, hairy stem, which divides into long, erect, flower-bearing branches, and rises two or three feet in height. The leaves are hairy, and stand on footstalks nerved on their under side. The lower are large and tripinnate, the upper, smaller and less compound; in both, the leaflets are divided into narrow pointed segments. The flowers are small, white, and disposed in many-rayed compound umbels, which are at first flat on the top and spreading, but, when the seeds are formed, contract so as to present a concave cup-like surface. A sterile flower, of a deep-purple colour, is often observable in the centre of the umbel. The general involucrum is composed of several leaves, divided into long narrow segments; the partial is more simple. The petals are five, unequal, and cordate. The fruit consists of two plano-convex hispid portions, connected by their flat surfaces.

Daucus Carota is exceedingly common in this country, growing along fences, and in neglected fields, which, in the months of June and July, are sometimes white over their whole surface with its flowers. It grows wild also in Europe, from which it is supposed by some botanists to have been introduced into the United States. The well-known garden carrot is the same plant, somewhat altered by cultivation. The officinal portions are the fruit of the wild, and the root of the cultivated variety.

1. Carrot Seed. Strictly speaking, these should be called the fruit. They are very light, of a brownish colour, of an oval shape, flat on one side, and convex on the other, and on their convex surface present four longitudinal ridges, to which stiff, whitish hairs or bristles are attached. They have an aromatic odour, and a warm, pungent, and bitterish taste. By distillation they yield a pale-yellow volatile oil, upon which their virtues chiefly depend. Boiling water extracts their active properties.

Medical Properties and Uses. Carrot seeds are moderately excitant and diuretic, and are employed in chronic nephritic affections, and in dropsy. As they possess the cordial properties of the aromatics, they are especially adapted to cases in which the stomach is enfeebled. They are said to afford relief in the strangury from blisters. From thirty grains to a drachm of the bruised seeds may be given at a dose, or a pint of the infusion, containing the virtues of half an ounce or an ounce of the seeds, may be taken during the day. The whole umbel is often used instead of the seeds alone.

2. Carrot Root. The root of the wild carrot is whitish, hard, coriaceous, branched, of a strong smell, and an acrid, disagreeable taste; that of the cultivated is reddish, fleshy, thick, conical, rarely branched, of a pleasant odour, and a peculiar, sweet, mucilaginous taste. The constituents of the root are crystallizable and uncrystallizable sugar, a little starch, extractive, gluten, albumen, volatile oil, vegetable jelly or *pectin*, malic acid, saline matters, lignin, and a peculiar crystallizable, ruby-red, neuter principle, without odour or taste, called *carotin*. According, however, to MM. Frorde and Sœauer, carotin, as well as a modification which has been named *hydrocarotin*, is in fact *cholesterin* coloured by a red pigment. (*Am. Journ. of Pharm.*, Nov. 1866, p. 505.) The substance called *vegetable jelly* was by some considered a modification of gum or mucilage, combined with a vegetable acid. Braconnot found it to be a peculiar principle, and named it *pectin* from the Greek (πηκτις), expressive of its characteristic property of gelatinizing. It exists more or less in all vegetables, and is abundant in certain fruits and roots from which jellies are prepared. It may be separated from the juice of fruits by alcohol, which precipitates it in the form of a jelly. This being washed with weak alcohol and dried, yields a semi-transparent substance bearing some resemblance to ichthyocolla. Immersed in 100 parts of cold water, it swells like bassorin, and ultimately forms a homogeneous jelly. With a larger proportion it exhibits a mucilaginous consistence. It is less acted on by boiling than by cold water. When perfectly pure it is tasteless, and has no effect on vegetable blues. A striking peculiarity is that, by the agency of a fixed alkali or alkaline earthy base, it is instantly converted into pectic acid, which unites with the base to form a pectate. This may be decomposed by the addition of an acid, which unites with the base, and separates the pectic acid. *Pectic acid* thus obtained is in the form of a colourless jelly, slightly acidulous, with the property of reddening litmus paper, scarcely soluble in cold water, more soluble in boiling water, and forming with the latter a solution, which, though it does not become solid on cooling, is coagulated by alcohol, lime-water, acids, or salts, and even by sugar if allowed to stand for some time. With the alkalies it forms salts, capable of gelatinizing; with the earths and metallic oxides, insoluble salts. Braconnot thinks that pectic acid exists in many plants already formed. M. Frémy found that pectin results, in fruits, from the reaction of acids upon a peculiar insoluble substance they contain when immature, called by him *pectose;* and that pectin is changed into pectic acid not only by alkalies, but also by vegetable albumen.

Medical Properties and Uses. The wild root possesses the same properties as the seeds, and may be used for the same purposes. That of the garden plant has acquired much reputation as an external application to phagedenic, sloughing, and cancerous ulcers, the fetor of which it is supposed to correct, while it sometimes changes the character of the diseased action. It is also useful in the ulcers which follow fevers. The root is brought to the proper consistence by scraping. In this state it retains a portion of the active principles of the plant, which render it somewhat stimulant. Boiled and mashed, as usually recommended, the root is perfectly mild, and fit only to form emollient cataplasms.* W.

* *Carrot Ointment.* The following formula for this ointment has been handed to us by Professor Procter, who has long been in the habit of preparing it. Take of grated carrot root half a pound, lard a pound, wax four ounces. Melt the lard and wax, add the carrot root, evaporate with a moderate heat the moisture of the root, and strain. It may be used in excoriated or ulcerated surfaces, requiring gentle stimulation. (*Note to the tenth edition.*)

CARTHAMUS. *U.S. Secondary.*

Safflower.

The florets of Carthamus tinctorius. *U.S.*

Fleurs de carthame, Safran batard, *Fr.;* Farber Saffor, *Germ.;* Cartamo, *Ital., Span.*

CARTHAMUS. *Sex. Syst.* Syngenesia Æqualis.—*Nat. Ord.* Compositæ Cynareæ. *De Cand.* Cynaraceæ. *Lindley.*

Gen. Ch. Receptacle paleaceous, setose. *Calyx* ovate, imbricated, with ovate scales, leafy at the end. *Seed-down* paleaceous, hairy, or none. *Willd.*

Carthamus tinctorius. Willd. *Sp. Plant.* iii. 1706. The *dyers' saffron* or *safflower* is an annual plant, with a smooth, erect stem, somewhat branched at top, and a foot or two in height. The leaves are alternate, sessile, ovate, acute, entire, and furnished with spiny teeth. The flowers are compound, in large terminal, solitary heads. The florets are of an orange-red colour, with a funnel-shaped corolla, of which the tube is long, slender, and cylindrical, and the border divided into five equal, lanceolate, narrow segments.

The plant is a native of India, the Levant, and Egypt, and is cultivated in those countries, as well as in various parts of Europe and America. The florets are the part employed. They are brought to us chiefly from the ports of the Mediterranean. Considerable quantities are produced in this country, and sold as American saffron.

Safflower in mass is of a red colour, diversified by the yellowness of the filaments contained within the floret. It has a peculiar slightly aromatic odour, and a scarcely perceptible bitterness. Among its ingredients are two colouring substances—one red, insoluble in water, slightly soluble in alcohol, very soluble in alkaline liquids, and called *carthamine* or *carthamic acid* by Döbereiner, who found it to possess acid properties; the other yellow, and soluble in water. It is the former which renders safflower useful as a dye-stuff. Carthamine mixed with finely powdered talc, forms the cosmetic powder called *rouge*. For more detailed information in relation to these principles, the reader is referred to the *Journal de Pharmacie* (3e sér., iii. 203).

These flowers are sometimes fraudulently mixed with saffron, which they resemble in colour, but from which they may be distinguished by their tubular form, and the yellowish style and filaments which they enclose.

Medical Properties. In large doses carthamus is said to be laxative; and, administered in the state of warm infusion, it proves somewhat diaphoretic. It is used in domestic practice, as a substitute for saffron, in measles, scarlatina, and other exanthematous diseases, in order to promote the eruption. An infusion, made in the proportion of two drachms to a pint of boiling water, is usually employed, and given without restriction as to quantity. W.

CARUM. *U.S.*

Caraway.

The fruit of Carum Carui. *U.S.*

Off. Syn. CARUI FRUCTUS. *Caraway Fruit.* The dried fruit of Carum Carui. *Br.*

Carvi, *Fr., Ital.;* Gemeiner Kummel, *Germ.;* Alcaravea, *Span.*

CARUM. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Umbelliferæ or Apiaceæ.

Gen. Ch. Fruit ovate-oblong, striated. *Involucre* one-leafed. *Petals* keeled, inflexed-emarginate. *Willd.*

Carum Carui. Willd. *Sp. Plant.* i. 1470; Woodv. *Med. Bot.* p. 102, t. 41. This plant is biennial and umbelliferous, with a spindle-shaped, fleshy, whitish root, and an erect stem, about two feet in height, branching above, and furnished with doubly pinnate, deeply incised leaves, the segments of which are linear and pointed. The flowers are small and white, and in erect terminal umbels, which are accompanied with an involucre, consisting sometimes of three or four leaflets, sometimes of one only, and are destitute of partial involucre.

The caraway plant is a native of Europe, growing wild in meadows and pastures, and cultivated in many places. It has been introduced into this country. The flowers appear in May and June, and the seeds, which are not perfected till the second year, ripen in August. The root, when improved by culture, resembles the parsnep, and is used as food in the north of Europe. The seeds are the part used in medicine. They are collected by cutting down the plant, and threshing it on a cloth. Our markets are supplied partly from Europe, partly from our own gardens. The American seeds are usually rather smaller than the German.

Caraway seeds (half-fruits) are about two lines in length, slightly curved, with five longitudinal ridges, which are of a light-yellowish colour, while the intervening spaces are dark-brown. They have an agreeable aromatic smell, and a sweetish, warm, spicy taste. These properties depend on an essential oil, which they afford largely by distillation. The residue is insipid. They yield their virtues readily to alcohol, and more slowly to water.

Medical Properties and Uses. Caraway is a pleasant stomachic and carminative, occasionally used in flatulent colic, and as an adjuvant or corrective of other medicines. The dose in substance is from a scruple to a drachm. An infusion may be prepared by adding two drachms of the seeds to a pint of boiling water. The volatile oil, however, is most employed. (See *Oleum Cari.*) The seeds are baked in cakes, to which they communicate an agreeable flavour, while they stimulate the digestive organs.

Off. Prep. Aqua Carui, *Br.;* Confectio Piperis, *Br.;* Oleum Cari, *U. S.;* Oleum Carui, *Br.;* Pulvis Opii Compositus, *Br.;* Tinctura Cardamomi Composita; Tinct. Sennæ, *Br.* W.

CARYOPHYLLUS. *U. S.*

Cloves.

The unexpanded flowers of Caryophyllus aromaticus. *U. S.*

Off. Syn. CARYOPHYLLUM. The dried unexpanded flower-buds of Caryophyllus aromaticus. *Br.*

Girofle, Clous de girofles, *Fr.;* Gewurznelken, *Germ.;* Garofani, *Ital.;* Clavos de espicia, *Span.;* Cravo da India, *Portuguese;* Kruidnagel, *Dutch;* Kerunfel, *Arab.*

CARYOPHYLLUS. *Sex. Syst.* Icosandria Monogynia.—*Nat. Ord.* Myrtaceæ.

Gen. Ch. Tube of the *calyx* cylindrical; limb, four-parted. *Petals* four, adhering by their ends in a sort of calyptra. *Stamens* distinct, arranged in four parcels in a quadrangular fleshy hollow, near the teeth of the calyx. *Ovary* two-celled, with about twenty ovules in each cell. *Berry* one or two-celled, one or two seeded. *Seeds* cylindrical, or half-ovate. *Cotyledons* thick, fleshy, convex externally, sinuous in various ways internally. *Lindley. De Cand.*

Caryophyllus aromaticus. Linn. *Sp.* 735; De Cand. *Prodrom.* iii. 262; Carson, *Illust. of Med. Bot.* i. 43, pl. 37.—*Eugenia caryophyllata.* Willd. *Sp. Plant.* ii. 965; Woodv. *Med. Bot.* p. 538, t. 193. This small tree is one of the most elegant of those inhabiting the islands of India. It has a pyramidal form, is always green, and is adorned throughout the year with a succession of beautiful rosy flowers. The stem is of hard wood, and covered with a smooth, grayish bark. The leaves are about four inches in length by two in breadth, obovate-oblong, acuminate at both ends, entire, sinuated, with many parallel veins on each side of the midrib, supported on long footstalks, and opposite. They have a firm consistence, and a shining green colour, and when bruised are highly fragrant. The flowers are disposed in terminal corymbose panicles, and exhale a strong, penetrating, and grateful odour.

The natural geographical range of the clove is extremely limited. It was formerly confined to the Molucca Islands, in most of which it grew abundantly before their conquest by the Dutch. By the monopolizing policy of that commercial people, the trees were extirpated in nearly all the islands except Amboyna and Ternate, which were under their immediate inspection. Notwithstanding, however, their jealous vigilance, a French governor of the Isles of France and Bourbon, named Poivre, succeeded, in the year 1770, in obtaining plants from the Moluccas, and introducing

them into the colonies under his control. Five years afterwards, the clove-tree was introduced into Cayenne and the West Indies, in 1803 into Sumatra, and in 1818 into Zanzibar. It is now cultivated largely in these and other places; and commerce has ceased to depend on the Moluccas for supplies of this spice.*

The unexpanded flower-buds are the part of the plant employed under the ordinary name of cloves.† They are first gathered when the tree is about six years old. The fruit has similar aromatic properties, but much weaker. The buds are picked by the hand, or separated from the tree by long reeds, and are then quickly dried. In the Moluccas they are said to be sometimes immersed in boiling water, and afterwards exposed to smoke and artificial heat, before being spread out in the sun. In Cayenne and the West Indies they are dried simply by solar heat.

Cloves appear to have been unknown to the ancients. They were introduced into Europe by the Arabians, and were distributed by the Venetians. After the discovery of the southern passage to India, the trade in this spice passed into the hands of the Portuguese; but was subsequently wrested from them by the Dutch, by whom it was long monopolized. Within a few years, however, the extended culture of the plant has thrown open the commerce in cloves to all nations. The United States derive much of their supply from the West Indies and Guiana. The Molucca cloves are said to be thicker, darker, heavier, more oily, and more highly aromatic than those cultivated elsewhere. They are known by the name of *Amboyna cloves*. The *Bencoolen cloves*, from Sumatra, are deemed equal if not superior by the English druggists.

Properties. Cloves resemble a nail in shape, are usually rather more than half an inch long, and have a round head with four spreading points beneath it. Their colour is externally deep-brown, internally reddish; their odour strong and fragrant; their taste hot, pungent, aromatic, and very permanent. The best cloves are large, heavy, brittle, and exude a small quantity of oil on being pressed or scraped with the nail. When light, soft, wrinkled, pale, and of feeble taste and smell, they are inferior. Those from which the essential oil has been distilled are sometimes fraudulently mixed with the genuine.

Trommsdorff obtained from 1000 parts of cloves 180 of volatile oil, 170 of a peculiar tannin, 130 of gum, 60 of resin, 280 of vegetable fibre, and 180 of water. M. Lodibert afterwards discovered a fixed oil, aromatic and of a green colour, and a white resinous substance which crystallizes in fasciculi, composed of very fine diverging silky needles, without taste or smell, soluble in ether and boiling alcohol, and exhibiting neither alkaline nor acid reaction. This substance, called by M. Bonastre *caryophyllin*, was found in the cloves of the Moluccas, of Bourbon, and of Barbadoes, but not in those of Cayenne, from which, however, it has since been procured. Berzelius considers it a stearoptene, and probably identical with that deposited by the oil of cloves when long kept. To obtain it, the ethereal extract of cloves is treated with water, and the white substance thrown down is separated by filtration, and treated repeatedly with ammonia to deprive it of impurities. Thus procured, Dr. Muspratt found it to consist of carbon, hydrogen, and oxygen, in the proportion represented by the formula $C_{10}H_8O$, or $C_{20}H_{16}O_2$. (*Pharm. Journ.*, x. 343.) Dr. Theod. Martius obtains it cheaply by exposing cloves, previously deprived as far as possible of oil by distillation with water, to distillation at a higher temperature, redistilling the brown liquid obtained until the distillate nearly ceases to have the taste or smell of cloves, and then purifying the residue by washing with water, and treating it with boiling alcohol and animal charcoal repeatedly, until the caryophyllin, which is deposited by the alcohol on cooling, is perfectly white. (See *Am. Journ. of Pharm.*, xxxii. 65.) It is an oxide of the neutral oil of cloves. M. Dumas has discovered another crystalline principle, which forms in the water distilled from

* Cloves from Cayenne, and from various West India islands, as Martinique, Guadaloupe, and Trinidad, have been for several years circulating in commerce. The author saw a specimen from Para, in Brazil, at the international exhibition at London (A.D. 1862). They were lighter coloured than those from the E. Indies. (*Note to the twelfth edition.*)

† The peduncles of the flowers have been sometimes employed. They possess the odour and taste of the cloves, though in a less degree, and furnish a considerable quantity of essential oil. The French call them *griffes de girofles*.

cloves, and is gradually deposited. Like caryophyllin, it is soluble in alcohol and ether, but differs from that substance in becoming red when touched with nitric acid. M. Bonastre proposes for it the name of *eugenin*. (*Journ. de Pharm.*, xx. 565.) It is said to be isomeric with eugenic acid, or the acid constituent of oil of cloves. (*Gregory.*) Water extracts the odour of cloves with comparatively little of their taste. All their sensible properties are imparted to alcohol; and the tincture when evaporated leaves an excessively fiery extract, which becomes insipid if deprived of the oil by distillation with water, while the oil which comes over is mild. Hence it has been inferred that the pungency of this aromatic depends on a union of the essential oil with the resin. For an account of the oil, see *Oleum Caryophylli*. The infusion and oil of cloves are reddened by nitric acid, and rendered blue by tincture of chloride of iron; facts of some interest, as morphia yields the same results with these reagents.

Medical Properties and Uses. Cloves are among the most stimulant of the aromatics; but, like others of this class, act less upon the system at large than on the part to which they are immediately applied. They are sometimes administered in substance or infusion to relieve nausea and vomiting, correct flatulence, and excite languid digestion; but their chief use is to assist or modify the action of other medicines. They enter into several officinal preparations. Their dose in substance is from five to ten grains.

The French Codex directs a *tincture of cloves* to be prepared by digesting for six days, and afterwards filtering, a mixture of four ounces of powdered cloves and sixteen of alcohol of 31° Cartier. Three ounces to the pint of alcohol is a sufficiently near approximation.

Off. Prep. Infusum Aurantii Compositum, *Br.;* Infusum Caryophylli; Mistura Ferri Aromatica, *Br.;* Oleum Caryophylli; Pulvis Cretæ Aromaticus, *Br.;* Spiritus Lavandulæ Compositus, *U. S.;* Syrupus Rhei Aromaticus, *U. S.;* Vinum Opii.

W.

CASCARILLA. *U. S.*

Cascarilla.

The bark of Croton Eluteria. *U. S.*

Off. Syn. CASCARILLÆ CORTEX. *Cascarilla Bark.* The bark of Croton Eluteria. *Br.*

Cascarille, *Fr.;* Cascarillrinde, *Germ.;* Cascariglia, *Ital.;* Chacarila, *Span.*

CROTON. *Sex. Syst.* Monœcia Monadelphia.—*Nat. Ord.* Euphorbiaceæ.

Gen. Ch. MALE. *Calyx* cylindrical, five-toothed. *Corolla* five-petaled. *Stamens* ten to fifteen. FEMALE. *Calyx* many-leaved. *Corolla* none. *Styles* three, bifid. *Capsule* three-celled. *Seed* one. *Willd.*

There has been much confusion in relation to the different species of Croton growing in the West Indies, and as to which of them the Cascarilla of the shops is to be ascribed. At present, however, it is generally admitted that this bark, which is brought exclusively from the Bahama Islands, is the product of Croton Eluteria; and, though it is probable that the proper C. Cascarilla may at one time have yielded a portion of its bark to commerce, at present little or none is derived from that species. The London College committed the error, which it afterwards corrected, of recognising *C. Cascarilla* of Don as the source of it. This botanist mistook the *Copalchi bark* of Mexico, which is produced by *Croton Pseudo-China* of Schiede, and somewhat resembles cascarilla, for the genuine bark, and hence proposed to transfer the specific name of Cascarilla to the Mexican plant. No fact is better ascertained than that the proper cascarilla bark is a West India product, and is never brought from Mexico.*

* *Copalchi bark* has been mistaken not only for cascarilla, but also for a variety of cinchona. Portions of it, having been taken to Europe, attracted the attention both of pharmacologists and physicians. Two kinds were noticed; one, in small slender quills, of an ash colour, bearing some resemblance to a variety of pale cinchona, but having the flavour of cascarilla, and burning with a similar odour; the other in larger quills, with a thick cork-like epidermis, very bitter, and yielding an aromatic odour when burnt. The former is the product of *Croton Pseudo-China;* the latter is of unknown origin, but conjecturally referred to *C. suberosum*. Mr. J. E. Howard states that the

In relation to the botany of this subject, the former intricacy has been in great measure if not entirely removed by the researches of Mr. John J. Bennett, who, having received specimens of the different species of Croton growing in the Bahamas from Dr. W. F. Daniell, by whom they were collected during a residence in those islands, was enabled, by comparing them with former specimens and descriptions, to discriminate the species previously confounded. (*Journ. of Linn. Soc.*, iv. 29.)

Croton Eluteria. Bennett, *Journ. Linn. Soc.*, iv. 29; Daniell, *Pharm. Journ. and Trans.*, 2d ser., iv. 145, figured at p. 150.— *Clutia Eluteria.* Woodv. *Med. Bot.*, 3d ed., iv. 633, t. 223. As described by Dr. Daniell, this, though commonly a shrub of from three to five feet high, sometimes appears in the form of a small tree with a stem from four to eight inches in diameter.* The stem is straight, and marked at intervals with white or grayish stains. The leaves are petiolate, from two to three inches in length by an inch or more in breadth, often somewhat cordate at the base, obtusely acuminate, pale or grayish-green above, and densely covered beneath with shining silvery scales, appearing white at a distance. They are smaller and narrower in the plants of arborescent growth. The flowers, which have a delicious odour, are monœcious, small, white, petiolate, and closely set in simple terminal or axillary spikes. The shrub is a native of the Bahamas, scarce at present in the island of New Providence, but still abundant in Andros, Long, and Eleutheria islands, from the latter of which it derived its botanical title. Daniell calls the plant sweet-wood. The name of *sea-side balsam* belongs to another species, *C. Balsamiferum* of Linnæus, which grows in the Bahamas and other W. India islands, and owes its name to the exudation of a balsamic juice from its young branches when wounded.

Croton Cascarilla. Bennett, *Journ. of the Linn. Soc.* iv. 30.— *Clutia Cascarilla.* Linn. *Sp. Plant.* ed. 1, p. 1042.— *Ricinoides elæagnifolio.* Catesby, *Hist. Carolin.* ii. t. 46. As described by Daniell, this is a shrub of from four to six feet, much branched, with a pale grayish-green stem, without the white stains of the former species. The leaves are petiolate, long, narrow, lanceolate, tapering towards each end, pointed, with flat, or somewhat undular margins, above smooth and green, beneath pale and very hairy. The flowers are monœcious, in simple terminal spikes, with small white petals tinged with yellow. They are very fragrant. The plant is a native of the Bahamas, and is said also to grow in Hayti. In the Bahamas it is much scarcer than formerly, and is said by Dr. Daniell to yield at present none of the Cascarilla of commerce, of which much was formerly derived from it. This species seems to have been confounded by some with *Croton lineare* of Jacquin, which grows in the Bahamas and most of the W. India islands, where it is known by the

quilled copalchi bark contains a bitter alkaloid, soluble in ether, and precipitable as a white hydrate from its acid solution. (*Pharm. Journ.*, xiv. 319.) Copalchi bark is an aromatic tonic, employed in Mexico in intermittents, and capable of useful application in all cases requiring a mild aromatic bitter. Dr. Stark has employed it advantageously in feeble states of digestion with irritable bowels, and found it, in one or two cases, to exhibit antiperiodic properties. It may be given in infusion, made with half an ounce of the bark to a pint of water, in the dose of one or two fluid-ounces three times a day. (*Ed. Med. and Surg. Journ.*, April, 1849, p. 410.)—*Note to the ninth and eleventh editions.*

After the publication of the tenth edition of this work, we received from Dr. Pleasants, U. S. Consul at Minatitlan, Isthmus of Tehuantepec, Mexico, a box of bark which it was thought might prove to be Peruvian bark, and had some reputation as an antiperiodic. It is in large quills, or partially rolled pieces, sometimes nearly flat, with a white or whitish epidermis, and a dark-brown colour of the proper bark, the outer surface of which appears irregularly striated on the removal of the epidermis. It has a bitter, aromatic taste, gives out when burnt the musk-like odour of cascarilla similarly treated, and though much larger than the specimens we have seen of copalchi bark, is probably derived either from the same tree, or from another species of Croton. (*Note to the eleventh edition.*)

* The plant referred to in former editions of this work, as having been seen by Dr. Wright in Jamaica, and called by him C. Eluteria, is, according to Mr. Bennett, a distinct species, *C. Sloanei*, which was confounded by Linnæus with the genuine cascarilla plant, under the name of *Clutia Eluteria.* The genuine plant was first described by him in his *Hortus Cliffortianus* (pp. 486–7), from a specimen in Clifford's herbarium in the British Museum, and afterwards apparently confused with a Jamaica specimen sent to him by Patrick Brown, from the latter of which the description of his Clutia Eluteria was drawn up, which is quite inapplicable to the original plant. It is the C. Sloanei also that was described by Schwartz in his *Flora Indiæ Occidentalis* (p. 1183), under the name of Croton Eluteria, and probably the same that was figured by Dr. Carson in his *Illust. of Med. Bot.* ii. 34, pl. 78. (See *Pharm. Journ.*, Aug. 1859, pp. 132–3.)—*Note to the twelfth edition.*

name of *wild rosemary*, owing probably in part to its fragrant smell, but still more to its narrow linear leaves with reflected margins.

Cascarilla is brought to this market from the West Indies, and chiefly, as we have been informed, from the Bahamas. It comes in bags or casks. We have observed it in the shops in two forms, so distinct as to merit the title of varieties. In one, the bark is in rolled pieces of every size, from three or four inches in length and half an inch in diameter to the smallest fragments, covered externally with a dull-whitish or grayish-white epidermis, which in many portions is partially, sometimes wholly removed, leaving a dark-brown surface, while the inner surface has a chocolate colour, and the fracture is a reddish-brown. The small pieces are sometimes curled, but have a distinct abrupt edge as if broken from the branches. The second variety consists entirely of very small pieces, not more than an inch or two in length, very thin, without the white epidermis, not regularly quilled, but curved more or less in the direction of their length, often having a small portion of woody fibre attached to their inner surface, and appearing precisely as if shaved by a knife from the stem or branches. Whether these two varieties are derived from distinct species, or differ only from the mode of collection, it is difficult to determine.*

Properties. Cascarilla has an aromatic odour, rendered much more distinct by friction, and a warm, spicy, bitter taste. It is brittle, breaking with a short fracture. When burnt it emits a pleasant odour, closely resembling that of musk, but weaker and more agreeable. This property serves to distinguish it from other barks. It was analyzed by Trommsdorff, and more recently by M. Duval, of Liseux, in France. The constituents found by the latter were albumen, a peculiar kind of tannin, a bitter crystallizable principle called *cascarillin*, a red colouring matter, fatty matter of a nauseous odour, wax, gum, volatile oil, resin, starch, pectic acid, chloride of potassium, a salt of lime, and lignin. The oil, according to Trommsdorff, constitutes 1·6 per cent., is of a greenish-yellow colour, a penetrating odour analogous to that of the bark, and of the sp. gr. 0·938. To obtain cascarillin, M. Duval treated the powdered bark with water, added acetate of lead to the solution, separated the lead by sulphuretted hydrogen, filtered, evaporated with the addition of animal charcoal, filtered again, evaporated at a low temperature to a syrupy consistence, and, having allowed the semi-liquid substance thus obtained to harden by cooling, purified it by twice successively treating it, first with a little cold alcohol, to separate the colouring and fatty matters, and afterwards with boiling alcohol and animal charcoal. The last alcoholic solution was allowed to evaporate spontaneously. Thus obtained, cascarillin is white, crystalline, inodorous, bitter, very slightly soluble in water, soluble in alcohol and ether, neuter, and destitute of nitrogen. (*Journ. de Pharm.*, 3e sér., viii. 96.) Either alcohol or water will partially extract the active matters of cascarilla; but diluted alcohol is the proper menstruum.

Medical Properties and Uses. This bark is aromatic and tonic. It was known in Germany so early as the year 1690, and was much used as a substitute for Peruvian bark by those who were prejudiced against that febrifuge in the treatment of remittent and intermittent fevers. It has, however, lost much of its reputation, and is now employed only where a pleasant and gently stimulant tonic is desirable; as in dyspepsia, chronic diarrhœa and dysentery, flatulent colic, and other cases of debility of the stomach or bowels. It is said to promote the flow of milk in the lower animals, and has been proposed with a view to the same effect in the human subject. It is sometimes advantageously combined with the more powerful bitters. It may be given in powder or infusion. The dose of the former is from a scruple to half a drachm, which may be repeated several times a day. Prof. Procter has published a formula for a fluid extract, which contains the virtues of a troyounce of the bark in a fluid-ounce. (*Am. Journ. of Pharm.*, March, 1863, p. 113.) In consequence of its pleasant odour when burnt, some smokers mix it in small quantity with their tobacco; but it is said, when thus employed, to occasion vertigo and intoxication.

Off. Prep. Infusum Cascarillæ; Tinctura Cascarillæ, *Br.* W.

* We have little doubt that the latter variety, which we have not seen for many years, was the product of C. Cascarilla. The fact that it has ceased to appear in our markets corresponds with the fact, stated by Dr. Daniell, that the bark of this species is not now collected; and the want of a white epidermis, by which the bark of C. Cascarilla is also characterized, tends to confirm this view of its origin. (*Note to the twelfth edition.*)

CASSIA FISTULA. *U.S.*

Purging Cassia.

The fruit of Cassia Fistula. *U.S.*

Off. Syn. CASSIÆ PULPA. *Cassia Pulp.* The pulp obtained from the pods of the Purging Cassia, Cassia Fistula. *Br.*

Casse, *Fr.;* Röhrenkassie, *Germ.;* Cassia, *Ital.;* Cana Fistula, *Span.*

CASSIA. *Sex. Syst.* Decandria Monogynia. — *Nat. Ord.* Fabaceæ or Leguminosæ. *Gen. Ch. Calyx* five-leaved. *Petals* five. *Anthers*, three upper sterile, three lower beaked. *Lomentum. Willd.*

The tree which yields the purging cassia is ranked by some botanists as a distinct genus, separated from the Cassia, and denominated *Cathartocarpus.* (See *Lindley's Flor. Med.*, 262.)

Cassia Fistula. Willd. *Sp. Plant.* ii. 518; Woodv. *Med. Bot.* p. 445, t. 160; Carson, *Illust. of Med. Bot.* i. 24, pl. 26. — *Cathartocarpus Fistula.* Persoon, *Synops.*, i. 459. This is a large tree, rising to the height of forty or fifty feet, with a trunk of hard, heavy wood, dividing towards the top into numerous spreading branches, and covered with a smooth ash-coloured bark. The leaves are commonly composed of five or six pairs of opposite leaflets, which are ovate, pointed, undulated, smooth, of a pale-green colour, from three to five inches long, and supported upon short petioles. The flowers are large, of a golden-yellow colour, and arranged in long, pendent, axillary racemes. The fruit consists of long, cylindrical, woody, dark-brown, pendulous pods, which, when agitated by the wind, strike against each other, and produce a sound that may be heard at a considerable distance.

This species of Cassia is a native of Upper Egypt and India, whence it is generally supposed to have been transplanted to other parts of the world. It is at present very extensively diffused through the tropical regions of the old and new continents, being found in Insular and Continental India, Cochin-China, Egypt, Nubia, the West Indies, and the warmer parts of the Continent of America. The fruit is the officinal portion of the plant. It is imported from the East and West Indies, chiefly the latter, and from South America.

Properties. Cassia pods are a foot or more in length, straight, or but slightly curved, cylindrical, less than an inch in diameter, with a woody shell, externally of a dark-brown colour, and marked with three longitudinal shining bands, extending from one end to the other, two of which are in close proximity, appearing to constitute a single band, and the third is on the opposite side of the pod. These bands mark the place of junction of the valves of the legume, and are represented as sometimes excavated in the form of furrows. There are also circular depressions at unequal distances. Internally the pod is divided into numerous cells by thin transverse plates, which are covered with a soft, black pulp. Each cell contains a single, oval, shining seed. The pods brought from the East Indies are smaller, smoother, have a blacker pulp, and are more esteemed than those from the West Indies.

We have seen a quantity of pods in this market sold as cassia pods, which were an inch and a half in diameter, flattened on the sides, exceedingly rough on the outer surface, and marked by three longitudinal very elevated ridges, corresponding to the bands or furrows of the common cassia. The pulp was rather nauseous, but in other respects seemed to have the properties of the officinal purging cassia. They corresponded exactly with a specimen of the fruit of *Cassia Brasilliana* brought from the West Indies, and were probably derived from that plant.

The heaviest pods, and those which do not make a rattling noise when shaken, are to be preferred; as they contain a larger portion of the pulp, which is the part employed. This should be black and shining, and have a sweet taste. It is apt to become sour if long exposed to the air, or mouldy if kept in a damp place. The pulp is extracted from the pods by first bruising them, then boiling them in water, and afterwards evaporating the decoction; or, when the pods are fresh, by opening them at the sutures, and removing the pulp by a spatula.

Cassia pulp has a slight rather sickly odour, and a sweet mucilaginous taste. From

the analysis of M. Henry it appears to contain sugar, gum, a substance analogous to tannin, a colouring matter soluble in ether, traces of a principle resembling gluten, and a small quantity of water.

Medical Properties and Uses. Cassia pulp is laxative, and may be advantageously given in small doses in cases of habitual costiveness. In quantities sufficient to purge, it occasions nausea, flatulence, and griping. In this country it is rarely prescribed, except as an ingredient in the confection of senna, which is a pleasant and useful laxative preparation. The dose of the pulp as a laxative is one or two drachms, as a purge one or two ounces.

Off. Prep. Confectio Sennæ. W.

CASSIA MARILANDICA. *U.S.*

American Senna.

The leaflets of Cassia Marilandica. *U.S.*

Cassia. See CASSIA FISTULA.

Cassia Marilandica. Willd. *Sp. Plant.* ii. 524; Bigelow, *Am. Med. Bot.* ii. 116; Barton, *Med. Bot.* i. 137. This is an indigenous perennial plant, of vigorous growth, sending up annually numerous round, erect, nearly smooth stems, which are usually simple, and rise from three to six feet in height. The leaves are alternate, and composed of from eight to ten pairs of oblong-lanceolate, smooth, mucronate leaflets, green on their upper surface, pale beneath, and connected by short petioles with the common footstalk, which is compressed, channeled above, and furnished near its base with an ovate, stipitate gland. The flowers, which are of a beautiful golden-yellow colour, grow in short axillary racemes at the upper part of the stem. The calyx is composed of five oval, obtuse, unequal yellow leaves; the corolla of the same number of spatulate, concave petals, of which three are ascending, and two descending and larger than the others. The stamens are ten, with yellow filaments and brown anthers, which open by a terminal pore. The three upper stamens bear short abortive anthers; the three lowermost are long, curved, and tapering into a beak. The germ, which descends with the latter, bears an erect style terminating in a hairy stigma. The fruit is a pendulous legume, from two to four inches long, linear, curved, swelling at the seeds, somewhat hairy, and of a blackish colour.

The *American senna*, or *wild senna* as it is sometimes called, is very common in all parts of the United States south of New York, and grows as far northward as the southern boundary of Massachusetts. It prefers a low, moist, rich soil, in the vicinity of water, and, though frequently found in dryer and more elevated places, is most abundant and luxuriant in the flat ground on the borders of rivers and ponds. It is sometimes cultivated in gardens for medical use. In the months of July and August, when in full bloom, it has a rich and beautiful appearance. The leaves should be collected in August or the beginning of September, and carefully dried.

They are sometimes brought into the market, compressed into oblong cakes, like those prepared by the Shakers from most herbaceous medicinal plants. The leaflets are from an inch and a half to two inches long, from one-quarter to half an inch in breadth, thin, pliable, and of a pale-green colour. They have a feeble odour, and a nauseous taste, somewhat analogous to that of senna. Water and alcohol extract their virtues. They were analyzed by Mr. Martin, of Philadelphia, and found to contain a principle analogous to *cathartin*, albumen, mucilage, starch, chlorophyll, yellow colouring matter, volatile oil, fatty matter, resin, and lignin, besides salts of potassa and lime. (*Am. Journ. of Pharm.*, i. 22.)

Medical Properties and Uses. American senna is an efficient and safe cathartic, closely resembling the imported senna in its action, and capable of being substituted for it in all cases in which the latter is employed. It is, however, less active; and, to produce an equal effect, must be administered in a dose at least one-third larger. It is habitually used by many practitioners in the country. Like senna it is most conveniently given in the form of infusion, and should be similarly combined in order to obviate its tendency to produce griping. W.

CASTANEA. *U. S. Secondary.*

Chestnut.

The leaves of Castanea vesca. *U. S.*

Chataigne, *Fr.;* Kastanie, *Germ.;* Castagna, *Ital.;* Castaña, *Span.*

Castanea. *Sex. Syst.* Monœcia Polyandria.—*Nat. Ord.* Cupuliferæ.

Gen. Ch. Male. *Ament* naked. *Calyx* none. *Corolla* five-petaled. *Stamens* ten to twenty. Female. *Calyx* five or six-leaved, muricate. *Corolla* none. *Germs* three *Stigma* pencil-formed. *Nuts* three, included in an echinated calyx. *Willd.*

This is a very small genus, separated from the original Fagus of Linn., including only two or three recognised species; the *Castanea vesca* of Europe and N. America, and *C. pumila* of the United States, which will be found described in Part III. of the present work. The European and American chestnut-trees are known under the same botanical title; as no points of difference can be found between them, which botanists in general are willing to recognise as authorizing distinct specific designations. Nevertheless, the author, in his own judgment, can scarcely avoid the conclusion, that they are distinct trees, differing in origin, and as much entitled to distinct names as the European and American white oaks, or indeed any other analogous species of the two continents. Thus, the general aspect of the two trees is such that the accustomed eye will at a glance recognise the difference, though it might be difficult to say in what exactly the difference consists. The much greater size, and somewhat peculiar shape of the fruit of the European, or, as it is commonly called, in this country, the Spanish Chestnut, is another very striking distinction, and, if permanent, should, we think, be admitted as a sufficient specific character. Besides, the European tree does not lose its distinctive character, under complete change of circumstances. Transplanted into North America, and propagated by the seed, it has retained, through a succession of generations, the original superiority in the size of its fruit, which, had the tree been of the same species as the American, would have almost certainly more or less deteriorated. Our own tree might, we think, very properly receive the name of *Castanea Americana* attached to it by Persoon. But, with the admitted designation of both plants, we must consider both the European and American plants as included in the U. S. Pharmacopœia; and both, therefore, requiring notice here.

Castanea vesca. Willd.; Michaux, *N. American Sylva*, iii. 9. *Castanea Americana.* Persoon. (See *Mérat et De Lens.*) The American chestnut is, under favourable circumstances, one of our largest and most magnificent native trees. Michaux states that he had measured several trees, the trunks of which, at six feet from the ground, were fifteen or sixteen feet in circumference, and their stature equal to that of the loftiest trees of the forest. So great a size, however, is rare. Its leaves are its most characteristic feature, and serve at once to distinguish it. They are from four to eight inches long by about two in breadth, oblong-elliptical, sharp at the end, strongly and somewhat unequally serrated, with prominent parallel nerves beneath, of a brilliant colour, and firm consistence. The only leaves that are liable to be confounded with them are those of the chestnut-oak, which have a very similar form and structure; but are at once distinguishable by the rounded crenate projections on the edge, instead of the sharp serratures of the chestnut. The male flowers are whitish, and disposed on axillary peduncles, four or five inches long; the fertile aments similarly disposed, but less conspicuous. The fruit is a spherical burr, an inch or two in diameter, and very prickly, containing two or three brown nuts, the appearance of which is too well known to require description here. When perfectly ripe, it opens and lets fall the seeds, remaining longer attached to the stem. The bark is very peculiar and characteristic in its appearance, with a longitudinal arrangement of its fibres. The wood is firm and elastic, though not compact, with a remarkable power of resisting decomposition from the weather, and therefore very valuable for posts and rails in fencing, for which it is much employed. On this account the tree is among the most valuable of those indigenous in this country. It is not well fitted

for fuel, in consequence of a great disposition to snap in the fire, and to throw off burning particles to a considerable distance. It may, however, be burned in close stoves.

The American chestnut is spread largely through the Eastern portions of the United States, from New Hampshire to the mountainous districts of Virginia, N. and S. Carolina, Georgia, and Tennessee, where it abounds; as also in the Middle States of New Jersey and Pennsylvania, though rare in the maritime parts of Virginia, and the other Southern States.

The European species is distributed in the south of Europe very much as the American is with us, preferring hilly regions, and abounding in Spain, the South and West of France, Switzerland, and Italy. It sometimes attains an enormous magnitude, and Michaux describes one, growing at Sancerre in France, which at six feet from the ground is thirty feet in circumference, and six hundred years ago was known as the *Great Chestnut.* Though supposed to be more than one thousand years old, its trunk is perfectly sound, and its branches are annually loaded with fruit. Much larger than this is the celebrated chestnut of Mount Etna, of which the trunk is said to be one hundred and sixty feet in circumference, though hollow in the centre, so that the tree lives by its bark. (*Mérat et De Lens.*) In Europe the young chestnut is much used for making hoops, for which it is preferred to all other wood on account of resisting the effects of air and moisture. For this purpose it is much cultivated in Europe, and cut when large enough. But the tree is still more valuable on account of its large nuts, which are much used as food, being a favourite on the table of the rich, and often the main dependence of the poor peasant, who considers himself well-off when possessed of a few healthy chestnut-trees. Whole provinces are said to be supported by this fruit. Though cultivated in small numbers in this country, so that their fruit is usually found in our markets at the proper season, and commands a high price, they have not been so extensively introduced as they ought to be, chiefly, in all probability, from their difficulty of propagation.* The inner bark of the chestnut has been vaunted in Europe as a remedy in dysentery. (*Mérat et De Lens.*) The leaves of our own chestnut are the only part recognised in the U. S. Pharmacopœia. They should be collected after perfect maturity, and before beginning to decay in autumn.

Properties. The peculiar form of the leaves has been already sufficiently described. Their texture is so flexible and tenacious that it is difficult to powder them. In preparing them for the action of a solvent, they must be comminuted by cutting and bruising them in a mortar. They are not, therefore, well fitted for percolation. (*Maisch.*) They have little smell, and a slightly astringent, and scarcely bitterish taste, so that they are not offensive to children. They yield their virtues freely to water, and, probably, less so to alcohol. They have not, so far as we have learned, been satisfactorily analyzed; but they contain a considerable portion of tannin.

* The author has made many attempts to cultivate the European chestnut, but has hitherto failed except in a single instance. The seeds, when planted, have often come up; but the young plant has perished upon an attempt to transplant it, or, at best, has lived but a few years. Yet there is no doubt that the European chestnut may be largely cultivated here, if the proper methods are employed. A proof of this is the presence of considerable quantities of what is called the Washington chestnut in some of our shops. This has the size and all the appearance of the Spanish chestnut, but is believed by some to be the result of the improvement of our native plant under cultivation. It is, however, undoubtedly, in the opinion of the author, nothing more nor less than the Spanish chestnut; and the connection of Washington's name with it is probably owing to the fact, that the trees producing it are descendants of one which sprang from a seed planted by Gen. Washington, when on a visit to Judge Peters at his country-seat, on the west bank of the Schuylkill. The only tree which the author has succeeded in raising, sprang from a nut which was given to him, with the assurance that it was the offspring of the Washington tree. The nut was planted in his garden in Philadelphia, and has grown into a young tree of several years old, but which has not yet produced fruit.

Michaux recommends the spreading of the European chestnut by means of grafting upon the native tree. This may be done by the insertion of a shoot, or in the following method. A branch of the wild tree is cut off at some distance from the stem, a girdle of the bark, from one to three inches wide, near the end is removed, and its place supplied by a piece of the same size from a branch of the cultivated tree. The lower edge of the latter strip is accurately adjusted to the natural bark, leaving a portion of the limb exposed at its cut extremity, which is scraped down so as to form a kind of dressing, and the whole protected by a coating of clay. (*Michaux.*)—*Note to the fourteenth edition.*

Medical Uses. The only remedial use of the leaves, so far as we have learned, has been in the treatment of hooping-cough. Their effects on the system do not appear to have been carefully studied; but their sensible properties do not indicate the possession of any extraordinary physiological power. A communication from Mr. G. C. Close, of Brooklyn, N. Y., calling attention to their efficacy in hooping-cough, made to the American Pharmaceutical Association, at the meeting of 1862, was the first intimation that has come to our notice of their claims to consideration as a medicine. Mr. Close received his information from an eminent physician of the city of New York, of more than thirty years' standing in his profession, who assured him that this was the best remedy he had ever employed in that disease. Dr. J. Unzicker, of Cincinnati, also found the leaves highly useful in hooping-cough, stating that they give decided relief in the course of two weeks, after which the disease rapidly declines to its termination. (*Med. and Surg. Reporter*, Oct. 29, 1867, p. 355.) Dr. J. Ludlow, also of Cincinnati, has followed the practice of Dr. Unzicker, with at least equal success. (*Am. Journ. of Med. Sci.*, April, 1869, p. 568, from *Cincinnati Lancet and Observer.*) Dr. F. P. Porcher, of Charleston, S. C., states in his "*Resources of the Southern Fields and Forests*" (p. 198), that an infusion of the leaves is esteemed in the South as a valuable domestic remedy in hooping-cough and other pectoral affections. They are said also to be used as a domestic remedy in this complaint in some parts of New Jersey. (*Am. Journ. of Pharm.*, Dec. 1871, p. 529.) But Prof. John M. Maisch, of Philadelphia, tells us that, having prepared some fluid extract of the leaves for a physician of the city, he was induced to try it in two of his own children, who had been attacked by the hooping-cough; but had found no good effect from it whatever; the children being first relieved of their spasms by the use of assafetida. (*Ibid.*)

The leaves may be administered in infusion or fluid extract. Dr. Unzicker prepared an infusion with three or four drachms of the leaves and a pint of boiling water, and gave of it, well sweetened, as much as the child would drink through the day. Prof. Maisch prepared a fluid extract by digesting sixteen troyounces (℥xvi) of the dried leaves, cut and bruised, and covered with hot water in an enamelled kettle, over night, then expressing; repeating the digestion and expression twice, with fresh portions of water; mixing each of the three watery infusions with a third of four fluidounces (f℥iv) of glycerin and of eight troyounces (℥viii) of sugar, and evaporating them to a small bulk; then mixing them, and continuing the evaporation to one pint; after which the fluid extract is set aside for several days, and decanted from the little sediment that forms. The dose is from a few drops to a teaspoonful, according to the age of the child. W.

CASTOREUM. *U. S., Br.*

Castor.

A peculiar concrete substance obtained from Castor fiber. *U. S.* The dried preputial follicles and their secretion, obtained from the Beaver, Castor Fiber, and separated from the somewhat shorter and smaller oil-sacs which are frequently attached to them. *Br.*

Castoreum, *Fr.;* Bibergeil, *Germ.;* Castoro, *Ital.;* Castoreo, *Span.*

In the beaver, *Castor fiber* of naturalists, between the anus and external genitals of both sexes, are two pairs of membranous follicles, of which the lower and larger are pear-shaped, and contain an oily, viscid, highly odorous substance, secreted by glands which lie externally to the sac. This substance is called castor. After the death of the animal, the follicles containing it are removed, and dried either by smoke or in the sun; and in this state are brought into the market.

This drug is derived either from the northern and northwestern parts of America, or from Russia; and is distinguished, according to its source, into the Canadian or American and Russian castor. It is supposed by some that the American and Russian beavers are distinct species, the former being a building, the latter a burrowing animal; and additional ground for the supposition is afforded by the fact that the products of the two differ considerably. Of the Russian but a very small portion

reaches this country. That which is brought to Philadelphia is derived chiefly from Missouri; but large quantities are collected in the northwestern regions of British America.*

Castor comes to us in the form of solid unctuous masses, contained in sacs about two inches in length, larger at one end than at the other, much flattened and wrinkled of a brown or blackish colour externally, and united in pairs by the excretory ducts which connect them in the living animal. In each pair one sac is generally larger than the other. They are divided internally into numerous cells, containing the castor, which, when the sacs are cut or torn open, is exhibited of a brown or reddish-brown colour, intermingled more or less with the whitish membrane forming the cells. Those brought from Russia are larger, fuller, heavier, and less tenacious than the American; and their contents, which are of a rusty or liver colour, have a stronger taste and smell, and are considered more valuable as a medicine. A variety of Russian castor, described by Pereira under the name of *chalky Russian castor*, is in smaller and rounder sacs than the American, has a peculiar empyreumatic odour very different from that of the other varieties, breaks like starch under the teeth, and is characterized by effervescing with dilute muriatic acid. In a specimen examined by Müller, 40·646 per cent. of carbonate of calcium was found. In the castor from Missouri, the contents of the sac are sometimes almost white, and evidently inferior. According to Jannarch, castor varies with the time of year at which it is collected, being lighter coloured, more fluid, and less copious in the follicles from February to July than in the remainder of the year. (*Pharm. Cent. Blatt*, Mai, 1847, p. 318.) It is said by M. Kohli that the Canadian castor, treated with distilled water and ammonia, affords an orange precipitate, while the matter thrown down from the Russian under similar treatment is white.

Properties. Good castor has a strong, fetid, peculiar odour; a bitter, acrid, and nauseous taste; and a colour more or less tinged with red. It is of a softer or harder consistence, according as it is more or less thoroughly dried. When perfectly desiccated, though still somewhat unctuous, it is hard, brittle, and of a resinous fracture. Its chemical constituents, according to Brandes, are volatile oil; a resinous matter; albumen; a substance resembling osmazome; mucus; urate, carbonate, benzoate, phosphate, and sulphate of calcium; acetate and muriate of sodium; muriate, sulphate, and benzoate of potassium; carbonate of ammonium; membranous matter; and a peculiar proximate principle discovered by M. Bizio, an Italian chemist, and called by him *castorin*. This principle crystallizes in long, diaphanous, fasciculated prisms, has the smell of castor, and a copperish taste. It is insoluble in cold water and cold alcohol; but is dissolved by 100 parts of the latter liquid at the boiling temperature, and by the essential oils. It possesses neither alkaline nor acid properties. It may be obtained by treating castor, minutely divided, with six times its weight of boiling alcohol, filtering the liquor while hot, and allowing it to cool. The *castorin* is slowly deposited, and may be purified by means of cold alcohol. M. Valenciennes, who could not obtain the crystals white and pure by simple treatment with alcohol, succeeded by first boiling a mixture of equal parts of castor and hydrated lime with water, and acting upon the residue, separated and dried, with boiling alcohol of the sp. gr. 0·823. The product exceeded 1 per cent. (*Pharm. Journ.*, Dec. 1861, p. 329.) It has been thought to be the active principle; but its claims are doubtful. The *volatile oil* may be obtained by repeated distillation with the same portion of water. It is pale-yellow, and has the smell and taste of castor.

* The statement in the text, that the lower of the two pairs of sacs is the one containing the castor, was made on the authority of Cuvier. In an appendix by Dr. W. W. Ely, to a treatise recently published on the "American Beaver and his Works," by Lewis H. Morgan, it is stated by Dr. Ely, who appears to have thoroughly studied the anatomy of the animal, at least in reference to this particular subject, that the upper pair are the real castor sacs, the lower containing an oily secretion, with very little dark-coloured castor. (*Pages* 300 and 303.)

In the same communication by Dr. Ely, the question is discussed as to the identity of the Russian and American beavers; and the conclusion arrived at, that, though there are striking differences between the skulls of the two, as also in some respects in the contents of the castor sacs, yet these are nothing more than can be accounted for by the different circumstances in which they are placed, and by their long separation on the two continents; and consequently the Russian and American beavers should be considered merely as varieties of the same species. (*Note to the thirteenth edition.*)

F. Wöhler has ascertained the existence of salicin in castor; also that it contains a small quantity of *carbolic acid*, one of the products of the distillation of coal-tar, to which he ascribes its odour. (See *Chem. Gaz.*, Jan. 1, 1849.) Dr. Pereira found that a portion of water distilled from American castor gradually lost its peculiar odour, and acquired that of the flowers of *Spiræa ulmaria*, and afterwards presented no trace of the presence of oil of castor. Upon testing it, he ascertained the existence in it of *hydruret of salicyl* (*oil of Spiræa ulmaria*), and concluded that the oil of castor had been converted into that principle. He further inferred that the oil is probably a volatile product of the salicin of the castor, and ascribes the carbolic acid to the same source. (*Pharm. Journ.*, xi. 200.) The salicin of the castor probably proceeds from the willow and poplar on which the beaver feeds.

Alcohol and ether extract the virtues of castor. An infusion made with boiling water has its sensible properties in a slight degree; but the odorous principle of the drug is dissipated by decoction.

The virtues of castor are impaired by age; and the change is more rapid in proportion to the elevation of temperature. Moisture promotes its speedy decomposition. It should not, therefore, be kept in damp cellars. In a dry cool place it may be kept for a long time without material deterioration. When quite black, with little taste or smell, it is unfit for use. The castor follicles are sometimes partly deprived of the castor, and its place supplied with sawdust. A factitious preparation has been sold, consisting of a mixture of various drugs, scented with genuine castor, intermingled with membrane, and stuffed into the scrotum of a goat. The fraud may be detected by the comparatively feeble odour, the absence of other characteristic sensible properties, and the want of the smaller follicles containing fatty matter, often attached to the bags of castor.

Medical Properties and Uses. Castor is moderately stimulant and antispasmodic. The experiments of Thouvenel prove that, in large doses, it quickens the pulse, increases the heat of the skin, and produces other symptoms of general excitement; but its force is directed chiefly to the nervous system, and in small doses it scarcely disturbs the circulation. It has also enjoyed a high reputation as an emmenagogue. It was employed by the ancients. Pliny and Dioscorides speak of it as useful in hysteria and amenorrhœa. In Europe, especially on the continent, it is still frequently prescribed in low forms of fever attended with nervous symptoms, in spasmodic diseases, such as hysteria and epilepsy, in many anomalous nervous affections, and in diseases dependent on or connected with suppression or retention of the menses. It is less used in this country. The dose in substance is from ten to thirty grains, which may be given in bolus or emulsion. The tincture is sometimes employed.

Off. Prep. Tinctura Castorei. W.

CATARIA. *U. S.*

Catnep.

The leaves and tops of Nepeta Cataria. *U. S.*

Cataire, *Fr.;* Katzenmünze, *Germ.;* Cattara, *Ital.;* Gatera, *Span.*

Nepeta. *Sex. Syst.* Didynamia Gymnospermia.—*Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Calyx dry, striate, five-toothed. *Corolla* with the upper lip undivided, the under lip three-parted, the middle division crenate. *Stamens* approximate.

Nepeta Cataria. Catnep or *catmint* is a perennial herbaceous plant, with a quadrangular, branching, somewhat hoary stem, from one to three feet high, and furnished with opposite, petiolate, cordate, dentate, pubescent leaves, which are green above and whitish on their under surface. The flowers are whitish or slightly purple, are arranged in whorled spikes, and appear in July and August. The plant is abundant in the United States, but is supposed to have been introduced from Europe.

The whole herb is used; but the leaves only are recognised in the U. S. Pharmacopœia. They have a strong, peculiar, rather disagreeable odour, and a pungent, aromatic, bitterish, camphorous taste. They yield their virtues to water. The active

constituents are volatile oil, and tannin of the kind which produces a greenish colour with the salts of iron.

In its operation upon the system, catnep is tonic and excitant, bearing considerable resemblance to the mints. It has had the reputation also of being antispasmodic and emmenagogue. Cats are said to be very fond of it, and it has been asserted to act as an aphrodisiac in these animals. It is employed as a domestic remedy, in the form of infusion, in amenorrhœa, chlorosis, hysteria, the flatulent colic of infants, &c.; but is little known in regular practice. Some of the older writers speak favourably of its powers. The leaves are said to relieve toothache if chewed, or held for a few minutes in contact with the diseased tooth. Two drachms of the dried leaves or herb may be given as a dose in infusion. W.

CATECHU. *U.S.*

Catechu.

An extract prepared principally from the wood of Acacia Catechu. *U. S.*

Off. Syn. CATECHU PALLIDUM. *Pale Catechu.* An extract of the leaves and young shoots of Uncaria Gambir (Nauclea Gambir). *Br.*

Cachou, *Fr.*; Catechu, *Germ.*; Catecu, Catciu, Catto, *Ital.*; Catecu, *Span.*; Cutt, *Hindoostanee.*

The British Pharmacopœia has entirely rejected the proper catechu, which, in the former edition, was recognised under the inappropriate name of Catechu Nigrum, retaining, by the name of Catechu Pallidum, a product which, though analogous to catechu, is entirely distinct, being derived from a different plant, and known commonly by a different name, that, namely, of gambir. We treat in the text of the proper catechu, and, in a note, of gambir among the catechus not recognised by the U. S. Pharmacopœia.

Acacia. See ACACIA.

Acacia Catechu. Willd. *Sp. Plant.* iv. 1079; Woodv. *Med. Bot.* p. 433, t. 157; Carson, *Illust. of Med. Bot.* i. 32, pl. 24. According to Mr. Kerr, whose description has been followed by most subsequent writers, Acacia Catechu is a small tree, seldom more than twelve feet in height, with a trunk one foot in diameter, dividing towards the top into many close branches, and covered with a thick, rough, brown bark. The leaves, which stand alternately upon the younger branches, are composed of from fifteen to thirty pairs of pinnæ nearly two inches long, each of which is furnished with about forty pairs of linear leaflets, beset with short hairs. At the base of each pair of pinnæ is a small gland upon the common footstalk. Two short recurved spines are attached to the stem at the base of each leaf. The flowers are in close spikes, which arise from the axils of the leaves, and are about four or five inches long. The fruit is a lanceolate, compressed, smooth, brown pod, with an undulated thin margin, and contains six or eight roundish flattened seeds, which when chewed emit a nauseous odour.

This species of Acacia is a native of the East Indies, growing abundantly in various provinces of Hindostan, and in the Burmese Empire. Pereira says that it is now common in Jamaica. Like most others of the same genus, it abounds in astringent matter, which may be extracted by decoction. Catechu is an extract from the wood of the tree.

This drug had been long known before its source was discovered. It was at first called *terra Japonica*, under the erroneous impression that it was an earthy substance derived from Japan. When ascertained by analysis to be of vegetable origin, it was generally considered by writers on the Materia Medica to be an extract of the *betel nut*, which is the fruit of a species of palm, denominated *Areca Catechu*. Its true origin was made known by Mr. Kerr, assistant surgeon of the civil hospital in Bengal, who had an opportunity of examining the tree from which it was obtained, and observing the process of extraction. According to Mr. Kerr, the manufacturer, having cut off the exterior white part of the wood, reduces the interior brown or reddish-coloured portion into chips, which he then boils in water in unglazed earthen vessels, till all the soluble matter is dissolved. The decoction thus obtained is evaporated first by artificial heat, and afterwards in the sun, till it has assumed a thick consist

ence, when it is spread out to dry upon a mat or cloth, being, while yet soft, divided by means of a string into square or quadrangular pieces. The account subsequently given by Dr. Royle, of the preparation of the extract in Northern India, is essentially the same. The process, as he observed it, was completed by the pouring of the extract into quadrangular earthen moulds. Our countryman, the Rev. Howard Malcolm, states, in his "Travels in South Eastern Asia," that catechu is largely prepared from the wood of Acacia Catechu near Prome, in Burmah. Two kinds, he observes, are prepared from the same tree; one *black*, which is preferred in China, and the other *red*, which is most esteemed in Bengal. It is said that the unripe fruit and leaves are also sometimes submitted to decoction.

The name *catechu* in the native language signifies the *juice of a tree*, and appears to have been applied to astringent extracts obtained from various plants. According to the U. S. Pharmacopœia, however, the term is properly restricted to the extract of Acacia Catechu; as it was not intended to recognise all the astringent products which are floating in Asiatic commerce; and those from other sources than the Acacia, though they may occasionally find their way into our shops, do so as an exception to the general rule. A minute account of the diversified forms and exterior characters which officinal catechu presents as produced in different localities, would rather tend to perplex the reader than to serve any good practical purpose. These characters are, moreover, frequently changing, as the drug is procured from new sources, or as slight variations may occur in the mode of its preparation. Commerce is chiefly supplied with catechu from Bahar, Northern India, and Nepaul through Calcutta, from Canara through Bombay, and from the Burmese dominions. We derive it directly from Calcutta, or by orders from London, and it is sold in our markets without reference to its origin. It is frequently called *cutch* by the English traders, a name derived, no doubt, from the Hindoostanee word *cutt.**

* In order not to embarrass the text unnecessarily, we have thrown together, in the form of a note, the following observations upon the varieties of catechu; those being first considered which are probably derived from *Acacia Catechu*, and, therefore, recognised as officinal in the U. S. Pharmacopœia.

1. *Officinal Catechu. U. S.*

The following, so far as we have been able to distinguish them, are the varieties of officinal catechu to be found in the markets of Philadelphia.

1. *Plano-convex Catechu. Cake Catechu.* This is in the form of circular cakes, flat on one side, convex on the other, and usually somewhat rounded at the edge, as if the soft extract had been placed in saucers, or vessels of a similar shape, to harden. As found in the retail shops, it is generally in fragments, most of which, however, exhibit some evidences of the original form. The cakes are of various sizes, from two or three to six inches or more in diameter, and weighing from a few ounces to nearly two pounds. Their exterior is usually smooth and dark-brown; but we have seen a specimen in which the flat surface exhibited impressions as if produced by coarse matting. The colour internally is always brown, sometimes of a light yellowish-brown or chocolate colour, but more frequently dark reddish-brown, and sometimes almost black. The cakes are almost always more or less cellular in their interior; but in this respect great diversity exists. Sometimes they are very porous, so as almost to present a spongy appearance, sometimes compact and nearly uniform; and this difference may be observed even in the same piece. The fracture is sometimes rough and dull, but in the more compact parts is usually smooth and somewhat shining; and occasionally a piece split in one direction will exhibit a spongy fracture, while in another it will be shining and resinous, indicating the consolidation of the extract in layers. This variety of catechu is often of good quality. It is common at present in our market, but we have been unable to trace its origin accurately. There can be little doubt, from its internal character, that it comes from the East Indies, and is the product of *A. Catechu:* but no accounts that we have seen of the preparation of the drug, in particular geographical sites, indicate this particular shape; and it is not impossible that portions of it may be formed out of other varieties of catechu by a new solution and evaporation.

2. *Pegu Catechu.* This is the product derived from the Burmese dominions, and named from that section of the country whence it is exported. It enters commerce, probably in general through Calcutta, in large masses, sometimes of one cwt., consisting of layers of flat cakes, each wrapped in leaves, said to be those of the *Nauclea Brunonis*. In this form, however, we do not see it in the shops; but almost always in angular, irregular fragments, in which portions of two layers sometimes cohere with leaves between them, indicating their origin. It is characterized by its compactness, shining fracture, and blackish-brown or dark Port-wine colour, so that when finely broken it bears considerable resemblance to kino. This is an excellent variety of catechu, and is not unfrequent in the shops.

3. *Catechu in Quadrangular Cakes.* This is scarcely ever found in the shops in its complete form, and the fragments are often such that it would be impossible to infer from them the original shape of the cake. This is usually between two and three inches in length and breadth, and somewhat less in thickness, of a rusty-brown colour externally, and dark-brown or brownish-gray within,

Properties. Catechu, as it comes to us, is in masses of different shapes, some in balls more or less flattened, some in circular cakes, some saucer-shaped, others cubical with a somewhat rough and dull fracture, but, when broken across the layers in which it is sometimes disposed, exhibiting a smoother and more shining surface. Guibourt speaks of the layers as being blackish externally and grayish within, and bearing some resemblance to the bark of a tree, a resemblance, however, which has not struck us in the specimens which have fallen under our notice. There is little doubt that this variety comes from the provinces of Bahar and Northern India, where the preparation of the drug was witnessed by Mr. Kerr and Dr. Royle, who both speak of it as being brought, when drying, into the quadrangular form. It has been called *Bengal Catechu*, because exported from that province.

Pale catechu, so far as the term is not applied to *gambir*, may be considered as belonging to this variety. A specimen with this name, which was sent from India to the great London exhibition, and which we had an opportunity of examining, was in oblong rectangular pieces, or fragments of such pieces, about three and a half inches long by an inch and a half in breadth, of a dirty yellowish colour within, and an earthy fracture, quite free from gloss, and bearing a much stronger resemblance to gambir than to ordinary catechu.

4. *Catechu in Balls.* We have seen this in two forms — one consisting of globular balls about as large as an orange, very hard and heavy, of a ferruginous aspect externally, very rough when broken, and so full of sand as to be gritty under the teeth; the other in cakes, originally, in all probability, globular, and of about the same dimensions, but flattened and otherwise pressed out of shape before being perfectly dried, sometimes adhering two together, as happens with the lumps of Smyrna opium, and closely resembling in external and internal colour, and in the character of their fracture, the quadrangular variety last described. The former kind is rare, and the specimens we have seen had been twenty years in the shop, and had very much the appearance of a factitious product. The latter is in all probability the kind known formerly as the *Bombay catechu;* as Dr. Hamilton, and, more recently, Major Mackintosh, in describing the mode of preparing catechu on the Malabar coast, of which Bombay is the entrepot, say that, while the extract is soft, it is shaped into balls about the size of an orange.

2. *Catechus not recognised as officinal in the U. S. Pharmacopœia.*

1. *Gambir. Terra Japonica. Catechu Pallidum, Pale Catechu.* Br. An astringent extract is abundantly prepared in certain parts of the East Indies, under the name of *gambir* or *gambeer*, and imported into Europe and America under that of terra Japonica. The plant from which it is obtained, called by Mr. Hunter, who first minutely described it, *Nauclea Gambir*, but by Roxburgh, De Candolle, and others, *Uncaria Gambir*, is a climbing shrub of the class and order *Pentandria Monogynia*, and natural order *Rubiaceæ* of Jussieu, *Cinchonaceæ* of Lindley. It is a native of Malacca, Sumatra, Cochin-China, and other parts of Eastern Asia, and is largely cultivated in the Islands of Bintang, Singapore, and Prince of Wales. The gambir is prepared by boiling the leaves and young shoots in water, and evaporating the decoction either by artificial or solar heat. When of a proper consistence, it is spread out into flat cakes in moulds or otherwise, and then cut into small cubes, which are dried in the sun. Sometimes these cohere into a mass when packed before being quite dry.

Gambir is in cubes, with sides about an inch square, is light and porous, so that it floats when thrown in water, is deep-yellowish or reddish-brown externally, but pale-yellowish within, presents a dull earthy surface when broken, is inodorous, and has a strongly astringent, bitter, and subsequently sweetish taste. It softens and swells up when heated, and leaves a minute proportion of ashes when burnt. It is partially soluble in cold water, and almost wholly so in boiling water, which deposits a portion upon cooling. Duhamel, Ecky, and Procter dissolved 87·5 per cent. of it in cold water by means of percolation. (*Am. Journ. of Pharm.*, xvi. 166.) Nees von Esenbeck found it to consist of from 36 to 40 per cent. of tannic acid, a peculiar principle called *catechuin* or catechuic acid, gum or gummy extractive, a deposit like the cinchonic red, and 2·5 per cent. of lignin. *Catechuic acid*, when perfectly pure, is snow-white, of a silky appearance, crystallizable in fine needles, unalterable if dry in the air, fusible by heat, very slightly soluble in cold water with which it softens and swells up, soluble in boiling water which deposits it on cooling, and soluble also in alcohol and ether. It very slightly reddens litmus paper, and, though colouring the solution of chloride of iron green, and producing with it a grayish-green precipitate, differs from tannic acid in not affecting a solution of gelatin. It bears considerable analogy to gallic acid in its relations to the metallic salts, but does not, according to Neubauer, bear the same relation to the tannic acid of catechu that gallic acid does to that of galls. On the contrary, instead of resulting from the oxidation of tannic acid, it is by heat converted into a substance analogous to tannin. (*Am. Journ. of Pharm.*, xxviii. 329 and 331; from *Liebig's Annalen*, xevi. 337.) M. Barthe has stated facts tending to show that the acid is tribasic, and that it is capable of being converted into gallic acid. (*Journ. de Pharm. et de Chim.*, Oct. 1867, p. 309.) Neubauer gives the composition as $C_{17}H_{12}O_{10}$, with the loss of one eq. of water at 212° F. According to MM. Kraut and Van Delden, who are said to confirm the results of Neubauer, the composition is $C_{24}H_{12}O_{10}$ (*Chem. News*, March 17, 1865, p. 125); but the difference in the proportion of carbon would seem to be altogether incompatible with this statement; and the probability is that there has been some mistake in giving the number of eqs. of this ingredient. To prepare it, the precipitate which falls upon the cooling of the decoction of gambir is well washed upon a filter with cold water, and again dissolved in boiling water with a little purified animal charcoal. The solution being filtered and allowed to stand, gradually deposits the acid, of a snow-white colour. To obtain it perfectly white in the dry state, it must be dried under an exhausted receiver with sulphuric acid. (*Wackenroder, Annal. der Pharm.*, xxxi. 72.) The sweet taste of gambir is thought to depend on this constituent.

Several varieties of gambir are described. Sometimes it is in oblong instead of cubical pieces, without differing in other respects from the ordinary kind; sometimes in small circular cakes, or

or oblong, or quite irregular, and of every grade in size, from small angular pieces, which are evidently fragments of the original cakes, to lumps which weigh one or two pounds. The colour is externally of a rusty brown more or less dark, internally varying from a pale-reddish or yellowish-brown to a dark liver colour. In some specimens it is almost black, in others somewhat like the colour of Port wine, and in others again, though rarely, dull-red like annotta. The extract has been distinguished into the *pale* and *dark* varieties; but there does not appear to be sufficient ground for retaining this distinction, at least in relation to the proper catechu obtained from the wood of A. Catechu. Under the name, however, of *pale catechu*, an astringent product has been recognised in the British Pharmacopœia, the proper name of which is *gambir*, and which has a wholly different origin. This is described in a note, among the catechus not recognised by our officinal standard. (See *page* 250.) Catechu is inodorous, with an astringent and bitter taste, followed by a sense of sweetness. It is brittle, and breaks with a fracture which is rough in some specimens, in others uniform, resinous, and shining. That which is preferred in our market is of a dark colour, easily broken into small angular fragments, with a smooth glossy surface, bearing some resemblance to kino. Catechu is often mixed with sand, sticks, and other impurities. From 200 parts of Bombay catechu, Sir H. Davy obtained 109 parts of tannic acid, 68 of extractive, 13 of mucilage, and 10 of insoluble residue. The same quantity of Bengal catechu yielded 97 of tannic acid, 73 of extractive, 16 of mucilage, and 14 of insoluble residue. Other experimenters have obtained results somewhat different. The proportion of tannic acid, which may be considered the efficient principle, varies from about 30 to 55 per cent. in the different varieties of the drug. The portion designated by Davy as extractive is said to contain, if it do not chiefly consist of a principle discovered by Buchner, and now called *catechuin* or *catechuic acid.* For a particular account of this principle, the reader is referred to the note (*page* 250), on the subject of gambir (*pale catechu*, Br.), of which it is a characteristic ingredient. The *tannic acid* is of the variety which precipitates

short cylindrical pieces, heavier than water, of a pale reddish-yellow colour, moderately astringent, gritty under the teeth, and quite impure; sometimes in very small cubes, distinguishable by the black colour they afford with tincture of iodine, indicating the admixture of sago, or other amylaceous matter; and, finally, in circular cakes of the size of a small lozenge flat on one side, and somewhat convex on the other, of a pale pinkish yellowish-white colour, and a chalky feel. This is most highly esteemed by the natives in India. (*Pereira.*) None of these varieties occur to any extent in our commerce.

Gambir was probably the substance first brought from the East under the name of *terra Japonica.* It is largely consumed in the East by the betel-chewers. Great quantities are imported into Europe, where it is used for tanning, calico-printing, dyeing, &c. In this country it is also largely consumed by the calico-printer. It is a strong astringent, and applicable to the same purposes as the officinal catechu.

2. *Areca Catechu.* This is obtained from the *areca nut*, or *betel nut*, which is the seed of *Areca Catechu*, a palm cultivated in all parts of India. (See *Part Third.*) It is prepared by boiling the nuts in water, and evaporating the decoction. There are two varieties; one of a black colour, very astringent, mixed with paddy husks and other impurities, and obtained by evaporating the first decoction; the other, yellowish-brown, of an earthy fracture, and pure, resulting from the evaporation of a decoction of the nuts which had been submitted to the previous boiling. The first is called *kassu*, the other *coury.* (Heyne, *Tracts, &c. on India.*) They are prepared in Mysore, and Ainslie states that both varieties are sold in the bazaars of Lower India, and used for the same purpose as the officinal catechu by the native and European practitioners. They are also much used for chewing by the natives. But they are seldom exported, and it is uncertain whether they find their way into European or American commerce. Pereira thought he had identified the *kassu* with a variety of catechu derived from Ceylon, where he had been informed that an extract of the areca nut is prepared. It was in circular flat cakes, from two to three inches in diameter, scarcely an inch thick, covered on one side with paddy husks, and internally blackish-brown and shining, like Pegu catechu.

Guibourt and Pereira describe other varieties, which we have not met with, and which are probably rare. One of these is the *Siam catechu*, in conical masses shaped like a betel nut, and weighing about a pound and a half. Its fracture is shining and liver-coloured, like that of hepatic aloes; in other respects it resembles Pegu catechu. Another is the *black mucilaginous catechu* of Guibourt, in parallelopipeds, an inch and a half in length by an inch in breadth. Internally it is black and shining, and its taste is mucilaginous and feebly astringent. A third is the *dull-reddish catechu* of Guibourt, in somewhat flattened balls, weighing three or four ounces, of a dull-reddish, wavy, and often marbled fracture. We saw something like this many years since, which had been brought upon speculation by a merchant from Calcutta, but it is not now in the market. Lastly, there is a *pale* or *whitish* catechu, in small roundish or oval lumps, with an irregular surface, dark or blackish-brown externally, very pale and dull internally, and of a bitter, astringent, and sweetish taste, with a smoky flavour. It is unknown in commerce.

iron of a greenish-black colour, and differs from most of the other varieties in not yielding grape-sugar when digested with dilute sulphuric acid. It is not, therefore, a glucoside. It precipitates gelatin, but not tartar emetic (*Kane*), and is not, like the tannic acid of galls, converted into gallic acid by exposure to the air. It may be distinguished by the name of *catechu-tannic acid*, or, as proposed by Berzelius, *mimo-tannic acid*, from its source in one of the *Mimoseæ*. Catechu is almost wholly soluble in a large quantity of water, to which it imparts a brown colour. The extractive or catechuic acid is much less soluble than the astringent principle, which may be almost entirely separated from it by the frequent application of small quantities of cold water. Boiling water dissolves it much more readily than cold, and deposits it of a reddish-brown colour upon cooling. Both principles are readily dissolved by alcohol or proof spirit, and are soluble also in ether. For the important reactions of catechu, see *Acidum Tannicum*.

M. de Meyer gives, as the best method of detecting adulteration of catechu, to treat the suspected drug with ether. Catechu of good quality, after repeated treatment with ether, loses 53 per cent. of its weight, and the dried residue weighs only 47 per cent. of the catechu employed. If this be exceeded, the drug must be proportionately impure. (*Journ. de Pharm.*, Juin, 1870, p. 479.)

Medical Properties and Uses. Catechu is gently tonic, and powerfully astringent. The dark-coloured has the latter property in a somewhat greater degree than the light, and is therefore usually preferred. The latter, being rather sweeter, is preferred by the Malays, Hindoos, and other E. Indians, who consume vast quantities of this extract by chewing it, mixed with aromatics and a small proportion of lime, and wrapped in the leaf of the *Piper Betel*. Catechu may be advantageously used in most cases where astringents are indicated, and, though less employed in this country than kino, is not inferior to it in virtues. The complaints to which it is best adapted are diarrhœa dependent on debility or relaxation of the intestinal exhalants, and passive hemorrhages, particularly that from the uterus. A small piece, held in the mouth and allowed slowly to dissolve, is an excellent remedy in relaxation of the uvula, and the irritation of the fauces and troublesome cough which depend upon it. Applied to spongy gums, in the state of powder, it sometimes proves useful; and it has been recommended as a dentifrice in combination with powdered charcoal, Peruvian bark, myrrh, &c. Sprinkled upon the surface of indolent ulcers, it is occasionally beneficial, and is much used in India for the same purpose, in the form of an ointment. An infusion of catechu may be used as an injection in obstinate gonorrhœa, gleet, and leucorrhœa, and we have found it highly beneficial, when thrown up the nostrils, in arresting epistaxis. The dose is from ten grains to half a drachm, which should be frequently repeated, and is best given with sugar, gum arabic, and water.*

Off. Prep. Infusum Catechu Compositum, *U. S.*; Tinctura Catechu, *U. S.*

Off. Prep. of Pale Catechu (Gambir). Infusum Catechu, *Br.*; Pulvis Catechu Compositus, *Br.*; Tinctura Catechu, *Br.*; Trochisci Catechu, *Br.* W.

CERA ALBA. *U. S., Br.*

White Wax.

Yellow wax, bleached. *U. S.* Bleached by exposure to moisture, air, and light. *Br.*
Cire blanche, *Fr.*; Weisses Wachs, *Germ.*; Cera bianca, *Ital.*; Cere blanca, *Span.*

* *Fluid Extract of Catechu.* Prof. Procter has suggested the following formula for a *fluid extract of catechu* based on the solvent power of glycerin over this extract. Eight *troyounces* of pure catechu, in moderately coarse powder, are mixed in a mortar with *four fluidounces* of glycerin so as to form a paste, to which enough diluted alcohol is added to make a pint. The liquid is poured into a bottle, shaken occasionally for twenty-four hours, and then strained through muslin. Each fluidrachm of the fluid extract represents thirty grains of catechu. (*Proceed. of Am. Pharm. Assoc.*, A.D. 1863, p. 241.)—*Note to the twelfth edition.*

CERA FLAVA. *U.S., Br.*

Yellow Wax.

A peculiar concrete substance prepared by Apis mellifica. *U.S.* The prepared honeycomb of the Hive Bee, Apis mellifica. *Br.*

Cire Jaune, *Fr.;* Gelbes Wachs, *Germ.;* Cera gialla, *Ital.;* Cera amarilla, *Span.*

Wax is a product of the common bee, *Apis mellifica* of naturalists, which constructs with it the cells of the comb in which the honey and larvæ are deposited. It was at one time doubted whether the insect elaborated the wax by its own organs, or merely gathered it from vegetables. The question was set at rest by Huber, who fed a swarm of bees exclusively on honey and water, and found that they formed a comb consisting of wax. This, therefore, is a proper secretion of the insect. It is produced in the form of scales under the rings of the belly. But wax also exists in plants, bearing in this, as in other respects, a close analogy to the fixed oils. It is, however, the product of the bee only that is recognised by the Pharmacopœias. This is directed in two forms: 1. that of *yellow wax* procured immediately from the comb; and 2. that of *white wax* prepared by bleaching the former. We shall consider these separately, and afterwards give an account of *vegetable wax*.

1. Cera Flava or *Yellow Wax.* This is obtained by slicing the comb taken from the hive, draining and afterwards expressing the honey, and melting the residue in boiling water, which is kept hot for some time in order to allow the impurities to separate, and either subside or be dissolved by the water. When the liquid cools the wax concretes, and, having been removed and again melted in boiling water, is strained and poured into pans or other suitable vessels. It is usually brought to market in round flat cakes of considerable thickness. The druggists of Philadelphia are supplied chiefly from the Western States and North Carolina, especially the latter, and from Cuba. Some of inferior quality is imported from Africa.

In this state, wax has a yellowish colour, an agreeable somewhat aromatic odour, and a slight peculiar taste. To the touch it is rather soft and unctuous, though of a firm solid consistence and brittle. It has a granular fracture; but when cut with a knife presents a smooth glossy surface, the lustre of which is so peculiar as, when met with in other bodies, to be called waxy. It does not adhere to the fingers, nor to the teeth when chewed, but is softened and rendered tenacious by a moderate heat. Its point of fusion is 142° F.; its specific gravity from 0·960 to 0·965. The colour, odour, and taste of yellow wax depend upon some associated principle or principles.

Various adulterations have been practised, most of which may be readily detected. Meal, earth, and other insoluble substances are at the same time discovered and separated by melting and straining the wax. When the fracture is smooth and shining instead of being granular, the presence of resin may be suspected. This is dissolved by cold alcohol, while the wax is left untouched. For other adulterating substances used, and the modes of detecting them, see the remarks which follow on white wax.

Yellow wax is used in medicine chiefly as an ingredient of plasters and cerates.

2. Cera Alba or *White Wax.* The colour of yellow wax is discharged by exposing it, with an extended surface, to the combined influence of air, light, and moisture. The process of bleaching is carried on to a considerable extent in Philadelphia. The wax, previously melted, is made to fall in streams upon a revolving cylinder, kept constantly wet, upon which it concretes, forming thin riband-like layers. These, having been removed, are spread upon linen cloths stretched on frames, and exposed to the air and light; care being taken to water and occasionally turn them. In a few days they are partially bleached; but, to deprive the wax completely of colour, it is necessary to repeat the whole process once, if not oftener. When sufficiently white, it is melted and cast into small circular cakes. The colour may also be discharged by chlorine; but the wax is said to be somewhat altered.* White wax some-

* The following process for purifying wax by steam has been patented by M. Cassgrand, in France, and is said to have been employed advantageously. Wax melted by steam is passed along

times contains one or more free fatty acids, consequent probably upon the employment of alkalies in bleaching it, which render it an unfit ingredient in the unctuous preparations of certain salts. Of these acids it may be deprived by means of alcohol.

Perfectly pure wax is white, shining, diaphanous in thin layers, inodorous, insipid, harder and less unctuous to the touch than the yellow, soft and ductile at 95° F., and fusible at about 155°, retaining its fluidity at a lower temperature. According to Saussure, its sp. gr. in the solid state is 0·966, at 178° F. 0·834, and at 201° 0·8247. By a great heat it is partly volatilized, partly decomposed; and, when flame is applied to its vapour, it takes fire and burns with a clear bright light. It is insoluble in water, and in cold alcohol or ether, but is slightly soluble in boiling alcohol and ether, which deposit it in a great measure upon cooling. The volatile and fixed oils dissolve it with facility, resin readily unites with it by fusion, and soaps are formed by the action of soda and potassa in solution. It is not affected by the acids at ordinary temperatures, but is converted into a black mass when boiled with concentrated sulphuric acid. Its ultimate constituents are carbon, hydrogen, and oxygen. Dr. John found it to consist of two distinct principles, one of which he called *cerin*, the other *myricin*. According to MM. Boudet and Boissenot, the former constitutes at least 70 per cent. of wax, melts at about 143°, dissolves in 16 parts of boiling alcohol, and is saponifiable with potassa, yielding margaric acid, a little oleic acid, and a fatty matter insusceptible of saponification called *cerain*; the latter melts at 149°, is dissolved by 200 parts of boiling alcohol, and is not saponifiable by potassa. M. Lewy inferred from his experiments that cerin and myricin are isomeric with each other and with wax; that by a boiling solution of potassa wax is wholly saponified, without the formation of glycerin; that both wax and cerin are converted into stearic acid by saponification; and that this, by a further oxidation, is changed into margaric acid. (*Journ. de Pharm.*, 3e sér., iii. 315.) Messrs. Warington and Francis, however, have found that the substance supposed to be stearic acid, though similar to that body in appearance, is wholly different from it in properties and composition, and is isomeric, if not identical, with the cerain above referred to. (*Philos. Mag.*, Jan. 1844, p. 20.)*

with the steam through a coiled tube or worm, is received into a double bottom heated by steam, where it is washed with water, and is then raised by a pump into another pan, also heated by steam, where it is again washed with water; and the whole operation is repeated three or four times; the wax being allowed to rest for about four or five minutes in the upper pan after each operation, and, after the last one, an hour or two for the subsidence of impurities. The wax is then granulated by means of cold water, allowed to dry for two or three days, and then exposed to light and air. The whole process is completed in a few days. (See *Am. Journ. of Pharm.*, xxvi. 525; from *Dub. Journ. of Industrial Progress.*)—*Note to the eleventh edition.*

* New views have been put forth as to the constitution of wax, in communications from B. Collins Brodie to the Royal Society of London. *Cerin*, when quite pure, he considers as a peculiar acid, having the constitution $C_{54}H_{54}O_4$, which he names *cerotic acid*. This he procures by precipitating a boiling alcoholic solution of cerin by means of an alcoholic solution of acetate of lead, treating the precipitated cerotate of lead by hot alcohol and ether until everything soluble is removed, then decomposing it with concentrated acetic acid, washing the separated cerotic acid with boiling water, and still further purifying it by solution in boiling absolute alcohol and refrigeration. The acid is deposited pure. It melts at 172° F., and on cooling concretes into a crystalline mass. When distilled alone, the greater portion of it passes unchanged; whereas, if mixed with the other constituents of wax, it is wholly decomposed; and it is, consequently, not found in the results of the distillation of wax itself. It is a singular fact that cerotic acid was not found in some beeswax brought from Ceylon, showing that wax varies much according to the circumstances under which it is produced. *Myricin*, when entirely separated from the cerotic acid, is saponifiable, but with difficulty; and from the results of saponification palmitic acid ($C_{32}H_{32}O_4$) was isolated, and a peculiar body, called by Mr. Brodie *melissine*, having the composition $C_{60}H_{62}O_2$, and considered by him as a wax-alcohol, convertible by the loss of two eqs. of hydrogen and the gain of two of oxygen, into melissic acid, as alcohol is converted into acetic acid. (See *Acetum.*)

In the examination of a variety of wax from China, Mr. Brodie found a substance called by him *cerotine* ($C_{54}H_{56}O_2$), which he regards as the alcohol of cerotic acid, into which it was converted by loss of hydrogen and gain of oxygen as above; that is, by oxidation, two eqs. of the hydrogen being converted into water.

According to these views, the varieties of wax are composed of substances having to each other similar relations to those which characterize alcohol and acetic acid resulting from fermentation. (*Chem. Gaz.*, vi. 225, and vii. 46.)

The *China wax*, above referred to, called *pe-la* by the Chinese, resembles spermaceti in whiteness and crystalline appearance, but is distinguished by greater hardness and friability, and a somewhat fibrous fracture. It melts at about 181° F., is very slightly soluble in alcohol or ether, is insoluble in cold oil of turpentine and rectified petroleum, but is dissolved by these fluids with the aid of

White wax has been variously adulterated. *White lead* sinks to the bottom of the vessel when the wax is melted. *Starch, meal*, and other *insoluble substances* remain behind when the wax is dissolved in oil of turpentine or benzine; and the starch is known by producing a blue colour with iodine added to water in which the wax has been boiled. *Water*, which is said to be sometimes fraudulently incorporated with it, by agitation when partially melted, is driven off by heat. *Fatty substances* render lime-water turbid, when agitated with it and allowed to stand. For the detection of stearin and stearic acid, M. Lebel dissolves the suspected wax in two parts of oil, beats the cerate thus formed with its weight of pure water, and then adds a few drops of solution of subacetate of lead. If stearin is present, there is an immediate decomposition, and the mixture acquires an extraordinary solidity from the formation of stearate of lead. (*Journ. de Pharm.*, 3e sér., xv. 302.) Vogel proposes chloroform as a means of detecting the adulteration with fatty matters. That liquid dissolves only 25 per cent. of wax, but stearin and stearic acid completely. If, therefore, wax, treated with 6 or 8 parts of chloroform, loses more than one-quarter of its weight, it may be considered as impure. (*Ibid.*, xvii. 374.) Overbeck detects stearic acid by the abundant effervescence produced from the escape of carbonic acid, when a small portion of the suspected wax is boiled in a solution, composed of one part of carbonate of sodium and fifty of distilled water. (*Pharm. Journ.*, xi. 128.) Fehling detects *stearic acid* and *resin* by boiling one part of the wax in twenty of alcohol, filtering the solution when cold, and then adding water. If either of these substances be present, there will be a flocculent precipitate, whereas if the wax be pure there will scarcely be an observable turbidness. The natural fats, as *tallow*, *suet*, *lard*, &c., are not amenable to this test; but it may be applied by first saponifying them, and thus converting them into the fatty acids, as the stearic. But, as wax itself is somewhat liable to be affected, it is necessary to avoid too strong an alkaline solution, and too long boiling in the process. To obviate such a result, 30 grains of the wax are to be boiled with two or three fluidounces of water containing 6 grains of pure hydrate of soda, and the mass saturated with a very dilute acid, and heated. The wax is then to be separated, dried between folds of blotting paper, and treated as above for stearic acid. (*Neues Repert. für Pharm.*, viii. 78.) For the detection of rosin cold alcohol is sufficient. It dissolves the rosin, and yields it on evaporation, attended with a very small portion of pure wax, which yields 2·4 per cent. to cold alcohol. (Ed. Davies, *Am. Journ. of Pharm.*, Nov. 1870, p. 537.) To detect *paraffin*, which is another adulteration said to be frequent, Prof. Landolt, of Bonn, heats the wax with fuming sulphuric acid (*Nordhausen*), which destroys the wax, converting it into a black jelly-like mass, while the paraffin is left as a transparent layer on the surface. (See *Am. Journ. of Pharm.*, xxxiv. 35.) M. Lies Bodart detects the same impurity by a somewhat complex process, based on the ether-

heat. These solubilities distinguish it from spermaceti. (*Pharm. Journ.*, xiv. 9.) It was formerly supposed to be of vegetable origin; but has been ascertained to be the product of an insect belonging to the genus Coccus, which fixes itself to the branches of a certain tree, and, investing them closely, becomes embedded in a waxy material, which is scraped off with the insects, and constitutes the crude wax. It is purified by melting and straining. (Hanbury, *Pharm. Journ.*, xii. 476.) The tree from which the wax is obtained has been ascertained to be the Fraxinus Chinensis of Roxburgh. (*Ibid.*, Sept. 1, 1859, p. 176.)

Mr. T. T. Cooper, in his "Travels of a Pioneer" in China, gives some interesting statements as to the production of this wax, which are the result of his own personal observations. It is chiefly the Province of S'zchuan, which is the seat of this industry; the cultivation of the China wax being a source of great wealth to this Province, second only in importance to the silk culture. The "wax trees" are all cut down at the height of 8 feet, leaving no branches, the trunks being about as thick as a man's thigh, and sending forth shoots in the spring. The insects are cultivated in a different Province, that of "Yunnan," whence vast quantities of the eggs are sent annually to S'zchuan, where they are received in little balls of the size of a pea. These are suspended, enclosed in young leaves, to the shoots of the tree in March. In about two months the larvæ appear, and feeding on the leaves soon attain the size of small butterflies, which spread themselves in immense numbers over the branches, which are whitened by them, so as to seem covered with feathery snow. The grub, as it advances to the chrysalis form, buries itself in a white secretion by which all the branches are coated an inch in thickness. These are then cut off near the stem and divided into small pieces, which are tied in bundles, and put into large cauldrons, where they are boiled in water till all the wax melts and rises to the surface. It is then skimmed off and run into moulds where it hardens. In the form thus produced, it is spread over the Empire, where it is used for candles and as medicine. (*Pharm. Journ.*, Jany. 1872, p. 569.)—*Note to the fourteenth edition.*

ification of the wax; the paraffin being left sufficiently pure to enable its proportion to be estimated. For the particulars of the process, the reader is referred to the *Journ. de Pharm. et de Chim.* (4e sér., iii. 287, A.D. 1866). A simpler method is that of M. Dullo, who treats the adulterated wax with ether. If this dissolves more than 50 per cent., the presence of paraffin is indicated. M. Payen resorts to the point of fusion as a means of detecting paraffin. This substance melts at a lower temperature than wax, and lowers the melting point of wax with which it is mixed. (*Ibid.*, 4e sér., ii. 233.) White wax should not melt below 150°; yellow not below 140°. (*Br.*) *Japan wax* is said also to be largely employed for adulterating beeswax; so that sometimes but little of the product of the bee is to be found in the mixture. To detect Japan wax, M. Dullo boils together for a minute 10 grammes (150 grains) of wax, 120 grammes of water, and 1 of soda. If there be Japan wax present, a soap will immediately form, which will slowly solidify on cooling. Beeswax does not saponify under these circumstances. (*Ibid.*, 4e sér., i. 448.) There are other less precise methods of detecting adulterations. Thus, spermaceti and lard render wax softer and less cohesive, of a smoother and less granular fracture, and of a different odour when heated. The melting point and specific gravity are lowered by tallow, suet, and lard. Legrip's cerecometer is based upon the altered specific gravity of wax when adulterated. Any one may apply this principle by making a mixture of alcohol and water such that pure wax will neither sink nor rise in it, but remain wherever placed. Adulterated wax would either swim or sink in this liquid. Pereira says that pure wax is yellowish-white; and that the white wax in circular cakes always contains spermaceti, added to improve its colour.

Medical Properties and Uses. Wax has little effect upon the system. Under the impression that it sheathes the inflamed mucous membrane of the bowels, it has been occasionally prescribed in diarrhœa and dysentery; and it is mentioned by Dioscorides as a remedy in the latter complaint. By Pœrner it is highly recommended in excoriations of the bowels, attended with pain and obstinate diarrhœa. His mode of using it is to melt the wax with oil of almonds or olive oil, and, while the mixture is still hot, to incorporate it by means of the yolk of an egg with some mucilaginous fluid. The dose is half a drachm three or four times a day. Another method is to form an emulsion by means of soap; but it is evident that the soap would be the most energetic ingredient. Wax is also used to fill cavities in carious teeth. Its chief employment, however, is in the formation of ointments, cerates, plasters, and suppositories. It is an ingredient in almost all the officinal cerates, which owe to it their general title.

3. Vegetable Wax. Many vegetable products contain wax. It exists in the pollen of numerous plants, and forms the bloom or glaucous powder which covers certain fruits, and the coating of varnish with which leaves are sometimes supplied. In some plants it is so abundant as to be profitably extracted for use. Such is the *Ceroxylon Andicola*, a lofty palm growing in the South American Andes. Upon the trunk of this tree, in the rings left by the fall of the leaves, is a coating of wax-like matter, about one-sixth of an inch thick, which is removed by the natives, and employed in the manufacture of tapers. It contains, according to Vauquelin, two-thirds of a resinous substance, and one-third of pure wax. Two kinds of wax are collected in Brazil, one called *carnauba*,* from the leaves of a palm growing in the province of Ceara, the other *ocuba*, from the fruit of a shrub of the province of Para. (*Journ. de Pharm.*, 3e sér., v. 154.)† But the form of vegetable wax best known in this

* This is obtained from *Ceroxylon carnauba* and other palms of Brazil, being found on the under surface of the leaves. It is hard, brittle, and buff-coloured, resembling the resins more than wax, and melts at 192° F., which is much higher than the fusing point of other kinds of vegetable wax. "It takes a fine polish when rubbed with any soft material," does not receive impressions from the finger at the natural temperature of the hand, and is adapted for polishing furniture, either alone or mixed with wax. (B. S. Proctor. See *Am. J. of Pharm.*, xxxv. 527.)—*Note to the twelfth edition.*

† *Japan Wax.* A substance under this name has been imported into Europe in considerable quantities, either directly from Japan, or through the Chinese ports. It is obtained from the berries of the *Rhus succedaneum* of Linnæus. It has come in two forms, the one, as originally distinguished by Mr. Hanbury, of circular cakes, about four inches in diameter, and an inch thick, flat on one side and somewhat convex on the other: the second, as brought directly from Japan, of large rectangular blocks, which are packed in chests. It bears a considerable resemblance to puri-

country is that derived from *Myrica cerifera*, and commonly called *myrtle wax*. The *wax myrtle* is an aromatic shrub, from one to twelve feet high, growing in the United States, from New England to Louisiana, and flourishing especially on the sea-coast. The fruit, which grows in clusters closely attached to the stems and branches, is small, globular, and covered with a whitish coat of wax, which may be separated for use. Other parts of the plant are said to possess medical virtues. The bark of the root is acrid and astringent, and in large doses emetic, and has been popularly employed in jaundice. The process for collecting the wax is simple. The berries are boiled in water, and the wax, melting and floating on the surface, is either skimmed off and strained, or allowed to concrete as the liquor cools, and then removed. To render it pure, it is again melted and strained, and cast into large cakes. It is collected in New Jersey, North Carolina, and New England, and particularly in Rhode Island.

Myrtle wax is of a pale grayish-green colour, somewhat diaphanous, more brittle and unctuous to the touch than beeswax, of a feeble odour, and a slightly bitterish taste. It is about as heavy as water, and melts, according to Mr. G. E. Moore, at from 116° to 120°. It is insoluble in water, scarcely soluble in cold alcohol, soluble, excepting about 13 per cent., in twenty parts of boiling alcohol, which deposits the greater portion on cooling, soluble also in boiling ether, and slightly so in oil of turpentine. It is readily saponifiable with the alkalies. By Dr. John it was found to consist, like beeswax, of cerin and myricin, containing 87 per cent. of the former and 13 of the latter; but a more accurate analysis by Mr. Moore gives as its constituents one part of palmitin and four of palmitic acid, with a little laurin or lauric acid. (*Am. Journ. of Sci. and Arts*, May, 1852, p. 319.) The green colour and bitterness depend upon distinct principles, which may be separated by boiling with ether. On cooling, the wax is deposited colourless, while the ether remains green. The colour is ascribed by Mr. Moore to chlorophyll.

Medical Properties and Uses. This variety of wax has been popularly employed in the United States as a remedy for dysentery; and we are told by Dr. Fahnestock that he found great advantage from its use in numerous cases during an epidemic prevalence of that complaint. He gave the powdered wax in doses of a teaspoonful frequently repeated, mixed with mucilage or syrup. (*Am. Journ. of Med. Sci.*, ii. 313.) It is occasionally substituted by apothecaries for beeswax in the formation of plasters, and is used in the preparation of tapers and candles. It is somewhat fragrant when burning, but emits a less brilliant light than common lamp oil.

W.

CERII OXALAS. *U.S., Br.*

Oxalate of Cerium.

Formula "$2CeO,C_4O_6 + 6HO$. A salt which may be obtained as a precipitate by adding solution of oxalate of ammonia to a soluble salt of cerium." *Br.*

Cerium is a metal, which was discovered in 1803 by Berzelius and Hisinger, and about the same time by Klaproth, who, however, described it as an earth. By the two former chemists it was recognised as a metal, and named cerium in honour of the goddess Ceres. It was obtained from a Swedish mineral, formerly from its great weight called *heavy stone of Bastnas* (Bastnas Schwerstein), but now named *cerite*, after the metal extracted from it. Besides cerite, it has been found in several other

fied beeswax, but is not quite so white, having a slightly yellowish tint, is softer, more friable, and has a somewhat rancid smell and taste. Its melting point is below that of wax, varying from 120°, as stated by Prof. Procter, to 125°, 126°, and even 131°, as observed in different specimens by Mr. Hanbury. It is much more soluble in alcohol than beeswax, is saponifiable with the alkalies, and is said to consist of palmitic acid and glycerin. It has been employed in the preparation of candles, which yield as brilliant light as those made of common wax. It is possible that it may be found useful in the preparation of cerates, &c. (*Note to the twelfth edition.*)

From Roucher's experiments it appears that there are two melting points of this wax, one corresponding closely with Prof. Procter's results, while the same wax rapidly heated to a point above that of fusion and then allowed to cool, if plunged into water at 42° C., melts into a transparent liquid: consequently melting at a point 12° C. below its freezing point in its ordinary state, which was 54° C.; the two temperatures being about equivalent in Fahrenheit's scale to 129° and 107°. (*Pharm. Journ.*, Aug. 1872, p. 122.)—*Note to the fourteenth edition.*

minerals, as gadalonite, orthite, &c. in the North of Europe, a number of different minerals from Greenland, and allanite near Bethlehem, in Pennsylvania. It is not easy to obtain it pure in the metallic state, as its oxides and salts are difficult of reduction. Berzelius describes it as in the form of pulverulent masses, of a deep chocolate-brown, which exhibit, however, under the burnisher a metallic appearance, and a dark gray colour. It is a bad conductor of electricity. Heated in the air it takes fire before the point of ignition, and burns vividly, passing to the state of peroxide. At ordinary temperatures it is oxidized in a moist atmosphere, giving out a strong and disagreeable smell of hydrogen. In water, especially when moderately heated, it rapidly oxidizes with the evolution of hydrogen, and the water does not become alkaline. There are two oxides of cerium, the protoxide and sesquioxide, which form salts with the acids. Sulphur and phosphorus combine with it. Of its compounds two only have been introduced into medicine, the nitrate and oxalate, of which the latter was recognised for the first time officinally in the present edition of the British Pharmacopœia, and in the U. S. Pharmacopœia of 1870.

Oxalate of cerium may be obtained from cerite, and Prof. F. F. Mayer, of New York, gives a process for the purpose, of which the following is an outline.

The mineral consists of silicates of cerium, lanthanium, and didymium, with numerous other substances in smaller proportion, the oxide of cerium constituting about 39 per cent. of the whole. The powdered mineral is made into a paste with sulphuric acid, and then heated over a lamp until the mass ceases to swell up, and no longer absorbs sulphuric acid very cautiously added. Upon the cooling of the mass, it is powdered, and exposed in a crucible to the heat of an anthracite fire until it assumes a pale brownish-red colour. It is now lixiviated first with hot water and then with nitric acid, and the solution treated with sulphuretted hydrogen in order to get rid of various metals by precipitation. To the clear liquid some muriatic acid is first added, and then a solution of oxalic acid, the former of which holds in solution the oxalate of calcium produced, the latter throws down oxalates of cerium and other metals. The precipitate, having been washed with warm water, is formed into a paste with a quantity of carbonate of magnesium equal to half that of the mineral employed; and the paste is dried on porous fire brick, finely powdered, and calcined till it becomes of a cinnamon colour. It now contains all of the cerium in the form of peroxide. To separate this the mass is treated with an excess of nitric acid, the solution evaporated to get rid of the excess of acid, then diluted with warm water, and lastly poured into a vessel containing boiling water acidulated with a little more than half of one per cent. of sulphuric acid. A yellow precipitate of basic sulphate of peroxide of cerium is formed, while a little of the neutral sulphate, and all the lanthanium and didymium, remain dissolved. The precipitate is now dissolved in stronger sulphuric acid, the solution digested with a few crystals of hyposulphite of sodium, in order to reduce the peroxide of cerium to protoxide, and the liquid, having been filtered, is treated with solution of oxalic acid, which causes a precipitate of oxalate of protoxide of cerium. This is washed with warm water, and dried. (*Am. Journ. of Pharm.*, Jan. 1860, p. 4.)

Thus obtained, oxalate of cerium is a snow-white granular powder, without smell or taste, the composition of which is represented by the formula $2CeO,C_4O_6+6HO$, as stated in the British Pharmacopœia. "Exposed to heat, it is decomposed, and ultimately leaves a black powder, which, in contact with the air, burns to yellow peroxide of cerium." *U. S.* The salt is insoluble in water, alcohol, or ether, but is dissolved by sulphuric acid. According to Prof. Mayer, its solution yields a precipitate with caustic alkalies, even in the presence of chloride of ammonium, which is not soluble in an excess of the precipitant. The British Pharmacopœia states that "if the salt be boiled with solution of potash and filtered, the filtrate is not affected by solution of chloride of ammonium, but, when supersaturated with acetic acid, it gives with chloride of calcium a white precipitate, soluble in hydrochloric acid." When heated to dull redness it yields a reddish-brown powder, which is wholly soluble without effervescence in boiling muriatic acid, and the resulting solution gives with solution of sulphate of potassium a white crystalline precipitate. *Br.*

Medical Properties. The salts of cerium are supposed to act as a tonic, with a

special influence over the nervous centres, as those of nitrate of silver, subnitrate of bismuth, sulphate of zinc, &c. But it is chiefly as a remedy in the sick stomach of pregnant women that the oxalate has been employed. Sir J. Y. Simpson, of Edinburgh, through whose authority the remedy has been brought into use, considers it the most successful remedy in that complaint that he has employed. (*Med. Times and Gaz.*, Sept. 1859, p. 280.) It is recommended also by Dr. Charles Lee, of New York, who has used it advantageously not only in the vomiting of pregnancy, but in that also of various other affections, as phthisis, hysteria, pyrosis, and atonic dyspepsia. (*Am. Journ. of Med. Sci.*, Oct. 1860, p. 393.) When in Edinburgh, in the autumn of 1860, we were informed by Prof. Simpson, that he considered oxalate of cerium as a good nervine tonic, and almost a specific in chorea. Dr. Thos. J. McKee, of Woodlawn, S. C., has employed oxalate of cerium with the happiest effects in a case of obstinate vomiting connected with uterine disease, and has, besides, found it a safe, pleasant, and highly useful remedy in the derangement of stomach and bowels to which children of a certain age are so liable. He has also seen it used, with the happiest effects, in the case of a young woman affected with incessant nausea and vomiting in an attack of fever. (*N. O. Med. and Surg. Journ.*, May, 1867, p. 746.) The dose is a grain, doubled if necessary, and repeated three times a day, or more frequently if a return of the vomiting should seem to require it. It may be given in pill or suspended in water.

Nitrate of cerium has also been employed, though not officinal. The late Dr. Simpson believed it to act as a nervine tonic, and has seen it useful in chronic intestinal eruption, irritable dyspepsia with gastrodynia and pyrosis, and chronic vomiting generally, as well as in that of pregnancy. The dose is the same as that of the oxalate, though it would be prudent to begin with a smaller quantity, as, being a soluble salt, it might be more disposed to irritate in over-doses. W.

CETACEUM. *U.S., Br.*

Spermaceti.

A peculiar concrete substance obtained from Physeter macrocephalus. *U.S.* Nearly pure cetine, obtained, mixed with oil, from the head of the Sperm Whale, Physeter macrocephalus; separated from the oil by filtration and pressure, and afterwards purified. *Br.*

Blanc de baleine, Spermaceti, Cetine, *Fr.;* Wallrath, *Germ.;* Spermaceti, *Ital.;* Esperma de bellena, *Span.*

The spermaceti whale is from sixty to eighty feet long, with an enormous head, not less in its largest part than thirty feet in circumference, and constituting one-third of the whole length of the body. The upper part of the head is occupied by large cavities, separated by cartilaginous partitions, and containing an oily liquid, which, after the death of the animal, concretes into a white spongy mass consisting of spermaceti mixed with oil. This mass is removed, and the oil allowed to separate by draining. The crude spermaceti, obtained from a whale of the ordinary size, is more than sufficient to fill twelve large barrels. It still contains much oil and other impurities, from which it is freed by expression, washing with hot water, melting, straining, and repeated washing with a weak boiling ley of potash. Common whale oil and the oil of other cetaceous animals contain small quantities of spermaceti, which they slowly deposit on standing.

Spermaceti is in white, pearly, semitransparent masses, of a crystalline foliaceous texture; friable, soft, and somewhat unctuous to the touch; slightly odorous; insipid; of the sp. gr. 0·943; fusible at 112° F. (*Bostock*), not under 100° (*Br.*); volatilizable at a high temperature without change, in *vacuo*, but partially decomposed if the air is admitted; inflammable; insoluble in water; soluble in small proportion in boiling alcohol, ether, and oil of turpentine, but deposited as the liquids cool; readily soluble in chloroform* and in the fixed oils; not affected by the mineral acids, except the sulphuric, which decomposes and dissolves it; rendered yellowish and rancid by long

* In consequence of its solubility in chloroform, stains made by dropping it on cloth may be quickly removed by that liquid. (*Note to the twelfth edition.*)

exposure to hot air, but capable of being again purified by washing with a warm ley of potash. As found in the shops it is not chemically pure, containing a fixed oil, and often a peculiar colouring principle. From these it is separated by boiling in alcohol, which on cooling deposits it in crystalline scales. Thus purified, it does not melt under 120° F., is soluble in 40 parts of boiling alcohol of the sp. gr. 0·821 (*Thenard*), and is harder, more shining, and less unctuous than ordinary spermaceti. The name of *cetin* was proposed for pure spermaceti by Chevreul. Its ultimate constituents are carbon, hydrogen, and oxygen. By the agency of the alkalies, it is with difficulty saponified, yielding an acid, called by MM. Dumas and Stass *ethalic acid*, and a peculiar principle named *ethal* by Chevreul. From a more recent analysis, however, by Dr. Heintz, it would appear that the ethalic acid is complex, consisting of not less than five distinct acids, viz. the margaric, palmitic, *cetic*, myristic, and cocinic, and that consequently pure spermaceti is a mixture of the salts of these acids with ethal. (*Chem. Gaz.*, x. 321.) *Ethal* is considered as bearing to a hypothetical carbohydrogen *cetyl* ($C_{32}H_{33}$) the same relation that alcohol bears to ethyl; that is, to be a hydrated oxide of cetyl, and is accordingly denominated *cetylic alcohol* ($C_{32}H_{33}O,HO$).

Medical Properties and Uses. Like the fixed oils, spermaceti has been given as a demulcent in irritations of the pulmonary and intestinal mucous membranes; but it possesses no peculiar virtues, and its internal use has generally been abandoned. It may be reduced to powder by the addition of a little alcohol or almond oil, or suspended in water by means of mucilage, or the yolk of eggs and sugar. A convenient mode of forming an emulsion with spermaceti, is to mix it first with half its weight of olive oil, then with powdered gum arabic, and lastly with water gradually added. Externally it is much employed as an ingredient of ointments and cerates.

Off. Prep. Ceratum Cetacei, *U. S.;* Charta Cantharidis, *U. S.;* Charta Epispastica, *Br.;* Unguentum Aquæ Rosæ, *U. S.;* Unguentum Cetacei, *Br.* W.

CETRARIA. *U. S., Br.*

Iceland Moss.

Cetraria Islandica (Acharius, *Lichen. Univ.*). *U. S.* The entire Lichen. *Br.*

Lichen d'Islande, *Fr.;* Isländisches Moos, *Germ.;* Lichene Islandico, *Ital.;* Liquen Islandico, *Span.*

CETRARIA. *Sex. Syst.* Cryptogamia Lichenes.—*Nat. Ord.* Lichenaceæ.

Gen. Ch. Plant cartilagino-membranous, ascending or spreading, lobed, smooth, and naked on both sides. *Apothecia* shield-like, obliquely adnate with the margin, the disk coloured, plano-concave; border inflexed, derived from the frond. *Loudon's Encyc.*

The genus *Lichen* of Linnæus has been divided by subsequent botanists into numerous genera, which have been raised to the dignity of a distinct order, both in the natural and artificial systems of arrangement. The name *Cetraria* has been conferred on the genus to which the Iceland moss belongs.

Cetraria Islandica. Acharius, *Lichenog. Univ.* 512.—*Lichen Islandicus.* Woodv. *Med. Bot.* p. 803, t. 271. Iceland moss is foliaceous, erect, from two to four inches high, with a dry, coriaceous, smooth, shining, laciniated frond or leaf, the lobes of which are irregularly subdivided, channeled and fringed at their edges with rigid hairs. Those divisions upon which the fruit is borne are dilated. The colour is olive-brown or greenish-gray above, reddish at the base, and lighter on the under than the upper surface. The fructification is in flat, shield-like, reddish-brown receptacles, with elevated entire edges, placed upon the surface of the frond near its border. The plant is found in the northern latitudes of the old and new continents, and on the elevated mountains further south. It received its name from the abundance in which it prevails in Iceland. It is also abundant on the mountains and in the sandy plains of New England.

The dried moss is of diversified colour, grayish-white, brown, and red, in different parts, with less of the green tint than in the recent state. It is inodorous, and has a mucilaginous, bitter taste. Macerated in water, it absorbs rather more than its own weight of the fluid, and, if the water be warm, renders it bitter. Boiling water

extracts all its soluble principles. The decoction thickens upon cooling, and acquires a gelatinous consistence, resembling that of starch in appearance, but without its viscidity. After some time the dissolved matter separates, and when dried forms semitransparent masses, insoluble in cold water, alcohol, or ether, but soluble in boiling water, and in solution forming a blue compound with iodine. This principle resembles starch in its general characters, but differs from it in some respects, and has received the distinctive name of *lichenin*. Berzelius found in 100 parts of Iceland moss 1·6 of chlorophyll, 3·0 of a peculiar bitter principle, 3·6 of uncrystallizable sugar, 3·7 of gum, 7·0 of the apotheme of extractive, 44·6 of the peculiar starch-like principle, 1·9 of the bilichenates of potassium and calcium mixed with phosphate of calcium, and 36·2 of amylaceous fibrin—the excess being 1·6 parts.

The starch-like substance named lichenin has been found to consist of two distinct proximate principles, one, for which the name of lichenin may be retained, while for the other, no particular designation has been chosen; but which we may, for convenience sake, call *lichenoid*, until a better name shall be adopted. The following are the results of the investigations into this subject by Th. Berg, published in the *Thèse de Dorpat*, A. D. 1872. According to M. Berg, cetraria yields 35·15 per cent. of the mixed principles, of which 20 per cent. is of lichenin, and 11·5 of the so-called lichenoid. To separate them, a decoction of the moss, concentrated to a small bulk, and still hot, is treated by alcohol at 85°. The lichenoid is deposited in flocculi, which gradually unite in a viscid mass. This, being washed by alcohol, until it ceases to be bitter, and then dried, yields a light, friable matter, partly soluble in cold water, with which it forms a yellow, limpid solution. To deprive it of mineral and colouring substances, it is dissolved in a little water, and precipitated afresh by alcohol. Lichenin is in soluble in cold water, but swells up and easily dissolves in hot water. It is insoluble in alcohol and in ether. It is only tinged by iodine. Lichenoid is, on the contrary, coloured blue by that reagent. It is in part dissolved in cold water; and the undissolved part is equally coloured blue by iodine. It is, like lichenin, insoluble in alcohol and ether. Both substances have strong analogies with starch, yet are distinct. For a further account of these principles, we must content ourselves with referring to the *Journal de Pharmacie* (Août, 1873, p. 154).

The name of *cetrarin* has been conferred on the bitter principle. The following process for obtaining it is that of Dr. Herberger. The moss, coarsely powdered, is boiled for half an hour in four times its weight of alcohol of 0·883. The liquid when cool is expressed and filtered, and treated with dilute muriatic acid, in the proportion of three drachms to every pound of moss employed. Water is then added in the quantity of about four times the bulk of the liquid, and the mixture left for a night in a closed matrass. The deposit which forms is collected on a filter, allowed to drain as much as possible, and submitted to the press. To purify it, the mass, while still moist, is broken into small pieces, washed with alcohol or ether, and treated with two hundred times its weight of boiling alcohol, which dissolves the cetrarin, leaving the other organic principles by which it has hitherto been accompanied. The greater part is deposited as the liquor cools, and the remainder may be obtained by evaporation. By this process one pound of moss yielded to Dr. Herberger 133 grains of cetrarin. This principle is white, not crystalline, light, unalterable in the air, inodorous, and exceedingly bitter, especially in alcoholic solution. Its best solvent is absolute alcohol, of which 100 parts dissolve 1·7 of cetrarin at the boiling temperature. Ether also dissolves it, and it is slightly soluble in water. Its solutions are quite neutral to test-paper. It is precipitated by the acids, and rendered much more soluble by the alkalies. Concentrated muriatic acid changes its colour to a bright blue. It precipitates the salts of iron, copper, lead, and silver. In the dose of two grains, every two hours, it has been used successfully in intermittent fever. (*Journ. de Pharm.*, xxiii. 505.) Drs. Schnedermann and Knopp have ascertained that the cetrarin above referred to consists of three distinct substances; 1. *cetraric acid*, which is the true bitter principle, crystallizable, and intensely bitter; 2. a substance resembling the fatty acids, called *lichstearic acid;* and 3. a green colouring substance, which they name *thallochlor*. These principles are obtained perfectly pure with great difficulty. (*Ann. der Pharm.*, lv. 144.)

The gum and starch contained in the moss render it sufficiently nutritive to serve as food for the inhabitants of Iceland and Lapland, who employ it powdered and made into bread, or boiled with milk, having first partially freed it from the bitter principle by repeated maceration in water. The bitterness may be entirely extracted by macerating the powdered moss, for 24 hours, in twenty-four times its weight of a solution formed with 1 part of an alkaline carbonate and 375 parts of water, then decanting the liquid, and repeating the process with an equal quantity of the solution. The powder, being now dried, is perfectly sweet and highly nutritious. This process was suggested by Berzelius.

Medical Properties and Uses. Iceland moss is demulcent, nutritious, and tonic, and well calculated for affections of the mucous membrane of the lungs and bowels, with debility of the digestive organs, or of the system generally. Hence it has been found useful in chronic catarrhs, and other chronic pulmonary affections attended with copious puruloid expectoration, in dyspepsia, in chronic dysentery and diarrhœa, and in the debility succeeding acute disease, or dependent on copious purulent discharge from external ulcers. At one time it possessed much reputation as a remedy in pulmonary consumption. It had long been employed in this disease, and in hæmoptysis, by the Danish physicians, before it became generally known. In the latter half of the last century it came into extensive use, and numerous cures supposed to have been effected by it are on record. But now that the pathology of phthisis is better understood, physicians have ceased to expect material advantage from it in that disease; and there is reason to believe that the cases which have recovered under its use, were simply chronic bronchitis. It acts only as a mild, nutritious, demulcent tonic; and can exercise no specific influence over the tuberculous affection.

It is usually employed in the form of decoction. (See *Decoctum Cetrariæ.*) By some writers it is recommended to deprive it of the bitter principle by maceration in water or a weak alkaline solution, before preparing the decoction; but we thus reduce it to the state of a simple demulcent, or mild article of diet, in which respect it is not superior to the ordinary farinaceous or gummy substances used in medicine. The powder is sometimes given in the dose of thirty grains or a drachm; and a preparation at one time obtained some repute, in which the ground moss was incorporated with chocolate, and used at the morning and evening meal as an ordinary beverage.

Off. Prep. Decoctum Cetrariæ. W.

CHENOPODIUM. *U. S.*

Wormseed.

The fruit of Chenopodium anthelminticum. *U. S.*

CHENOPODIUM. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Chenopodiaceæ.

Gen. Ch. Calyx five-leaved, four-cornered. *Corolla* none. *Seed* one, lenticular, superior. *Willd.*

Chenopodium anthelminticum. Willd. *Sp. Plant.* i. 1304; Barton, *Med. Bot.* ii. 183. This is an indigenous perennial plant, with an herbaceous, erect, branching, furrowed stem, which rises from two to five feet in height. The leaves are alternate or scattered, sessile, oblong-lanceolate, attenuated at both ends, sinuated and toothed on the margin, conspicuously veined, of a yellowish-green colour, and dotted on their under surface. The flowers are very numerous, small, of the same colour with the leaves, and arranged in long, leafless, terminal panicles, composed of slender, dense, glomerate, alternating spikes.

This species of Chenopodium, known commonly by the names of *wormseed* and *Jerusalem oak*, grows in almost all parts of the United States, but most vigorously and abundantly in the southern section. It is usually found in the vicinity of rubbish, along fences, in the streets of villages, and in open grounds about the larger towns. It flowers from July to September, and ripens its seeds successively through the autumn. The whole herb has a strong, peculiar, offensive, yet somewhat aromatic

odour, which it retains when dried. All parts of the plant are occasionally employed; but the fruit only is strictly officinal. This should be collected in October.*

Wormseed, as found in the shops, is in small grains, not larger than the head of a pin, irregularly spherical, very light, of a dull, greenish-yellow, or brownish colour, a bitterish, somewhat aromatic, pungent taste, and possessed in a high degree of the peculiar smell of the plant. These grains, when deprived, by rubbing them in the hand, of a capsular covering which invests the proper seed, exhibit a shining surface of a very dark colour. They abound in a volatile oil, upon which their sensible properties and medical virtues depend, and which is obtained by distillation. (See *Oleum Chenopodii.*) The same oil impregnates to a greater or less extent the whole plant.

Medical Properties and Uses. Wormseed is one of our most efficient indigenous anthelmintics, and is thought to be particularly adapted to the expulsion of the round worms in children. A dose of it is usually given before breakfast in the morning, and at bedtime in the evening, for three or four days successively, and then followed by calomel or some other brisk cathartic. If the worms are not expelled, the same plan is repeated. The medicine is most conveniently administered in powder, mixed with syrup, in the form of an electuary. The dose for a child two or three years old is from one to two scruples. The volatile oil is more frequently given than the fruit in substance; though its offensive odour and taste sometimes render it of difficult administration. The dose for a child is from five to ten drops, mixed with sugar, or in the form of emulsion. A tablespoonful of the expressed juice of the leaves, or a wineglassful of the decoction prepared by boiling an ounce of the fresh plant in a pint of milk, with the addition of orange-peel or other aromatic, is sometimes substituted in domestic practice for the ordinary dose of the fruit and oil.

The fruit of *Chenopodium ambrosioides*, which is also an indigenous plant, and very prevalent in the Middle States, is said to be used indiscriminately with that of *C. anthelminticum*. It may be distinguished by its odour, which is weaker and less offensive, and to some persons agreeable. The plant itself is often confounded with the true wormseed, from which it differs in having its flowers in leafy racemes. This species of Chenopodium has been employed in Europe as a remedy in nervous affections, particularly chorea. Five or six cases of this disease, reported by Plenk, after having resisted the ordinary means, yielded to the daily use of an infusion of two drachms of the plant in ten ounces of water, taken in the dose of a cupful morning and evening, and associated with the employment of peppermint.

C. Botrys, known by the vulgar name of *Jerusalem oak*, is another indigenous species, possessing anthelmintic virtues. It is said to have been used in France with advantage in catarrh and humoral asthma.

Off. Prep. Oleum Chenopodii, *U. S.* W.

CHIMAPHILA. *U. S.*

Pipsissewa.

The leaves of Chimaphila umbellata (Pursh, *Flor. Amer. Sept.*). *U. S.*

Chimaphila. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Pyrolaceæ.

Gen. Ch. Calyx five-toothed. *Petals* five. *Style* very short, immersed in the germ. *Stigma* annular, orbicular, with a five-lobed disk. *Filaments* stipitate; stipe discoid, ciliate. *Capsules* five-celled, opening from the summits, margins unconnected. *Nuttall.*

This genus was separated from *Pyrola* by Pursh. It embraces two species, *C.*

* C. anthelminticum is cultivated to a considerable extent in Maryland, twenty or thirty miles north of Baltimore. The seeds are sown in small beds of rich mould early in spring, and during the month of June the young plants are pulled up, and set out in ridges three feet apart, with intervals of from six to ten inches. The plants do not require to be renewed oftener than once in four or five years. The crop of the second year is more productive than the first. The plant is fit for distillation during the first half of September. The distillation is carried on in the same neighbourhood. The whole herbaceous part of the plant is used. It is said to yield from 1·5 to 2 per cent. of the oil, and the produce of an acre will yield 20 pounds. (See *Am. Journ. of Pharm.*, xxii. 304.)

umbellata and *C. maculata*, which are both indigenous, and known by the common title of *winter-green*. The generic title is formed of two Greek words, χειμα winter, and φιλος a friend. *C. umbellata* only is officinal.

Chimaphila umbellata. Barton, *Med. Bot.* i. 17; Carson, *Illust. of Med. Bot.* i. 62, pl. 53. — *Pyrola umbellata.* Willd. *Sp. Plant.* ii. 622; Bigelow, *Am. Med. Bot.* ii. 15. The pipsissewa is a small evergreen plant, with a perennial, creeping, yellowish root (rhizome), which gives rise to several simple, erect or semiprocumbent stems, from four to eight inches in height, and ligneous at their base. The leaves are wedge-shaped, somewhat lanceolate, serrate, coriaceous, smooth, of a shining, sap-green colour on the upper surface, paler beneath, and supported upon short footstalks, in irregular whorls, of which there are usually two on the same stem. The flowers are disposed in a small terminal corymb, and stand upon nodding peduncles. The calyx is small and divided at its border into five teeth or segments. The corolla is composed of five roundish, concave, spreading petals, which are of a white colour tinged with red, and exhale an agreeable odour. The stamens are ten, with filaments shorter than the petals, and with large, nodding, bifurcated, purple anthers. The germ is globular and depressed, supporting a thick and apparently sessile stigma, the style being short and immersed in the germ. The seeds are numerous, linear, chaffy, and enclosed in a roundish, depressed, five-celled, five-valved capsule, having the persistent calyx at the base.

This humble but beautiful evergreen is a native of the northern latitudes of America, Europe, and Asia. It is found in all parts of the United States, extending even to the Pacific Ocean. It grows under the shade of woods, and prefers a loose sandy soil, enriched by decaying leaves. The flowers appear in June and July. All parts of the plant are endowed with active properties. The leaves and stems are kept in the shops.

C. maculata, or *spotted winter-green*, probably possesses similar virtues. The character of the leaves of the two plants will serve to distinguish them. Those of C. maculata are lanceolate, rounded at the base, where they are broader than near the summit, and of a deep olive-green, veined with greenish-white; those of the officinal species are broadest near the summit, gradually narrowing to the base, and of a uniform shining green.

Properties. Pipsissewa, when fresh and bruised, exhales a peculiar odour. The taste of the leaves is pleasantly bitter, astringent, and sweetish, that of the stems and root unites with these qualities a considerable degree of pungency. Boiling water extracts the active properties of the plant, which are also imparted to alcohol. The leaves have been examined by Mr. Samuel Fairbank, who found in them gum, starch, sugar, extractive, pectic acid, tannic acid, resin, fatty matter, chlorophyll, yellow colouring matter, lignin, a peculiar whitish substance which he calls chimaphilin, and various inorganic substances, as potassa, lime, magnesia, chloride of sodium, and sulphuric, phosphoric, and silicic acids. The *chimaphilin* was obtained by agitating a tincture with chloroform, allowing the mixture to stand, removing the lighter liquid, and allowing the chloroformic solution to evaporate. A yellow crystalline substance was left, which, purified by solution in alcohol, filtration, and spontaneous evaporation, constituted the substance in question. It was also obtained by simply distilling the stems with water. It is in beautiful, golden-yellow, acicular crystals, inodorous, tasteless, fusible, volatilizible unchanged, insoluble or nearly so in water, soluble in alcohol, ether, chloroform, and the fixed and volatile oils, and possessed of neither acid nor alkaline properties. (*Journ. and Trans. of the Md. Col. of Pharm.*, March. 1860.) The active principle of the leaves does not appear to have been isolated, though probably contained in the substance called bitter extractive. The so-named chimaphilin has no claims to this character, nor, we think, to the name given to it, which should be reserved for the active principle when discovered. The pungency of the stems is said by Mr. Fairbank to reside in the resin.

Medical Properties and Uses. This plant is diuretic, tonic, and astringent. It was employed by the aborigines in various complaints, especially scrofula, rheumatism, and nephritic affections. From their hands it passed into those of the European settlers, and was long a popular remedy in certain parts of the country, before

it was adopted by the profession. The first regular treatise in relation to it that has come to our knowledge, was the thesis of Dr. Mitchell, published in the year 1803; but it was little thought of till the appearance of the paper of Dr. Sommerville, in the 5th volume of the London Medico-chirurgical Transactions. By this writer it was highly recommended as a remedy in dropsy; and his favourable report has been sustained by the subsequent statements of many practitioners. It is particularly useful in cases attended with disordered digestion and general debility, in which its tonic properties and usual acceptability to the stomach prove highly useful auxiliaries to its diuretic powers. Nevertheless, it cannot be relied on exclusively in the treatment of the complaint; for, though it generally produces an increased flow of urine, it has seldom effected cures. Other disorders, in which it is said to have proved useful, are calculous and nephritic affections, and in general all those complaints of the urinary passages for which uva ursi is prescribed. It is much esteemed by some practitioners as a remedy in scrofula, both before and after the occurrence of ulceration; and it has certainly proved highly advantageous in obstinate ill-conditioned ulcers and cutaneous eruptions, supposed to be connected with the strumous diathesis. In these cases it is used both internally, and locally as a wash.

The decoction is the preparation usually preferred, and may be taken to the amount of a pint in twenty-four hours. The watery extract may be given in the dose of twenty or thirty grains four times a day. Prof. Procter prepares a syrup by macerating four ounces of the leaves, finely bruised, in eight fluidounces of water for thirty-six hours, and then subjecting the mass to percolation till a pint of fluid is obtained, which is reduced one-half by evaporation, and incorporated with twelve ounces of sugar. One or two tablespoonfuls may be given for a dose. Prof. Procter has suggested also a fluid extract, prepared in the same manner as the saccharine fluid extracts of the U. S. Pharmacopœia, especially that of uva ursi. A fluidrachm of it would represent a drachm of pipsissewa.

Off. Prep. Decoctum Chimaphilæ, *U. S.* W.

CHIRETTA. *U. S.*

Chiretta.

The herb and root of Agathotes Chirayta. *U. S.*

Off. Syn. CHIRATA. *Chiretta.* The entire plant, Ophelia Chirata. *Br.*

AGATHOTES. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Gentianaceæ.

Gen. Ch. Corolla withering, rotate, in æstivation twisted to the right; with glandular hollows protected by a fringed scale upon the segments. *Anthers* not changing. *Stigmas* sessile. *Capsules* conical; one-celled, with spongy placentæ upon the sutures. *Seeds* indefinite, minute. (*Lindley.*)

Agathotes Chirayta. Don, *Lond. Philos. Mag.* 1836, p. 76.—*Gentiana Chirayta.* Fleming, *Asiat. Research.* xi. 167.—*Ophelia Chirata.* Grisbach. The *chirayta* or *chiretta* is an annual plant, about three feet high, with a branching root, and an erect, smooth, round stem, branching into an elegant leafy panicle, and furnished with opposite, embracing, lanceolate, very acute, entire, smooth, three or five-nerved leaves. The flowers are numerous, peduncled, yellow, with a four-cleft calyx having linear acute divisions, the limb of the corolla spreading and four-parted, four stamens, a single style, and a two-lobed stigma. The capsules are shorter than the permanent calyx and corolla. The plant is a native of Nepaul, and other parts of Northern India. The whole of it is officinal. It is gathered when the flowers begin to decay.

The dried plant is imported into Europe in bundles, consisting mainly of the stems, with portions of the root attached. The stems, which have been already described, contain a yellowish pith. All parts of the plant have a very bitter taste, which is strongest in the root. This is without odour. It imparts its virtues to water and alcohol; and they are retained in the extract. According to Lassaigne and Boissel, the stems contain resin, a yellow bitter substance, brown colouring matter, gum, and various salts. Flückeger and Höhn, who have subsequently examined the stems and roots, have extracted from them sugar, wax, chlorophyll, soft resin, tannin,

an acid which they name *ophelic*, and a peculiar bitter substance, denominated *chiratin*. The acid is syrupy, deliquescent, yellowish-brown, at first slightly sour, afterwards intensely bitter. It is soluble in water with some turbidness, probably owing to resin mixed with it, and completely soluble in alcohol, or a mixture of this with ether. It decomposes certain salts, and forms amorphous compounds with acids. Chiratin is a yellow, hydroscopic powder, but feebly crystallizable, very bitter, sparingly soluble in cold water, more so in hot water, and readily dissolved by alcohol and ether. It is neutral to test-paper, and yields a copious precipitate with tannic acid. By the action of acids, chiratin is separated into ophelic acid, and a yellowish-brown, amorphous substance, bitter, scarcely soluble in water, readily soluble in spirit, and not reducing copper solutions, as the ophelic acid does. Höhn gives it the formula $C_{25}H_{24}O_6$, and names it *chiratogenin*. (*Pharm. Journ.*, Aug. 1870, p. 106.)

Medical Properties and Uses. Chiretta has long been used in India. It has been introduced into Europe, and appears to be highly esteemed; but has not been employed to any considerable extent in this country. Its properties are those of the pure bitters, and probably do not differ from those of the other members of the family of Gentianaceæ. (See *Gentiana*.) Like these, in over-doses it nauseates and oppresses the stomach. Some have supposed that, in addition to its tonic properties, it exerts a peculiar influence over the liver, promoting the secretion of bile and correcting it when deranged, and restoring healthy evacuations in cases of habitual costiveness. But it may well be doubted whether it produces any other effects of this kind than such as are incident to its tonic power. It has been used in dyspepsia, and in the debility of convalescence, and generally in cases in which corroborant measures are indicated. In India it has been successfully employed in intermittents and remittents, combined with the seeds of *Guilandina Bonduc*. It may be given in powder, infusion, tincture, or extract. The dose in substance is twenty grains. A fluid extract may be made in the same manner as that of gentian.

Off. Prep. Infusum Chiratæ, *Br.*; Tinctura Chiratæ, *Br.* W.

CHLORAL. *U. S.*

Chloral.

Syn. Hydrate of Chloral. *U. S.*

In adopting the name chloral to designate the hydrate of chloral, the U. S. Pharmacopœia has followed many precedents in chemical nomenclature; as, for example, the use of the terms potassa, soda, and ammonia, for the hydrates of those alkalies respectively, and sulphuric, nitric, and muriatic acids, as titles of the combinations of the acids with water. This is the more especially appropriate in the present instance, as anhydrous chloral is never used medically; and a physician or apothecary would, in the existing state of knowledge on the subject, be inexcusable, who should make any mistake by confounding these terms. In the present article, therefore, whenever the simple term chloral is used, it is the hydrate that is intended; and, whenever the pure uncombined substance is referred to, it is by the designation of *anhydrous chloral*.

Perhaps no medicine has come so rapidly into extensive use as that now under consideration. Though discovered by Liebig so long since as 1832, and afterwards investigated by Dumas, who determined its chemical formula, it was not until 1869 that its remedial properties were brought before the medical public, by a communication to the Medical Society of Berlin, by Dr. Otto Liebreich, of Berlin, their original discoverer. At this time there is probably no remedial agent more universally employed throughout the civilized world.

Anhydrous Chloral. In preparing anhydrous chloral, the simple method originally employed by Liebig, of acting directly on alcohol by chlorine is generally preferred, even, we believe, by the larger manufacturers; though a more complex proceeding has been suggested by Stædeler, of distilling together proximate vegetable principles, as fecula, sugar, &c., with black oxide of manganese and muriatic acid. A current of chlorine is passed into absolute alcohol, and continued until hydrochloric acid ceases to escape, when the product is agitated with three times its measure of sulphuric

acid. Upon gently warming the mixture on a water-bath, an oily liquid separates and rises to the surface of the acid. This being decanted, and distilled first from a little fresh sulphuric acid, and then from a small quantity of quicklime, which should be completely covered with the liquid throughout the process, is pure anhydrous chloral. But certain precautions are necessary to insure a satisfactory result. One of these is that both the chlorine and alcohol should be perfectly free from water; and another that the current of chlorine must be maintained slowly but steadily from beginning to end. According to Gerhardt, the formula of anhydrous chloral is $C_4Cl_3O_2H$; in other words aldehyd $C_4H_4O_2$, in which 3 eqs. of hydrogen have been replaced by 3 eqs. of chlorine. The alcohol $C_4H_6O_2$ may be supposed to give up 2 eqs. of its hydrogen to form aldehyd, which exchanges 3 of its eqs. of hydrogen for 3 eqs. of the chlorine, the hydrogen forming hydrochloric acid with 3 other eqs. of the chlorine. The reaction may then take place between one eq. of the alcohol and eight of the chlorine, the former merely losing two eqs. of its hydrogen, which, with the 3 eqs. of the hydrogen of the aldehyd, take up 5 of the 8 eqs. of chlorine; the three others going to replace the 3 eqs. of hydrogen lost by the aldehyd. The name of chloral was derived from the *chlor*ine and *al*cohol from which it is formed. The anhydrous chloral thus formed is a colourless liquid, of a penetrating disagreeable odour, of little taste, very readily volatilizable, and of the sp. gr. 1·518; thus closely resembling chloroform in volatility and density.

Meta-chloral. By agitating anhydrous chloral and concentrated sulphuric acid, a change is effected in the chloral, by which, without alteration of composition, it becomes a solid insoluble in water, which is designated as *insoluble chloral.* It is tasteless, of a white colour resembling porcelain, and insoluble in alcohol and ether. Regnault proposes to name it *meta-chloral.* Personne considers it isomeric with anhydrous chloral, in a different molecular state. The latter has tried its effects on animals, and ascribes to it a value little differing from that of the hydrate. (*Arch. Gén.*, Sept. 1870, p. 332.) It has not hitherto been employed therapeutically.

Alcoholate of Chloral. A compound obtained by M. Roussin which he announced as pure hydrate of chloral, was found by M. Personne to contain no water, but to be in fact a compound of alcohol and chloral, and is now known by the name of *alcoholate of chloral.* It results directly from the action of absolute alcohol on anhydrous chloral, and has properties quite distinct from the hydrate. It is, for example, nearly insoluble in water; but is perfectly soluble in chloroform, ether, chloride of carbon, absolute alcohol, and oil of turpentine. Mr. A. H. Mason could not obtain it crystallized from its solutions. He states that heat does not change it; and gives as a simple test to distinguish it from the hydrate, its deficient solubility in water. (*Pharm. Journ.*, Jany. 1871, p. 542.) The alcoholate of chloral is said to have therapeutic properties analogous to those of the hydrate; but is considered on the whole inferior, and is not employed.

The three forms of chloral, the *anhydrous*, the isomeric *meta-chloral*, and the *alcoholate*, described above, have been more or less introduced into the European markets, and require some notice here, to prevent them from being confounded with the hydrate, which is the only one officinal. The following observations will be confined to this compound; and the reader will note that whether the simple term chloral, or the exact designation hydrate of chloral, is used, the same substance is intended.

Properties of Hydrate of Chloral, or *Chloral*, U.S. This results from simply mixing anhydrous chloral with water. Acicular crystals soon form, which consist of an eq., each, of the chloral and water, $C_4Cl_3O_2H+HO$, constituting hydrate of chloral, or officinal chloral. As employed in the U. States, this comes, we believe, exclusively from Europe, and chiefly from Germany. It occurs in our shops mainly in two forms, in distinct crystals, or in crystalline plates, about three lines in thickness, broken into small irregular, angular pieces, so as to be readily introduced into broad-mouthed bottles. The pieces, while retaining their tabular form, are somewhat translucent, but usually covered with a white powder, which somewhat conceals that property. This is the more common form and the cheapest; but the crystals are to be preferred, as their purity may be relied on. They are small, acicular, and sometimes

aggregated in small masses by the adhesion of their surface. Chloral is white, of a peculiar pungent odour, and an acrid pungent taste, especially affecting the velum pendulum. The odour has been compared to that of an over-ripe melon. Exposed to the air it very slowly volatilizes, and, like camphor, when inclosed in a bottle, covers the interior surface with numerous minute crystallizations. According to Mr. A. H. Mason, its boiling point is from 100° to 110° C. (*Pharm: Journ.*, Jany. 1871, p. 542.) The pure hydrate does not take fire when heated in a spoon, but evaporates without residue. It is very soluble in water (in its own weight of distilled water, *U. S.*); and the act of solution is attended with the development of heat. It is soluble also in absolute alcohol and ether; but is not dissolved by cold chloroform, terchloride of carbon, oil of turpentine, or bisulphide of carbon. With the aid of heat, however, its solution may be effected; and the solution, on cooling, deposits it in beautiful crystals, which are generally needle-shaped; but, when deposited from sulphide of carbon, they are prisms. (A. H. Mason, *ut supra.*) The watery solution is prone to decomposition, which is ultimately attended with the development of algæ. It should not, therefore, be kept long in this state. (Dr. E. Labbée, *Arch. Gén.*, Sept. 1870, p. 31.) It is soluble in the fixed oils. In its relation to acids and alkalies it is neuter. When equal parts of chloral in crystals and of camphor in small fragments are shaken together in a bottle, and allowed to stand, they liquefy, forming a clear solution. When chloral and sulphuric acid are mixed, the temperature is greatly reduced. A solution of chloral (the hydrate) dissolves morphia, quinia, and most of the vegetable alkaloids. (R. F. Fairthorne, *Am. J. of Pharm.*, Oct. 1871, p. 447.) An important chemical reaction of chloral is that which takes place when the hydrate, or either of its other forms, is placed under the influence of an alkali. Chloroform is developed, and along with it a formiate of the alkali employed. Thus, in a strong solution of potassa, put a pinch of powdered chloral, and almost instantly the odour of chloroform becomes sensible, and some oil-like globules of chloroform are visible at the bottom of the vessel. The reaction is explained by the following formula; $C_4Cl_3O_2H + HO$ (hydrate of chloral) $+ KO$ (potassa) $= C_2Cl_3H$ (chloroform) $+ C_2HO_3$ (formic acid) $+ KO$ (potassa). This relation of chloral to chloroform would serve as a ready test of the former; and may be used also to determine its quality; for pure hydrate of chloral ought by calculation to yield 76·35 per cent. of chloroform, and the best known yields, according to the table of Mason, 71·5 (72·20, Selden). If, therefore, the product of chloroform should fall much below the latter percentage, the parcel acted on is probably impure. When blood is agitated with chloral, in consequence of the alkali it contains, it produces the same change, and the smell of chloroform becomes sensible after a time; and Richardson was able to collect a certain quantity by distillation. (Labbée.) Important pathological inferences have been drawn from this result. The following tests of purity are given in the U. S. Pharmacopœia. The aqueous solution is not precipitated by nitrate of silver, and when mixed with an equal bulk of nitric acid and heated no red vapours are evolved. The solution acidulated with sulphuric acid and faintly tinged with permanganate of potassium, is not decolorized within three hours. The crystals float on sulphuric acid, and, when the two are agitated together, the acid becomes temporarily turbid, but remains colourless after being heated. *U. S.* Shaken with oil of mint, hydrate of chloral becomes first rose-coloured, and then deep cherry-red; nor is this colour altered by boiling. Sulphuric acid deepens the colour, and chloroform causes a deep violet tint. The other essential oils occasion no such change. (*Journ. de Pharm.*, Oct. 1873, p. 351.)

Medical Properties and Uses. Dr. Liebreich began his experiments on chloral, with the lower animals, and having thus ascertained its efficiency and safety, when properly regulated, tried its effects on the human subject, and very successfully. From his experiments it may be inferred that, though locally somewhat irritant to the surface of application, it acts after absorption as a sedative, first directly to the cerebral nerve centres, then directly to those of the spinal marrow, and finally the heart; though in the last case it operates chiefly, if not exclusively, through the cerebral or spinal nerve centres, as it has been found that, upon the division of the spinal bulb in a frog, it was much more difficult to bring the heart under the influence than

before such division; and the direct application to the ventricle, did not produce a permanent effect on the heart. (*Arch. Gén.*, Sept. 1870, p. 341.)

Beyond all other remedial influences produced by chloral, the soporific is that for which it is distinguished. In a full dose it produces, 10 to 20 minutes after having been taken, a quiet, placid sleep, which usually continues about three hours, when it ceases, generally without any unpleasant symptom in its progress, or after its termination. This is true as a general rule, but in some instances the ordinary doses fail to cause sleep, and in others the sleep is attended with dreams and hallucinations, and followed by unpleasant symptoms, such as are apt to succeed other hypnotics, especially opium; as nausea, headache, unpleasant nervous disorder, &c. These diversities may be ascribed in part to peculiarity of constitution; but more frequently, in all probability, they are owing to morbid conditions existing at the time, which oppose themselves to the proper action of the choral. In an individual in health chloral will probably almost always induce a calm sleep, differing little from the natural.

As an anæsthetic, relieving pain, spasm, and various nervous disorders, chloral has considerable power, but inferior to that which it exerts as a soporific, and surpassed by that of some other narcotics.

Liebreich, induced by the resemblance of the effects of chloral and chloroform, was disposed to ascribe the action of the former to the production of the latter in the blood after absorption, through the agency of the soda in the circulation; and it is asserted that the evolution of chloroform which always takes place when chloral and an alkali are allowed to react, may be observed in the blood out of the body, when chloral is introduced into it. But this does not render it certain that chloroform is developed in the blood in the body by the use of chloral; such a development has not been proved by the examination of the blood; and, if the odour of chloroform is observed in the breath of animals to which large doses of chloral have been given (*Richardson*), it would only show that this is one of the forms in which chloral escapes from the body. Besides, if the theory were true, the effects should not be those of chloroform alone; but of this with those of formiate of sodium also, which would be necessarily generated with the chloroform. Moreover, the effects of the two narcotics are not so precisely alike that those of one could be justly ascribed to the other; for, while both are at once hypnotic and anæsthetic, chloral has more decidedly the former property, and chloroform the latter; and neither effect of the one is precisely that of the other.

Along with its sedative action on the heart, chloral also somewhat reduces the temperature. In the human subject, however, this effect is small from moderate doses. The loss in man is only some tenths of a degree; the maximum in a child is 1·2°. (*Bouchut.*) The respiration is diminished by therapeutic doses. By larger quantities its regularity is disturbed, by still larger its diminution is more decided, and under still larger it ceases.

Has chloral any direct action on the blood? Richardson states that the structure of the globules is disturbed, and the power of coagulation lessened or lost; after poisoning the blood is black.

Chloral has little effect on the secretions, though it is said somewhat to increase the secretion of urine. In man, it is stated by Bouchut that, in accordance with his observations, this secretion is not only increased, but has been found also augmented in density; at the same time reducing the cupro-potassic liquor, and rendered brown by potassa or subnitrate of bismuth; as if a temporary glycosuria might have been produced. Formic acid has never been found in the urine as a result of the taking of chloral. (*Arch. Gén.*, Sept. 1870, p. 346.)

It is asserted by some writers that chloral in small doses operates at first by increasing the sensitiveness of the surface, though subsequently operating as an anæsthetic. I am disposed, however, to ascribe the supposed hyperæmia to a misinterpretation of the local excitement always produced by the direct application of chloral to any of the surfaces; an excitement which may even extend in a slight degree from the surface affected sympathetically to the system, producing a gentle general stimulation, so slight, however, as usually to escape notice.

Various disordered conditions have been described as the occasional result of the

exhibition of chloral, whether arising from peculiarity of constitution in individuals, or the incompatability with it of certain morbid states of system. Such are vaso-motor paralysis, transient skin neurosis, acute purpura, and great prostration of the heart's action, sometimes amounting to paralysis of that organ; and sometimes ending fatally, even though the doses of the chloral used were within the limits ordinarily deemed safe. (See paper by Dr. J. C. Brown, *Lancet*, April 8, 1871, pp. 473–4–5.) Two cases are recorded by Dr. J. W. Burman in which, under the use of chloral, continued for ten days or two weeks, a scarlet eruption came out over the body, closely resembling scarlet fever, and, like it, attended with fever, and in one instance with a pulse of 120. It may, however, be considered questionable, whether these may not have been cases of genuine scarlatina, with but an accidental connection with the use of chloral. The cases both eventuated favourably, and were the only instances in which untoward accidents attended the use of chloral in the Devon county asylum, though 25lbs. of the drug had been administered altogether. (*Ibid.*, March 16, 1862.) Dr. Hawkes, though a strong advocate for the use of chloral, has found it repeatedly prejudicial in the general paralysis of mania, in elderly persons with feeble circulation and impaired nutrition. The result was increased congestion of the ganglionic centres, gradual failure of strength, and advance of the paralytic symptoms. (*Ibid.*, Jan. 6, 1872, p. 9.) It is said, in the ordinary dose, sometimes to produce disagreeable and even fearful dreams; but, as in the case of opiates, these may be generally relieved by increasing the dose, and thus producing sound sleep.

In large doses chloral is poisonous; and numbers of cases are on record in which it has caused death. Dr. Richardson, of London, states that 180 grains is a fatal dose, and that it would be imprudent to give more than 120 grains in 24 hours; as the system could not decompose and eliminate more than 5 or 7 grains per hour. But, according to more recent observations, even the latter quantity might be dangerous. Dr. Jolly relates two cases in which 5 grammes (about 76 grains), given every night, caused death, in one case after the fifth dose, and, in the second, after the thirteenth, without abnormal symptoms until after the last dose, when the action of the heart and respiration suddenly ceased, and the patient died. (*New York Med. Journ.*, Nov. 1872.) These cases would appear to justify the statement of the cumulative action of the drug, made by some observers. Dr. Fuller recorded a case in which a single dose of thirty grains proved fatal in a young lady, and two others in which the same quantity caused alarming symptoms in similar circumstances; so that the highest dose to begin with in ordinary diseases, especially in young women, should not exceed twenty-five grains. Death seems to be produced by a direct reduction of the heart's action and powers, amounting to paralysis of that organ. After death, the blood is found dark coloured, and, according to Richardson, the corpuscles are altered, and coagulability lost or impaired. In poisoning by chloral, if the case be seen early, the stomach should be thoroughly evacuated by an emetic or the stomach-pump, and the system afterwards supported by stimulants, as milk punch, carbonate of ammonium, &c. Dr. Liebreich recommends strychnia as an antidote; having found that poisonous doses of the two substances, introduced into the same animal, neutralize each other's operation, and no serious effect ensues.

Medical Uses. It is simply as a soporific that chloral is most efficient and most employed. For producing sleep no medicine equals it except opium; and to this it is often preferable as wanting the properties which render opium inapplicable in certain cases, as in active congestion and acute inflammation of the brain, and, to a certain degree, in constipation of the bowels. It is, moreover, much less liable than opium to meet peculiarities of individual constitution, which revolt against its use, and to produce those secondary effects which almost forbid the administration of opium to certain persons, as headache, delirium, and nausea and vomiting on awaking. In fact, chloral may be said to be universally applicable wherever there is an indication for producing sleep; and there is only one supposable condition in which its use as a soporific would be forbidden; the co-existence, namely, of insomnia with such a prostration of the heart's action and powers, as to render the least additional sedative influence on the organ almost necessarily fatal. In pure nervous insomnia, and in the same affection attendant on other diseases, as in acute fevers, active congestion of the brain, cerebral

inflammation, mania, delirium tremens, &c., it will generally cause sleep for a few hours, which may be maintained by a due repetition of the dose; fifteen to twenty or twenty-five grains being generally sufficient for a commencing dose, to be repeated in half the quantity in an hour or two, if the first dose fail. The sleep is usually calm and undisturbed for three or four hours; and may be renewed, if required, by the repetition of the dose. Chloral is often used as an anodyne, for the relief of pain, though in this respect inferior to either chloroform or opium; yet it is sometimes preferable to either, in consequence of unpleasant effects attending or following these narcotics. It has been found peculiarly efficacious in neuralgic pains, especially in the trifacial neuralgia, the sub-occipital, and the sciatic. In the nervous pains of phthisis also, and those sometimes accompanying zona, it has proved successful in certain hands. More than a temporary and palliative effect must not be expected in these cases; as chloral does not remove the cause of the disease, and, therefore, cannot be relied on for its permanent cure. As an anæsthetic in surgical operations it cannot be depended on; though in some minor cases, as in the extraction of teeth, it has proved sufficient; and Spencer Wells and other surgeons use it after their operations, to enable their patients to sleep, and thus escape the painful consequences of the wound. In the same way, it may be expected to prove useful in accidental wounds, given immediately after their occurrence.

The remedy is given in other forms of nervous disorder with more or less benefit. In delirium of an active character, as in fevers and maniacal paroxysms, it would appear to be indicated; and in delirium tremens it has succeeded admirably in some hands in somewhat larger than the ordinary doses, even when opium had failed; though the reverse is also true, opium having procured sleep, when chloral has been given without effect.

In spasms chloral is often useful, though generally inadequate to the cure of the more violent and obstinate of these affections. It has proved useful in the so-called hepatic, nephritic, and uterine colics. In many cases of *tetanus*, it has been given with more or less success, though it has entirely failed in others. Combined with morphia in this complaint, it is said to have led to brilliant success in the hands of Prof. Verneuil of Paris. The dose required in this affection is much larger than that employed in ordinary cases. *Hydrophobia* is among the affections in which a cure by chloral has been claimed; but it may be said, with great certainty, that the disease in this case was not true hydrophobia, but a nervous counterfeit. There are two other spasmodic diseases in which chloral has been employed, *chorea* and *epilepsy*. In the former of these diseases it has been used with success by some, but has as completely failed with others; in the latter it is at best but an occasional palliative; and the same must be said of its use in *hysteria*. A number of successful results of its use in *puerperal convulsions* are recorded; but it is at best a doubtful remedy. It has proved advantageous in obstetrics when rigidity of the os uteri was attended with rare and ineffectual pains, and the patient was in a state of exhaustion; and has been employed to procure sleep after delivery, and to quiet nervous agitation before.

In *strangulated hernia* occasional, but not uniform, success has followed its use. In *incontinence of urine* and *spermatorrhœa* it sometimes proves useful by quieting irritation. *Spasmodic croup* and *spasmodic asthma* are complaints which have occasionally yielded to the remedy. *Hiccough* and other forms of *nervous cough* may be relieved by it. A case of *violent singultus*, which had for a week resisted all the ordinary remedies, including musk, promptly yielded to chloral. *Insanity* is often relieved by chloral, through its soporific and anæsthetic as well as sedative influence; but, when a fixed disease, is not cured by it. Cures have been asserted to have been produced by it in *epidemic cholera;* and it may be used to relieve the violent pains and spasms of that disease; and the same may be said in regard to dysentery.

Locally it has been used with extraordinary success in syphilitic ulcers. After a few applications, the specific character of the diseased surface ceases, healthy granulations form, and the ulcer heals like a common wound. Facetella records sixty-nine cases cured, of which several were old, and had resisted ordinary treatment for twelve or fifteen months. (*Am. Journ. of Pharm.*, July, 1872, p. 300.)

Dose and Administration. The full commencing dose under ordinary circumstances should not exceed twenty-five grains, to be increased, if necessary, until the dose adapted to the individual be ascertained; the ability to produce sleep being the criterion. A good plan is to begin with fifteen or twenty grains, and repeat the dose in an hour or two, if the first produce no effect. For children it must be decreased in proportion to the age, according to the general rule. Chloral is seldom or never administered in pill or powder; but always in the liquid state, generally dissolved in water or mucilage of gum arabic. The taste and odour of the solution will be improved by making the menstruum a mixture of two measures of orange-flower water to one of simple syrup. A convenient proportion will be two drachms of chloral to four fluidounces of menstruum; a tablespoonful, containing fifteen grains, being taken for a dose. The pure watery solution may be used in subcutaneous injections in the same dose as by the mouth. Twice or three times as much may be given by enema. The solid chloral has also been given in capsules. W.

CHLOROFORMUM VENALE. *U.S.*

Commercial Chloroform.

In the U.S. Pharmacopœia of 1850 a process was given for the preparation of chloroform; in the present edition, the drug, in its impure commercial form, has been placed in the Materia Medica Catalogue, while a process is given in the second part of the work for its purification. Thinking it expedient that what is to be said on the subject should all be included under the same head, we refer the reader to the article Chloroformum Purificatum in Part II.

Off. Prep. Chloroformum Purificatum, *U.S.* B.

CHONDRUS. *U.S.*

Irish Moss.

Chondrus crispus. *U.S.*

Chondrus. *Sex. Syst.* Cryptogamia Algæ.—*Nat. Ord.* Algaceæ.

Gen. Ch. Frond cartilaginous, dilating upwards into a flat, nerveless dichotomously divided expansion, of a purplish or livid-red colour. *Fructification*, subspherical capsules in the substance of the frond, rarely supported on little stalks, and containing a mass of minute free seeds. *Greville.*

Chondrus crispus. Greville, *Alg. Brit.* 129, t. 15.—*Sphærococcus crispus.* Agardh.—*Fucus crispus.* Linn. The *Irish moss*, or *carrageen* as it is frequently called, consists of a flat, slender, cartilaginous frond, from two to twelve inches in length, dilated as it ascends until it becomes two or three lines in width, then repeatedly and dichotomously divided, with linear, wedge-shaped segments, and more or less curled up so as to diminish the apparent length. The capsules are somewhat hemispherical, and are embedded in the disk of the frond. The plant grows upon rocks and stones on the coast of Europe, and is especially abundant on the southern and western coasts of Ireland, where it is collected. It is also a native of the United States, and is said to be gathered largely on the southern sea-coast of Massachusetts, where it is partly torn from the rocks, and partly collected upon the beach, on which it is thrown up during storms. It is prepared for market by spreading it out high on the beach, to dry and bleach in the sun. (Aug. P. Melzar, *Proceed. of the Am. Pharm. Assoc.*, A.D. 1860.) An elaborate account of the plant, its distribution on the sea-coast of Massachusetts, and of the mode of gathering and curing it, is given by Mr. G. Hubert Bates, of Scituate, Mass., in a paper published in the U.S. Agricultural Report for 1866. (See *Am. Journ. of Pharm.*, Sept. 1868, p. 417.)

When collected, it is washed and dried. In the fresh state it is of a purplish colour, but, as found in the shops, is yellowish or yellowish-white, with occasionally purplish portions. It is translucent, of a feeble odour, and nearly tasteless. It swells in cold water but does not dissolve. Boiling water dissolves a large proportion of it, and the solution, if sufficiently concentrated, gelatinizes on cooling. According

to Feuchtwanger, it contains starch and pectin, with compounds of sulphur, chlorine, and bromine, and some oxalate of calcium. Herberger found 79·1 per cent. of pectin, and 9·5 of mucus, with fatty matter, free acids, chlorides, &c., but neither iodine nor bromine. M. Dupasquier discovered in it both of these elements, which had generally escaped attention in consequence of their reaction, as soon as liberated, upon the sulphuret of sodium resulting from the decomposition of the sulphate of sodium of the moss when charred. (*Journ. de Pharm.*, 3e sér., iii. 113.) The pectin Pereira thought peculiar, and proposed to call *carrageenin*. It is distinguished from gum by affording, when dissolved in water, no precipitate with alcohol; from starch, by not becoming blue with tincture of iodine; from pectin, by yielding no precipitate with acetate of lead, and no mucic acid by the action of nitric acid. M. Ch. Blondeau gives the name of *goëmine* to a substance obtained by boiling carrageen (goémon, *Fr.*) for several hours in distilled water, and precipitating the mucilaginous liquid by alcohol. The precipitate, being redissolved in water, yields on evaporation thin, transparent, elastic plates, resembling ichthyocolla, which soften and swell up on contact with cold water. This substance, which is probably complex, is without smell or taste, neutral to test-paper, and dissolves completely in alkaline liquids. Upon analysis, it gave 21·80 per cent. of carbon, 4·87 of hydrogen, 21·36 of nitrogen, 2·51 of sulphur, and 49·46 of oxygen. The most noteworthy point is the large proportion of nitrogen, exceeding that of most albuminoid substances, and probably giving highly nutritious properties to the Irish moss. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 159, A. D. 1865.)

Carrageen is nutritive and demulcent, and, being easy of digestion and not unpleasant to the taste, forms a useful article of diet in cases in which the farinaceous preparations, such as tapioca, sago, barley, &c., are usually employed. It has been particularly recommended in chronic pectoral affections, scrofulous complaints, dysentery, diarrhœa, and disorders of the kidneys and bladder. It may be used in the form of decoction, made by boiling a pint and a half of water with half an ounce of the moss down to a pint. Sugar and lemon-juice may usually be added to improve the flavour. Milk may be substituted for water, when a more nutritious preparation is required. It is recommended to macerate the moss for about ten minutes in cold water before submitting it to decoction. Any unpleasant flavour that it may have acquired from the contact of foreign substances is thus removed. W.

CIMICIFUGA. *U.S.*

Cimicifuga. Black Snakeroot.

The root of Cimicifuga racemosa. *U.S.*

Cimicifuga. *Sex. Syst.* Polyandria Di-Pentagynia.—*Nat. Ord.* Ranunculaceæ. *Gen. Ch. Calyx* four or five-leaved. *Petals* four to eight, deformed, thickish, sometimes wanting. *Capsules* one to five, oblong, many-seeded. *Seeds* squamose. *Nuttall.*

Cimicifuga racemosa. Torrey, *Flor.* 219; Carson, *Illust. of Med. Bot.* i. 9, pl. 3.—*C. Serpentaria.* Pursh, *Flor. Am. Sept.* p. 372.—*Actæa racemosa.* Willd. *Sp. Plant.* ii. 1139.—*Mucrotys racemosa.* Eaton's *Manual*, p. 288. This is a tall stately plant, having a perennial root, and a simple herbaceous stem, which rises from four to eight feet in height. The leaves are large, and ternately decomposed, having oblong-ovate leaflets, incised and toothed at their edges. The flowers are small, white, and disposed in a long, terminal, wand-like raceme, with occasionally one or two shorter racemes near its base. The calyx is white, four-leaved, and deciduous; the petals are minute, and shorter than the stamens; the pistil consists of an oval germ and sessile stigma. The fruit is an ovate capsule containing numerous flat seeds.

The *black snakeroot*, or *cohosh* as this plant is sometimes called, is a native of the United States, growing in shady or rocky woods from Canada to Florida, and flowering in June and July. The root is the part employed.

Properties. The dried root consists of a thick, irregularly bent or contorted body or caudex, from one-third of an inch to an inch in thickness, often several inches in length, furnished with many slender radicles, and rendered exceedingly rough and

jagged in appearance by the remains of the stems of successive years, which to the length of an inch or more are frequently attached to the root. The colour is externally dark-brown, almost black, internally whitish; the odour, though not strong, is peculiar and rather disagreeable, and is gradually lost by keeping; the taste is bitter, herbaceous, and somewhat astringent, leaving a slight sense of acrimony. The root yields its virtues to boiling water. It was found by Mr. Tilghman, of Philadelphia, to contain gum, starch, sugar, resin, wax, fatty matter, tannic and gallic acids, a black colouring matter, a green colouring matter, lignin, and salts of potassa, lime, magnesia, and iron. (*Journ. of Phil. Col. of Pharm.*, vi. 20.) It no doubt also contains, when fresh, a volatile principle, with which its virtues may be in some degree associated; as we are confident that it is more efficacious in the recent state, than when long kept. In fact, Mr. Geo. H. Davis, in a more recent analysis, has separated by distillation a small proportion of volatile oil, having decidedly the peculiar odour of the root. Mr. Davis also found, in addition to the principles above mentioned, albumen and extractive among the organic, and silica among the inorganic constituents. The sugar, moreover, noticed by him was of the uncrystallizable variety, and the resin of two kinds, one soluble in alcohol but not in ether, the other soluble in both these menstrua. (*Am. Journ. of Pharm.*, xxxiii. 396.)

A crystallizable principle has been obtained from the root by Mr. T. Elwood Conrad. After failing to obtain any volatile principle from the fresh root by distillation, he prepared a strong tincture of the root, treated this with the solution of subacetate of lead, which precipitated resin, tannin, and colouring matters, then filtered, and precipitated the lead by sulphuretted hydrogen in excess, and allowed the tincture to evaporate spontaneously; and, finally, having treated the residuary powder with benzene, afterwards washed it with water, dissolved it to saturation in strong alcohol, and treated the solution with alumina. The mixture was allowed to evaporate to a dry mass, which was nearly exhausted with alcohol. The solution being allowed to evaporate, left behind a crystalline mass, somewhat resembling alum. This substance has little taste on account of its extreme insolubility in the saliva; but in alcoholic solutions had very strongly the acrid taste characteristic of the fresh root. The crystals were very soluble in cold, and more so in hot alcohol, soluble also in chloroform, and slightly in ether. They were fusible and inflammable. They were neuter, possessing neither acid nor alkaline properties. Their effects on the system were not examined. (*Am. Journ. of Pharm.*, April, 1871, p. 151.)

Medical Properties and Uses. The effects of cimicifuga in health have not been fully investigated. It was at one time considered a mild tonic, with the property of stimulating the secretions, particularly those of the skin, kidneys, and bronchial mucous membrane; and has been thought by some to have an especial affinity for the uterus. It undoubtedly exercises considerable influence over the nervous system, probably of a sedative character; but this influence, so far as our observation has gone, is shown more in morbid states of that system than in health. Dr. Hildreth, of Ohio, found it, in large doses, to produce vertigo, impaired vision, nausea and vomiting, and a reduction of the circulation; but from very large quantities he observed no alarming narcotic effects. Dr. N. S. Davis uniformly found it to lessen the force and frequency of the pulse, to soothe pain, and allay irritability. (*Trans. of Am. Med. Assoc.*, i. 352.) Its common name was probably derived from its supposed power as an antidote to the bite of the rattlesnake. It was originally employed in domestic practice in rheumatism, dropsy, hysteria, and various affections of the lungs, particularly those resembling consumption. The first published notice of its use in phthisis was by Dr. Thomas J. Garden, of Charlotte, Virginia. (*Am. Med. Recorder*, October, 1823.) Several cases of chorea were recorded by Dr. Jesse Young, in which it effected cures; and the editor of the *Am. Journ. of Med. Sciences* stated that he had been informed by Dr. Physick that he had known it, in the dose of ten grains every two hours, to prove successful in the cure of that complaint in several instances. Dr. Young gave a teaspoonful of the powdered root three times a day. (*Am. Journ. of Med. Sci.*, ix. 310.) We have administered the medicine in chorea with complete success, and have derived the happiest effects from it in a case of periodical convulsions connected with uterine disorder. Dr. Hildreth has found

it, in combination with iodine, very advantageous in the early stages of phthisis. (*Ibid.*, N. S., iv. 281.) Dr. F. N. Johnson has employed it with extraordinary success in acute rheumatism; the disease generally yielding completely within eight or ten days. (*Trans. of Am. Med. Assoc.*, i. 352.)

It may be given in substance, decoction, tincture, or extract. The dose of the powder is from a scruple to a drachm. The *decoction* has been much used, but is thought by some not to contain all the virtues of the root. An ounce of the bruised root may be boiled for a short time in a pint of water, and one or two fluidounces given for a dose. From half a pint to a pint of the decoction may be taken without inconvenience during the day. The *tincture* may be made in the proportion of four ounces to the pint of diluted alcohol, and given in the dose of one or two fluidrachms. In acute rheumatism, the remedy is recommended by Dr. Davis, in the dose of from thirty to sixty drops of the tincture, or twenty grains of the powder, repeated every two hours till its effects are observed. (*Ibid.*, p. 356.) Dr. Brundige speaks, in the strongest terms, of the efficacy of a saturated tincture of the dried root, as an application about the eye, and to the outer surface of the eyelids in ophthalmia. (*Med. Exam.*, N. S., vii. 809; from the *N. Y. Med. Gaz.*) Dr. Kœhler, of Schuylkill Haven, Pa., after failing with the decoction and simple tincture in the treatment of chorea, succeeded satisfactorily with an *acetous tincture*, made by digesting, for fourteen days, five ounces of the root with a menstruum consisting of one fluidounce of diluted acetic acid, eight of alcohol, and eleven of water. The dose is the same as that of the simple tincture. (*N. Am. Med.-chir. Rev.*, iii. 189.) In the *Medical and Surgical Reporter* (April 18, 1868), Dr. G. Adolphus, of Logansport, Ind., gives an enthusiastic report of the efficacy of this remedy, within his own experience; as having no equal in diseases of the lungs, especially in asthenic forms of pneumonia, in chronic bronchitis, and pulmonary tuberculosis; as superior to all other remedies in chorea; and as exercising a very favourable influence over anomalous nervous diseases in females, in periodical headache with tincture of gelsemium, in scrofulous affections, in amenorrhœa in which it is the surest remedy known to the author, and as a mild tonic in nervous affections. The only form in which he has found it reliable is that of strong and saturated tincture, of which he gives from ten to thirty drops. A *fluid extract* is now officinal; and a *dry extract* has been prepared by Professor Procter. The dose of the former is from 30 to 60 minims, of the latter from 4 to 8 grains.* The practitioners calling themselves eclectics use, under the name of *cimicifugin*, an impure resin obtained by precipitating a saturated tincture of the root with water. It is given in the dose of a grain or two. The name, however, is inappropriate, as it should be reserved for the pure active principle when discovered. (See *N. J. Med. Reporter*, viii. 247.)

Off. Prep. Extractum Cimicifugæ Fluidum, *U. S.* W.

CINCHONA. *U. S.*

Cinchona.

Syn. Peruvian Bark; Cinchona Bark.

"The bark of all species of the genus Cinchona, containing at least two per cent. of the proper cinchona alkaloids, which yield crystallizable salts." *U. S.*

Varieties.

CINCHONA FLAVA. *Yellow Cinchona. Syn.* Calisaya Bark. *U. S.* The bark of Cinchona Calisaya. (Weddell, *Hist. Nat. des Quinquinas*, 30.) It should contain not less than two per cent. of alkaloids which yield crystallizable salts. *U. S.*

* The dry extract is prepared in the following manner. Sixteen ounces of the recently dried root, in powder, are put into a percolator for volatile liquids, and a mixture of a pint of alcohol and half a pint of ether is gradually added. After the liquid has ceased to pass, diluted alcohol is poured in until the filtered liquid equals a pint and a half, which is set aside in a warm place, and allowed to evaporate spontaneously until reduced to half a pint. The percolation is continued with diluted alcohol until two pints of tincture are obtained. The two tinctures are evaporated separately to the consistence of syrup, then mixed, and carefully evaporated to dryness by means of a water-bath. (*Am. Journ. of Pharm.*, xxvi. 107.)—*Note to the eleventh edition.*

CINCHONÆ FLAVÆ CORTEX. *Yellow Cinchona Bark.* The bark of Cinchona Calisaya. *Br.*

CINCHONA PALLIDA. *Pale Cinchona. U.S.* The bark of Cinchona Condaminea (Humb. and Bonpl., *Plant. Equinoct.*, i. 33), and of Cinchona micrantha (Ruiz and Pavon, *Flor. Peruv.*, ii. 52). *U.S.* CINCHONÆ PALLIDÆ CORTEX. *Pale Cinchona Bark.* The bark of Cinchona Condaminea, *vars.* chahuarguera *Pavon*, and crispa *Tafalla. Br.*

CINCHONA RUBRA. *Red Cinchona. Syn.* Red Bark. *U.S.* The bark of Cinchona succirubra (*Pavon*). It should contain not less than two per cent. of alkaloids which yield crystallizable salts. *U.S.* CINCHONÆ RUBRÆ CORTEX. *Red Cinchona Bark.* The bark of Cinchona succirubra, *Pavon. Br.**

Quinquina, *Fr.;* China, Peruvianische Rinde, *Germ.;* China, *Ital.;* Quina, *Span.*

Botanical History.

Though the Peruvian bark was introduced into Europe so early as 1640, it was not till the year 1737 that the plant producing it was known to naturalists. In that year La Condamine, on a journey to Lima, through the province of Loxa, had an opportunity of examining the tree, of which, upon his return, he published a description in the Memoirs of the French Academy. Soon afterwards Linnæus gave it the name of *Cinchona officinalis*, in honour of the Countess of Cinchon, who is said to have first taken the bark to Europe; but, in his description of the plant, he united the species discovered by La Condamine with *C. pubescens*, a specimen of which had been sent to him from Santa Fé de Bogota. For a long time it was not known that more than one species existed; and C. officinalis continued, till a comparatively recent period, to be recognised by the Pharmacopœias as the only source of the Peruvian bark of commerce. But a vast number of plants belonging to the Linnæan genus Cinchona were in the course of time discovered; and the list became at length so unwieldy and heterogeneous, that botanists were compelled to distribute the species into several groups, each constituting a distinct genus, and all associated in the natural family of Cinchonaceæ. Among these genera, the *Cinchona* is that which embraces the true Peruvian bark trees, characterized by the production of the alkaloids, quinia, cinchonia, &c., as well as by certain botanical peculiarities, among which the most distinctive is probably the dehiscence of the capsule from the base towards the apex, or from below upward. The new genera *Exostemma* and *Buena* embrace species which have been, perhaps, most frequently referred to as Cinchonas; but they are sufficiently characterized, the former by the projection of the stamens beyond the corolla, a peculiarity which has given name to the genus, the latter by the different shape of the corolla, the separation of the calyx from the fruit at maturity, and the opening of the capsule from above downward. More recently Weddell has separated several generally admitted species from Cinchona, and instituted a new genus, which he proposes to name *Cascarilla*. This includes the former

*The British Pharmacopœia gives the following methods of testing these varieties.

1. "*Test of Yellow Cinchona.* Boil 100 grains of the bark, reduced to very fine powder, for a quarter of an hour, in a fluidounce of distilled water acidulated with ten minims of hydrochloric acid; and allow it to macerate for twenty-four hours. Transfer the whole to a small percolator, and, after the fluid has ceased to drop, add at intervals about an ounce and a half of similarly acidulated water, or until the fluid which passes through is free from colour. Add to the percolated fluid solution of subacetate of lead until the whole of the colouring matter has been removed, taking care that the fluid remains acid in reaction. Filter, and wash with a little distilled water. To the filtrate add about thirty-five grains of caustic potash, or as much as will cause the precipitate which is at first formed to be nearly redissolved, and afterwards six fluidrachms of pure ether. Then shake briskly, and, having removed the ether, repeat the process twice with three fluidrachms of ether, or until a drop of the ether employed leaves on evaporation scarcely any perceptible residue. Lastly, evaporate the mixed ethereal solutions in a capsule. The residue, which consists of nearly pure Quinia, when dry, should weigh not less than two grains, and should be readily soluble in diluted sulphuric acid.

2. "*Test for Pale Cinchona.* Two hundred grains of the bark, treated in the manner directed in the test for yellow cinchona bark, with the substitution of chloroform for ether, should yield not less than one grain of alkaloids.

3. "*Test for Red Cinchona.* One hundred grains of the bark, treated in the manner directed in the test for yellow cinchona, with the substitution of chloroform for ether, should yield not less than 1·5 grain of alkaloids." *Br.* (*Note to the thirteenth edition.*)

Cinchona magnifolia of Ruiz and Pavon (*C. oblongifolia* of Mutis), the *C. stenocarpa* of Lambert, the *C. acutifolia* of Ruiz and Pavon, the *C. oblongifolia* of Lambert, the *C. macrocarpa* of Vahl, and the *C. cava* of Pavon, which differ from the true Cinchona in having the dehiscence of the capsules from the apex towards the base, or from above downward, and the barks of which contain neither of the alkaloids above referred to. (Weddell, *Hist. Nat. des Quinquinas*, p. 77.) With this brief preliminary notice, we shall proceed to consider the true Cinchonas. It may be proper, however, first to say, that the botanists who have personally observed these plants, besides *La Condamine*, of whom we have before spoken, are chiefly *Joseph de Jussieu*, who in the year 1739 explored the country about Loxa, and gathered specimens still existing in the cabinets of Europe; *Mutis*, who in 1772 discovered Cinchona trees in New Granada, and afterwards, aided by his pupil *Zea*, made further investigations and discoveries in the same region; *Ruiz* and *Pavon*, who in 1777 began a course of botanical inquiries in the central portions of Lower Peru, and discovered several new species; *Humboldt* and *Bonpland*, who visited several of the Peruvian bark districts, and published the results of their observations after 1792; *Pöppig*, who travelled in Peru so late as 1832, and published an account of his journey about the year 1835; and finally *Weddell*, whose researches in Bolivia are so well known, and have been so productive of valuable information in relation to the Calisaya bark.

Cinchona. *Sex. Syst.* Pentandria Monogynia. — *Nat. Ord.* Cinchonaceæ.

Gen. Ch. Calyx with a turbinate tube, and a persistent five-toothed limb. *Corolla* with a round tube, a five-parted limb, and oblong lobes valvate in æstivation. *Stamens* with short filaments inserted into the middle of the tube, and linear anthers entirely closed. *Stigma*, bifid, subclavate. *Capsule* ovate or oblong, somewhat furrowed on each side, bilocular, crowned with the calyx, septicidal-dehiscent, with the mericarps loosened from the base towards the apex, the introflexed part disjoined. *Placentæ* elongated. *Seeds* numerous, erect, imbricated upward, compressed, winged, with a membranous margin, and a fleshy albumen.—The plants composing this genus are trees or shrubs. The leaves are opposite, upon short petioles with flat margins, and are attended with ovate or oblong, foliaceous, free, deciduous stipules. The flowers are terminal, in corymbose panicles, and of a white or purplish rose colour. (*De Candolle.*)

The genuine Cinchona trees are natives exclusively of South America.* In that

* *Transplantation of the Cinchona trees, and Cultivation in new Sites.* For a long time after the discovery of the virtues of Peruvian bark, no attempt appears to have been made to transplant to other countries the trees which produced it. In 1737, La Condamine collected a large number of young plants, with a view of conveying them to Europe; but, after having descended the Amazon in safety for more than a thousand leagues, they were washed overboard, near the mouth of that river, from the boat containing them, and were all lost. After this failure, though the idea of transplanting the Cinchonas was occasionally suggested, nothing was done until 1846–7, when Dr. Weddell, now celebrated for his successful exploration of the region of the Calisaya bark, sent some seeds to France, which were planted with success in the *Jardin des Plantes*, and thus supplied some of the conservatories of Europe with specimens of the plant. But the first successful effort, with a view to great practical results, was made in 1853, by the Dutch Government, by whom Mr. Hasskarl, formerly superintendent of the botanical garden in Java, was sent to South America on this important mission. A number of young Cinchona plants were sent by him directly across the Pacific to Batavia, which they reached before the close of 1854. From these, and from seeds obtained from other sources, which were planted in the mountains of Java, in sites selected for their supposed conformity in climate with the native locality of the Cinchona, have sprung plantations, which in 1860 contained nearly a million of trees, of which 15,000 or 16,000 were of the C. Calisaya. Dr. De Vrij obtained from the bark of one of the Cinchona plants of Java, not five years old, 3·12 per cent. of quinia, which is equal to the product of the Bolivian trees. Many of the trees, at the end of 1861, were thirty feet high. Unfortunately, however, most of the plants in Java are comparatively valueless species; and the success of the Dutch has thus been retarded.

The English East India Government has been more successful. Stimulated by the suggestions of Dr. Royle, and by the partial success of the Dutch, they engaged, in 1859, the services of Mr. Clements B. Markham, who proceeded to Bolivia, in South America, and, after almost incredible hardships, arising partly from the nature of the country and partly from the jealousy of the native authorities, succeeded in collecting and transmitting to England upwards of 400 Calisaya plants. Most of these, however, were so much injured, on their way from England to India, by the excessive heat of the Red Sea, that very few, on their arrival in Hindostan, had sufficient life remaining to grow when planted. Happily, the deficiency was supplied by seeds of C. Calisaya sent from Java, where they were produced, to Calcutta, at the request of the English Governor General. (De Vrij, *Pharm. Journ.*, April, 1863, p. 440.) Whilst Mr. Markham was in Bolivia, other agents were

continent, however, they are widely diffused, extending from the 19th degree of south latitude, considerably south of La Paz, in Bolivia, to the mountains of Santa Martha,

collecting other species in Peru and Ecuador, whence seeds of the pale and red bark Cinchonas reached India, and, being planted in the selected sites, proved to be very productive.

The sites selected for the Cinchona plantations were in the Neilgherry Hills, in Southern India, in the Presidency of Madras, at the junction of the East and West Ghauts, near the Sanitary Station of Ootacamund, at heights varying from 5000 to 7450 feet above the sea. These positions unite the peculiar characters of the native region of the Cinchonas in the Andes, not only as regards elevation and latitude, but also as to atmospheric moisture, an excess of which, for the greater portion of the year, seems essential to the perfection of these trees. But, though a certain excess of atmospheric moisture is necessary, yet the trees do not grow well in a wet soil, as Mr. Cross, who personally inspected the region in the Andes where the best barks are obtained, found the Cinchona plants only on the dry slopes, and never on wet ground. He remarked, moreover, that constant dampness of the atmosphere is unfavourable, as a certain amount of dry weather is necessary for the ripening of the capsules. In regard to the temperature, which is about the same throughout the year, he observed that during the hottest days the thermometer rose to 59° or 60°, falling to 46° or 48° at night; but at the upper limit it ranged, during the day, from 46° to 48°, and at night fell to 35° or 36°. (*Am. Journ. of Pharm.*, March, 1867, p. 161.)

Besides the Neilgherry Hills, other sites were selected for experimental plantations; and, since the first introduction of the Cinchona trees, their culture has been extended to various points from Hakgalla, in the Island of Ceylon, to the Himalaya Mountains; as in the Wynaad, the Coorg, the hills of Travancore, and especially at Peermede in the Presidency of Madras; in Sikkim and Darjeeling in the Presidency of Bengal; at Lingmulla in the Presidency of Bombay; and in the valley of Kangra in the Punjab; from the southern to the northern extremity of British India. As stated in the twelfth edition of the Dispensatory, the success of the enterprise was at that time secure. In April, 1863, there were in the Neilgherry plantations alone 120,000 Cinchona trees, of which 45,000 were of the *C. succirubra*, which yields the genuine red bark, 1500 of the *C. Calisaya*, and others of less valuable, but still productive species. It had also at that time been determined, that the bark of the young cultivated trees was quite as productive in alkaloids as that of the same species in their native country of the Andes. Under the fostering care of the British Government, and the wise and energetic management of Mr. W. G. MacIvor, to whom the superintendence of the government plantations has been entrusted, the undertaking has been prosecuted with great, indeed with astonishing success; so that a new source of Cinchona bark has been opened to meet the demands of the world, which is capable of indefinite extension, and which will ere long rival in productiveness, if it do not exceed, the South American Andes. In the various localities above indicated, the government has favoured the extension of the enterprise among the native chiefs and private individuals, thus securing the cultivation of the Cinchonas as one of the permanent industries of that great region. Already, in April, 1866, the number of these trees cultivated in British India much exceeded two millions; and the bark is now obtained in such quantities as to be actually delivered for consumption in the London market. (*Journ. de Pharm. et de Chem.*, Dec. 1867, p. 433.)

Besides the general fact of the success of the culture, other results, as unexpected as they are important, have been obtained within the last few years. It was ascertained at an early period, that the productiveness of these plants in alkaloids had not been diminished by the transplantation; it is now known that this productiveness has in fact been very considerably increased. Another highly important result is the discovery by Mr. MacIvor, that the yield in alkaloids is greatly augmented by a certain treatment of the trees. It had been noticed that the cinchona alkaloids, especially in any other form than that of sulphate, were apt, on exposure to the direct light of the sun, to become reddened by the generation of colouring matter, at the expense of the alkaloid. It was a very natural inference that a similar change might take place in the living plant, as a consequence of which the proportion of alkaloids they were capable of producing might be greatly diminished. To obviate this presumed effect, Mr. MacIvor was induced to make the experiment of covering the stems of the growing trees with a layer of moss, so as completely to protect the bark against the influence of sunlight. The result was favourable beyond all expectation: and the yield of the bark thus protected in alkaloids is said to be doubled, tripled, or increased even in larger proportion. Another highly important fact has been ascertained, that the South American plan of cutting down the trees, and then decorticating them is not only unnecessary, but is greatly wasteful. For, though shoots are often put forth from the stump, which in time will become fruitful trees, yet a much more economical plan is to make the old tree continuously productive. For this purpose, nothing more is necessary than to treat them as the cork-bearing oak of the south of Europe is treated by the cork gatherers. If a slip is removed longitudinally from the trunk, from top to bottom, by covering the decorticated portion with moss, the bark is renewed, at least as rich as previously in the alkaloids, while from time to time other strips may be taken, till the whole of the old bark is removed, and the new ready for removal by a repetition of the same process; and the tree is thus preserved indefinitely, probably for the whole normal length of its life.

It will be remembered that the first successful effort towards the transplantation of the Cinchona trees, on a large scale, was made by the Dutch in the Island of Java. Unfortunately, as before stated, the plants first introduced were mostly of inferior species; and, moreover, the system of cultivation first adopted, of planting the Cinchonas in the thick shade of the original forest, was not the one most favourable to their growth. From these causes the progress of the culture towards useful practical results was less rapid than in British India; but a supply of seeds from the valuable species has been obtained from Hindostan; and a better method of cultivation has been adopted, so that the enterprise is advancing more favourably; and there is no doubt that Java, like British India, will in future times be an important source of supply, to meet the increasing demand.

Attempts have also been made to introduce the new culture into the West India island of Jamaica;

or, according to Weddell, to the vicinity of Caracas, on the northern coast, in about the 10th degree of north latitude. They follow, in this distance, the circuitous course of the great mountain ranges, and for the most part occupy the eastern slope

and the Cinchonas which were planted in the mountains, at an elevation of 4000 feet, are said to be growing luxuriantly; so that there is every reason to believe that the great work may ultimately succeed in this locality also.

The French have been less successful than the Dutch and English. The first plants taken by Weddell from Peru to Paris have all perished. Subsequently trials have been made in the Isle of Bourbon, and at Guadaloupe, but these are yet only at the commencement. In Algiers, where situations believed to be suitable were selected for plantations among the mountains, no satisfactory results have yet been attained. The Brazilians have had somewhat better success near Rio Janciro, though the plantations are yet recent; and it is said that plants have been introduced into the Azores, which are growing well. (Soubeiran, *Journ. de Pharm.*, Feb. 1868, p. 139.)

It is somewhat doubtful whether, within the limits of the United States, there are conditions of climate essential to the profitable cultivation of these trees; but the question is one of great interest, and well worth the attention of our government. (*Note to the twelfth and thirteenth editions.*)

Cultivation of the Cinchona, continued. Several years having elapsed since the foregoing account of the transplantation of the Cinchona trees and their cultivation in new sites was written, some modifications have occurred in the condition of this enterprise, which require notice, in order that the existing state of things may be brought to the attention of the reader. It is deemed expedient that the remarks which may be thought proper in this respect, should be made in the form of a distinct note, rather than interspersed through the former, interrupting its continuity, and rendering it more or less confused.

In British India, the introduction and culture of the Cinchona trees may be considered as permanently established, almost beyond the power of accident to interrupt it; although it has scarcely yet been positively determined that the new cultivation will be self-sustaining. Yet there can, we think, be no doubt that, when all the preliminary measures are completed, and experience shall have taught the persons concerned all that is necessary to secure the best results, the desired end must be attained against all the competition which can be brought against it from the partially exhausted forests of the Andes.

Accounts from the *Neilgherry plantations* in Southern India, which were the first results of British enterprise in this direction, state that 25,000lbs. of bark, the product of the government plantations for the year 1873, were prepared for shipment to the London market; and it was expected that a large quantity, besides, would be sent from the private plantations in the same neighbourhood. The number of Cinchona trees belonging to the government in this district was estimated at more than a million, of which nearly one-half were varieties of C. officinalis, which, in facility of propagation, and productiveness in quinia, seems to be superior to all other species.

The plantations in the *Sikkim hills and Darjeeling*, in the Presidency of Bengal, seem to have made a relatively equal progress; and it is said that the private planters, in these locations, have a fair promise of large returns from their investment. Upwards of 1,600,000 was given by the superintendent as the number of the permanent Cinchona trees in the government plantations at Darjeeling in British Sikkim on April 1, 1872; 1,000,000 being of C. succirubra, 77,500 of C. Calisaya, 29,667 of C. micrantha, 100,000 of C. officinalis and varieties, and 5092 of C. Pahudiana. (*Pharm. Journ.*, Oct. 1872, p. 325.)

The trees of the Sikkim plantation are liable to two diseases, which somewhat retard their progress; one constitutional and usually fatal, the other local and not ordinarily fatal. The former seems to result from excessive dampness of the soil, and does not occur when this is dry. It begins at the root; the leaves fade and fall, and the tree dies. The latter form of disease shows itself in patches on the stems and branches, and seldom proves destructive; simply interfering with the growth so far as the bark is disorganized. There is little doubt that it is a parasitic affection, and would yield to the application of parasiticides. (*Ibid.*, p. 324.)

The *mountainous districts of Ceylon* are said to offer an equally promising future for the enterprise.

Of the different varieties of the Cinchona under culture in India, 23 different specimens were received by Mr. Howard, of London, most of which exactly resemble the same kinds grown in S. America. (*Ibid.*, Feb. 1873, p. 647.)

It is a singular fact, recently observed, that the application of manures of the ordinary kind to the Cinchona trees, without much improving the growth of the plant, have a remarkable effect in increasing the product of the alkaloids. (*Ibid.*, Jan. 1873, p. 521.)

The condition of the culture in Java has much improved, so as fully to justify the favourable anticipation entertained in the former edition of the Dispensatory. At the latest accounts there had been 1,800,000 trees planted; and the bark of several species having been examined, was found to contain largely of quinia and the other alkaloids; one of the varieties of Calisaya yielding 9·09 per cent. of quinia and 10·47 of alkaloid product altogether; and a variety of C. officinalis, that with small pointed leaves, 5·92 of quinia and 9·49 total alkaloids. (*Ibid.*, Nov. 1873, p. 341.) Of the bark, moreover, 14,000lbs. had been prepared for delivery to market this season.

The work in *Jamaica* seems to be successfully going on, and many years cannot elapse before this island will become the seat of a profitable cultivation. Attempts have been made by private individuals to introduce the cultivation into *Mexico;* but, though many of the plants grow freely, it is yet too soon to determine what will be the probable result.

The Cinchonas have been introduced also into Saint Helena; and, on the Island of Reunion (Bourbon), though the first trees perished from want of attention to the peculiarities of climate demanded by them, yet later attempts with better knowledge have succeeded well, and the trees are in admirable condition, justifying the anticipation that in the near future Reunion will be definitely endowed with this precious plant. (*Journ. de Pharm.*, Avril, 1870, pp. 323–6.)—*Note to the fourteenth edition.*

of the second range of the Cordilleras. Those which yield the bark of commerce grow at various elevations upon the Andes, seldom less than 4000 feet above the sea; and require a temperature considerably lower than that which usually prevails in tropical countries.

There has been much difficulty in properly arranging the species of Cinchona. One source of the difficulty is the varying shape of the leaves of the same species, according to the degree of elevation upon the mountainous declivities, to the severity or mildness of the climate, the greater or less humidity of the soil, and to various circumstances in the growth of individual plants. Even the same tree often produces foliage of a diversified character; and a person, not aware of this fact, might be led to imagine that he had discovered different species from an examination of the leaves from one and the same branch. The fructification partakes, to a certain extent, of the same varying character. Lambert, in his "*Illustration of the genus Cinchona*," published in 1821, after admitting with Humboldt the identity of several varieties which had received specific names from other botanists, described nineteen species. De Candolle enumerated only sixteen. Lindley admits twenty-one known species, and five doubtful. Weddell describes twenty-one species, including eight new ones of his own, and two doubtful, and excluding several before admitted by other writers, which he joins to his new genus Cascarilla.

Until recently, it was impossible to decide from which species of Cinchona the several varieties of bark were respectively derived. The former references of the yellow bark to *C. cordifolia*, of the pale to *C. lancifolia*, and of the red to *C. oblongifolia*, have been very properly abandoned in all the Pharmacopœias. It is now universally admitted that the officinal barks, known in the market by these titles, are not the product of the species mentioned. It is stated by Humboldt, that the property of curing agues belongs to the barks of all the Cinchonas with hairy and woolly blossoms, and to these alone. All those with smooth corollas belong to the genus Cascarilla of Weddell. Within a few years much light has been thrown upon the botanical history of the different varieties of bark, and at present most if not all of the valuable varieties can be traced to their sources. The following species are acknowledged by the Pharmacopœia of the U. States.

1. *Cinchona Calisaya.* Weddell, *Hist. Nat. des Quinquinas*, p. 30, t. 3. This is a lofty tree, with a trunk often two feet or more in diameter, and a summit usually rising above the other trees of the forest. The leaves are petiolate, oblong or lanceolate-obovate, from three to six inches long and one or two in breadth, obtuse, acute or slightly attenuated at the base, softish, above smooth, of a velvety aspect, and obscurely green, beneath smooth and of a pale emerald hue, with scrobiculi at the axils of the veins, but scarcely visible on the upper surface. The stipules are about as long as the petioles, oblong, very obtuse, and very smooth. The flowers are in ovate or subcorymbose panicles. The calyx is pubescent, with a cup-shaped limb, and short triangular teeth; the corolla is rose-coloured, with a cylindrical tube about four lines long, and a laciniate limb fringed at the edges; the stamina are concealed in the tube, with anthers more than twice as long as the filaments. The fruit is an ovate capsule scarcely as long as the flower enclosing elliptical lanceolate seeds, the margin of which is irregularly toothed, with a fimbriated appearance. The tree grows in the forests, upon the declivities of the Andes, at the height of 6000 or 7000 feet above the ocean, in Bolivia and the southernmost part of Peru.*

* The cultivation of the C. Calisaya, which in its native mountains is said to be the most beautiful, as well as the richest in quinia of all the species, has been less successful than that of the C. succirubra, micrantha, &c., in the E. Indies. Though great pains had been taken to secure proper seeds and young plants for transplantation, from some unknown cause, probably from ignorance of the precise circumstances of climate and soil best adapted to this species, the attempts made for its introduction have not met with satisfactory success. The plants are of stunted growth, with the appearance of shrubs rather than of trees, and a sombre aspect of the leaves, the furthest possible from the magnificent *Calisaya* trees in their native forest of Bolivia. Nor has the chemical examination of the bark of the young trees been more satisfactory. According to Mr. Markham, the Calisaya avoids the banks of a river, never being found within several hundred feet of it, and prefers the steepest declivities of the mountain sides, and a great deal of shade, though not too much of it; and he considers the best locality for the young trees, one in which they may receive shade from taller trees, while they receive sunshine through the spreading branches. Nor is it certain that the best variety of the Calisaya is that which has been introduced into India. It is hoped, therefore, that better success may reward further efforts for the naturalization of this species, by

A variety of this species, described by Weddell under the name of *Josephiana*, is a mere shrub, not more than twelve feet high, with a slender stem, erect branches, and a strongly adherent bark. This variety is found in some places covering extensive surfaces destitute of forest trees. Weddell supposes that these tracts had once been covered with forests, which, having been destroyed by fires, have been succeeded by this stunted growth springing from the roots, and prevented from receiving its full development by the want of protection from other trees.

Mr. Markham states that the natives recognise three varieties of the Calisaya; 1. *Calisaya amarilla* or *fina* (*a. vera* of Weddell); 2. *C. morada* (*C. Boliviana*, Wedd.); and 3. *C. verde* or *alta*, a very large tree, growing lower in the valley than the other varieties, and distinguished by having the veins of the leaves never purple, but always green. (*Am. J. of Pharm.*, 1866, p. 422.) By the discovery of this species, the long unsettled point of the botanical source of Calisaya bark has been determined. The immense consumption of that bark, and the wasteful methods pursued by the bark gatherers have caused the rapid destruction of the tree; and already it has disappeared from the neighbourhood of inhabited places, except in the form of a shrub. Weddell was compelled to make long journeys on foot through the forests, by paths scarcely opened, before he could get a sight of the tree in its full vigour.

2. *Cinchona Condaminea.* Humb. and Bonpl. *Plant. Equin.* i. p. 33, t. 10; Lindley, *Flor. Med.* 414; Carson, *Illust. of Med. Bot.* i. 53, pl. 45.—*Cinchona officinalis.* Linn.; Hooker, *Bot. Mag.* t. 5364. This tree, when full grown, has a stem about eighteen feet high and a foot in thickness, with opposite branches, of which the lower are horizontal, and the higher rise at their extremities. The bark of the trunk yields when wounded a bitter astringent juice. The leaves are of variable shape, but generally ovate-lanceolate, about four inches in length by less than two in breadth, smooth and scrobiculate at the axils of the veins beneath. The flowers are in axillary, downy, corymbose panicles. The tree grows on the declivities of the mountains, at an elevation of from about a mile to a mile and a half, and in a mean temperature of 67° F. It was seen by Humboldt and Bonpland in the neighbourhood of Loxa, and is said also to grow near Guancabamba and Ayavaca in Peru. It is now admitted to be the source of the *crown bark of Loxa.* Weddell considers as varieties of this species, though with some hesitation, as he has never seen them alive, the following: 1. *Candolli* (*C. macrocalyx* of Pavon and De Candolle); 2. *lucumæfolia* (*C. lucumæfolia* of Pavon and Lindley); 3. *lancifolia* (*C. lancifolia* of Mutis), hereafter referred to as a distinct species; and 4. *Pitayensis*, growing in New Granada.* The last mentioned variety has subsequently been raised by Weddell to the rank of a distinct species.

due attention to the circumstance referred to. (*Journ. de Pharm. et de Chim.*, Juillet, 1867, p. 22; also *Am. Journ. of Pharm.*, Sept. 1866, p. 421.)—*Note to the thirteenth edition.*

It appears from more recent reports (A.D. 1874) that the cultivation of this species of Cinchona is regarded more hopefully than it was some years since, when the preceding edition of this work was published. (*Note to the fourteenth edition.*)

* Botanists seem disposed to return to the old Linnæan designation of this species, *Cinchona officinalis*, of which three varieties are recognised, under the names of *Bonplandiana, Uritusinga*, and *Crespilla*, all yielding the crown barks. Of these the *Bonplandiana* seems to have been most successfully transplanted, as upwards of 750,000 are now growing in the plantations of British India. (*Broughton.*) The varieties of this species seem to flourish best at a greater elevation than the C. succirubra, growing at heights from 5500 or 6000 feet even to 8350 feet above the level of the sea. The effect of the moss in increasing the productiveness of this species in alkaloids has been highly satisfactory. (*Markham.*) Instead, however, of cinchonia being the prominent alkaloid of this species, as in the pale barks of Loxa, the quinia has been found most abundant in the Indian bark, and, though the former alkaloid is generally present, yet it is usually in small proportion. Indeed, Mr. Broughton states that the trees of the variety Bonplandiana yield a bark nearly equal to the fine Calisaya bark of Bolivia, and superior in some respects for manufacturing purposes to the richer red barks, as it yields its alkaloids more readily in a free state, in consequence of the smaller amount of resin and colouring matter contained in it.

The following results were obtained by Mr. Broughton in the chemical examination of the bark of this species. The dried bark of the trunk yielded altogether in alkaloids (hydrated) 3·6 per cent., of which 2·8 per cent. was quinia (or of alkaloid soluble in ether), and only 0·8 per cent. was of cinchonia and cinchonidia jointly; and 2·8 per cent. of crystallized sulphate of quinia was obtained. Another specimen was even more productive, yielding 3·0 per cent. of quinia. The bark of the same species, which had been renewed in six months under the mossing process, gave a total of alkaloids (hydrated) 6·8 per cent., of which 4·8 was of quinia, and 2·0 of cinchonia and cinchonidia jointly; and 4·1 per cent. of crystallized sulphate of quinia was obtained. (*Pharm. Journ. and Trans.*, Nov. 1867, p. 241.)—*Note to the thirteenth edition.*

3. *C. micrantha.* Ruiz and Pavon, *Fl. Peruv.* ii. 52, t. 194; Lindley, *Flor. Med.* 412; Carson, *Illust. of Med. Bot.* i. 52, pl. 44. This is a large tree, forty feet high, with oblong leaves, from four to twelve inches in length and from two to six in breadth, scarcely acute, smooth, shining on the upper surface, and scrobiculate at the axils of the veins beneath. The flowers are in terminal, loose, leafless panicles, and are smaller than those of any other species except C. lancifolia. (*Lindley.*) The tree grows, according to Ruiz and Pavon, in the mountains near Chicoplaya, Monzon, and Puebla de San Antonio, according to Pöppig, at Cuchero, and, according to Weddell, in the Peruvian province of Carabaya, and in Bolivia. Ruiz states that its bark is always mixed with that sent into the market from the provinces of Panatahuas, Huamilies, and Huanuco. The Edinburgh and Dublin Colleges ascribed to it the *cinchona cinerea*, the *gray* or *silver bark* of British commerce; and the U. S. Pharmacopœia recognises it as one of the sources of pale bark, as it undoubtedly is.*

There is another species, recently determined, and first officinally recognized in the U.S. Pharmacopœia of 1870, which, as the source of the genuine red bark, is scarcely less important than either of the preceding, and has, within a few years, acquired additional value from the great success with which it has been transplanted, and propagated in the Highlands of Hindostan. We refer to the species denominated, after Pavon, Cinchona succirubra.

4. *C. succirubra.* Pavon, *MS.;* Howard, *Pharm. Journ. and Trans.*, Octob. 1856, p. 209, with a figure.—*C. ovata*, var. *erythroderma.* Weddell, *Hist. Nat. des Quinquinas*, p. 60. This species has been satisfactorily ascertained to produce the proper officinal red bark, the origin of which remained so long unknown, or at least undetermined. The name of C. succirubra originated with Pavon, having been applied by him, in an unpublished manuscript, to an undescribed species yielding the bark called *cinchona colorada de Huaranda*, which has been shown to be identical with officinal red bark; while a specimen of the plant itself, in the collection of Ruiz and Pavon at Kew, upon examination by Mr. J. E. Howard, of London, proved to correspond exactly with a specimen of the red-bark tree which that gentleman had received from South America. The same plant was described by Weddell, in his *Natural History of the Cinchonas*, as a variety of C. ovata, under the designation of *Cinchona ovata*, var. *erythroderma*, and was conjectured by him to be the source of red bark, though he did not at the time feel justified in giving a decided opinion. This point, however, having been subsequently determined, and the plant elevated to the dignity of a new species, Mr. Howard proposed at first to name it *Cinchona erythroderma*, not only from courtesy to Dr. Weddell, but also from the appropriateness of the name itself, implying the redness of the bark; but Pavon's name of *succirubra* was afterwards preferred on the ground of priority, being itself also (red-juiced) expressive of a quality of the tree. This species is, when full-grown, of great magnitude; but almost all the older trees have been destroyed, and few now remain with a stem so much as a foot in diameter. The branches have a silvery epidermis, corresponding with that of the red bark in quills as often seen in the market. The leaves are ovate, varying greatly in size, often as much as nine inches by six, narrow-

* The C. micrantha, which is the source of the Lima or Huanuco pale bark, is among the species which have been most successfully cultivated in India. The successful introduction of this species into Hindostan is ascribed to the sagacious and prompt measures of Mrs. Markham, who, having accompanied her husband Mr. Markham to Arequipa, during his absence in the forests, engaged an agent, furnishing him with necessary instructions, to collect and send to the coast the young plants of this species. The C. micrantha is cultivated along with C. succirubra, at an elevation less than 6000 feet, and attains a similar magnitude. It is a most singular fact that, though in its native country of Huanuco and Huamilies, the C. micrantha yields barks which contain cinchonia, almost to the exclusion of all other alkaloids, yet, when transplanted to India, it undergoes a great change in this respect, and, as there cultivated, has been found by Mr. Howard to yield a large proportion of quinidia. The effect of mossing the stem in this species is equal to that produced on the succirubra. Thus, the bark of a tree two and a half years old, with its stem unprotected, furnished only 1·86 of alkaloids altogether; while a bark of the same age, which had been covered with moss for a year, gave 7·52 per cent. of alkaloids, of which 5·82 were of the more valuable kinds. (Markham, *Journ. de Pharm. et de Chim.*, Juillet, 1867, p. 21.) But it appears that this change in the micrantha bark does not always take place; for Mr. Broughton gives, as the result of an analysis of this bark, taken from a tree four and a half years old, 7·1 per cent. as the total yield of alkaloids, of which cinchonia constituted 6·8 per cent., and quinia only 0·3. (*Pharm. J and Trans.*, Nov. 1867, p. 242.)—*Note to the thirteenth edition.*

ing towards the base, somewhat membranaceous, pubescent beneath, and green on both sides. The tree inhabits a region in the present republic of Ecuador, on the western slope of Chimborazo, the sea-port of which is the town of Guayaquil.*

Besides the foregoing species, several others deserve a brief notice, either as contributing to furnish the bark of commerce, or on account of the attention they have received from pharmacologists.

5. *C. scrobiculata.* Humb. and Bonpl. *Plant. Equin.* i. p. 165, t. 47; Weddell, *Hist. Nat. des Quinquinas*, p. 42, t. 7. This species was united by Lindley with C. micrantha; but Weddell, who has had ample opportunities of forming a just conclusion, considers it as one of the best characterized species of the genus. According to this author, the scrobiculi at the axils of the veins on the under surface of the leaf, which are one of the most prominent of its peculiarities, are not usually found in C. micrantha, as stated in its description; but what have been taken for them, in the latter species, are simply small bundles of hairs. The tree was seen by Humboldt and Bonpland, forming large forests near the city of Jaen de Bracomoros; and Weddell states that it is met with also in the Peruvian provinces of Cuzco and Carabaya. Large quantities of the bark were formerly collected at Jaen, and sent to the coast to be shipped for Lima. At present the traders in this bark are said by Weddell to

* This species is that which has, up to the present time, been most successfully cultivated in British India. The following account of it, as cultivated in the East, is taken from a letter from Mr. Markham, who has done so much for the introduction of the Cinchonas, dated at Ootacamund, January 16, 1866. The finest trees, under favourable circumstances, attain in two years an average height of 6 feet, and diameter of stem of 6 inches, and in the third year a height of 15 feet and a diameter of 15 inches. This species grows most perfectly at a height of from 4000 to 5000 feet above the sea. At a lower elevation the bark is much thinner, and less rich in alkaloids. This species is peculiarly disposed to send up shoots from its stump when cut down; and, if these are treated with moss to the stem, they will, if cut at the end of three years, yield a considerable product of alkaloids, so that a periodical harvest may be obtained from them; and though this is less successful than the method of removing strips of the bark, as practised in the government gardens, yet, as it requires less care, it may probably be advantageously practised among native cultivators, should these engage largely in the work. Mr. Markham has noticed two varieties of the C. succirubra, growing in India, one with rose-coloured flowers and beautifully green leaves, the other with flowers nearly white, and pale leaves; and the difference in this and other analogous cases may be connected with the proportion or variety of the alkaloid.

As to the yield of the C. succirubra in alkaloids, Mr. Markham states that, while the bark of a tree two years and a half old gives 2·43 per cent. when not treated with moss, it will yield 5·20 per cent. if kept covered with moss for one year; and that the alkaloid product, under the treatment with moss, has gradually increased from 2·80 per cent. after continuance of the treatment for only 6 months, to 11·34 per cent. when it had extended to 18 months. The yield of the reserved bark, after partial decortication, obeys a similar rule, being 2·72 per cent. after one year, and 5·85 at the end of 18 months. Much the largest proportion of alkaloid product of this species consists of quinia, but it also yields a considerable proportion of cinchonia, and is less easily treated for extraction of the quinia than Calisaya bark, in consequence of the large proportion of red colouring matter contained in it. (*Journ. de Pharm. et de Chim.*, Juillet, 1867, p. 17.)

In the month of April, 1867, it was estimated that the number of this species growing in British India was about 800,000; the whole number of all the species being nearly 2,500,000. (*Ibid.*, Mars, 1868, p. 208.)

From an official report by Mr. J. Broughton, Quinologist to the Indian government, made April 1, 1867, the following table is extracted, containing the product in alkaloids of four different specimens of C. succirubra bark, obtained from the government plantations.

VARIETIES.	I.	II.	III.	IV.
Total alkaloids (hydrated),	4·85	7·00	6·40	6·4
Soluble in ether (quinia),	3·25	4·25	4·75	1·7
Cinchonia and cinchonidia,	1·60	2·75	1·65	4·7
Sulphate of quinia crystallized,	3·00	4·00	4·65	1·7

It appears that these barks give a considerably larger product than the average of the genuine red barks of S. America, though, so far as stated, not favoured by the mossing process. Another interesting point is the difference of the yield of the different specimens, not only in relation to the whole alkaloid product, but also to the alkaloids severally; the quinia largely predominating except in the 4th sample, in which it is greatly exceeded by the two others jointly. The result is probably connected with natural diversities in the tree, such, for example, as that noticed by Markham, referred to above in this note; and it will no doubt be important to study these varieties in regard to practical results. The root bark of this species was also examined, and found to contain the alkaloids in proportion, not very different from the bark of the stem. (*Pharm. Journ. and Trans.*, Nov. 1867, p. 239.)—*Note to the thirteenth edition.*

be chiefly at Cuzco. The bark of the younger branches has been ranked with the pale or gray barks; that of the larger branches has been sometimes employed to adulterate the Calisaya.

6. *C. lancifolia.* Mutis, *Period. de Santa Fé*, p. 465; Lindley, *Flor. Med.* 415. This is one of the species discovered by Mutis in New Granada, and by the disciples of that botanist was considered as embracing many trees which had received distinct specific designations. By the London College it was long recognised as the source of one of the officinal barks, under the impression, probably, that it was identical with *C. Condaminea*, which was known to yield one of the most highly valued varieties. It is, however, a native of New Granada; and, as none of the barks recognised by the Pharmacopœias come from Carthagena, its product, which must be shipped from that port, cannot be considered as ranking among them. It yields the *orange bark* of Mutis, or *fibrous Carthagena bark* of present pharmacologists. This bark, at one time much neglected, has within a few years come into extensive use, having been found to yield the alkaloids in very large proportion.

7. *C. cordifolia.* Mutis, in *Humb. Magaz. Berlin*, 1807, p. 117; Lindley, *Flor. Med.* 839; Carson, *Illust. of Med. Bot.* i. 51, pl. 43. This is a spreading tree, fifteen or twenty feet high, with a single, erect, round stem, covered with a smooth bark of a brownish-gray colour. It was first discovered by Mutis in the mountains about Santa Fé de Bogota, in New Granada, and grows at elevations varying from 5800 to 9500 feet. It was formerly considered by the British Colleges as the source of their *yellow bark;* but has been ascertained not to produce the officinal bark, which never comes from the region where it is known to grow. Guibourt found that the *quina amarilla*, or *yellow bark of Santa Fé*, which is probably produced by C. cordifolia, is identical with *hard Carthagena bark.* Weddell states that the tree grows also in Peru, and yields the white and ash-coloured barks of Loxa.

8. *C. Boliviana.* Weddell, *Hist. Nat. des Quinquinas*, p. 50, t. 9. This tree was discovered and named by Weddell, who found it growing in Bolivia and Peru, extending somewhat further northward than C. Calisaya, but not so far towards the south. In the northern parts of Bolivia the two species frequently grow together. The bark of C. Boliviana is generally mixed in commerce with the proper Calisaya, from which it cannot always be easily distinguished. This is less to be regretted, as, according to Weddell, the properties of the two barks are not essentially different. It is said that this botanist now considers his C. Boliviana as scarcely more than a variety of C. Calisaya; and Mr. Markham, who joins in this opinion, proposes to designate the plant *Cinchona Calisaya*, var. *Morada.* (*Pharm. Journ.*, Sept. 1863, p. 108.) The close resemblance of the products of the two trees is a strong evidence of their specific identity.

9. *C. ovata.* Ruiz and Pavon, *Fl. Peruv.;* Weddell, *Hist. Nat. des Quinquinas*, p. 42, t. xi. and xii. This species grows in close groves, in warm places at the foot of the Andes, near Pozuzo and Panao, about ten leagues from Huanuco. Lindley considers it quite distinct from *C. pubescens* of Vahl, and *C. cordifolia* of Mutis, with both of which it has been confounded. Ruiz calls its bark *cascarillo pallido* or pale bark, and states that it was not to be found in commerce. Von Bergen, however, upon comparing a specimen of the *cascarillo pallido* in the collection of Ruiz with the Jaen bark, found them identical. From Weddell's statements it would seem that this species is widely diffused in Peru and Bolivia, and varies extremely in the character of its bark in different situations. In the parts visited by him, the finer qualities pass for Calisaya bark; and in the Peruvian province of Carabaya, bordering on Bolivia, it is habitually employed to sophisticate that bark. He believes also that much of the quilled bark of Loxa and Huanuco must be referred to this species. The *C. ovata*, var. *erythroderma*, is now known to be the source of the officinal red bark, and has been raised to the position of a species, under the name of C. succirubra. (See p. 282.)

10. *C. Pitayensis.* Weddell. For figures of the leaves, flowers, and fruit of this species, the reader is referred to a paper by Mr. J. E. Howard, in the *Pharm. Journ. and Trans.* (Aug. 1864, p. 48). They were drawn from specimens collected by Mr. Jervise. From specimens of the bark gathered by Mr. Robert Cross in the

lofty mountain ridges near Popayan, where the temperature varies from 30° to 69° F., there can be no doubt that this tree is the source of the finest red-coloured Pitaya bark, which is among the most valuable now collected, having yielded as high a percentage as 8·6 of alkaloids. As described by Mr. Cross, the tree, though 60 or 70 feet high, is relatively very slender, having a diameter of the stem rarely exceeding 18 inches or 2 feet. The branches are also slender, and the leaves small and lanceolate, and always, before falling, of a deep-red or purple colour. The range of the tree is rather limited, being confined to a few square miles of the steep forest-covered slopes, northward of the volcano Purace, belonging to the central Cordillera. The bark of the root is more valuable than that of the trunk and branches; the former yielding 5 per cent. of quinia, the latter only 4 per cent. Its produce is already becoming scarce; but, as the tree is easily cultivated, and grows very rapidly, there is reason to believe that it may hereafter become more abundant. (See *Am. Journ. of Pharm.*, Nov. 1865, p. 473.)

In addition to the species above mentioned, the following, for a description of which we refer to Lindley's Flora Medica, yield barks possessing febrifuge properties.—11. *C. nitida* of the Flora Peruviana, incorrectly confounded, according to Lindley, with C. lanceolata by De Candolle, and C. Condaminea by Lambert, grows in groves, in cold situations upon the Andes, in the Peruvian provinces of Huanuco, Tarma, Huamilies, and Xuaxa, and is probably the source of the finest variety of commercial *Lima bark.*—12. *C. lucumæfolia* of Pavon, confounded by Lambert with C. Condaminea, grows near Loxa, and probably contributes to the Loxa or pale barks.—13. *C. lanceolata* of the Flora Peruviana is found at Cuchero, and various other places fifteen or twenty leagues distant from Huanuco, where it forms groves in lofty cold situations upon the Andes. Its bark is said by Ruiz and Pavon to be called *yellow bark*, from the colour of its inner surface, and to resemble Calisaya bark in flavour.—14. *C. ovalifolia* of Humboldt and Bonpland, the *C. Humboldtiana* of Römer and Shultes, and of De Candolle, is a shrub from six to nine feet high, inhabiting the province of Cuença, where it forms considerable forests. It probably contributes to the Loxa barks, although its product is said to be of inferior quality.—15. *C. pubescens* of Vahl, considered by Lindley as identical with *C. purpurea* of the Fl. Peruv., is a tree of considerable magnitude, distinguished by the violet tint of its large leaves, and the purple colour of its flowers. It occurs in groves on the lower mountain ridges in the provinces of Loxa, Jaen, Pantahuas, &c., was seen by Pöppig at Cuchuo, and is stated to grow also in New Granada. The bark is inferior, and is said to be employed for adulterating the better kinds. A specimen taken to Europe by Pöppig was found by Reichel to be identical with the Huamilies bark. By Weddell it is stated to be the bark known in French commerce as *Cusco bark*, and closely to resemble that of C. cordifolia.—16. *C. hirsuta* of the Fl. Peruv. grows on wooded mountains in the province of Panatahuas near Huanuco, and is said to yield a good bark, called formerly *quinia delgadilla* or *delgada*, now scarcely collected.—17. *C. glandulifera* of the Fl. Peruv. is a shrub of about twelve feet, flourishing on the mountains N. W. of Huanuco, and yielding an excellent bark, unknown in commerce, called by the inhabitants *cascarillo negrillo* from its blackish epidermis. In its flowering season, it perfumes the forest by the scent of its blossoms.—18. *C. Mutisii* of Lambert (*C. glandulifera* of Lindley) is considered among the best characterized species. It grows in Loxa, but its bark is unknown.

Besides the above species, Lindley enumerates, 19. *C. rotundifolia* of Ruiz and Pavon, growing in the province of Loxa; 20. *C. villosa* of Pavon (C. Humboldtiana of Lambert), growing at Jaen of Loxa; and 21. *C. caduciflora* of Bonpland, growing near Jaen de Bracomoros; not to mention the species joined by Weddell to his now admitted genus of Cascarilla. None of the species referred to in this paragraph are known to yield bark to commerce. To these must now be added, 22. *C. amygdalifolia* of Bolivia and Peru; 23. *C. australis* of Bolivia, the most southern of all the known species, growing as far south as the 19th degree of latitude; 24. *C. purpurascens;* 25. *C. Chomeliana;* 26. *C. asperifolia*, also of Bolivia; and 27. *C. Carabayensis* of Carabaya; all of which were discovered and described by Weddell; but from none of which is commercial bark procured. *C. dichotoma* of the Fl.

Peruv., *C. macrocalyx* of De Candolle, *C. crassifolia* of Pavon, in De Candolle's Prodromus, *C. pelalba* of the same authority, and *C. Muzonensis* of Goudot in De Candolle's Prodromus, are considered by Lindley as uncertain species.*

Perhaps too much importance has been attached to the study of particular species of Cinchona. The character of the product of any one species varies much according to the part of the plant decorticated, and the circumstances of its growth. Weddell has made some observations on this point, which, if confirmed, may lead to important practical results.†

Commercial History.

For more than a century after Peruvian bark came into use, it was procured almost exclusively from the neighbourhood of Loxa. In a memoir published A.D. 1738, La Condamine speaks of the bark of Rhiobambo, Cuença, Ayavaca, and Jaen de Bracomoros. Of these places, the first two, together with Loxa, lie within the ancient kingdom of Quito, at the southern extremity; the others are in the same vicinity, within the borders of Peru. The drug was shipped chiefly at Payta, whence it was carried to Spain, and thence spread over Europe. Beyond the limits above mentioned, the Cinchona was not supposed to exist, till, in the year 1753, a gentleman of Loxa discovered it, while on a journey to Santa Fé de Bogota, in numerous situations along his route, wherever, in fact, the elevation of the country was equal to that of Loxa, or about 6500 feet above the level of the sea. This discovery extended through Quito into New Granada, so far as two degrees and a half north of the equator. But no practical advantage was derived from it; and the information

* The addition of *C. Pahudiana*, of Howard, must now be made; as this species, so nearly valueless in its native country, and when first taken to India, where it was extensively planted, found so unproductive as greatly to disappoint the hopes that had been entertained, has, under the process of mossing the trunk, so far improved as to give hope that it may yet take rank among the valuable species. Mr. Howard has extracted from a specimen of the bark recently sent to him 1·60 per cent. of crystallized sulphates. (*Pharm. J. and Trans.*, Nov. 1867, p. 243.)—*Note to the thirteenth edition.*

Another addition to the number of species must now be admitted in the *C. caloptera* of Miquell, by whom the new species was described in 1868, having been discovered in Java, where it was introduced by mistake and cultivated as C. succirubra, from which it differs not only in the leaves, but in the character of the bark, which is entirely distinct from that of the red bark tree. (*Pharm. Journ.*, March, 1873, p. 723.) Still another species has been discovered by Mr. J. E. Howard, and named *C. Rosulenta*. It is a native of Ocana in New Granada. It is closely analogous both in appearance and chemical composition to C. succirubra; but the leaves are quite different, approaching those of C. ovata, but with more prominent and rigid nerves. The bark too has a more roseate hue than the genuine red bark. (*Am. J. of Pharm.*, Aug. 1872, p. 367.)—*Note to the fourteenth edition.*

† The fundamental idea is, that the chemical character of the bark is connected with peculiarities in its intimate structure, and that by knowing the latter we may ascertain, with an approach to certainty, the former also: and thus, as the virtues of the bark depend on its chemical constitution, we may have reliable criteria of its value. Now in the different barks there are three varieties of structure; the dead exterior layers being left out of the question. *First*, as in the *Calisaya bark*, which consists of the inner bark or liber, the whole substance is filled with short fusiform fibres, which, whether viewed in a longitudinal or transverse section, are seen, with the aid of the microscope, to be isolated by a cellular tissue, in the midst of which they are regularly disposed in parallel lines, lying end to end without absolute junction. It is known that this bark abounds in quinia, and owes its virtue to that constitutent.

In the *second variety*, such as the flat bark of *C. scrobiculata*, a cellular coat exists outside of the liber. In this, under the microscope, the inner layer is seen to consist of fibres more closely arranged, more numerous and much larger than in the preceding, and firmly attached at their extremities; and they suddenly diminish in number as we approach the outer surface, where the bark consists solely of cells.

The *third variety*, of which the bark of *C. pubescens* is an example, consists chiefly of cellular tissue, with a few irregular series of fibres in the inner half: and these fibres are three or four times as large as in the other varieties. In the two latter barks cinchonia is the predominant alkali; but it is not very abundant in either, and least so in the one last mentioned. The inference is, that quinia is most largely developed in those barks in which the fibres are short and intimately mixed with cells; while the cinchonia is more especially deposited in the tissue exclusively cellular. The fracture in the first variety is, from its structure, fibrous, but short-fibrous throughout; that of the second and third is smooth where cells exist exclusively, and with long fibres where fibres exist. A short, smooth fracture, therefore, as in the young barks, or a fracture partly smooth and partly long-fibrous, as in the older barks which have not thrown off their cellular layer, indicates a cinchona bark, and one comparatively feeble; while a fracture uniformly short-fibrous indicates a variety abounding in quinia and energetic; and, in proportion as a bark approaches this latter condition, will it prove to be efficacious. (*Note to the ninth edition.*)

lay buried in the archives of the vice-royalty, till subsequent events brought it to light. To Mutis belongs the credit of making known the existence of the Cinchona in New Granada. He first discovered it in the neighbourhood of Bogota, in 1772. A botanical expedition was afterwards organized by the Spanish government, with the view of exploring this part of their dominions, and the direction was given to Mutis. Its researches eventuated in the discovery of several species of Cinchona in New Granada; and a commerce in the bark soon commenced, which was carried on through the ports of Carthagena and Santa Martha.

To these sources another was added about the same time, A.D. 1776, by the discovery of the Cinchona in the centre of Peru, in the mountainous region about the city of Huanuco, which lies on the eastern declivity of the Andes, northeast of Lima, at least six degrees south of the province of Loxa. To explore this new locality, another botanical expedition was set on foot, at the head of which were Ruiz and Pavon, the distinguished authors of the Flora Peruviana. These botanists spent several years in that region, during which time they discovered numerous species. Lima became the entrepot for the barks collected around Huanuco; and hence probably originated the name of Lima bark, so often conferred, in common language, not only upon the varieties received through that city, but also upon the medicine generally.

Soon after the last-mentioned discovery, two additional localities of the Cinchona were found; one at the northern extremity of the continent near Santa Martha,* the other very far to the south, in the provinces of La Paz and Cochabamba, then within the vice-royalty of Buenos Ayres, now in the republic of Bolivia. These latter places became the source of an abundant supply of excellent bark, which received the name of Calisaya. It was sent partly to the ports on the Pacific, partly to Buenos Ayres.

The consequence of these discoveries was a vast increase in the supply of bark, which was now shipped from the ports of Guayaquil, Payta, Lima, Arica, Buenos Ayres, Carthagena, and Santa Martha. At the same time the average quality was probably deteriorated; for, though many of the new varieties were possessed of excellent properties, yet equal care in superintending the collection and assorting of the bark could scarcely be exercised in a field so much more extended. The varieties now poured into the market soon became so numerous as to burden the memory, if not to defy the discrimination of the druggist; and the best pharmacologists found themselves at a loss to discover any permanent peculiarities which might serve as the basis of a proper and useful classification. This perplexity has continued more or less to the present time; though the discovery of the alkaline principles has presented a ground of distinction before unknown. The restrictions upon the commerce of South America, by directing the trade into irregular channels, had also a tendency to deteriorate the character of the drug. Little attention was paid to a proper assortment of the several varieties; and not only were the best barks mixed with those of inferior species and less careful preparation, but the products of other trees, bearing no resemblance to the Cinchona, were sometimes added, having been artificially prepared so as to deceive a careless observer. The markets of this country were peculiarly ill-furnished. The supplies, being derived chiefly, by means of a contraband trade, from Carthagena and other ports on the Spanish Main, or indirectly through the Havana, were necessarily of an inferior character; and most of the good bark which reached us was imported by our druggists from London, whither it was sent from Cadiz. A great change, however, in this respect, took place, after the ports on the Pacific were opened to our commerce. The best kinds of bark were thus rendered directly accessible to us; and the trash which formerly glutted our markets is now in great measure excluded. Our ships trading to the Pacific run along the

* In relation to this locality of the Cinchonas, we are now informed that Dr. Ernst, President of a Scientific Society of Caracas, in an excursion from that place, discovered on the slopes of several mountains, groups of the *Cinchona Cordifolia*, var. *rotundifolia*, Weddell, *C. rotundifolia* of Pavon, at the height of 4500 feet above the sea. The bark of this tree is said to be the variety known in commerce as the *Ashy Crown bark*, one of the Loxa barks. The bark was found to contain 0·5 per cent. of quinia, and 0·67 of cinchonia. (*Am. Journ. of Pharm.*, Sept. 1870, p. 449.)—*Note to the fourteenth edition.*

American coast from Valparaiso to Guayaquil, stopping at the intermediate ports of Coquimbo, Copiapo, Arica, Callao, Truxillo, &c., from all which they probably receive supplies. Much good bark has of late also been imported from Carthagena, and other ports of the Caribbean Sea,* being brought down the Magdalena river from the mountainous regions of New Granada; and, since the completion of the railroad across the Isthmus, large quantities reach this country by way of Panama, to which place they are brought chiefly from the Pacific Ports of Buenaventura and Guayaquil. An additional source of supply has recently been opened through the Amazon; a considerable quantity of bark having been taken to the London market from the port of Para, in Brazil, brought down that river, probably from the Peruvian province of Huanuco. According to Mr. Howard, the bark thus obtained is of inferior quality, yielding but a small proportion of alkaloids. (*Pharm. Journ.*, Dec. 1863, p. 248.)†

The persons who collect the bark are called in South America *Cascarilleros.* Considerable experience and judgment are requisite to render an individual well qualified for this business. He must not only be able to distinguish the trees which produce good bark from those less esteemed, but must also know the proper season and age at which a branch should be decorticated, and the marks by which the efficiency or inefficiency of any particular product is indicated. The bark gatherers begin their work with the setting in of the dry season in May. Sometimes they first cut down the tree, and afterwards strip off the bark from the branches; in other instances they decorticate the tree while standing. The former plan is said to be the most economical; as, when the tree is cut down, the stump pushes up shoots which in the course of time become fit for decortication, while, if deprived of its bark, the whole plant perishes. The operator separates the bark by making a longitudinal incision with a sharp knife through its whole thickness, and then forcing it off from the branch with the back of the instrument. Other means are resorted to, when the trunk or larger limbs are decorticated. According to Pöppig, the bark is not separated until three or four days after the tree is felled. It must then be speedily dried, as otherwise it becomes deteriorated. For this purpose it is taken out of the woods into some open place, where it is exposed to the sun. In drying it rolls up, or becomes quilled; and the degree to which this effect takes place is proportionate directly to the thinness of the bark, and inversely to the age of the branch from which it was derived. In packing the bark for exportation, it often happens that several different kinds are introduced into the same case. The packages are, in commercial language, called *seroons.* As found in this market they are usually covered with a case of thick and stiff ox-hide, lined within by a very coarse cloth, apparently woven out of some kind of grass.

The Cinchona forests, being in very thinly inhabited districts, do not, for the most part, belong to individuals, but are open to the enterprise of all who choose to engage in the collection of the bark. The consequence is, that the operations are carried on without reference to the future condition of this important interest; and the most wasteful modes of proceeding are often adopted. Nevertheless, the great extent to which the Cinchona forests prevail, spreading, as they do, with some interruptions, over thirty degrees of latitude, and occupying regions which can never be applied to agricultural purposes, almost precludes the idea of their even remote extinction.

The bitterness of the Cinchona is not confined to its bark. The leaves and flowers also have this property, which in the former is associated with acidity, in the latter with a delicious aroma, which renders the air fragrant in neighbourhoods where the

* The commerce in bark of the Port of *Santa Martha*, especially its exportation to this country, has of late much increased. In 1870, according to official statements, the shipments were 1,846,643lbs, valued at £63,770. In 1871 this amount had increased to 3,415,149lbs, valued at £133,791, or about double. To this country the shipments have largely increased. The average annual quantity sent to New York during the five years from 1865 to 1869 inclusive, was less than 300 seroons. In 1870, it rose to more than 2000, and in 1871 to 8500 seroons. (*Pharm. Journ.*, June, 1873, p. 1040.)—*Note to the fourteenth edition.*

† An interesting history of the commerce in the Cinchona barks, by Dr. H. A. Weddell, will be found in the *American Journ. of Pharm.* (xxvi. 539, Nov. 1854), originally from his *Voyages dans le Nord de la Bolivie*, Paris, 1853.

trees abound. The wood is nearly tasteless; but the bark of the root has the same virtues as that of the trunk; and rich mines of underground treasure may await future explorers, in regions which have been stripped of their trees either by fire or the axe. It was a reasonable conclusion from the circumstance, which appears to have been sufficiently established by experiment in the East Indies, that the production of quinia is increased by covering the stems of the growing trees with moss, and thereby excluding the light, that this alkaloid would especially abound in the bark of the root, naturally protected from the light; but the fact has not yet been sufficiently determined by experiment to justify positive conclusion.*

It was at one time supposed that the leaves might have sufficient of the active principles of the bark to justify their use in medicine; but, though they have proved useful as a tonic, experiment has not shown them to be possessed of decided antiperiodic powers, and, on chemical examination, they have yielded but a small proportion of the characteristic alkaloids.

Classification.

To form a correct and lucid system of classification is the most difficult part of the subject of bark. An arrangement founded on the botanical basis is liable to the objection, that the product of the same species may vary according to the age of the bark and the situation of the tree; and, besides, is at present scarcely practicable; as, though our knowledge of the source of the several varieties has very much extended, it is still defective on some points.

The Spanish merchants adopted a classification, dependent partly on the place of growth or shipment, and partly on the inherent properties, or supposed relative value of the bark. So long as the sources of the drug were very confined, and the varieties few, this plan answered the purposes of trade; but at present it is quite inadequate; and, though some of the names originally conferred upon this principle are still retained, they are often uncertain or misapplied.

Perhaps, on the whole, the best arrangement for pharmaceutical and medicinal purposes is that founded upon difference of colour. It is true that dependence cannot be placed upon this property alone; as barks of a similar colour have been found to possess very different virtues; and, between the various colours considered characteristic, there is an insensible gradation, so that it is not always possible to decide where one ends and the other begins. Still it has been found that most of the valuable barks may be arranged, according to their colour, in three divisions, which, though mingling at their extremes, are very distinctly characterized, in certain specimens, by peculiarity not only in colour, but also in other sensible properties, and even in chemical constitution. The three divisions alluded to are the *pale*, the *yellow*, and the *red*. This arrangement has been adopted in the U. S. and Br. Pharmacopœias; and as, until recently, almost all the highly esteemed barks were brought from the Pacific coast of South America, and those from the northern coast were deemed inferior, it was only the former that were recognised under the three divisions referred to. Of late, however, some of the best barks, and most productive in alkaloids, have been brought from the ports on the Gulf of Mexico; so that the restriction of the officinal barks to the Pacific coast was abandoned at the late revision

* Dr. De Vrij, on examining a specimen of C. Pahudiana, grown in Java, obtained from the bark of the stem 1·274 per cent. of alkaloids (cinchonidine and cinchonicine, without any quinia), and afterwards from the bark of the root, 2·818 per cent. of alkaloids, of which 1·849 was quinia. Another specimen, only two years old, yielded to him from the bark of the stem 0·09 per cent. of alkaloid, without a trace of quinia; while from the root, treated so as to separate all the woody fibres, he obtained 1·941 per cent. of alkaloids, of which more than three-fourths was quinia. Four other species yielded, for the most part, analogous results. C. Calisaya of Java gave 3·676 per cent. of alkaloids from bark of the stem, and 4·430 from that of the root; the same species from Hindostan 1·89 to 3·10; C. lancifolia of Java 4·13 to 2·94; C. succirubra, No. 1, from Ootacamund (E. India) 2·10 to 2·00; C. succirubra from the same place 2·65 to 7·514; and C. micrantha from Ootacamund 2·791 to 4·166. The result of all his experiments justified, he thought, an appeal to his government to devote a small portion of ground to the cultivation of the C. Pahudiana, with the view of obtaining quinia from the roots when two years old; as he believed that the alkaloids might then be profitably obtained; but his application was not favourably received; and the correctness of his inference remains still undetermined. (*Journ. de Pharm.*, Janv. 1869, pp. 17–23.) —*Note to the fourteenth edition.*

of the U. S. Pharmacopœia; and the much better rule was adopted of recognising all the Cinchona barks as officinal, which might contain two per cent. of their proper alkaloids. Nevertheless the former officinal varieties have been retained. In describing, therefore, the different kinds of barks, we shall treat first, under the officinal titles of *pale*, *yellow*, and *red*, of those originally brought only from the ports of the Pacific; while those coming to us from the northern ports of New Granada and Venezuela will be subsequently considered under the heading of *Carthagena barks*, by which name they have been generally known in commerce. The commercial name will be given whenever a knowledge of it can be useful. It is proper to state that the different barks are often mingled in the same package, and that, in deciding upon the character of a seroon, the druggist is guided rather by the predominance than the exclusive existence of certain distinctive properties.

1. Pale Bark.

The epithet *pale*, applied to the barks of this division, is derived from the colour of the powder. The French call them *quinquinas gris*, or gray barks, from the colour of the epidermis. They come into the market in cylindrical pieces, of variable length from a few inches to a foot and a half, sometimes singly, sometimes doubly quilled, from two lines to an inch in diameter, and from half a line to two or three lines in thickness. The kinds which were formerly deemed the finest are about the size of a goosequill; but experience has shown that the young barks are not the most efficient. Their exterior surface is usually more or less rough, marked with transverse and sometimes with longitudinal fissures, and of a grayish colour, owing to adhering lichens. The shade is different in different samples. Sometimes it is a light gray, approaching to white, sometimes dull and brown, sometimes a grayish fawn, and frequently diversified by the intermixture of the proper colour of the epidermis with that of the patches of lichens. The interior surface, in the finer kinds, is smooth; in the coarser, occasionally rough and somewhat ligneous. Its colour is a brownish orange, sometimes inclining to red, sometimes to yellow, and, in some inferior specimens, of a dusky hue. The fracture is usually smooth, with some short filaments on the internal part only. In the coarser barks it is more fibrous. The colour of the powder is a pale fawn, which is of a darker hue in the inferior kinds. The taste is moderately bitter and somewhat astringent, without being disagreeable or nauseous. Authors speak also of an acidulous and aromatic flavour. The better kinds have a feeble odour, which is distinct and agreeably aromatic in powder and decoction. The pale barks are chemically characterized by containing *a much larger proportion of cinchonia and quinidia or cinchonidia than of quinia;* and their infusion does not yield a precipitate with solution of sulphate of sodium. Their appearance generally indicates that they were derived from the smaller branches. They are collected in the provinces about Loxa, or in the country which surrounds the city of Huanuco, northeast of Lima, and are probably derived chiefly from Cinchona Condaminea, C. nitida, and C. micrantha.

There are several commercial varieties of pale bark, obtained from different sources, and differing more or less in properties. The most highly esteemed of these is the *Loxa bark*, the finest specimens of which are sometimes called *crown bark of Loxa*, from the impression that they have the same origin and character with the bark, formerly selected with great care for the use of the King of Spain and the royal family. The pale bark collected about Huanuco is named either *Lima bark*, because taken to that city for commercial distribution, or *Huanuco bark*, from its place of collection. The former name has been more common in this country, where, indeed, this commercial variety has not unfrequently been confounded with the Loxa bark. Other pale barks are the *Jaen* and *Huamilies barks*, which are scarcely known as distinct varieties in the United States.*

* The following description of the several varieties of *pale bark* has been derived mainly from the works of Von Bergen, Guibourt, and Pereira, probably the highest European authorities on this subject; the first in Germany, the second in France, and the third in England. We have consulted also other pharmacological writers, and have derived advantage from the recent observations of Dr. Weddell and M. Delondre, and of Mr. J. E. Howard, of London, who has carefully examined the rich collection of Pavon deposited in the British Museum, and compared the specimens with

In this country, the pale bark has fallen into disuse. As it yields little *quinia*, it is not employed in the manufacture of the sulphate of that alkaloid, which has

the barks of commerce. Our remarks are put in the form of a note; as the information in relation to these varieties can be of little use to the student, though it may aid the druggist or manufacturer.

For a proper understanding of the subject, the reader should have some idea of the general structure of the bark. In the young barks there are four layers, viz.: 1. the *epidermis* or outer coat, often covered or incorporated with lichens; 2. the *periderm* or suberous coat, sometimes of a cork-like character; 3. the *cellular coat* or *green layer*, often containing resin; and 4. the *liber*, or inner coat, which is more or less fibrous.

1. *Loxa Bark. Crown Bark.—Quinquina de Loxa*, Fr.—*Loxa China, Kron-China*, Germ. The following is Von Bergen's description of this variety, contained in his splendid work upon bark, entitled *Versuch einer Monographie der China*, published in Hamburg in the year 1826. This bark is in cylindrical tubes, strongly rolled, from six to fifteen inches long, from two lines to an inch in diameter, and from half a line to two lines thick. The outer surface is more or less rough, seldom much wrinkled longitudinally, but marked with numerous transverse fissures, which usually run round the bark, and divide it into rings, the edges of which are somewhat elevated. In the smallest quills these fissures are not very obvious; in the larger, they are distant and apt to be interrupted. In the largest the surface is sometimes very rough and even warty. The proper colour of the epidermis is dark-gray, sometimes almost black, sometimes ash-coloured, and occasionally inclining to fawn; but frequently diversified by whitish lichens, which are in some instances so numerous as to cover almost the whole exterior of the bark, and to give it a light-gray appearance. The inner surface is smooth and uniform, and of the colour of cinnamon, with occasionally a reddish tinge. The fracture in the smaller quills is quite smooth, in the larger somewhat fibrous. The bark is of a rather firm consistence, and when cut transversely exhibits a resinous character. Its odour is compared by Guibourt to that perceived in damp woods, by Von Bergen to that of tan. Its taste is acidulous, astringent, and bitterish. The powder is of a dull cinnamon colour.

Guibourt, in the edition of his *Histoire des Drouges* published in 1850, describes four chief varieties of Loxa bark, under the names severally of 1. *Quinquina de Loxa gris compacte*, 2. *Quinquina de Loxa brun compacte*, 3. *Quinquina de Loxa rouge fibreux de roi d'Espagne*, and 4. *Quinquina de Loxa jaune fibreux*. Of these the first two appear to be embraced in the description above given from Von Bergen. The third is distinguished from the common Loxa bark by its eminently fibrous texture, and its slight astringency to the taste. It is scarcely to be found in commerce. The fourth was almost the only variety of Loxa bark known in the French market. It is in quills, very thin, and usually very much rolled, but slightly rough externally, with minute transverse fissures, generally covered with a thin whitish coat which gives it a light-gray colour, reddish and very smooth internally, and of a very finely fibrous fracture. Its taste is astringent and bitter, and its odour sufficiently marked. The pieces from the trunk are much larger, and may even have a thickness of two lines, with some resemblance to the Calisaya; but its outer surface, scarcely rough, and often longitudinally wrinkled, the fineness of its texture, and the smoothness of its inner surface readily distinguish it. Guibourt has no hesitation in referring it to *C. macrocalyx*.

English druggists distinguish Loxa bark into 1. the *picked crown bark*, which consists of the finest, thinnest, and longest quills; 2. the *silvery crown bark*, somewhat larger in size, and characterized by a whitish silvery appearance of the epidermis, derived from adhering lichens; and 3. the *leopard crown bark*, named from its speckled appearance, depending on whitish lichens alternating with the dark-brown epidermis. Dr. Pereira, in the last edition of his work on Materia Medica, the publication of which was completed after his death (A.D. 1853), distinguishes the following varieties of Loxa bark.—1. *Original or old Loxa Bark.* This is the original *crown bark*, and derived its name from the circumstance, that parcels of it were found on board a captured Spanish vessel returning from S. America, put up with peculiar care, and marked as for the royal family. It was in slender quills, thirteen inches long, tied up in bundles about three inches in diameter. Similar bundles were afterwards imported, and still occasionally come in the seroons of commercial crown bark. This bark is believed to have been derived from *C. Condaminea*, variety *vera* of Weddell; but, as the tree is nearly exhausted, little is obtained from it at present; and what is commonly called Loxa, or crown bark, is derived from other varieties of C. Condaminea, or from other species.—2. *White Crown Bark.* This is in small and large quills; the former having a silvery appearance from the presence of crustaceous lichens, and exhibiting numerous transverse cracks; the latter without these transverse fissures, but ragged externally from longitudinal rents in the epidermis, with a satin-like lustre of the surface thus exposed. It is the produce of *C. Condaminea*, var. *lucumæfolia* of Weddell, *C. lucumæfolia* of Pavon.—3. H.O. *Crown Bark.* This is the variety usually found in commerce, and has been named from the brand H.O. with a crown, adopted in the time of the Spanish government in S. America. It is in quills from six to fifteen inches long, from two lines to an inch in diameter, and from one-third of a line to two lines thick. Some of the quills are without lichens, thin, externally brown and shrivelled, with numerous longitudinal wrinkles, but with few transverse fissures. The internal surface is cinnamon-coloured, and the fracture pale-yellow. Others are larger, coarser, grayish externally from lichens, with many transverse fissures, some of which quite surround the quills. Others again are twisted, and have a patchy black and white appearance from the adhering lichens. The botanical origin of this bark is not certainly known; though Howard ascribes it to *C. glandulifera*. (*Pharm. Journ.*, xii. 128.) It comes from the port of Payta.*—4. *Ashy Crown Bark.* This is in quills about the size of the fingers, having an external surface mottled with white, gray, and black or soot-like patches of powdery and crustaceous lichens, sometimes also marked with rusty fungoid warts. The epidermis has longitudinal wrinkles and transverse fissures; the internal surface is of an orange or cinnamon

* This is probably the variety of white bark from which a hitherto undiscovered alkaloid has been obtained, to which the name *Paytine* has been given after the name of the port at which the bark is received This alkaloid will be described hereafter. (*Note to the fourteenth edition.*)

almost superseded the bark as a remedy in intermittents; and the red or yellow bark is preferred by physicans when it is necessary to resort to the medicine in substance.

colour. Mr. Howard found it identical with the bark, in Pavon's collection, ascribed to *C. rotundifolia* of that botanist, *C. cordifolia*, var. *rotundifolia* of Weddell. It is stated to be imported from Lima; and, according to Mr. Howard, large quantities are used for pharmaceutical purposes.* (*Ibid.*, 126.)—5. *Wiry Loxa Bark.* This is in very slender, wire-like quills, internally smoothish and brown, in some places slightly gray, without lichens, and almost destitute of transverse fissures. Many of the quills are lined within with a thin shaving of pale-yellow wood. The fracture is short and resinous. The taste is very astringent and but slightly bitter, and, as the bark is almost destitute of alkaloids, it is very nearly worthless. It is brought from Payta; but its botanical source is unknown.

The earlier analyses gave as constituents of the Loxa barks cinchonia and quinia, generally with a predominance of the former alkaloid. Since the discovery of *quinidia* and *cinchonidia*, these also have been found, sometimes in considerable proportion. The different varieties vary much in their yield of alkaloids; the larger barks, in all the varieties, affording more than the smaller. An average of several results, stated by Geiger, gives about 0·48 per cent. of cinchonia, and 0·06 of quinia. In the thickest pieces, Thiel found 1·0 per cent. of cinchonia, and 0·03 of quinia. According to Soubeiran, one pound of Loxa bark yields from a drachm and a half to two drachms of sulphate of cinchonia. From some fine old Loxa bark not now in the market, Mr. Howard obtained 0·714 per cent. of quinia, 0·514 of quinidia (or cinchonidia), and 0·04 of cinchonia. From the *H.O. crown bark*, which at that time was the variety usually found in commerce, he got from small quills 0·57 per cent. of quinidia and 0·6 of cinchonia, and from larger 1·05 of the former and 0·8 of the latter, and no quinia from either. (Pereira, *Mat. Med.*, 3d ed., p. 1639.) From the *ashy crown bark* the same chemist got 0·418 per cent. of quinia and quinidia jointly, and 0·914 of cinchonia. (*Pharm. Journ.* xii. 126.) From these results it would appear either that the older Loxa barks contained much more quinia than the modern, or that what was supposed to be quinia was really the then unknown alkaloid quinidia or cinchonidia. The strong reaction of a solution of gelatin with the infusion of Loxa bark indicates the presence of much tannic acid.

2. *Lima* or *Huanuco Bark. Cinchona Cinerea, Gray Bark, Silver Bark*, Ed.—*Quinquina de Lima*, Fr.—*China Huanuco, Graue China*, Germ. Lima or Huanuco bark was introduced into notice about the year 1779, after the discovery of Cinchona trees in the central regions of Peru; but Pöppig says that the trade in it began in 1785. The first name originated from the circumstance that the bark entered into commerce through the city of Lima; the second was derived from the name of the city (Huanuco or Guanuco), in the more immediate neighbourhood of which the trees were found. There would seem to be two varieties of this bark, which come either in separate packages, or mixed together in the same. They are distinguished in England as *fine* and *coarse* gray barks, and have a different botanical origin; the former having been ascertained by Mr. Howard to belong to *C. nitida*, and the latter being ascribed to *C. micrantha*, probably with justice.

Fine Gray Bark.—Quinquina Rouge de Lima. Guibourt. The dimensions of this variety do not materially differ from those of the preceding, although in the largest pieces the diameter is somewhat greater. Many of the smaller quills have a more or less spiral form. At the edge of most of the complete quills, a sharp oblique cut with a knife is observable. The epidermis is usually adherent. The exterior surface is marked with longitudinal wrinkles or furrows, which in the thick pieces often penetrate quite through the outer coating of the bark. Transverse fissures are also generally observable; but they never run wholly round the quill, often not more than a quarter or half round, and do not exhibit elevated borders. In some pieces the epidermis is rubbed off, either wholly or in spots; and in a few the entire thickness of the external layers is here and there removed, exhibiting the proper bark in patches. The colour externally is very light-gray, almost milk-white, with occasionally bluish-gray and darkish spots intermingled. Where the outer crust which imparts this whitish colour is wanting, the surface is grayish-fawn or reddish-gray, and in the thicker pieces of a dark cinnamon colour. The inner surface, though in the smaller quills sometimes tolerably uniform, is generally more or less uneven, fibrous, or splintery, especially in the larger pieces, in which may often be observed adhering yellowish-white splinters of wood. The colour is usually a rusty brown inclining somewhat to red, with occasionally a purplish tinge. The transverse fracture is smooth exteriorly, fibrous or splintery interiorly. The longitudinal fracture is generally somewhat uneven, without being splintery, and exhibits here and there minute shining spots. The inner layers of the bark are usually soft and friable. The colour of the powder is a full cinnamon-brown. The odour of the bark is like that of clay, and in this respect different from that of all other varieties. The taste is at first acidulous, astringent, and slightly aromatic, and ultimately bitter and adhesive.

Coarse or Inferior Gray Bark. The characters of this bark as a distinct variety were first given by Guibourt, who calls it *quinquina de Lima gris brun*. The following is his description. "It is in the form of long tubes, well-rolled, from the size of a quill to that of the little finger, offering very often longitudinal wrinkles, formed by desiccation. The exterior surface is, moreover, moderately rugose, often nearly destitute of transverse fissures, having a general deep-gray tint, but with black or white spots, and bearing here and there the same lichens as the Loxa barks. The inner bark is of a deep-brownish yellow, and formed as it were of agglutinated fibres." (*Hist. des Drogues*, 4e ed., iii. 108.) Mr. Howard says of this bark that its predominant feature is its general *woody texture*, a feature very observable on reducing it to powder, while the only hard portion of the former variety is a resinous circle existing between the inner and outer coats. He further states, as distinctions between the two varieties, that the one now described is thinner than the former; that its prevailing superficial colour, independently of the white lichenous covering, is *glaucous green*, and the colour of its substance *rusty yellow*, while the *fine gray*, as regards the inner

* This is the tree, of which considerable numbers have recently been found in the near vicinity of Caracas.

There is no doubt, however, that *cinchonia* possesses febrifuge properties little inferior to those of *quinia;* and the same is probably the case with *quinidia* and *cinchonidia;*

surface, varies superficially from a maroon colour to rust, and as regards the outer is brown, the substance of the bark being red; that a decoction of the former is pale, and gives a small flocculent deposit on cooling, while one of the latter is brown, and lets fall a copious sediment. (*Pharm. Journ.*, xii. pp. 15 and 16.)

The Edinburgh College referred the Lima bark, which it denominated *cinchona cinerea* or *gray bark*, to *C. micrantha*. There is at present little room to doubt, from the observations of Guibourt, Pereira, and Howard, that it is only the *coarse or inferior variety* that belongs to that species; while the *fine gray bark* must be ascribed to *C. nitida*, which also grows in the neighbourhood of Huanuco.

The Lima or Huanuco barks contain a considerable proportion of the alkaloids, though cinchonia predominates over quinia, and the latter is said to exist in a form in which it is difficultly crystallized, at least in the fine variety. Howard gives, as the result of his analysis of the *fine gray bark* (C. nitida), 1·4 per cent. of cinchonia, 0·571 of quinia, and 0·142 of quinidia (or cinchonidia), amounting altogether to 2·113 per cent. (*Pharm. Journ.*, xii. 12.) It also contains much tannic acid. (*Ibid.*, p. 161.) In the *inferior kind* (*C. micrantha*) he found 1·25 of cinchonia, 0·243 of quinia, 0·28 of quinidia (or cinchonidia), together 1·773 per cent. (*Ibid.*, p. 14.) Geiger gives as the average of several results, in relation to Lima or Huanuco bark, 1·72 per cent. of cinchonia and 0·29 of quinia. Von Santen got from the best specimens, as the maximum, 2·73 per cent. of cinchonia, and no quinia. Delondre obtained from the different varieties from 0·2 to 0·6 per cent. of sulphate of quinia, and from 0·8 to 1·2 of sulphate of cinchonia. (*Quinologie*, pp. 27, 28.) It would, therefore, appear that this variety of bark must become valuable, if cinchonia should come into general use.

3. *Jaen Bark. Ash Bark.— China Jaen, Blasse Ten-China*, Germ.— *Quinquina de Loxa cendré* of Guibourt. This variety probably derives its name from the province of Jaen de Bracomoros, near Loxa, where large quantities of bark have been collected. The Jaen bark is always in quills, which do not differ much in size from those of the Loxa bark, but are distinguishable by being frequently curved longitudinally, or bent in different directions, and somewhat spiral. The outer coat is often partially or entirely rubbed off, leaving the surface smooth and soft to the touch. When the epidermis is perfect, it exhibits small, irregular, transverse fissures, with sometimes faint longitudinal fissures and wavy wrinkles, and here and there a few warts, but no deep furrows. The colour varies from light or ash-gray to light yellow, diversified with blackish and brownish spots. When the outer coat is rubbed off, it inclines still more to yellow. Considered in mass, the bark always appears somewhat yellowish or straw-coloured. The exterior layers are soft and rather spongy, and may be readily scraped by the nail. The inner surface is exceedingly diversified, sometimes smooth, sometimes uneven and splintery. It is usually of a dull-cinnamon colour. The bark is very brittle, and the fracture smooth in the smaller quills, more or less uneven and sometimes splintery in the larger, and in neither having a resinous appearance. The odour is sweetish, and is compared to that of tan. The taste is acidulous, slightly astringent, and bitter, without being disagreeable. The colour of the powder is cinnamon-brown. The bark is very deficient in alkaloids. Some experimenters have found none, or only traces, while the highest product obtained was 80 grains of quinia and 13 grains of cinchonia from a pound. M. Munzini, of Paris, extracted from it an alkaline principle which he believed to be peculiar, and named *cinchovatin;* but others believe that it is identical with the *aricina* of Pelletier; and Mr. Howard can discover no difference between it and quinidia. (*Pharm. Journ.*, xii. 127.) Mr. Howard does not coincide in the general opinion of the great poverty of the *ash bark* in alkaloids. He found in a mean-looking specimen 0·86 per cent. of cinchonia, and 0·61 of quinidia (or cinchonidia). (*Ibid.*, p. 127.) Delondre obtained, on the large scale, 0·4 of sulphate of cinchonia and 1·0 of sulphate of quinia. (*Quinologie*, p. 29.) Von Bergen believes this bark to be the product of C. ovata; and Mr. Howard confirms this reference.

Von Bergen describes a variety of pale bark, under the name of *dark Jaen bark* (*dunkele Ten-China*), or *pseudo Loxa*, which resembles the Loxa, but may be distinguished by the oblique or bent shape of the quills, and the uneven, fibrous, or splintery appearance of the inner surface. It seldom comes in large pieces. Pereira considers it identical with the *ashy crown bark* already described. (See *page* 291.)

4. *Huamilies Bark.— China Huamilies*, Germ. This bark is little known as a distinct variety. Its commercial name was derived from the province of Huamilies, in the interior of Peru, northward of Huanuco, and a part of the region explored by the botanical expedition under Ruiz and Pavon. It came into notice in Germany about the beginning of the present century. It is in quills and flat pieces. The quills are from three lines to an inch and a half in diameter, from five to sixteen inches long, and from half a line to three lines thick. The flat pieces, which are usually only fragments of the largest quills, are from one to two inches broad, and six to twelve inches long. In general all the layers of the bark are present, but sometimes the outer coat, and even the whole of that part usually called the epidermis in our descriptions of bark (including those outer layers which in the tree are destitute of vitality, having been thrown outward by the annually renewed layers beneath them), are wanting in spots, though very seldom entirely absent. The epidermis is comparatively thin, very brittle, soft, and spongy. The outer surface, in the small and middling quills, is sometimes nearly smooth, but usually marked with wavy longitudinal wrinkles, and beset here and there with warts. These warts are abundant upon the thick pieces, which they sometimes almost entirely cover. Transverse fissures are seldom found, and only in the thick pieces. The colour of the epidermis is usually grayish-fawn, here and there passing into a rusty brown; but in the thicker pieces, in which the warts are abundant, it is between a liver and chestnut colour, often mixed with a tinge of purple. When the epidermis is wanting, the colour is often a full ochre-yellow. The inner surface is sometimes uniform and almost smooth,

so that, should the source of quinia begin to fail, the pale bark may come into more extensive use for the preparation of the other alkaloids.

2. Yellow Bark.

The officinal term yellow bark is applicable only to the valuable variety of the drug called commercially *Calisaya*, a name which has been said, though erroneously, to be derived from a province in Bolivia, near the city of La Paz, where the bark is collected.* By the druggists *Calisaya bark* is arranged in two sub-varieties, the quilled and the flat, which sometimes come mixed together in the same seroon, sometimes separate. It is called by the French *quinquina jaune royal* (royal yellow bark), from its resemblance to a variety formerly collected for the Spanish king.

The *quilled Calisaya* (*Calisaya arrolada* of the Spanish Americans) is in pieces from three inches to two feet long, from a quarter of an inch to two or three inches in diameter, and of equally variable thickness. The epidermis is of a brownish colour, diversified or concealed by silvery-white, whitish, or yellowish lichens, is marked by longitudinal wrinkles and transverse fissures, and is often partially separated, and generally easily separable from the proper bark. In the larger kinds, it is thick, rough, deeply indented by the transverse fissures, which often surround the quills, and is composed of several layers, separated from each other by a reddish-brown membrane. The epidermis yields a dark-red powder, and is tasteless and inert. It is desirable, therefore, to get rid of it before the bark is powdered, as the medicine is thus procured of greater strength. The bark itself, without the epidermis, is from one to two lines in thickness, compact, of a short-fibrous texture, and when broken presents shining points, apparently the termination of small fibres running longitudinally, which, examined by the microscope, are found, when freed from a salmon-coloured powder that surrounds them, to be yellow and transparent. When the bark is powdered, they readily separate, in the form of spicula, which, like those of cowhage, insinuate themselves into the skin, and produce a disagreeable itching and irritation. The colour of the bark is brownish-yellow with a tinge of orange, the taste less astringent than that of the pale bark, but much more bitter; and the bitterness is somewhat peculiar. The external part of the proper bark is more bitter and astringent, and consequently stronger in medicinal power, than the internal. The odour is faint, but when the bark is boiled, resembles that of the pale varieties. The small quills closely resemble some of the pale barks, but may be distinguished by their very bitter taste.

The *flat Calisaya* (*Calisaya plancha* of the Spaniards), which is derived from the large branches and trunk, is in pieces of various lengths, either quite flat, or but slightly curved, and generally destitute of the epidermis, which has been obviously removed through its own want of adhesiveness to the proper bark, and not by a knife, as is the case with some inferior barks in other respects resembling the Calisaya. The inner surface is like that of the quilled pieces; the outer is irregular, marked

sometimes slightly fibrous, rarely splintery. The colour of this surface is rusty-brown, occasionally reddish and in the fibrous or splintery pieces of an ochre-yellow. The fracture in the smaller quills is rather even, in the larger presents short fibres, and is sometimes even splintery. The odour of the bark is feeble but agreeable, the taste somewhat aromatic, bitterish, and slightly astringent. The powder is of a full-cinnamon colour. The average product of cinchonia and quinia, as stated by Geiger, is 0·67 per cent. of the former, and 0·25 of the latter; so that the bark, though dissimilar in appearance to the other varieties of pale bark, agrees with them in containing more cinchonia than quinia. Von Santen obtained, as the maximum, 1·2 per cent. of cinchonia, and little or no quinia. Huamilies bark, on the authority of Reichel, has been referred to *C. pubescens* (*C. purpurea* of the *Flor. Peruv.*); but Dr. Pereira and Mr. Howard agree in believing it to be the product of *C. Condaminea*, variety *Chahuarguera* of De Candolle, considered by Weddell as identical with his *C. Condaminea*, variety *vera*. The bark here described is noticed by Guibourt, who names it *quinquina Huamilies ferrugineux*. The same author makes four other varieties of Huamilies bark; viz. the *gris terne, mince et rougeâtre blanc*, and *jaune de Cuença*. (*Note to the tenth edition.*)

* No such province exists in Bolivia. According to M. Laubert, the name is a corruption of *collisalla*, said to be derived from *colla*, a remedy, and *salla*, a rocky country. (*Journ. de Pharm.*, xxii. 614.) Weddell refers the origin of the name to the words *colli* and *saya*, which in the Quichua language signify *red* and *sort*, and have probably been applied from the redness which the outer denuded surface of the bark assumes in drying, or from the red colour which the leaves sometimes exhibit.

with confluent longitudinal furrows and ridges, and somewhat darker coloured than the inner, being of a brownish fawn, frequently diversified with darker stains. The bark is of uniform fracture throughout, generally thicker than the quilled, more fibrous in its texture, less compact, less bitter, and possessed of less medicinal power. Though weaker than the proper bark of the quills, it is usually, in equal weight, more valuable than that variety, because free from the useless epidermis.

The officinal yellow bark is characterized by its strongly bitter taste, with little astringency; by its fine brownish-yellow, somewhat orange colour, which is still brighter in the powder; and by *containing a large proportion of quinia with very little cinchonia.* The salts of quinia and lime are so abundant, that a strong infusion of it instantly affords a precipitate when crystals of sulphate of sodium are added. (Guibourt, *Hist. des Drogues*, 4ème ed., iii. 131.)*

* *Calisaya bark* is described by Von Bergen, under the name of *China Regia* or *König's China* We present a brief abstract of his description, omitting the form and dimensions, which are given in the text. The epidermis,* which in many of the small quills is partly wanting, in the flat pieces usually quite wanting, is very thick and brittle, constituting from a third to one-half of the bark, and, in some of the largest quills or partially quilled pieces, even two-thirds. In the latter case, it often consists of six or eight different layers. The quills are generally marked with longitudinal wrinkles and furrows, and always with transverse fissures. These fissures, which often form complete circles round the quills, have usually an elevated border, and sink so deeply in many of the larger pieces, that they are observable upon the proper bark. In the smaller pieces they are often faint, but usually crowded. The colour of the epidermis varies from whitish-gray to bluish-gray; but it is very much diversified by lichens, so as to present yellowish-white, ash-gray, and blackish spots. When the outer layer of the epidermis is wanting, as is not unfrequently the case to a greater or less extent, the colour is somewhat sooty-brown, or almost liver-brown. The outer surface of the pieces without epidermis is of a colour between cinnamon-brown and dark rusty-brown. The inner surface, in the pieces of all dimensions, is uniform and almost smooth, but exhibits fine longitudinal fibres closely compressed. Splinters of wood are never found adhering to the inner surface. The prevailing colour of this surface is a rather dark or full-cinnamon brown, passing sometimes into a rusty brown, but seldom reddish. This bark breaks more easily in the longitudinal direction than any other variety, exhibiting a chestnut-brown colour in the part answering to the epidermis, a more or less dark cinnamon-brown in that answering to the proper bark. The transverse fracture of the epidermis is rather even, that of the inner bark fibrous or splintery. A resinous layer may be seen beneath the epidermis, which usually remains when the latter is removed, and communicates to the flat pieces the dark colour which distinguishes their external surface. Small sharp splinters, which in the longitudinal fracture appear like shining points, are apt to insinuate themselves into the skin when the bark is handled. The odour is feebly tan-like; the taste slightly acidulous, strongly but not disagreeably bitter, somewhat aromatic, feebly astringent, and rather durable. The powder is of a fine cinnamon hue.

Weddell speaks of a variety of Calisaya bark having a dark-coloured external surface, which is often wholly of a vinous black, and of another which has a less uneven surface, sometimes semicellular, and of a paler colour. The former, he says, is denominated in Bolivia *Calisaya zamba*, *C. negra*, or *C. macha;* the latter *Calisaya blancha.*

Thiel obtained from the flat Calisaya 2·3 per cent. of quinia, and 0·08 of cinchonia; *Michaelis* from the flat 3·7 per cent., and from the quill 2·0 per cent. of quinia, but no cinchonia; *Von Santen* from the flat, an average of 2·0 per cent. of quinia, and little or no cinchonia; *Wittstock,* on an average, 3·0 per cent. of sulphate of quinia, and 0·12 of cinchonia. (*Geiger.*) Riegel obtained, as the lowest product 2·18 per cent., and the highest 3·8 per cent. of quinia. (*Pharm. Journ.*, xii. 249.) MM. Delondre and Bouchardat have obtained from the flat Calisaya, without epidermis, from 3·0 to 3·2 per cent. of sulphate of quinia, and 0·6 to 0·8 per cent. of sulphate of cinchonia; and from the quilled with epidermis 1·5 to 2·0 per cent. of the former, and from 0·8 to 1·0 per cent. of the latter. (*Quinologie*, pp. 23 and 26.) M. Guilliermond has recently obtained the very large product of 6 per cent. of quinia from a specimen of quilled Calisaya, without epidermis (*Journ. de Pharm.*, Janvier, 1862, p. 42); and still more recently, Mr. Howard has, in one or two selected specimens, obtained 7 or 8 per cent. of sulphate of quinia. (*Am. Journ. of Pharm.*, Sept. 1866, p. 420.) Calisaya bark without epidermis should yield from 3 to 3·5 per cent. of officinal sulphate of quinia.

False or Spurious Calisaya Barks.

The great value of Calisaya bark has led to the substitution for it, or fraudulent admixture with it, of other varieties bearing a more or less close resemblance to it in character or appearance. Some of these are not much inferior to the genuine bark, others of little value; and it is highly important that they should be distinguished. We give below a brief notice of such as are described in pharmacological works, or have come under our own observation. Weddell states that the characters by which the true Calisaya bark may be best distinguished from all others are, 1. the shortness of the fibres in the whole surface of its transverse fracture, 2. the facility with which these may be separated, 3. the uniform fawn colour, without any white marking in its thickness, 4. the

* By the epidermis is here understood the whole of the external layers which are accumulated upon the outer surface of the bark by the annual renewal of the cortical layers, and the consequent separation of those of former years, which remain, but without life, attached to the external surface. A different meaning is attached to the term by Von Bergen; but, as we have taken pains to make the description in every instance correspond with our definition, we do not misrepresent his meaning.

Until the recent most valuable researches of Weddell, nothing was known with certainty as to the particular species which yields Calisaya bark. At present there

great density of the bark, which is such that, when the nail is drawn across it, a shining track is often left, 5. the depth of the depressions on its outer surface, and the prominence of the ridges that separate them. These remarks refer to the flat variety. The quills are not so easily distinguished, as they closely resemble certain other varieties, especially the bark of C. scrobiculata and C. rufinervis, and the fracture does not give signs so precise as in the older barks. The surest test is the greater bitterness of the genuine. From their deficiency in compactness, spurious Calisaya barks are called by the French *Calisaya légere*, or *light Calisaya*.

1. *Bark of C. Calisaya*, variety *Josephiana* of Weddell. This is not known as a distinct variety in Europe or this country; but it is very probably mingled more or less with the genuine, as it is collected in Bolivia. It is in quills, of a brown, grayish-black, or slate colour on the outer surface, which is also covered with pale lichens. The inner surface is irregular, in consequence of the difficulty with which it is separated from the wood. From the *roots of the same variety*, which are probably the remains of former forest trees, is obtained another kind of bark, in short pieces, flattish, undular, or more or less contorted, destitute of epidermis, internally fibrous or almost smooth, slightly cellular externally, of a uniform ochreous yellow, and of a decided bitterness, though not so strong as that of good Calisaya, which it resembles in its internal structure. The Peruvians call it *ichu-cascarilla*. (Weddell.) These barks can scarcely be considered as adulterations, as they have the virtues of the genuine.

2. *Bark of C. Boliviana*. Weddell states that this is almost always mixed in commerce with genuine Calisaya, from which it is often difficult to distinguish it. This is of the less consequence, as it is probably not much inferior in virtue. The following is Weddell's description. The quilled is in all points similar to the quilled Calisaya. The flat consists exclusively of the inner bark. It is generally not so thick as the Calisaya, but of equal density. The furrows on the outer surface are not so deep, and the ridges which separate them more rounded. The colour of this surface is a brownish-yellow fawn, with here and there greenish shades, of the inner, a somewhat reddish or orange fawn. The fracture is like that of the Calisaya, but exhibits spots of a light almost white colour, which are never seen in that variety. The taste is a strong and agreeable bitter, which is developed more quickly than that of the Calisaya.

3. *Bark of C. ovata*, var. *rufinervis* of Weddell. This variety of C. ovata inhabits Bolivia and the southern province of Peru called *Carabaya*, where the bark is said by Weddell to be largely employed for adulterating the Calisaya. It is known in Peru by the name of *Cascarilla Carabaya*. It sometimes so closely resembles Calisaya as to be with difficulty distinguished. In the *quilled*, the outer coating sometimes differs only in being somewhat less thick. In other instances it has but a few annular fissures, is finely wrinkled longitudinally, and varies in colour from a light gray to a deep brown, being often completely covered with mosses and lichens. It is generally easily separable from the inner coat, the uncovered surface of which is of a light-brownish fawn, and smooth, or marked with longitudinal depressions corresponding to rents in the outer coat. The inner surface is grayish or reddish-yellow, and finely fibrous; the transverse fracture fibrous; the resinous circle scarcely observable; the taste quickly bitter and astringent. The *flat* kind is of variable form, often closely resembling the Calisaya, but generally much lighter. Sometimes it consists solely of the inner bark, but more frequently has a portion greater or less of the cellular coat attached. The outer surface is sometimes smooth, with a few linear transverse depressions, and wholly cellular; in other instances, uneven, with roundish depressions, fibrous at bottom; and is of a grayish-fawn or reddish colour, sometimes marbled with darker shades. The inner surface is of a dull grayish-yellow, or brilliant orange, with fine parallel fibres. The transverse fracture is more or less corky exteriorly, and fibrous-stringy within, or of the latter character in the whole thickness. It has considerable bitterness, which is rapidly developed in the recent barks.

Carabaya Bark. Under this name a bark has within a few years been introduced into the commerce of this country and Europe, derived from the province of Carabaya, through the port of Islay or that of Arica. Dr. Pereira describes it as follows.—It is thin and flimsy, of a more or less rusty colour, and in some of the pieces very similar to the *Huamilies*. The *quills* are about as thick as the finger, and of variable length, sometimes even two feet, coated or uncoated; the coated having a dull-rusty or grayish-rusty, warty surface, marked by longitudinal furrows, but rarely by transverse; the uncoated sometimes presenting a dark or more or less tea-green tint. The *flat pieces* consist of the liber alone, or of this with a portion of the cellular coat. The outer surface of the liber, in some of the uncoated pieces, is blackish, with rusty, round, flattish warts. Sometimes it looks as if dusted over with a yellowish powder. The liber itself is more or less orange; but some pieces resemble red bark in colour. Whether this is the product of *C. ovata* is uncertain: but, taking its source into consideration, and the fact stated by Weddell that the bark of that species is gathered largely in Carabaya, and known by the same name in Peru, the probabilities seem to be greatly in favour of this opinion. Pereira states that its total yield of alkaloids, including quinia, cinchonia, and quinidia, is from 3 to 4 per cent. In the *Quinologie* of MM. Delondre and Bouchardat (p. 26), the product of the better specimens is stated to be from 1·5 to 1·8 per cent. of sulphate of quinia, and 0·4 to 0·5 per cent. of sulphate of cinchonia. It is, therefore, a valuable bark.

A variety of *flat bark*, imported into the United States as *Carabaya*, is in irregular pieces, some very small, the largest about 9 inches in length, generally very thin; for the most part destitute of epidermis, but sometimes with portions of the outer coat attached: on the *outer surface*, when uncoated, of a dull-cinnamon hue, with spots of a different colour sometimes much darker, more or less irregular from slight elevations and shallow depressions, somewhat furrowed longitudinally, seldom so transversely; on the *inner surface*, of a lighter hue than on the outer, smooth and somewhat shining when viewed obliquely, with fine compact straight fibres; with a decided fibrous fracture, sometimes smooth toward the outer edge; and, when handled, readily yielding spicula

is no variety of which, in this respect, we have more accurate knowledge. The genuine bark is derived from the newly described species, named *C. Calisaya;* but

which penetrate the fingers like those of Calisaya. In one specimen shown us by Messrs. Powers and Weightman, the outer surface was almost completely covered with the sub-epidermic layer, with little or none of the epidermis itself, and was remarkably uniform in its aspect, though sometimes presenting numerous slight longitudinal wrinkles from drying, and a few shallow transverse impressions. We are informed that this variety contains more cinchonia than quinia, and have little doubt that it is the bark referred to by Weddell as the product of *C. ovata*, var. *rufinervis*.

4. *Bark of C. scrobiculata.* The younger bark of this tree has, we think, undoubtedly been imported among the pale or gray barks. The larger or flat pieces have been fraudulently substituted for Calisaya. Of these, according to Pereira, there are two varieties, derived from different varieties of the tree.

a. *Cusco Bark. Red Bark of Cusco.* (*Delondre and Bouchardat,* Quinologie, p. 26.) *Bark of St. Ann. Bark of C. scrobiculata,* var. *Delondriana.* This is collected in the province of Cusco, in the south of Peru; and the town of Cusco is said by Weddell to be the centre of its commerce. It is the kind to which Guibourt has attached the name of *light Calisaya.* Weddell thus describes it: "Less dense than the Calisaya; consisting generally of the liber and a thin layer of the cellulo-resinous tissue; thickness from 5 to 10 millimetres (2 to 4 lines). Outer surface obscurely *red,* smooth, with some linear transverse impressions, or more or less irregular; exhibiting often superficial cavities filled with fungous detritus; raised in other instances into asperities or irregular warts, or more rarely presenting an exfoliation of the cellular coat, as complete as in the Calisaya, with digital confluent furrows fibrous at bottom, and the ridges which separate them. *Interior surface* uniform, of fine and straight grain, and of a handsome *reddish-orange* colour. *Transverse fracture* more or less cork-like on the outside, according to the thickness of the cellular portion; on the inside very fibrous, with long, pliable, stringy fibres, and of a lighter colour than the outer part. *Longitudinal fracture* presenting numerous splinters with shining points, less marked than in the Calisaya, and medullary rays more numerous and visible. *Taste* bitter, strong and quickly developed in the middling sized barks, with perceptible astringency. This bark yields from 0·7 to 0·8 per cent. of sulphate of cinchonia, and from 0·3 to 0·4 of sulphate of quinia." (*Hist. Nat. des Quinquinas,* pp. 44, 45.)

b. *Peruvian Calisaya.* Bark of *C. scrobiculata,* var. *genuina,* Weddell. This is imported from Lima. Pereira describes it as occurring in flat pieces, closely resembling the genuine Calisaya in colour, for which it is often sold. They are thicker and denser than the last-mentioned variety, from which they also differ in colour. Externally the bark is smoother than the Calisaya; and the ridges between the furrows are more rounded. The fracture is fibrous, and the taste, in the larger pieces, less bitter than that of Calisaya. (*Mat. Med.,* 3d ed., p. 1629.)

This bark is probably the same with that referred to in the eighth and ninth editions of this Dispensatory (p. 236 of the 9th), as having been imported into the United States about the year 1848; having been consigned to a manufacturing chemist of this city by a commercial house in Valparaiso, with the information that it had been sent to them by Dr. J. Villamil, and had been gathered in the forests of Huanuco in Peru. The pieces are generally without the epidermis, which appears to have separated spontaneously, and, when retained, has the transverse fissures and longitudinal furrows characteristic of the Calisaya. The colour and consistence of the bark are the same as in the genuine; and it even presents the shining spicula which characterize the latter, though they are less numerous, and do not so readily penetrate the fingers. The taste is very bitter. Examined chemically by Professor Procter, it was found to afford a precipitate with sulphate of sodium, in consequence of containing kinate of calcium, and thus in another point approaches the Calisaya; but he could not detect in it a trace of quinia. The only alkaloid it was found to contain was cinchonia, of which there was the large proportion of 2·8 per cent.; so that this must rank with the valuable barks. For a more particular account of it, the reader is referred to a paper by Prof. Procter in the *American Journal of Pharmacy* (xix. 178).

5. *Bark of Cinchona pubescens,* var. *Pelleteriana* of Weddell. *Cusco Bark. Arica Bark.* This was first known in France by the name of Arica bark, from the port at which it was shipped; but, both in French and English commerce, this name has given way to the more appropriate one of *Cusco bark,* derived from the Peruvian province in which it is collected. Dr. Pereira says that it was first introduced into Europe in 1829 as yellow or Calisaya bark. From the statements of Weddell, there seems to be little doubt that it is the product of the tree referred to at the heading of this paragraph; as specimens collected by himself in the mountains of Cusco were found identical with the bark as known in Europe. The following is his description condensed.—In the *quilled,* the outer coat is thin, very adherent, almost smooth, sometimes with traces of annular fissures, o. a uniform dirty-gray colour, or marbled with darker shades. The proper bark is, without, of an obscure yellow, sprinkled with little brown spots when artificially denuded, and marked with some superficial longitudinal wrinkles; within, is obscurely yellow and a little reddish, coarsely fibrous, and often rough to the touch. The transverse fracture is exteriorly corky and quite short, without a resinous circle, and inwardly with a few short thick fibres. *The flat pieces* are very dense, and consist about equally of cellular coat and liber. The outer surface is smoothish, sometimes slightly wrinkled longitudinally, of an ochre-yellow more or less brownish, and frequently marbled with grayish or silvery spots, which are the remains of the epidermis. The inner surface is brownish or reddish, thick and fibrous. The transverse fracture is cork-like outwardly, of short woody fibres inwardly. A fresh cut surface in the same direction shows inwardly rows of large isolated semitranslucent points, corresponding to the section of the cortical fibres, agglutinated in bundles. The longitudinal fracture is almost without splinters. The epidermis, when it remains on the large barks, is thin, unequal, sometimes warty, of an obscure gray, and more or less brownish or even greenish in some spots. When it has been scraped, the bark sometimes presents deep-brown spots, which are the points where the prominences in the cellular coat had raised the epidermis so as to form

the bark of *C. Boliviana*, another of the species discovered by Weddell, is sometimes mixed with it in the same seroons. It is produced exclusively in Bolivia, formerly upper Peru, and in the southern portion of the adjoining Peruvian province of Carabaya. Before these countries were separated from Spain, it was shipped as well from Buenos Ayres as from the ports on the Pacific; but at present it comes only from the latter. As first announced in this work, from information derived from merchants long personally engaged in commercial transactions on the Pacific coast of South America, the bark is brought from the interior to the port of Arica, whence it is sent to various other ports on the coast. The interior commerce in the drug has its centre chiefly in the town of La Paz. The trade in this bark has been much diminished, in consequence partly of its greater scarcity, partly of restrictions by the Bolivian government.

It is generally supposed to have been first introduced into commerce towards the end of the last century, and it was probably not known by its present name till that period; but La Condamine states that the Jesuits of La Paz, at a period anterior to the discovery of the febrifuge of Loxa, sent to Rome a very bitter bark by the name of *quinaquina*, which, though supposed by that traveller to have been derived from the Peruvian balsam tree, was very probably, as conjectured by Guibourt, the true cinchona. Besides, Pomet, in his *History of Drugs*, published in 1694, speaks of a bark more bitter than that of Loxa, obtained from the province of Potosi, which

the little warts referred to. These are sometimes decayed, and upon falling leave roundish depressions. The taste of the bark is bitter, astringent, and somewhat pungent. (*Hist. Nat. des Quinquin.*, p. 56.)

Von Bergen says that this bark somewhat resembles the fibrous Carthagena. Inexperienced persons might mistake it for the Calisaya. Guibourt says that it may be readily distinguished by a more regularly cylindrical form, its smoother outer surface, the remains of the white and fungous layer, by its two shades of colour, orange or brownish externally, and whitish or very pale internally, and by not yielding a precipitate with sulphate of sodium.

Pelletier supposed that he had found a new alkaloid in this bark, which he named *aricina;* but the substance he obtained is now thought to have been some modification of one of the other alkaloids. The chief alkaloid in the bark is cinchonia. Frank obtained 48 ounces of it from 100 lbs. of the bark, and only a trace of quinia: Winckler, 256 grains from 16 ounces of a good specimen, and only 77 grains from the same quantity of an inferior one. Guibourt estimates the proportion at a drachm for every pound, and observes that the bark is rich in cinchonic red.

6. Bark of *C. micrantha*, var. *rotundifolia* of Weddell. As this variety grows in Bolivia, and the flat bark derived from it simulates Calisaya, it is very probable that its product has been sometimes used to adulterate the latter bark. Weddell says of it that it has little density, and consists of the liber alone, or of this and the cellular coating, which is generally semi-fungous and imperfectly exfoliated. The *external surface* is unequal, presenting superficial concavities similar to those of Calisaya, and separated by irregular corky eminences, but sometimes though rarely smooth from the persistence of the whole cellular coating, and is of a bright and grayish orange-yellow. The *internal surface* is considerably fibrous, of the same colour as the external, but of a more lively tint. The *transverse fracture* is stringy; the *longitudinal* but slightly splintery, and of a dull surface. The *taste* is decidedly bitter and quickly developed, a little pungent, scarcely astringent. (*Hist. Nat. des Quinquinas*, p. 53.)

7. Bark of *C. amygdalifolia*. This species also inhabits Bolivia, and its bark may possibly sometimes contaminate the Calisaya, as it has been largely collected. Pereira states that it is imported alone or mixed with other Bolivian barks, both quilled and flat. According to the same author, it is distinguished from the Calisaya by its lightness, its more orange colour, the presence of the cellular coat in the pieces deprived of epidermis, the stringy transverse fracture, the splintery longitudinal fracture, the want of marked annular fissures in the epidermis, and the astringent and but slightly bitter taste. Mr. Howard obtained from a portion of the quills 0·7 per cent. of quinidia and a trace of cinchonia; from the flat 0·23 of quinidia and the same of cinchonia. (Pereira's *Mat. Med.*, 3d ed., p. 1629.)—*Note to the tenth edition.*

Yellow bark of Guayaquil. Under this name MM. Delondre and Bouchardat describe a bark, occurring in very long rolls, of a colour like that of Chinese cinnamon, with the outer surface marked by rather close but shallow longitudinal furrows, with traces of a very thin, white epidermis; the inner surface browner, uniform, and compact; the fracture resinous exteriorly, and shortly fibrous interiorly. The bitterness is strong, without astringency. Delondre obtained from it 3·0 per cent. of sulphate of cinchonia, and 0·3 to 0·4 of sulphate of quinia. (*Quinologie*, p. 32.) This bark is scarce in commerce; but we have been told that portions have been brought from Guayaquil, across the Isthmus of Panama. It will be very valuable, should cinchonia come, as it ought to do, into general use.

A *false bark* has been sometimes mixed with the genuine Calisaya, which it resembles so closely as not to be easily distinguished by the eye. According to Weddell, it is the bark of *Gomphosia chlorantha*, a lofty tree, growing in the same forests where the *Calisaya* is found. It is distinguished by a peculiar odour, and by exhibiting in its transverse section, under the microscope, "a peculiar fasciculate disposition of the cortical fibres, and some vessels gorged with a ruby-coloured juice." It does not contain a particle of alkaloid, but yields a volatile oil on which its odour depends. (Howard, *Pharm. Journ.*, xiv. 318.)—*Note to the eleventh edition.*

borders upon that of La Paz; and Chomel also states that the cinchona tree inhabited the mountains of Potosi, and produced a bark more esteemed than that which grew in the province of Quito. (Guibourt, *Journ. de Pharm.*, xvi. 235.) It is possible that, though known at this early period, it may have gone out of use; and its reintroduction into notice, towards the end of the last century, may have been mistaken for an original discovery.*

3. Red Bark.

The name of this variety is very appropriately applied; as the colour is usually distinct both in the bark and the powder. In South America it is called *cascarilla roxa* and *colorada*. Some writers have divided it into several sub-varieties; but, in relation to the true red bark, there does not seem to be ground for such division in any essential difference of properties. Like the *Calisaya*, it comes in quills and flat pieces, which are probably derived from different parts of the same tree. It is imported in chests.

Some of the pieces are entirely rolled, some partially so, as if they had been taken from half the circumference of the branch; others are nearly or quite flat. They vary greatly in size, the quill being sometimes less than half an inch in diameter, sometimes as much as two inches; while the flat pieces are occasionally very large and thick, as if derived from the trunk of a tree. They are covered with a reddish-brown or gray, sometimes whitish epidermis, which is rugged, wrinkled longitudinally, and in the thicker pieces marked with furrows, which in some places penetrate to the surface of the proper bark. In many specimens, numerous small roundish or oblong eminences, called warts, may be observed upon the outer surface. Beneath the epidermis is a layer, dark-red, brittle and compact, which possesses some bitterness and astringency, but much less than the interior parts. These are woody and fibrous, of a more or less lively brownish-red colour, which is usually very distinct, but in some specimens passes into orange and even yellowish-brown; so that it is not always possible to distinguish the variety by this property alone. The taste is bitter and astringent, and the odour similar to that of other good barks. Red bark is chemically distinguished by *containing considerable quantities of both quinia and*

* The great value of Calisaya bark will justify us in giving a brief account of its mode of collection, as described by Weddell from personal observation. The tree producing it grows in the Bolivian provinces Enquisivi, Yungos, Larecaja, and Caupolican. At present it is necessary to travel for eight or ten days from the nearest inhabited place, in order to reach the forest where it is found of a size and in numbers which will repay the trouble of gathering the bark. The Cascarilleros are persons educated from infancy to the business. Several of them are engaged in the service of a merchant or small company, by whom they are sent, at any period of the year except during the rains, upon an expedition under the charge of a leader called a Mayordomo. Having previously received information which governs the direction of their journey, they proceed to the vicinity of their intended operations, and establish a camp in a convenient position. Henceforward the neighbourhood is considered as belonging exclusively to the party, and no other bark-gatherers pretend to interfere. From the camp the Cascarilleros are despatched singly or in small bands, in different directions into the forests, through which they have to make their way, often with great labour and fatigue. Each man carries with him provisions for a long absence. The trees do not form forests of themselves, but are scattered singly or in groups more or less close. From some convenient point of view the explorer scans the top of the forest, and is able to recognise, at a great distance, from the peculiarity of its aspect, not only one of the Cinchonas, but the particular species of which he is in search. Sometimes he is directed by the appearance of the dry leaves upon the ground. Having found a suitable tree, he first fells it, cutting as near the soil as possible, then lops off the branches, and detaches by blows with a wooden mallet, or the back of his axe, the outer or dead layers of the bark, which easily separate. He next makes incisions through the bark, so as to isolate pieces usually fifteen to twenty inches long by three or four broad, which he removes by means of a knife or other instrument. The branches are decorticated without separating the epidermis. The pieces obtained from these are simply allowed to dry in the sun, and, rolling themselves up, form the quilled variety. The pieces from the trunk are disposed in square piles, one being placed over the other, and the whole kept down by some heavy body. They are thus prevented from rolling as they dry. When sufficiently dried they are carried to the camp on the back of the gatherer, who often consumes several days in his returning journey, and undergoes incredible fatigue. At the camp, the bark is assorted, and the portion deemed fit for commerce is sent to the town, on the backs of men or of mules, where it is packed in bales or seroons, covered with fresh hides. The most wasteful methods of collecting the bark prevail, the only object being present convenience. Not only is the tree felled, but the bark is frequently removed from the stump down into the very earth, so as to prevent the growth of sprouts, which would otherwise spring up from the old roots, and in the course of time afford another crop. (*Note to the ninth edition.*)

cinchonia. It yields a turbid salmon-coloured decoction with water. Mr. Howard, in examining slender sections of a fine specimen of red bark under the microscope, noticed numerous stellate groups of crystals diffused irregularly throughout its substance, which he believed to consist of kinovate of quinia, formed during the drying of the bark. He also noticed other crystalline forms which he ascribed to the kinovates severally of cinchonia, quinidia, and cinchonidia. (*Pharm. Journ. and Trans.*, May, 1865, p. 584.)*

The species of Cinchona which produces red bark has been unknown until very recently. The notion derived from Mutis, and once generally prevalent, that it was obtained from the *C. oblongifolia* of that botanist, was long since demonstrated to be incorrect. For the proofs upon this point, which have now ceased to have any practical importance, the reader is referred to the article CINCHONA, section RED BARK, in early editions of this work. It has been supposed that red bark may be derived from the same species with one or more of the pale barks, but taken from the larger branches of the trunk. This opinion received some support from a statement made

* The *red bark* is described by Von Bergen under the name of *China rubra* or *rothe China*. The following is an abstract of his description. The quills are from two lines to an inch and a quarter in diameter, from one-third of a line to two lines thick, and from two to twelve inches or more in length. The smaller quills are often spiral. The flat pieces are from one to two inches broad, from three-eighths to a quarter of an inch thick, and of the same length as the quills. In the smaller and middling-sized quills, the external surface exhibits longitudinal wavy wrinkles. In the thicker pieces, these wrinkles, between which are here and there longitudinal furrows, often elevate themselves into roundish or oblong warts, which are of a somewhat friable and granular consistence. The longitudinal furrows sometimes penetrate to the bark. Transverse fissures seldom occur. The colour in the smaller quills varies from a fawn-gray to a dull reddish-brown, in the larger is reddish-brown or chestnut-brown with a tinge of purple. When the wrinkles and warts are rubbed off, the peculiar brownish-red colour of the bark appears. The pieces are often in part or almost wholly covered with a whitish-gray or yellowish-white coat, either belonging to the epidermis or consisting of lichens. In some of the quills the epidermis is wanting in spots, which exhibit a dirty reddish-cinnamon colour. The inner surface is delicately fibrous and almost uniform in the small quills, but becomes more fibrous and uneven in the larger, and in the flat pieces is splintery and very irregular. Its colour varies with the size of the pieces, being a reddish-rusty brown in the least, redder in the larger, and a full brownish-red in the largest. The inner surface is also sometimes yellowish, or brownish, or of a dirty appearance. It becomes darker when scraped with the nail. The fracture exhibits the different colours of the epidermis, the inner bark, and a resinous layer between the two. It is usually smooth in the smaller quills, fibrous in the larger, and at the same time fibrous and splintery in the largest pieces. The fracture of the epidermis, however, is in all either smooth, or only here and there somewhat granular. The odour is like that of tan, and earthy; the taste strongly but not disagreeably bitter, somewhat aromatic, and not lasting. The powder is of a dull brownish-red colour.

Experiments upon many different specimens of red bark, as stated by Pfaff, give as an average product 1·7 per cent. of pure cinchonia, and 0·44 of sulphate of quinia. The highest product obtained was 3·17 per cent. of cinchonia, and 0·15 of sulphate of quinia. Another specimen yielded 1·21 per cent. of the former, and 1·33 of the latter. Pelletier and Caventou obtained 0·8 per cent. of cinchonia, and 1·7 of quinia. (*Geiger.*) Dr. E. Riegel, of Carlsruhe, obtained from one specimen of the best red bark 4·16 per cent. of alkaloids (2·65 of quinia and 1·51 of cinchonia), and from another 3·85 per cent. (*Pharm. Journ.*, xii. 250.) Delondre obtained from the genuine red bark, "*bright red*," 2·0 to 2·5 per cent. of sulphate of quinia, and 1·0 to 1·2 of sulphate of cinchonia; from the "*pale red*" 1·5 to 1·8 of the former, and 0·5 to 0·6 of the latter. (*Quinologie*, p. 30.) It appears, therefore, that the proportion of the alkalies is exceedingly different in different specimens; and it is highly probable that some of the barks experimented upon were inferior red barks, not properly belonging to this variety. The degree of bitterness is, perhaps, the best criterion of their efficacy, short of a chemical examination.

Guibourt divides the red bark into two principal varieties, which he distinguishes by the names of *quinquina rouge verruqueux*, and *quinquina rouge non verruqueux*, from the presence or absence of the warts upon the outer surface. There is, however, no real distinction between the varieties, as they possess the same virtues, and differ only in being derived from different parts of the same tree; the warty, it is asserted, being derived from the root and trunk, the non-warty from the branches. (Howard, *Pharm. Journ.*, xvi. 210.) He describes also four other red barks; 1. *Rouge orangé verruqueux*, differing from the true warty kind by its more orange colour, its very thin epidermis, its finer fibres, and the less thickness of the large barks; 2. *Rouge blanchissant à l'air*, characterized by the whitening of its fracture in the air, and by its little bitterness; 3. *Rouge de Lima*, with a whitish epidermis, an ochreous reddish liber, and of excellent qualities (see *Fine Gray Bark*, p. 292); and 4. *Rouge pâle à surface blanche*, resembling the first of these varieties, but distinguishable by its whiter epidermis, and generally lighter colour. Under the same head may be ranked his *quinquina de Jaën ou de Loxa rougeâtre*, which has a dark-gray epidermis, and a uniform fibrous proper bark, reddish or deep-brown, and of a very astringent taste with little bitterness. (*Note to the second, fourth, ninth, and twelfth editions.*)

A specimen of bark in our possession, brought by Dr. Dillard, of the U. S. Navy, from the Pacific, and labelled *red bark of Cuença*, has a thick epidermis like that of the ordinary red bark, is of a very deep dark-red colour, and possesses little bitterness.

by La Condamine, in his memoir upon cinchona. We are told by this author that three kinds of bark were known at Loxa; the white, the yellow, and the red. The white, so named from the colour of the epidermis, scarcely possessed any medicinal virtue, and was obtained from a tree entirely distinct from that which yielded the two other varieties. The red was superior to the yellow; but he was assured, on the very best authority, that the trees producing them grew together, and were not distinguishable by the eye. Of the three varieties mentioned by La Condamine, the white, which was probably one of the inferior barks with micaceous epidermis, does not reach us; and that which he calls yellow is probably identical with the pale variety of the Pharmacopœias, as this grows abundantly about Loxa. At the date of the publication of the edition of this work preceding the last, it had been rendered extremely probable by Mr. Howard, that the genuine red bark is derived from the trunk and larger branches of the *Cinchona ovata*, var. *erythroderma* of Weddell, growing on the western slopes of the mountains Assuay and Chimborazo, eastward of Guayaquil, in about 2° of south latitude. (*Pharm. Journ.*, xvi. 207.) Since that period, this ascription has been found to be correct, though the variety referred to has been raised to the dignity of a species, *C. succirubra*, which is now generally admitted to be the source of the officinal red bark.

Non-officinal or Carthagena Barks.

Under this head may be classed all the Cinchona barks brought from the northern Atlantic ports of South America. In commerce, they are variously called *Pitaya*, *Bogota*, *Carthagena*, *Maracaybo*, and *Santa Martha barks*, according to the place in the vicinity of which they are collected, or the particular port at which they may be shipped. Formerly these barks were for the most part of inferior quality, and were therefore not recognised in the Pharmacopœias; but the deficient supply and consequent high price of Calisaya have directed enterprise into other quarters; and within a few years large quantities of very good bark have been imported from New Granada, derived chiefly from the neighbourhood of Bogota and Popayan, and brought down the river Magdalena. Since the completion of the railroad across the Isthmus of Panama, considerable quantities have been brought to us by that route, being shipped from the port of Buenaventura, on the Pacific coast. There can be little doubt that the commerce in these barks will continue and increase; as some of them are inferior in their yield of alkaloids only to the Calisaya, if even to that variety, and the region from which they are procured is almost virgin soil. It has appeared to us, from an examination of such of them as have come under our notice, that they may all, at least with one exception, be referred without violence to some one or another of the varieties of Carthagena bark already recognised; but these better kinds formerly seldom reached the market; because, partaking of the general reputation of the inferior barks from the same region, it was feared that they might not pay the cost of importation. Most of the Carthagena barks are characterized by a soft, whitish or yellowish-white epidermis, which may be easily scraped by the nail, and which, though often more or less completely removed, almost always leaves behind traces sufficient to indicate its character. Those of them which may, in other respects, bear some resemblance to Calisaya, are in general readily distinguishable by this character of the epidermis when it remains, and, when it is wanting, by the peculiar appearance of the outer surface, showing that the exterior coating has been scraped off, or shaved off with a knife. They all contain the alkaloids in greater or less proportion, though they differ much in this respect. In reference to the relative proportion of the different alkaloids, they have nothing in common, except perhaps that they yield proportionately more cinchonia, cinchonidia, and quinidia than the Calisaya, resembling, in this respect, the pale and red barks. Inferior barks, with the soft, white epidermis, are found on the western coast of South America, where they are known as *white barks;** but they seldom reach us. In the state of

* *Paytine* or *Paytina*. Having been requested by a merchant to examine for quinia a *white bark* from the Pacific port of *Payta*, Dr. O. Hesse, in the year 1870, discovered that the bark contained alkaloids, but not one of those proven to exist in the proper Cinchona barks. The alkaloid specially noticed by him, may be prepared from the alcoholic extract, by treating this with soda, and

powder, the inferior Carthagena barks were formerly, and are still, to a certain extent, kept in the shops, and sold for tooth-powder, &c., under the name of *common bark.* They have not unfrequently been substituted, either fraudulently or by mistake, for the better kinds.

The Carthagena barks were formerly classified, according to their colour, into the *yellow*, *orange*, *red*, and *brown;* but this mode of distinction must now be abandoned; for these varieties of colour may be found in barks identical in other respects, and derived from the same species of Cinchona. The well characterized Carthagena barks may all be referred to one of the three following varieties.

1. *Hard Carthagena Bark. Hard Yellow Carthagena Bark. Yellow Bark of Santa Fé. Common Yellow Carthagena Bark.—China flava dura.* Von Bergen. —*Quinquina de Carthagène jaune pale.* Guibourt. This is in pieces of various size and form, sometimes wholly or partially quilled, and sometimes flat; and the flat pieces present the appearance of having been warped in drying, being frequently curved longitudinally backward, and sometimes also in the transverse direction or spirally. The quills are from three to eight lines in diameter, from half a line to a line and a half thick, and from five to nine and rarely fifteen inches long. The flat pieces are thicker, from half an inch to two inches broad, and from four to eight and sometimes twelve inches in length. As found in this market, the bark is sometimes in small, irregularly square or oblong, flattish, and variously warped pieces, from one to four inches long, and from one to three lines in thickness, mixed with small quills or fragments of quills; the former appearing as if chipped from the trunk or large branches, the latter evidently derived from the small branches. In this shape it was treated of in some former editions of this work, as a distinct variety, under the name of *Santa Martha Bark*, which it at one time held in the market; but a closer examination has convinced us that it is the same bark as the one above described, though collected in a different manner. The quills are generally more covered with the whitish epidermis than the flat pieces, in which it is often nearly or quite removed. The inner surface of the latter, though sometimes smooth, is often rough and splintery, as if forcibly separated from the wood. The colour of the proper bark is a pale, dull, brownish-yellow, darker in parcels which have been long kept; and the surface often appears as if rubbed over with powdered bark. The texture is rather firm and compact, and the fracture abrupt, without being smooth or presenting long splinters. The taste is bitter and nauseous. This variety of bark is now universally ascribed to C. cordifolia. *

agitating with ether, which dissolves the alkaloid with some colouring matter. The ethereal liquid, agitated with dilute sulphuric acid, furnishes a solution of the sulphate. This is decolourized by a little animal charcoal, almost neutralized with heat by ammonia, then, after cooling, is treated with iodide of potassium, until this ceases to produce a precipitate. The salt thus formed is entirely deposited in 24 hours. Separated from the mother-water, it is treated with dilute solution of soda, and shaken with ether. This, holding the alkaloid in solution, is separated from the heavier liquid; and, having been washed with water, yields, on spontaneous evaporation, the alkaloid in fine colourless crystals. Dr. Hesse gives the new alkaloid the name of *paytine*, after the port whence the bark was obtained.

Paytine is in well-defined prismatic crystals. It has a bitter taste. It melts at 156° C., and distils partially at a higher temperature, leaving a carbonaceous residue. It is very soluble in alcohol, ether, benzine, and chloroform, but little soluble in water and alkaline solution. According to the analysis of Hesse it is represented by the formula $C_{42}H_{24}N_2O_4$ for the pure anhydrous alkaloid, with the addition of two eqs. of water in the crystals. It seems to be without poisonous properties, as dogs have taken it freely without evil results. It has not been tried on man; but is a good subject for therapeutical experiment, especially in miasmatic fevers. According to Dr. Hesse, the bark which yields it, though bearing a superficial resemblance to the Calisaya, cannot, from its interior structure, have been the product of a Cinchona. The bark is in pieces about one foot long, two inches broad, and two or three lines thick; and consists mainly of greenish-yellow cells, between which is lodged, in large quantities, a white pulverulent matter. It has so little firmness that its fibres are crushed under the pressure of the finger nail. It has been found to contain another alkaloid besides paytine; but this has not been examined. For further particulars about the alkaloid see the *Journal de Pharmacie* (Nov.–Dec. 1870, p. 389).—*Note to the fourteenth edition.*

Cinchona cuprea. China cuprea. In a copper-coloured bark from the London market thus designated Dr. O. Hesse found 1 per cent. of quinia and a little cinchonia: Mr. J. E. Howard had previously obtained similar results. Nevertheless, Dr. Fluckeger does not admit that the bark can be derived from a Cinchona, as its structure is entirely different from that of the barks belonging to that genera.—(*Am. Journ. of Pharm.*, May, 1872, p. 213.)—*Note to the fourteenth edition.*

* We introduce, in the form of a note, more detailed and precise information on the subject of the Carthagena barks than our space allows in the text; because, in the present condition of the

2. *Fibrous Carthagena Bark. Fibrous Yellow Carthagena Bark. Spongy Carthagena Bark. Bogota Bark. Coquetta Bark.* — *Quinia naranjanda.* Mutis. — *Quinquina orangé.* Humboldt. — *China flava fibrosa.* Von Bergen. — *Quinquina Carthegène spongieux.* Guibourt. This is in quills or half-quills, or is slightly rolled; and there are comparatively few pieces which are quite flat, even among the largest barks. The quills are from half an inch to an inch and a half in diameter, and of extremely variable length, with a yellowish-brown epidermis, often covered with crustaceous lichens so as to render the surface of the bark whitish and smooth, and exhibiting not unfrequently longitudinal and transverse fissures. The larger barks, which are much the most frequent in commerce, are usually from six to twelve inches long, from one to two inches broad, and from two to five lines in thickness; but they often vary much from these dimensions, being sometimes in the smallest fragments, and sometimes forming semi-cylinders four or five inches in diameter, a foot and a half long, and nine lines thick. They are usually without epidermis, which has been scraped off, or pared off with a knife, leaving the surface smooth and uniform in the former case, and somewhat angular in the latter. Sometimes, however, the epidermis either partially or wholly remains, when it generally exhibits the soft whitish surface characteristic of most of the Carthagena barks. The bark is very fibrous, presenting generally, when broken, long, sometimes stringy splinters, though the outer edge of the fracture is occasionally short from the cellular, or remains of the suberous coat. Its texture is loose, soft, and spongy under the teeth, and the bark itself is usually light. The colour both of the trimmed outer surface, and the inner, and of the bark itself, varies from an ochreous or light brownish-yellow, to orange, and red; but, for the most part, it presents more or less of the orange tint, which induced Mutis to give it the title of *orange bark.* The red colour is found especially in the largest barks. The larger pieces are sometimes marked on the outside with a deep spiral impression, produced probably by a climbing plant winding around the stem of the tree. The colour of the powder is yellowish, with not unfrequently an orange tint. The taste is more or less bitter; but varies in this respect extremely; some barks being almost insipid, while others have a very decided taste. There can be little doubt that these barks are all derived from the Cinchona lancifolia of Mutis. It is asserted that the red variety of the bark is obtained from trees which grow side by side with those which yield the yellow or orange.

The productiveness of the fibrous bark in alkaloids varies greatly in the different specimens. Thus, while some have scarcely yielded any product, others have been found to afford more than three per cent. They probably contain all the cinchona alkaloids; but some have been found more abundant in one, and others in another. Thus, the red is said to be especially rich in quinidia (cinchonidia); a Pitaya bark, which we believe to belong to the fibrous Carthagena, has yielded a very large product of quinia; while, in not a few specimens which have been examined, the cinchonia predominates. (*Am. Journ. of Pharm.*, xxv. 308.) It is probable that the

manufacture of the cinchona alkaloids, it is important to be able to distinguish the several varieties, and estimate their value.

Hard Carthagena Bark. The following is a somewhat precise description of this variety, taken from Von Bergen. The account of the dimensions and shape of the pieces, given in the text, is sufficiently particular. The epidermis is in many pieces partially or almost wholly wanting. The outer surface is on the whole rather smooth, though it usually exhibits a few faint longitudinal furrows and transverse fissures, and pieces are occasionally found with hard warts or protuberances. In the flat pieces, the epidermis, when present, has somewhat the consistence of cork, and is composed of several layers. The colour of the epidermis varies from yellowish-white to ash-gray, and is sometimes diversified by bluish-gray or blackish lichens. When it is wanting, the colour is between a dark cinnamon and brownish-yellow. These shades, however, are seldom clear, and the flat pieces have usually a somewhat dusty aspect. The inner surface of the quills is tolerably uniform, that of the flat pieces uneven or faintly furrowed and even splintery, the points of the splinters often projecting. Its colour, which is almost always dull, as if the surface were dusty, varies between a light cinnamon and a dull ochre-yellow, and in some pieces is rusty-brown, or fawn-gray, or even whitish-yellow. The bark does not readily break in the longitudinal direction. The transverse fracture presents short splinters, and is sometimes fibrous. When cut transversely, the bark obscurely exhibits a very small darker-coloured resinous layer beneath the epidermis. The odour is feeble, the taste astringent and bitter, but not strongly so. The powder is of the colour of cinnamon. This bark yielded, according to Von Bergen, on an average of two experiments, 0·57 per cent. of cinchonia, and 0·33 of sulphate of quinia. Goebel and Kirst found in a pound 56 grains of quinia and 43 of cinchonia. Dr. Pereira states that it contains quinidia (cinchonidia).

richness in these principles depends in some degree on the natural position of the plants; those growing in low situations being less productive than those higher on the mountains.*

A specimen labelled *yellow bark of Loxa*, brought from South America several years since by Dr. Dillard, of the U. S. Navy, and said to be used in Loxa for making extract of bark, presents characteristics closely analogous to those of fibrous Carthagena bark, sufficiently so to justify the supposition that it was derived from the same species of Cinchona; and we have seen a specimen sent hither from Guayaquil, which has the same character, and is so rich in alkaloids as to be worked with advantage.†

* Karsten states that the bark of C. lancifolia, which on the average yields 2·5 per cent. of sulphate of quinia and from 1·0 to 1·5 per cent. of sulphate of cinchonia, often yields neither, and sometimes 4·5 per cent. of the two. The bark of the young branches yields much less than that of the trunk. (*Am. Journ. of Pharm.*, xxx. 534.)

† *Fibrous Carthagena Bark.* The following is an abbreviation of Von Bergen's description of this variety. In shape and dimensions, it does not materially differ from the preceding; but the flatter pieces are almost always a little rolled, or curved laterally. The epidermis is in general either in part or wholly rubbed off. When it is present, the outer surface is nearly smooth, only marked here and there with faint irregular transverse fissures and longitudinal furrows. Its colour varies from a dirty-whitish gray to yellowish, but is sometimes more or less dark. When the outer surface is rubbed off, as is almost always the case in the flat pieces, the colour is nearly pure ochre-yellow. Where the whole thickness of the outer coat is wanting, as happens here and there in spots, the surface is dark-cinnamon, or dark ochre-yellow, and commonly dull or powdery. The inner surface is usually even, but sometimes irregular and splintery, and always harsh to the fingers, leaving small splinters sticking in the skin when drawn over it. It is of a nearly pure ochre-yellow colour, and is very powdery. The fracture distinguishes this variety from the preceding, and from all others. The longitudinal fracture is strikingly fibrous, and in the flat pieces the fragments still hang together by connecting fibres. The bark, moreover, breaks obliquely, and the fracture even of the outer coat, which in other varieties is almost always smooth, is here uneven or rough-grained. The transverse fracture exhibits very long and thin splinters or fibres, which are very flexible, and may almost be said to be soft. No traces of a resinous appearance are observable in the fracture. The odour is feeble, the taste at first woody and flat, afterwards slightly bitter and astringent, and weaker in this than in any other variety of bark. The colour of the powder is intermediate between that of cinnamon and yellow ochre. The highest product of this bark in alkaloids was about 0·59 per cent. of cinchonia, and 0·52 of sulphate of quinia.

The above description does not embrace all the varieties of this bark which have since been introduced into commerce: nor does it by any means represent the finest specimens. The *highly fibrous character of the bark, its looseness of texture, relative lightness, and sponginess under the teeth*, are properties common to all the specimens; but in appearance and virtues they vary considerably; so much so, indeed, that it is only of late that they have been united under one name, and traced to one source.

In the edition of this work of 1843, we described a kind of bark of which large quantities had then recently been imported in a vessel from *Maracaybo*, and which, from its possession in a high degree of the properties just referred to, we were disposed to rank with this variety; and subsequent observation has tended to prove the correctness of this reference. In general aspect it bore some resemblance to the flat Calisaya, particularly in the appearance of its inner surface; but it differed in being thicker, less hard, compact, and heavy, and much more fibrous, and especially in the character of its outer surface, which had the appearance as though the exterior coating had been removed by scraping or cutting with a knife, and not spontaneously separated at the natural juncture, as in the Calisaya. The pieces were considerably larger than those we had previously seen of the fibrous Carthagena, and differed somewhat in colour, having much more of the orange tint, especially in the outer portion, where it was decidedly reddish in some of the pieces. Though less bitter than the Calisaya, and without the property of precipitating sulphate of sodium, it nevertheless had a decided bitterness; and its infusion afforded a copious precipitate with infusion of galls, indicating the presence of no inconsiderable portion of the alkaline principles.

Recently we have had opportunities, through the kindness of Messrs. Powers & Weightman, of examining several varieties of the fibrous bark brought from Bogota and Popayan, which have proved of great value as sources of the cinchona alkaloids, and which we propose briefly to describe, in connection with a statement, derived from the same highly respectable source, of their yield of these valuable principles.

Bogota Bark. Fusagasuga Bark. Coquetta Bark. The first of these names is derived from the entrepot of the trade in this bark; the second, from the particular district where it is collected. Of the origin of the third, by which it is known in English commerce, we are not informed. The bark is in pieces of various lengths, often exceeding a foot, sometimes nearly flat, but generally more or less rolled, and occasionally forming semi-cylinders more than an inch in diameter. It is often either partially or wholly covered with the whitish, soft, micaceous epidermis characteristic of Carthagena barks. In other instances this has been removed by scraping, or sometimes by chipping, and the deep strokes of the knife or hatchet are not unfrequently observable. The pieces are often of considerable thickness, usually rather firm, though very fibrous, and spongy under the teeth. The colour is brownish-yellow with a tinge of red. Mr. Weightman obtained from it from 1 to 1·3 per cent. of sulphate of quinia, and from 0·3 to 0·4 per cent. of sulphate of cinchonia. An inferior variety of Bogota bark, not designated as Fusagasuga, yielded him only 0·4 of sulphate of quinia. In the *Am. Journ. of Pharm.* (xxv. 308) is a statement of results obtained in

3. *Hard Pitaya Bark.—Pitaya Condaminea Bark.* Pereira.—*Quinquina brun de Carthagène. Quinquina Pitaya, ou de la Colombia, ou d'Antioquia.* Guibourt. This bark, though seen by Guibourt so long since as 1830, did not come into general notice until some years afterwards. Much of it has been imported into Philadelphia, coming sometimes through Carthagena, and sometimes over the Isthmus of Panama, whither it is brought from Buenaventura. The following description is drawn from an examination of the bark contained in several seroons that have come under our notice. It is in small irregular pieces, from less than an inch to about four inches long, which are obviously the fragments of larger pieces both quilled and flat. Dr. Pereira states that he had pieces more than a foot in length. In thickness it varies from less than a line to four or five lines. Most of the fragments are covered with the whitish, soft epidermis, characteristic of the Carthagena barks; but some of them have a dark-brown epidermis, rugose with innumerable cracks in all directions; and others are partially or wholly destitute of the outer covering, presenting generally, in the denuded part, a dark uniform or somewhat wrinkled surface. The inner surface is finely and compactly fibrous, and of a dull yellowish-brown colour with a reddish tinge; and the whole of the liber or true bark has the same colour and texture. But outside of the liber there is in many pieces a very distinct resinous layer, which is sometimes of considerable thickness, and, when cut across by a knife, exhibits a dark reddish-brown, shining surface. The resinous layer is the most striking peculiarity of the bark, though not present in all of the pieces, which sometimes consist of the liber alone. The fracture is towards the interior shortly fibrous, towards the exterior often smooth, in consequence of the layer just referred to. The whole bark is rather hard, compact, and heavy; differing in this respect very decidedly from the last mentioned variety. It has more resemblance to the hard Carthagena, from which, however, it differs by its deeper and redder colour, its much more developed resinous coat, and its occasional grater-like epidermis. The taste is very bitter, and the yield in alkaloids considerable. Mr. Weightman informed us that he had obtained from it an average product of 1·6 per cent. of sulphate of quinia, and 0·34 of sulphate of cinchonia, independently of the amorphous or uncrystallizable alkaline matter. It must, therefore, be ranked among the efficient barks, though not so productive as the fine variety of fibrous bark denominated soft Pitaya. It contains also a large proportion of resin.

the examination of the Bogota (Fusagasuga) bark, which were, on the average of four specimens, 0·95 per cent. of cinchonia or quinidia or both, 1·45 of sulphate of quinia (equivalent to about 1·09 of the uncombined alkaloid), and 1·0 of extractive residue, which is presumed to consist mainly of amorphous quinia; so that the whole of the alkaline ingredients amounted to about 3·04 per cent.

Soft Pitaya Bark. Calisaya of New Granada (*Delondre and Bouchardat,* Quinologie, p. 33). This, though said to be brought from the Pitaya mountain near Popayan, is wholly different from the *hard Pitaya* described in the text as one of the varieties of Carthagena bark. It is imported from Carthagena, whither it is brought down the Magdalena river, and from the Pacific port of Buenaventura, whence it is sent to us by the Isthmus of Panama. From the specimens we have seen of the soft Pitaya, we have no hesitation in classing it with the fibrous Carthagena barks, though superior to the others, probably in consequence of the more elevated site of its growth. It comes broken up into small irregular fragments of larger pieces, either quilled, partially rolled or flat. Few of the fragments exceed four inches in length, and many are very minute. Indeed, in some of the seroons, much of their contents seem to be almost in the state of a very coarse powder. This condition of the bark no doubt depends partly on its great fragility; but it is probable that it is purposely broken up for the convenience of close package in the hide seroons. The fragments are almost all destitute of epidermis, but when portions of it remain, it has the usual whitish, soft, micaceous character, common to all these barks. The outer surface, which consists of a thin sub-epidermic suberous layer, is remarkably uniform and smooth, apparently from the careful scraping to which it has been subjected. By far the greater part of the bark consists of the liber, which is highly fibrous, though very soft, easily broken, and yielding with great facility under the teeth. The colour is externally and internally a uniform fine brownish-yellow, with an orange tint, and is brighter than in most others of the analogous barks. The taste is very bitter. Mr. Weightman obtained from ordinary specimens of this bark 2·0 per cent. of sulphate of quinia, and 0·05 of sulphate of cinchonia; from a very fine specimen, 3·0 per cent. of the former, and but a trace of the latter. It is, therefore, one of the most valuable varieties of bark, scarcely yielding in productiveness to Calisaya. The results stated in the *Am. Journ. of Pharm.* (xxv. 308) even exceed these. The average yield of four different specimens, including the uncrystallizable product, was 4·42 of alkaloids, probably in the state of sulphates, and, without the uncrystallizable matter, about 3·4 per cent. (*Note to the tenth and eleventh editions.*)

This bark comes from the mountain of Pitaya near Popayan, and the particular seroons examined by ourselves were said to have been brought down the Magdalena river from the town of Honda. It is referred by Dr. Pereira and Mr. Howard to the *Cinchona Condaminea*, var. *Pitayensis* of Weddell, of which that author has more recently made a distinct species, under the name of *Cinchona Pitayensis.* (*Ann. des Sci. Nat.*, May, 1849.)*

False Barks.

Before dismissing the subject of the varieties of cinchona, it is proper to observe that numerous barks have at various times been introduced into the market, and sold as closely resembling or identical with the febrifuge of Peru, which experience has proved to differ from it materially, both in chemical composition and medical virtues. These barks are generally procured from trees formerly ranked among the Cinchonas, but now arranged in other genera. They are distinguished from the true Peruvian bark by the absence of its peculiar alkaloids. Among them are 1. a bark known to the French pharmaceutists by the name of *quinquina nova* or *new bark*, which, though at one time thought to be possessed of some virtues, has been proved to be worthless, and was ascertained by Guibourt to be the produce of the *C. oblongifolia* of Mutis, now ranked in Weddell's genus Cascarilla ;† 2. the *Caribæan bark*, from Exostemma Caribæa ; 3. the *St. Lucia bark*, or *quinquina piton* of the French, derived from Exostemma floribunda ; and 4. a bark of uncertain botanical origin, called in France *quinquina bicolore*, and in Italy *china bicolorata*, and sometimes erroneously named *Pitaya bark.* Of these the last only is known in this country. A considerable quantity of it was some time since imported into New Orleans, whence a portion reached this city. The specimen in our possession is in quills, for the most part singly, but in some instances doubly rolled, from eight or ten inches to more than two feet in length, and from a quarter of an inch to an inch or more in diameter.

* *Hard Pitaya Bark.* The following is Guibourt's description of this bark. "In the young barks, the crust is fine, whitish externally, fissured, almost like the young red Lima barks. In the large barks, and in the parts not worn by rubbing, the crust is always whitish exteriorly, but interiorly it is rust-coloured and fungous. The liber presents a very fine fibrous texture, joined to a considerable density and hardness; the internal surface is smooth and reddish; its taste is very bitter and disagreeable, and its watery infusion strongly precipitates with sulphate of sodium. It yields largely of the alkalies, but proportionately more cinchonia than quinia." Guibourt obtained 2·3 per cent. of cinchonia, and 1·15 of sulphate of quinia; or about 3·16 per cent. of pure alkaloids. (*Hist. Nat. des Drogues*, 3ème ed., iii. 141.)

Under the title of *Pitaya-Condaminea Bark*, Pereira describes this variety as follows. "Bark consisting of single or double quills, or half-rolled pieces. I have specimens which are more than a foot in length. Some samples, however, which I have received, consist of pieces not more than two or three inches in length, sometimes entirely, at others only partially coated; the partially coated pieces consist of the suberous and cellular coats and liber. Epidermis, when present, dark-brown, frequently coated by crustaceous lichens, marked by numerous, closely set, transverse cracks, with prominent or slightly everted borders, which give the bark a grater-like feel; and here and there presenting round or oval warts, or fungoid rusty tubercles, varying in size from a grain of wheat to a seed of coffee, and usually marked like the latter with a longitudinal, sometimes also with a transverse fissure. The suberous coat in some pieces much developed, spongy or fungous, fawn-yellow, sometimes brown in the interior, and yellow externally and internally. Resinous tissue on the inside of the suberous coat, from which it is definitely separated, shining, of a dark-reddish colour. Liber gradually passing into the resinous coat, hard, dense, dark, reddish-brown; cortical fibres small and short. Pitaya-Condaminea bark is firm and heavy, and has a very bitter, rather disagreeable taste, which is slowly developed." It contains cinchonia, quinidia (cinchonidia), and quinia. (*Mat. Med.*, 3d ed., p. 1643.)—*Note to the tenth edition.*

† This was formerly called *red Carthagena bark*, but must not be confounded with the genuine red Carthagena bark, which belongs to the *fibrous Carthagena*, already noticed. As described by Guibourt, it is in pieces a foot or more long, rolled when small, open or nearly flat when larger, in general perfectly cylindrical, with a whitish, thin, uniform epidermis, showing scarcely any fungi, and but a few transverse fissures, which are sometimes quite wanting; one to three lines thick without the epidermis ; of a pale carnation, becoming deeper in the air, especially upon the outer surface, which, when destitute of epidermis, is always reddish-brown ; of a fracture which is foliaceous in the outer part, and short-fibrous in the inner ; and exhibiting under the microscope, between its fibres, and especially between the laminæ, a great abundance of two granular matters, of which one is red and the other whitish. In some pieces the fracture exhibits, nearer the external than the internal surface, a yellow, transparent, resinous or gummy exudation. The taste is flat and astringent like that of tan, the odour feeble, between that of tan and of the pale barks. The powder is decidedly red. It contains neither quinia nor cinchonia. Its most interesting constituents are a *peculiar tannic acid, kinic acid, kinovic acid* discovered by Winckler, and a peculiar red colouring matter called *kinovic red.* (Hlasiwetz, *Chem. Gaz.*, ix. 421 and 441.)

The outer surface is of a dull grayish-olive colour, with numerous large oval or irregular spots, much lighter coloured, sometimes even whitish and slightly depressed beneath the general surface, as if a layer of the epidermis had fallen off within their limits. It is to this appearance that the bark owes the name of *bicolorata*. The colour of the internal surface is deep-brown or almost blackish; that of the fresh fracture, brownish-red. The bark is hard, compact, and thin, seldom as much as a line thick, and breaks with a short rough fracture. It is inodorous, and has a very bitter taste, not unlike that of some of the inferior kinds of cinchona.*

The inner bark of an India species of *Hymenodictyon*, formerly considered as a Cinchona, and named *C. excelsa*, has been supposed to possess properties analogous to those of genuine cinchona. It has been chemically examined by Mr. Broughton, who succeeded in obtaining from it a pure crystalline principle, ascertained to be identical with *æsculin*, the characteristic principle of *Æsculus Hippocastanum*, or common horsechestnut. He could find no trace of any of the cinchona alkaloids. (*Pharm. J. and Trans.*, March, 1868, p. 418.)

Chemical History.

In the analysis of Peruvian bark, the attention of chemists was at first directed exclusively to the action of water and alcohol upon it, and to the determination of the relative proportions of its gummy or extractive and resinous matter. The presence of tannin and of various alkaline or earthy salts in minute quantities was afterwards demonstrated. Fourcroy made an elaborate analysis, which proved the existence of other principles in the bark besides those previously ascertained. Dr. Westring was the first who attempted the discovery of an active principle in the bark, on which its febrifuge virtues might depend; but he was not successful. Seguin afterwards pursued the same track, and endeavoured, by observing the effects of various reagents, to discover the relative value of different varieties of the drug; but his conclusions have not been supported by subsequent experiment. M. Deschamps, an apothecary of Lyons, obtained from bark a crystallizable salt of lime, the acid of which Vauquelin afterwards separated, and called *kinic acid*. The latter chemist also pushed to a much further extent the researches of Seguin as to the influence of reagents, and arrived at the conclusion that those barks were most efficient which gave precipitates with tannin or the infusion of galls. Reuss, of Moscow, succeeded in isolating a peculiar colouring matter from red bark, which he designated by the name of *cinchonic red*, and obtained a bitter substance which probably consisted in part of the peculiar alkaline principles subsequently discovered. The first step, however, towards the discovery of cinchonia and quinia appears to have been taken by the late Dr. Duncan, of Edinburgh, so early as 1803. He believed the precipitate, afforded by the infusion of cinchona with that of galls, to be a peculiar vegetable principle, and accordingly denominated it *cinchonine*. Dr. Gomez, a Portuguese physician, convinced that the active principle of bark resided in this cinchonine, but mixed with impurities, instituted experiments upon some pale bark, which resulted in the separation of a white crystalline substance, considered by him to be the pure *cinchonine* of Dr. Duncan. It was obtained by the action of potassa upon an aqueous infusion of the alcoholic extract of the bark, and was undoubtedly the principle now universally known by the name of *cinchonine* or *cinchonia*. But Dr. Gomez was ignorant of its precise nature, considering it to be analogous to resin. M. Laubert afterwards obtained the same principle by a different process, and described it under the name of *white matter*, or *pure white resin*. To Pelletier and Caventou was reserved the honour of crowning all these experiments, and applying the results which they obtained to important practical purposes. In 1820, they demonstrated the alka-

* In previous editions of this work, it was stated that this bark had been employed in Italy successfully in intermittents, and that Folchi and Peretti had discovered in it a new alkaloid, which they named *pitayna*. But there is reason to believe that this was a mistake, caused by the confused use of the name Pitaya bark; and that the bark employed in Italy, and analyzed by the chemists mentioned, was that described as *hard pitaya* in a preceding page. It is conjectured that the alkaloid *pitayna* may have been either quinidia or cinchonidia, or a mixture of the two. (*Note to the tenth and eleventh editions.*)

line character of the principle discovered by Gomez and Laubert, and gave it definitively the name of *cinchonine*. They discovered in the yellow or Calisaya bark another alkaline principle, which they denominated *quinine*. Both these bases they proved to exist in the barks, combined with *kinic acid*, in the state of *kinate of cinchonine and of quinine*. It was, moreover, established by their labours that the febrifuge property of bark depends upon the presence of these two principles. In 1833, MM. O. Henry and Delondre discovered a new alkaloid, but afterwards, finding its composition in its anhydrous state the same as that of quinia, concluded that it was a hydrate of that base. About 1844, Winckler announced anew the existence of the same principle which he considered distinct, and named *chinidine;* and, under the similar title of *quinidine*, it is now generally admitted to a place among the cinchona alkaloids. In 1853, M. Pasteur found that what had been considered as quinidine consisted in fact of two alkaloids, for one of which he retained the name of quinidine, and called the other *cinchonidine;* and, on pushing his investigations further, he ascertained that no less than six alkaloids may be obtained from different varieties of Peruvian bark; namely, *quinine* and *quinidine* isomeric with each other, *cinchonine* and *cinchonidine* also isomeric, and two others, derivatives from the preceding through the agency of heat, viz., *quinicine* from quinine, and *cinchonicine* from cinchonine, each being isomeric with the alkaloid from which it is derived. As the termination *a* or *ia* has been generally adopted by American and English chemists to distinguish the organic alkaloids from other organic proximate principles, the names of which terminate in *in* or *ine*, the terms quinine and cinchonine of the French writers have been changed with us into *quinia* and *cinchonia*. On the same principle, *quinidine*, *quinicine*, *cinchonidine*, and *cinchonicine* should be called respectively *quinidia*, *quinicia*, *cinchonidia*, and *cinchonicia*. This method of designating the vegetable alkaloids is uniformly followed in the present work.*

It has before been stated, on more than one occasion, that the three officinal varieties of bark are distinguished by peculiarities of composition. We give the result of the analysis of each variety, as obtained by Pelletier and Caventou. (*Journ. de Pharm.*, vii. 70, 89, 92.)

Pale bark of Loxa contains, 1. a fatty matter; 2. an insoluble red colouring matter; 3. a yellow colouring matter; 4. tannin, or soluble red colouring matter; 5. gum; 6. starch; 7. lignin; 8. kinate of calcium; 9. *kinate of cinchonia, with a very minute proportion of kinate of quinia.*

Yellow Calisaya bark contains the fatty matter, the cinchonic red, the yellow colouring matter, tannin, starch, lignin, kinate of calcium, and *kinate of quinia, with a comparatively small proportion of kinate of cinchonia.*

Red bark contains the fatty matter, a large quantity of the cinchonic red, the yellow colouring matter, tannin, starch, lignin, kinate of calcium, and *a large proportion both of kinate of quinia and of kinate of cinchonia.*

Carthagena bark generally contains the same ingredients with the red bark, but in different proportions. It has less of the alkaline matter, which it also yields with much greater difficulty to water, in consequence of the abundance of insoluble cinchonic red which it contains, and which either involves the salts of quinia and cin-

* Reference has been made in a note to the discovery, by Pelletier and Coriol, of an alkaloid called *aricina* in the Arica or Cusco bark. It was obtained by the same process as that employed in the extraction of quinia from yellow bark. It is white, crystallizable, and distinguishable from cinchonia, which it in many respects resembles, by exhibiting a green colour under the action of nitric acid, and by the property, possessed by its sulphate, of forming a tremulous jelly when a saturated boiling solution of the salt is allowed to cool. Manzini obtained from Jaën bark an alkaline substance which he supposed to be peculiar, and named *cinchovatin;* but the same had been obtained by Bouchardat, and considered by him, as well as by Pelletier, to be identical with *aricina;* and Winckler, having extracted a portion from the bark, and examined it with great care, coincided in this conclusion. (*Journ. de Pharm.*, 3e sér., ii. 95 et 313; *Central Blatt*, A. D. 1844, p. 126.) Much doubt, however, exists on the subject of this supposed alkaloid, and by Mr. Howard it is thought most probably to have been quinidia.

Besides the alkaloids mentioned in the text, the claims of which as characteristic constituents of Peruvian bark are admitted, and besides the aricina of Pelletier, there are others, the discovery of which has been from time to time announced, but of which the pretensions to this rank have not been so satisfactorily determined. Of these mention will be made in notes, as the opportunity offers; our limits not permitting that they should be introduced into the text of the work.

chonia so as to prevent the full contact of water, or retains these alkaloids in combination. (*Journ. de Pharm.*, vii. 105.)

Besides quinia and cinchonia, there can be little doubt that two other alkaloids, *quinidia* and *cinchonidia* as they are denominated in this work, exist in Peruvian bark; and it is highly probable that, though found most abundantly in the pale, and some of the Carthagena barks, they are contained at least occasionally, to a greater or less extent, in all; while two others *quinicia* and *cinchonicia*, if they do not pre-exist in the barks, result from the processes employed in the separation of the alkaloids just mentioned.

Another bitter principle was extracted from Calisaya bark by Winckler. He named it *kinovic bitter;* but, having been supposed to possess acid properties, it was afterwards denominated *kinovic acid.* It is thought to exist in the bark in a free state (Schwartz, *Pharm. Cent. Blatt*, 1852, p. 194), as well as combined with one or more of the alkaloids. The nauseous taste of some of the barks has been ascribed to this principle.

By the experiments of Henry jun. and Plisson, it may be considered as established, that the alkaloids of the different varieties of bark are combined at the same time with kinic acid, and with one or more of the colouring matters, which, in relation to these substances, appear to act the part of acids. This idea was originally suggested by Robiquet. (*Journ. de Pharm.*, xii. 282, 369.) The compounds of quinia, cinchonia, &c. with the colouring matter, are scarcely soluble in water, while their kinates are very soluble.

From these statements it appears that the three officinal varieties of bark differ little except in the proportion of their constituents. All contain quinia and cinchonia; the yellow bark most of the first, the pale of the second, and the red a considerable quantity of both. All probably contain, occasionally at least, the other characteristic alkaloids. Gum was found in the pale, but not in the red or yellow. Kinovic bitter, though first discovered in the yellow, probably exists in others.

The odour of bark appears to depend on a *volatile oil*, which Fabroni and Trommsdorf obtained by distillation with water. The oil floated on the surface of the water, was of a thick consistence, and had a bitterish, acrid taste, with the odour of bark.*

The *fatty matter*, which was first obtained pure by M. Laubert, is of a greenish colour as obtained from the pale bark, orange-yellow from the yellow. It is insoluble in water, soluble in boiling alcohol, which deposits a part of it on cooling, very soluble in ether even cold, and saponifiable with the alkalies.

The *cinchonic red* of Reuss, the *insoluble red colouring matter* of Pelletier and Caventou, is reddish-brown, insipid, inodorous, largely soluble in alcohol especially when hot, and almost insoluble in ether or water, though the latter dissolves a little at the boiling temperature. The acids promote its solubility in water. It precipitates tartar emetic, but not gelatin; but if treated with a cold solution of potassa or soda, or by ammonia, lime, or baryta, with heat, and then precipitated by an acid, it acquires the property of forming an insoluble compound with gelatin, and seems to be converted into tannin. It is precipitated by subacetate of lead. It is most abundant in the red bark, and least so in the pale. Berzelius supposed it to be formed from tannin by the action of the air. According to Schwartz, it results from the absorption by the tannin of three eqs. of oxygen, and the elimination of two eqs. of carbonic acid and one eq. of water. (*Pharm. Cent. Blatt*, 1852, p. 194.) There is reason to believe that it is also produced by changes in the alkaloids under the influence of light.

The *yellow colouring matter* has little taste, is soluble in water, alcohol, and ether, precipitates neither gelatin nor tartar emetic, and is itself precipitated by subacetate of lead.

* A very careful chemical examination of several varieties of Peruvian bark has been made by Dr. E. Reichardt, the results of which are given in a paper, which received a prize from the Philosophical Society of Jena. The following are the constituents of the barks examined. 1. *Organic constituents;* quinia, cinchonia, ammonia, kinic acid, kinovic acid, cincho-tannic acid, oxalic acid, sugar, wax, cinchonic red, humic acid, and cellulose. 2. *Inorganic constituents;* chloride of potassium, carbonates of potassium, magnesium, and calcium, phosphates of calcium, aluminium, and iron, silicate of calcium, sulphate of calcium, and oxide of manganese. (*Chem. Pharm. Cent. Blatt*, Sept. 12, 1855, p. 637.)—*Note to the eleventh edition.*

The *tannic acid*, *tannin*, *cincho-tannic acid*, or *soluble red colouring matter* of Pelletier and Caventou, has been considered as possessing all the properties which characterize the proximate vegetable principles associated together under the name of tannic acid. It has a brownish-red colour and austere taste, is soluble in water and alcohol, combines with metallic oxides, and produces precipitates with the salts of iron, which vary in colour according to the variety of bark, being deep-green with the pale bark, blackish-brown with the yellow, and reddish-brown with the red. It also forms white precipitates with tartar emetic and gelatin, and readily combines with atmospheric oxygen, becoming insoluble. It must, however, differ materially from the tannic acid of galls, which could not exist in aqueous solutions containing cinchonia and quinia without forming insoluble compounds with them.

But the most interesting and important constituents of Peruvian bark are the alkaline and active principles quinia, cinchonia, &c., and the kinic and kinovic acids, with the former of which the latter principles are combined. In relation to these, therefore, we shall be more minute in our details.

Quinia. As usually prepared, quinia is whitish, rather flocculent, and not crystalline; but it may with care be crystallized from its alcoholic solution in silky needles; and Liebig obtained it from a somewhat ammoniacal watery solution in the same form. It is inodorous and very bitter. At about 300° F. it melts without chemical change, and on cooling becomes brittle. By carefully regulated heat, it may be sublimed unchanged, assuming a crystalline form. (Waddington, *Pharm. Journ. and Trans.*, March, 1868, p. 413.) It is soluble in about 400 parts of cold and 250 of boiling water, is very soluble in alcohol and ether, and dissolved by the fixed and volatile oils.* The alcoholic solution is intensely bitter. Quinia is unalterable in the air. It forms salts with the acids which readily crystallize. The tannate, tartrate, and oxalate are said to be insoluble or nearly so, but are dissolved by an excess of acid. The acetate, according to Prof. J. M. Maisch, is so slightly soluble that it is precipitated from a solution of the sulphate by the acetates of magnesium and the alkalies. (*Am. Journ. of Pharm.*, xxx. 386.) When recently precipitated quinia, diffused in water, is exposed to the action of a stream of carbonic acid gas, the quinia is dissolved; and, if the solution be exposed, acicular crystals of carbonate of quinia are deposited, which effloresce in the air, are soluble in alcohol, but insoluble in ether, have an alkaline reaction, and effervesce with acids. After the deposition of the crystals has ceased, the solution yields quinia on evaporation. (Langlois, *Comptes Rendus*, Nov. 7, 1853, p. 727.) Freshly precipitated quinia is scarcely soluble to an appreciable extent in an excess of potassa, but is more readily dissolved by ammonia. (Wadgymar, *Am. Journ. of Pharm.*, Sept. 1866, p. 451.)

Quinia and its salts may be distinguished from all other vegetable alkalies and their salts, excepting only quinidia, by the beautiful emerald-green colour which results, when their solution is treated first with solution of chlorine and then with ammonia, and which changes to a white or violet upon saturation with a dilute acid. The least quantity of quinia may be detected by powdering the substance supposed to contain it, then shaking it with ether, and adding successively the tests just mentioned. Its salts are precipitated by the bichlorides of mercury and platinum, and of a buff colour by the terchloride of gold.

In relation to the property, possessed by quinia, of imparting fluorescence to its watery solution, which is possessed also, though in less degree, by other cinchona alkaloids, there will be occasion to speak under Sulphate of Quinia, in Part II. of this work; in connection with the singular discovery, by Dr. Bence Jones, of London, of a substance normally present in the animal system having analogous properties, and therefore named by him "*animal quinoidine*."

The composition of quinia is differently given. According to Liebig, it consists of twenty eqs. of carbon, twelve of hydrogen, one of nitrogen, and two of oxygen

* A different statement of the solubility of quinia has been made by Fausto Sestini, on the basis of his own observations, in the *Bulletin de la Société Chimique* (Fev. 1866). He finds that one part of quinia requires 1667 parts of water for solution at 20° C., and 902 parts at the boiling point. The hydrate of quinia requires 1428 parts at 20°, and 773·4 at 100° C. Alkalies diminish the solubility, and soda more than potassa; water containing one-sixth of soda dissolving none. (*Am. J. of Pharm.*, July, 1869, p. 330.)—*Note to fourteenth edition.*

($C_{20}H_{12}NO_2$), and its combining number is 162. This formula is based on the supposition that, of the two salts which quinia forms with most acids, the one containing the smallest proportion of acid is a di-salt, consisting of two eqs. of base and one of acid, and the other neutral, consisting of one eq. of each. Another view is, that the first of these salts is neutral, and the second a bi-salt; and, if this be admitted, the above combining number must be doubled. Upon the latter supposition, the formula, according to Laurent, is $C_{38}H_{22}N_2O_4$ and the combining number 310; according to Regnault and Strecker, the former is $C_{40}H_{24}N_2O_4$ and the latter 324, being just double the number of Liebig, and probably correct, at least so far as concerns the relative proportion of the several ingredients.*

There is reason to believe that quinia may become uncrystallizable without change of composition, and impart to its salts the same uncrystallizable character. In this state it is called *amorphous quinia*. This is always among the substances left in the mother-waters after the crystallization of sulphate of quinia, in its preparation from Calisaya bark. More will be said of this under sulphate of quinia in the *second part* of this work.

Quinia is obtained by treating its sulphate with the solution of an alkali, collecting the precipitate, washing it till the water comes away tasteless, then drying it, dissolving it in alcohol, and slowly evaporating the solution.

The most important artificial salt of quinia is the *sulphate*, the process for procuring which, as well as its properties, will be hereafter described. The *valerianate* has been introduced into the U. S. Pharmacopœia, and the *citrate of iron and quinia* both into this and the British, which give processes for their preparation. The *phosphate*, *acetate*, *citrate*, *lactate*, *camphorate*, *ferrocyanate*, *tannate*, *arsenite*, *antimoniate*, *urate*, *hypophosphite*, and *chlorate*, have also been employed or recommended; but none of them has yet gained admittance into the Pharmacopœias, and none probably is superior to the officinal sulphate. The first five may be prepared by saturating a solution of the acids respectively with quinia, and evaporating the solutions. The *camphorate* is recommended as a substitute for the valerianate. (*Am. Journ. of Pharm.*, July, 1865, p. 254.) The *ferrocyanate* is directed to be made by boiling together two parts of sulphate of quinia and three of ferrocyanide of potassium in a very little water, pouring off the liquor from a greenish-yellow substance of an oily consistence which is precipitated, washing the latter with distilled water, then dissolving it in strong alcohol at 100° F., filtering immediately, and afterwards evaporating the solution. (*Am. Journ. of Pharm.*, xii. 351.) M. Pelouze, however, found this preparation to be pure quinia, mixed with a little Prussian blue. (*Archives Gén.*, 3e sér., xv. 236.) The *tannate* may be prepared by precipitating the infusion of bark, or solution of sulphate of quinia, by the infusion of galls or solution of tannic acid, and then washing and drying the precipitate. It has the advantage of possessing little taste, while experience has shown that it is little if at all inferior in antiperiodic powers to the sulphate; but its amorphous condition renders it more liable to adulteration. Either of these salts may be given in

* Langlois found the carbonate of quinia, deposited from a solution in carbonic acid water, to contain one eq. of acid and one of base, admitting the combining number of the latter to be 162; and, if this salt be considered neutral, the result will tend to confirm the view of Liebig. (*Comptes Rendus*, Nov. 7, 1853, p. 727.) On the contrary, Adolphus Strecker, who has made an elaborate analysis of quinia and its compounds, has adopted the formula $C_{40}H_{24}N_2O_4$ (eq. 324), basing his opinion chiefly on the composition of the double chloride of platinum and quinia, and on the fact, that the only crystallizable nitrate he could obtain coincides with the officinal sulphate, and that in this compound one eq. of oxide of silver may be made to replace one eq. of water, so as to form a nitrate of silver and quinia. (See *Am. Journ. of Pharm.*, xxvii. 241 and 321.) To the same point tends the fact, that the officinal sulphate of quinia is the more permanent of the two sulphates. Upon the whole, we are inclined to the view which considers the formula to be $C_{40}H_{24}N_2O_4$, and the combining number 324. (*Note to the eleventh edition.*)

Oxyquinia. Schutzenberger has ascertained that when sulphate of quinia is boiled with a solution of nitrate of potassium, nitrogen escapes with effervescence, and the liquid, after cooling, deposits, on the addition of ammonia, a white, granular substance, which, when dissolved in alcohol, and obtained in a dry state by the evaporation of the menstruum, assumes a transparent, resinous appearance. By contact with water it becomes crystalline. This substance has alkaline properties, and differs from quinia only in containing two additional eqs. of oxygen. It has, therefore, been named *oxyquinia*. (*Comptes Rendus*, Juillet 12, 1858, p. 81.) — *Note to the twelfth edition.*

the same dose as the sulphate. *Arsenite of quinia* has been recommended by Dr. Ringdon, especially in chronic cutaneous affections. He prepares it by boiling 64 grains of arsenious acid, with half the quantity of carbonate of potassium, in four fluidounces of distilled water until dissolved, adding water enough to make the solution measure four fluidounces, and then mixing five drachms of this solution with two scruples of sulphate of quinia, previously dissolved in boiling distilled water. The arsenite of quinia is thrown down in the form of a white curdy precipitate, which is to be washed on a filter and dried. It is uncrystallizable, insoluble in water, and soluble in alcohol. The dose is one-third of a grain, given at first twice a day, and afterwards three and four times a day. (*Prov. Med. and Surg. Journ.*, Aug. 25, 1847.) *Antimoniate of quinia* has been recommended by Dr. La Camera, of Naples, as a febrifuge, being especially applicable to cases of doubtful periodicity. It unites, he thinks, the evacuant properties of the antimonials with the antiperiodic property of quinia. The dose is two or three grains, four times a day. (*Journ. de Pharm.*, 3e sér., xxv. 471.) The *urate of quinia* is thought by Dr. Pérayre, of Bordeaux, to be peculiarly efficacious in obstinate intermittents. It is prepared by boiling 10 parts of crude quinia in water, adding gradually 20 parts of crystallized uric acid, and, after sufficient ebullition, filtering and evaporating. A yellow salt is obtained, sometimes amorphous, more frequently crystalline, soluble in hot and less so in cold water, and, according to the author, capable of curing intermittent fever in smaller doses than the sulphate, with less cerebral disturbance, less bitterness, and easier tolerance by the stomach. (*Journ. de Pharm.*, 3e sér., xxxvii. 139.) The *hypophosphite of quinia* has been brought into notice by Dr. J. Lawrence Smith, of the University of Louisville, who prepares it by mixing, in a large porcelain capsule, 50 ounces of sulphate of quinia, 2 gallons of distilled water, and 2 ounces of hypophosphorous acid, heating the mixture to 200°, and then adding a solution of hypophosphite of barium sufficient to produce complete decomposition, an excess of the latter salt being scrupulously avoided. Sulphate of barium and hypophosphite of quinia are formed, the latter in solution. The solution is filtered while hot, and on cooling deposits the salt in crystals. If the sulphate of barium be washed, the washings added to the mother-waters of the first crystallization, and the mixed liquors carefully evaporated, a fresh crop of crystals will be obtained. The salt consists of one eq. of quinia (admitting the double numbers) and one of hypophosphorous acid, with two eqs. of water of crystallization. (*Am. Journ. of Pharm.*, Sept. 1860, p. 410.)*

Cinchonia. This, when pure, is white, crystallizable from its alcoholic solution in four-sided prisms with oblique terminal facets, soluble in 2500 parts of boiling water, almost insoluble in cold water, soluble in boiling alcohol which deposits a portion upon cooling, and slighly soluble in ether and in the fixed and volatile oils.† Its bitter taste, at first not very obvious in consequence of its difficult solubility, is developed after a short time by the solution of a minute portion in the saliva. Its alcoholic, ethereal, and oleaginous solutions are very bitter. By heat it is melted and partially changed, and, if the heat be cautiously increased, sublimes into a matted

* The *chlorate of quinia* is best prepared, according to Mr. C. R. C. Tichborne, from chlorate of barium. He mixes in a porcelain dish 310 grains of chlorate of barium dissolved in a little boiling water with 2 ounces avoird. of sulphate of quinia, and 12 ounces of hot water, at 194° F.; a slight excess of the sulphate being used to ensure the precipitation of all the barium. Owing to this excess, a slight pellicle of sulphate of quinia floats on the surface. Apply heat, and gradually add a very little precipitated carbonate of barium till the coating of sulphate is replaced by a slight oily pellicle of alkaloid. The chlorate of quinia is now obtained by evaporation and crystallization. For a mode of preparing the chlorate of barium, see a communication from Dr. C. Lewis Diehl, in the *Amer. Journ. of Pharm.* (March, 1868, p. 101).

The chlorate crystallizes from its solution in fungoid tufts, consisting of filiform, snow-white crystals, radiating from a centre. It melts with heat, and in the air at length takes fire, burning vividly, and if dry sometimes with explosion, leaving a carbonaceous residue. It is very soluble in boiling water, but sparingly in cold, and is deposited from its hot solution on cooling. Gently warmed with muriatic acid, it emits chlorine copiously; and ammonia now added in excess occasions an emerald-green colour; thus showing that it is a compound of chloric acid and quinia. (*Pharm. Journ. and Trans.*, 2d ser., viii. 135.)—*Note to the thirteenth edition.*

† According to Hesse, cinchonia is soluble at 68° F. in 3670 parts of water, in 125·7 parts of alcohol of 0·852, and in 371 parts of ether of 0·7305. (See *Am. Journ. of Pharm.*, xxxv. 54.)—*Note to the twelfth edition.*

tissue of fine crystals, which have the same formula as the pure alkaloid. (Hlasiwetz, *Chem. Gaz.*, ix. 90.) Waddington found it to sublime readily, without change, and in perfectly characteristic crystals. (*Pharm. J. and Trans.*, March, 1868, p. 414.)* Its alkaline character is very decided, as it neutralizes the strongest acids. Of the salts of cinchonia, the sulphate, nitrate, muriate, phosphate, and acetate are soluble in water. The neutral tartrate, oxalate, and gallate are insoluble in cold water, but soluble in hot water, alcohol, or an excess of acid. Winckler has shown that cinchonia is rendered uncrystallizable or amorphous by sulphuric acid in excess, aided by heat; a fact of importance in the preparation of the sulphate of this alkaloid. (*Chem. Gaz.*, March 15, 1848.) Cinchonia is but little more soluble in carbonic acid water than in pure water, and does not, like quinia, yield crystals of the carbonate on exposure of its carbonic acid solution. (*Comptes Rendus*, Nov. 7, 1853, p. 727.)

Several processes have been employed for the preparation of cinchonia. One of the simplest is the following. Powdered pale bark is submitted to the action of sulphuric or muriatic acid very much diluted, and the solution obtained is precipitated by an excess of lime. The precipitate is collected on a filter, washed with water, and treated with boiling alcohol. The alcoholic solution is filtered while hot, and deposits the cinchonia when it cools. A further quantity is obtained by evaporation. If not perfectly white, it may be made so by converting it into a sulphate with dilute sulphuric acid, then treating the solution with animal charcoal, filtering, precipitating by an alkali, and redissolving by alcohol in the manner already mentioned. It may also be obtained from the mother-waters of sulphate of quinia by diluting them with water, precipitating with ammonia, collecting the precipitate on a filter, washing and drying it, and then dissolving it in boiling alcohol, which deposits the cinchonia in a crystalline form upon cooling. It may be still further purified by a second solution and crystallization.

The same remarks in relation to equivalent composition apply to cinchonia as those already made in reference to quinia. According to the view which considers the salts as basic and neutral, cinchonia consists of twenty eqs. of carbon, twelve of hydrogen, one of nitrogen, and one of oxygen ($C_{20}H_{12}NO$); and its combining number is 154. This is the formula of Liebig. The other view would double these numbers; the formula being $C_{40}H_{24}N_2O_2$, and the eq. 308.

Exposed to the air, cinchonia does not suffer decomposition, but very slowly absorbs carbonic acid, and acquires the property of effervescing slightly with acids. It is precipitated of a sulphur-yellow by the terchloride of gold. Chlorine-water dissolves it or any of its salts without change; but if ammonia be now added, a white precipitate is produced. It is thus distinguishable from quinia. Dr. J. W. Bill, U. S. A., proposes ferrocyanide of potassium as a very delicate test of cinchonia. If added to the solution of a salt of this alkaloid, it produces a yellowish-white curdy precipitate, which is dissolved upon the application of a gentle heat, but is again deposited, when the liquid cools, as an abundant crop of golden-yellow crystals. No other alkaloid exhibits the same reaction. A cloudy precipitate is produced by the same reagent with a salt of quinia; but this does not happen when the ferrocyanide is in excess; and, if the precipitate is dissolved by heat, no subsidence takes place on cooling. Hence, in the application of this test to cinchonia, a slight excess of the ferrocyanide should be added. (*Am. Journ. of Sci. and Arts*, July, 1858, p. 108.)

By the action of permanganate of potassium cinchonia is decomposed, with the effect of producing, besides other products, a distinct neuter principle, named *cinchotenine*, a crystallizable acid, the *carbonycinchonic*, and a new alkaloid, which the authors name *hydrocinchonine*, as it differs from cinchonine (cinchonia) only in having two additional eqs. of hydrogen. For a special account of these principles the reader can consult the *Pharmaceutical Journal* (Nov. 1869, p. 291); from a paper by Messrs. Caventou and Willm, presented to the Chem. Society of Paris.

* It is asserted that the muriates of quinia, cinchonia, and quinidia, heated on a slip of platinum, short of combustion, emit a purple vapour like iodine. Neither the alkaloids nor their sulphates have this property; but the addition of one-tenth of muriate will cause the evolution of the coloured vapour. (*J. de Pharm. et de Chim.*, 4e sér., iii. 397.)—*Note to the thirteenth edition.*

Sulphate of cinchonia (*disulphate* of Liebig), the only salt of this base which has been employed in a separate state, is now one of the U. S. officinals, and will be treated of in the *second part* of this work among the *Preparations.*

Quinidia (*quinidine*) and *Cinchonidia* (*cinchonidine*). It has been already stated that the substance, at one time considered as a peculiar alkaloid, and denominated quinidia or quinidine, has been ascertained to be generally complex, and to consist of two distinct alkaloids in variable proportions. For one of these, in consequence of its similarity in chemical constitution to quinia, Pasteur retained the name of quinidine (quinidia), while he called the other, from a similar resemblance to cinchonia, cinchonidine (cinchonidia). It is unfortunate that Pasteur's quinidine is the alkaloid which in general constitutes the smaller proportion of the complex substance formerly so named; his cinchonidine existing in it much more largely, and sometimes, there is reason to believe, constituting almost the whole of it. Nevertheless, it is necessary to adopt the nomenclature of Pasteur, as corresponding strictly with the chemical relations of the several substances concerned. The student will, therefore, take care not to confound the quinidia as formerly described with the pure alkaloid of the same name, and to recollect that the former substance corresponds more closely with cinchonidia (the cinchonidine of Pasteur), and sometimes probably consists of it exclusively, or nearly so.

Quinidia (*quinidine*, Pasteur) is isomeric with quinia, having the constitution $C_{40}H_{24}N_2O_4$, or $C_{20}H_{12}NO_2$. It crystallizes readily in rhombic prisms, which contain four eqs. of water, and effloresce on exposure to the air. It is sublimable by heat without change, and is condensed in a crystalline form. (*Waddington.*) It resembles quinia not only in composition, but also in its chemical relations with chlorine and ammonia, being rendered green by the successive action of those agents. According to Dr. Herapath, it resembles quinia also in causing a fluorescent appearance when dissolved in water, which is not the case with either cinchonia or cinchonidia, or is so at least in a much less degree. (See *Am. Journ. of Pharm.*, xxix. 245.) It differs, however, in its greater facility of crystallization, in its much less solubility in ether, and in its influence on polarized light, quinidia producing deviation to the right, and quinia to the left. De Vrij, of Rotterdam, states, as the result of his observation, that quinidia (of Pasteur) forms a salt of very difficult solubility with hydriodic acid; and, consequently, when a solution of iodide of potassium is added to a solution of sulphate of quinidia, a white precipitate takes place. By this test quinidia may be distinguished from the other cinchona alkaloids, and detected when mixed with them in solution; no other yielding a precipitate with iodide of potassium. (See *Am. Journ. of Pharm.*, xxix. 233.) Dr. Herapath proposes another test to distinguish this alkaloid from quinia. If to a solution of sulphate of quinia in acetic acid tincture of iodine be added, and the mixture heated and then allowed to cool, a beautiful emerald-green compound is formed; while sulphate of quinidia treated in the same way, yields a brown precipitate. When the mixture of this alkaloid with cinchonidia is exposed to hot air, the crystals of quinidia effloresce, and may be distinguished from the others by their opaque whiteness. For practical purposes this separation is unnecessary; for there is probably no appreciable difference in their effects as remedial agents.*

* Cinchonia, quinia, quinidia, and strychnia, when heated with caustic potassa, yield acrid vapours, which condense into an oily liquid having alkaline properties, for which the name of *quinoléin* was proposed by its discoverer Mr. Gerhardt, and which is also called *cincholin*. It has a peculiar odour, not unlike that of the bean of St. Ignatius, and an extremely acrid and bitter taste; is slightly soluble in water, and freely so in alcohol, ether, and the volatile oils; forms crystallizable salts with the acids; and is characterized by producing a yellow crystalline precipitate with chromic acid. It results also from the dry distillation of quinia. (*Journ. de Pharm.*, 3e sér., ii. 341.) Dr. A. W. Hofmann has found that the substance called *leucol*, existing in coal-gas naphtha, is identical with cincholin. (*Chem. Gazette*, June, 1845, p. 251.) More recently Mr. C. Greville Williams has shown that the alkaline matter called cincholin is complex, and that several volatile alkaloids result from the decomposition of cinchonia by potassa with heat, analogous to those found in coal-gas tar. (*Ibid.*, Aug. 15, 1855, p. 301. See also *Gregory's Chemistry*, 4th ed., Lond., p. 400.) Dr. Stenhouse proposes, as a test of the presence of alkaline principles in bark, to macerate with dilute sulphuric acid, precipitate with solution of carbonate of potassium or sodium in excess, and distil the precipitate with a great excess of caustic potassa or soda. Cincholin will distil over in oily drops, recognisable by its peculiar odour and strong alkaline properties. (*Philos. Mag.*, xxvi. 199.)

Cinchonidia (*cinchonidine*, Pasteur) is isomeric with cinchonia, having the constitution $C_{40}H_{24}N_2O_2$, or $C_{20}H_{12}NO$, and agrees also with that alkaloid in forming anhydrous crystals, and in not producing the green colour with chlorine and ammonia. It differs in being more soluble in ether, and in producing deviation to the left in its influence on polarized light; cinchonia producing deviation to the right. (Regnault, *Cours Élément. de Chim.*, 4e ed., iv. 314.) If, on exposure to hot air, white effloresced crystals show themselves, it may be taken for granted that there is an admixture of quinidia. It sublimes readily unchanged, assuming a more or less crystalline form, and, with a carefully regulated heat, perfect crystals may be obtained. (*Waddington.*)

Sulphate of cinchonidia. We are informed by Messrs. Powers & Weightman that they have prepared large quantities of this salt, and, having distributed it extensively for trial, have received assurances from various sources that it has proved equal as a therapeutic agent to sulphate of quinia.

As the two preceding alkaloids have not been thoroughly investigated, in their perfectly pure and isolated state, in reference either to their chemical or practical relations, it will be proper to state what has been made known of the commercial quinidia, in which they are believed to exist, in general conjointly.

Commercial quinidia, consisting generally of proper quinidia with a much larger proportion of cinchonidia, and sometimes, there is reason to believe, exclusively, or nearly so, of the latter alkaloid, was carefully examined by H. G. Leers, from whose paper, published originally in the *Ann. der Chem. und Pharm.* (May, 1852), the following account of its properties has been chiefly derived. It readily crystallizes from its alcoholic solution, by spontaneous evaporation, in hard, shining, colourless crystals, which are easily pulverized, and yield a snow-white powder. They melt without decomposition or loss of water at 347° F., and on cooling concrete into a grayish-white crystalline mass. At a higher heat they take fire, and burn with the odour of kinole, and volatile oil of bitter almonds. Their taste is bitter, but less intensely so than that of quinia. Quinidia is soluble, according to Leers, in 2580 parts of water at 62°, and in 1858 parts at 212°, in 143 (169 Winckler) of ether, and 12 of alcohol of 0·835, both at 62° F.; but its solubilities must, of course, vary more or less according to the relative quantities of its two components, quinidia proper and cinchonidia, contained in it. With the acids it forms salts, most of which are beautifully crystallizable, and much more soluble than those of quinia. There are, as of quinia and cinchonia, two sets of the salts of quinidia, which may be considered either as neutral and acid, or as basic and neutral. When treated first with chlorine and then with ammonia, it does not like quinia yield a green colour, nor like cinchonia a white one, but remains unaffected. It differs from quinia also by its much less solubility in ether. From the aqueous solution of its salts, the alkalies, their carbonates, and bicarbonates throw down pulverulent precipitates not soluble in an excess of the precipitant. With phosphate of sodium, nitrate of silver, and bichloride of mercury it forms white, with terchloride of gold light-yellow, and with bichloride of platinum orange-yellow precipitates. It may be obtained by first precipitating it from the solution of one of its salts by an alkali, and then repeatedly dissolving in alcohol and crystallizing, until it is entirely freed from a greenish-yellow resinous substance which is apt to attend it. From quinia it may be separated by repeated washing with ether, until the ethereal solution no longer affords evidence of the presence of quinia by the test of chlorine and ammonia. In this state it must be looked on as unmixed cinchonidia. One of the distinctive characters of this complex alkaloid is, according to Guibourt, that, while *oxalate of quinia* is quite insoluble in water, *oxalate of quinidia* (*commercial*) is very soluble, and easily crystallizable by refrigeration or evaporation. (*Journ. de Pharm.*, 3e sér., xxii. 414.)

Sulphate of quinidia (*commercial*) is, according to one view, neutral, consisting of one eq., each, of quinidia, sulphuric acid, and water; according to another, basic, containing two eqs. of base, one of acid, and one of water, and therefore a disulphate. It is in long, shining, silky acicular crystals, soluble in 130 parts of water at 62° F., in 16 parts at 212°, readily soluble in alcohol, but almost insoluble in ether.

It is obtained from the quinidia (strictly, cinchonidia) barks by the same process as that by which sulphate of quinia is procured from the Calisaya. When the two alkaloids are contained in the same bark, the sulphate of quinidia (commercial) remains in the mother-waters in consequence of its greater solubility. By the addition to its solution of a quantity of sulphuric acid equal to that which it contains, it is converted into the bisulphate (sulphate on the basic view), crystallizable in fine acicular crystals like asbestos.

Quinicia (*quinicine*) and *Cinchonicia* (*cinchonicine*). When quinia and cinchonia, or quinidia and cinchonidia, or their salts, are exposed to heat, these alkaloids have been found by Pasteur to be changed into other but isomeric alkaloids; quinia and quinidia into quinicia, isomeric with themselves; and cinchonia and cinchonidia into cinchonicia, isomeric with its own antecedents. These new alkaloids are, therefore, products rather than educts, and generally result, in greater or less proportion, from the processes employed in extracting the other alkaloids from bark; though it is not impossible that they may pre-exist in bark to a certain extent, being formed by a natural process, from the same original alkaloids, either in the living tree, or in the barks while drying, after separation from the tree.

Quinicia is almost insoluble in water, but very soluble in alcohol, and differs from quinia in causing deviation of the plane of polarization to the right instead of the left (*Regnault*), and in being apparently uncrystallizable.

Cinchonicia is also insoluble in water and soluble in alcohol. It agrees with cinchonia, from which it is derived, in producing deviation of the plane of polarization to the right; but differs from cinchonidia in this respect; and differs from both of these alkaloids in being amorphous or uncrystallizable.

The *amorphous quinia* of Liebig (*quinoidine* or *quinoidia*) is probably when pure identical with quinicia; but, as it occurs in commerce, it is generally a mixture of this with cinchonicia. For a particular account of it, see *Sulphate of Quinia*, in the *second part* of this work.*

* *Cinchonidia of Wittstein.* Wittstein has announced the discovery of a new alkaloid in a variety of bark belonging probably to the division of barks here considered under the name of fibrous Carthagena barks. He calls the alkaloid *cinchonidine;* but it must not be confounded with the cinchonidine of Pasteur. (*Am. Journ. of Pharm.*, xxix. 115.) From the researches of Dr. Herapath, it appears that its claims to be considered as a distinct alkaloid are well founded; its iodo-sulphate being readily distinguishable by the eye from the other iodo-sulphates examined by him. (*Pharm. Journ.*, xvii. 468.) It ought, therefore, to receive another designation, in order to prevent confusion.

β. cinchonine of Schwabe. Still another cinchona alkaloid has been brought into notice by Schwabe, who extracted it from quinoidine. He calls it *β. cinchonine* (*β. cinchonia*), and obtained it by dissolving quinoidine in dilute muriatic acid, precipitating with ammonia, washing the precipitate successively with cold and hot water and drying it, treating it with cold alcohol for 24 hours, then exhausting it successively with alcohol and water, and finally dissolving it in dilute sulphuric acid. The solution was heated, and, carbonate of sodium being added till a pellicle began to form, was set aside to cool. Sulphate of β. cinchonia was now deposited in crystals, from which the pure alkaloid was obtained by precipitating an acidulated solution with ammonia. It differs from the other cinchona alkaloids in the shape of its crystals, solubilities, and chemical properties. For an account of some of these properties, see *Am. Journ. of Pharm.* (March, 1861, p. 174). O. Hesse, however, having compared the β. cinchonia of Schwabe with cinchonia obtained directly from bark, believes them to be identical. (*Ibid.*, Jan. 1863, p. 54.) There seems also to be a discrepancy in the account of the alkaloid given in the journal from which this sketch is extracted, which tends to invalidate the conclusions of the paper. Thus, the alkaloid is said to be soluble in 173 parts of cold alcohol; yet is also said to be procured from the quinoidine after having been completely exhausted by water and cold alcohol.

Huanochine. This was extracted by Erdmann from a variety of bark imported into Bremen, twenty years or more since, supposed to be flat Huanuco bark, derived from Cinchona nitida. He obtained it by boiling the bark with water acidulated with muriatic acid, treating the decoction with caustic soda in slight excess, washing the precipitate thus obtained and dissolving it in diluted acetic acid, again precipitating with caustic soda, digesting the precipitate with alcohol, decolorizing with animal charcoal, filtering, evaporating and crystallizing. The substance obtained was found to be an alkaloid, isomeric with quinia, yet differing from this and all the other cinchona alkaloids in properties. It crystallized in small prisms, which were tasteless, almost insoluble in water, soluble in 400 parts of alcohol of 80 per cent. at 62° F. and in 110 parts at the boiling point, in 600 parts of ether at 62° and 470 parts of boiling ether, readily fusible and volatilizable, and inflammable, burning with a smoky flame, and without residue. Though tasteless itself, its salts were very bitter. The alkaloid was found efficient as an antiperiodic. To us, however, it seems most probable, from the method of obtaining the alkaloid, that it is a mixture of cinchonia with one or more of the other known cinchona alkaloids. (See *Am. Journ. of Pharm.*, xxix. 553.)—*Note to the twelfth edition.*

From the researches of M. Carles, reported in the *Journal de Pharmacie et de Chimie* (Sept. 1870, p. 161), in relation to the influence of certain agencies in modifying the condition of the cinchona alkaloids, especially quinia, it appears that, while thorough and prolonged pulverization of the bark has very little effect on the alkaloids it contains, exposure to light, heat, and moisture, each, manifestly modifies their condition; but how far this modification affects their therapeutic value has not been determined.

Kinic Acid (*called also Cinchonic or Quinic Acid*), *and the Kinates of Cinchonia and Quinia.* It may be desirable to procure the alkaline principles in the state of saline combination in which they exist in the bark; as it is possible that they may exert an influence over the system in this state, somewhat different from that produced by their combinations with the sulphuric or other mineral acid. As it is impossible to procure the kinates immediately from the bark in a pure state, it becomes necessary first to obtain the kinic acid separately, which may thus become of some practical importance. We shall, therefore, briefly describe the mode of procuring it, and its characteristic properties. By evaporating the infusion of bark to a solid consistence, and treating the extract with alcohol, we have in the residue a viscid matter consisting chiefly of mucilage with kinate of calcium, which is insoluble in alcohol. If an aqueous solution of this substance be formed, and allowed to evaporate at a gentle heat, crystals of the kinate will be deposited, which may be purified by a second crystallization. The salt thus obtained, being dissolved in water, is decomposed by means of oxalic acid, which precipitates the lime, and leaves the *kinic acid* in solution. This may be procured in the crystalline state by spontaneous evaporation, though as usually prepared, it is in the form of a thick syrupy liquid. The crystals are transparent and colourless, sour to the taste, and readily soluble in alcohol and in water. The kinates of cinchonia and quinia may be obtained either by the direct combination of their constituents, or by the mutual decomposition of the sulphates of those alkaloids and kinate of calcium. *Kinate of cinchonia* has a bitter and astringent taste, is very soluble in water, is soluble also in alcohol, and is crystallized with difficulty. *Kinate of quinia* is also very soluble in water, but less so in rectified alcohol. Its taste is very bitter, resembling exactly that of yellow bark. It crystallizes in crusts of a mammillated form, and opaque or semi-transparent. The salt is with difficulty obtained free from colour, and only by employing the ingredi-

Quinamina. Quinamine. Chinamin. Under the last of these names, Dr. O. Hesse has announced a new alkaloid, which he has found among quinidia, quinia, and other alkaloids, in the bark of *C. succirubra*, cultivated in India. Without informing us of the mode of obtaining it he gives the following description of his new alkaloid. It crystallizes in very long, asbestos-like, white prisms, without water of crystallization. It is insoluble in water, and solution of potassa or ammonia; is readily dissolved by hot alcohol, which deposits it in crystals, and less readily by diluted alcohol. Ether dissolves it rather easily at ordinary temperature, more readily when boiling hot, and gives it up crystallized on cooling and evaporation. In alcoholic solution it has an alkaline reaction. It neutralizes sulphuric and muriatic acids, with the latter forming an amorphous salt, with the former one that crystallizes with difficulty in hexagonal scales and short prisms. Its reaction with chloride of gold is very characteristic; the solution of the muriate producing with it a yellowish-white precipitate, which soon becomes purple, and separates gold; the supernatant liquid assuming a purplish-red, and afterwards a brown colour. (For other characters, see the *Am. Journ. of Pharm.*, July, 1872, p. 302.)

The discovery of still another alkaloid in the cinchona barks has been announced by Mr. David Howard, of London, nephew of the celebrated J. E. Howard. He found it in the mother-liquor from the manufacturers of sulphate of quinia. The extreme solubility of its salts has probably hitherto assisted to prevent its detection, and renders it very difficult to separate it from the uncrystallizable quinia. He obtained it by treating the impure alkaloids of the mother-liquor referred to with ether, evaporating the ether, dissolving the residue in a saturated solution of oxalic acid in water, and allowing the solution to crystallize. The oxalate was purified by recrystallization with the addition of animal charcoal; but Mr. Howard was never able to free it entirely from the colouring matter.

The alkaloid itself, obtained by precipitation from a solution of one of its salts by potassa or soda, is a yellowish oily liquid. It has not been obtained pure in the solid state, because it is decomposed by heat, and will not give up its water in vacuo. It has a peculiar bitter taste, very much less in intensity and duration than that of the other cinchona alkaloids. It is very soluble in alcohol, and largely so in ether, from which it separates in the form of an oil on spontaneous evaporation. It is a strong base, probably stronger even than quinia. Chlorine followed by ammonia produces with solutions of its salts the green colour characterizing quinia and quinidia. Its salts are generally very soluble. Mr. Howard has been unable to ascertain whether this alkaloid exists in all the species of Cinchona, or, if not, to which it belongs. A name for it seems to have

ents in a state of extreme purity. (*Ann. de Chim. et de Phys.*, Juillet, 1829.)* Lauteman found, in experiments upon himself, that kinic acid, when taken into the system, undergoes a conversion into hippuric acid, and in this state escapes with the urine. (*Ann. der Chem. und Pharm.*, cxxv. 9.) M. Rabuteau has investigated the physiological properties of kinic acid, and has found it closely to resemble the ordinary vegetable acids, being harmless in its effects on the system, and forming with water a refreshing drink like lemonade. Like other vegetable acids, also, it is decomposed in the system, forming when taken in the state of an alkaline salt, a carbonate of the alkali, in the blood, and rendering that fluid alkaline. (*Am. Journ. of Med. Sci.*, Oct. 1872, p. 524.) Kinic acid is said by Zwenger to have been found in the leaves of *Vaccinium Myrtillus*. (*Am. Journ. of Pharm.*, March, 1861, p. 128.)

Kinovic Bitter. Kinovin. Kinovic Acid. Originally discovered in the false bark called quinquina nova or new bark, this substance has since been found in the Calisaya bark, and probably exists, in greater or less proportion, in all the Cinchona barks. It was detected by Dr. De Vrij not only in the bark, but also in the wood and leaves of C. Calisaya and C. lucumæfolia. (*Journ. de Pharm.*, Avril, 1860, pp. 225 and 258.) It is white, uncrystallizable, almost insoluble in water, but readily dissolved by alcohol and ether. It is very bitter, and, as it is asserted to have no febrifuge virtues, may on this account mislead the judgment in relation to the activity of the bark in which it may be found. Some barks are said to owe their bitterness mainly to this ingredient. It consists of carbon, hydrogen, and oxygen; its formula being, according to Hlasiwetz and Gilm, $C_{60}H_{48}O_{16}$. It has been supposed to possess acid properties, and a solution of its combination with magnesia is said to precipitate solutions of acetate of lead, bichloride of mercury, and the salts of cinchonia. Winckler gives, as a certain test of its presence in any bark, the sulphate of copper, which is indifferent to infusion of bark containing none of this principle, but detects the smallest proportion of it by producing a dirty-green colour, soon followed by the deposition of a fine similarly coloured powder. This is a salt of copper, and has a very bitter and metallic taste. (See *Am. Journ. of Pharm.*, xxv. 343.) Hlasiwetz and Gilm deny the acid properties of this substance, considering it a glucoside, capable of being resolved, through the action of muriatic acid on its alcoholic solution, into a peculiar acid, and a kind of sugar which they consider as identical with the mannitan of Berthelot. This acid they propose to call *kinovic acid*, adopting the name which has been given to the kinovic bitter under the impression of its acid character. Its formula is $C_{48}H_{38}O_4$. It is white, in rhomboidal crystals, insoluble in water, but slightly soluble in ether, somewhat more so in boiling alcohol, but very soluble in ammonia and the fixed alkalies. All its solutions are decidedly bitter. Its acid properties are feeble, yet it is capable of decomposing the alkaline carbonates. (*Journ. de Pharm.*, Nov. 1859, p. 386.) These results have been confirmed by Dr. De Vrij, who proposes the following method of isolating the *kinovic bitter*. Macerate powdered cinchona with a very weak solution of caustic potassa or soda, precipitate

been modestly reserved by Mr. Howard, until his observations shall have been confirmed by others. (*Pharm. Journ.*, April, 1871, p. 845.)

It is a somewhat curious coincidence with the above discovery, that Messrs. Powers & Weightman, chemical manufacturers, of this city, have for several years been in the habit of separating from the mother-liquors of sulphate of quinia an alkaloid before unknown to them, and wholly different from any one of the cinchona alkaloids of which they have seen a description. There can be little doubt that it is a distinct alkaloid. That it is different from Howard's, we can give our personal testimony; as a specimen of the pure alkaloid, which was shown us, and which was obtained from the alcoholic solution, was in handsome crystals, while Howard's is in the form of an oily liquid. We are authorized to state that a particular account of this alkaloid will ere long be made public. (*Note to the fourteenth edition.*)

* When kinic acid is mixed with sulphuric acid and deutoxide of manganese, and distilled, a neuter substance called *kinoïle* or *kinone* is obtained, in crystalline needles, of a beautiful golden-yellow colour and high lustre, fusible and volatilizable without change, and having a peculiar odour. The production of this substance, when a concentrated decoction of a bark is distilled with half its weight of sulphuric acid and deutoxide of manganese, has been proposed as a test of the presence of kinic acid in the bark, and consequently of its belonging to the cinchona barks. If there be the least quantity of that acid, the first portion of liquid distilled will have a yellow colour and the odour of kinone, and will become bright-green on the addition of chlorine-water. (*Philos. Mag.*, xxvi. 198.) The test, however, cannot be fully relied on; as it has been ascertained that caffeic acid also yields kinone, when treated as above with sulphuric acid and deutoxide of manganese. (Stenhouse, *Am. Journ. of Pharm.*, xxvi. 249, from *Philos. Mag.*)

the filtered liquid with an acid, redissolve the precipitate in milk of lime to separate the cinchonic red, filter and precipitate the solution boiling hot with muriatic acid, separate the precipitate, wash it, express as much as possible, and lastly dry it on porous stones, and powder it. Thus prepared, the kinovic bitter forms soluble compounds with magnesia and lime, and has been employed, in this mode of combination, as a tonic in the hospital of Batavia, with encouraging success. (*Ibid.*, Avril, 1860, p. 258.) Dr. Kerner (*Deutsche Klin.*, xx. p. 81) speaks very favourably of kinovic acid, as an excellent tonic, and at the same time perfectly safe; producing no narcotic symptoms, and, given to adults in the quantity of half an ounce or three-quarters, causing not the slightest ill effect. He prefers it in the form of kinovate of calcium, of which 40 grains is the average dose. (*Am. Journ. of Med. Sci.*, Oct. 1869, p. 543.)

Incompatibles. Of the relations of bark to the several solvents employed in pharmacy we shall speak hereafter, under the heads of its infusion, decoction, and tincture; where we shall also have an opportunity of mentioning some of the more prominent substances which afford precipitates with its liquid preparations. It is sufficient at present to state that all the substances which precipitate the infusion of bark do not by any means necessarily affect its virtues; as it contains several inert ingredients which form insoluble compounds with bodies that do not disturb its active principles. As *tannic acid* forms with the alkaloids compounds insoluble in water, it is desirable that substances containing this acid, in a free state, should not be prescribed in connection with the infusion or decoction of bark; for, though these insoluble tannates might be found efficacious if administered, yet, being precipitated from the liquid, they would be apt to be thrown away as dregs, or at any rate would communicate, if agitated, an unpleasant turbidness. The same may be said of the *tincture* and *compound solution of iodine*, which form insoluble compounds with all the cinchona alkaloids, and of the *alkalies*, *alkaline carbonates*, and *alkaline earths*, which precipitate these alkaloids from their aqueous solution.

Estimation of Value. It is evident, from what has been said, that an infusion of bark, on account of the tannin-like principle which it contains, may precipitate gelatin, tartar emetic, and the salts of iron, without having a particle of cinchonia, quinia, or other alkaloid in its composition; and that consequently any inference as to its value, drawn from these chemical properties, would be fallacious; but, as the active principles are thrown down by the tannic acid of galls, no bark can be considered good which does not afford a precipitate with the infusion of this substance.*

It is impossible to determine, with accuracy, the relative proportion of the active ingredients in the different varieties of cinchona; as the quantity is by no means uniform in different specimens of the same variety. The results of the most recent experiments have been already stated under the head of the several varieties of bark described. But it is highly important, in relation to any particular sample of bark, to be able to ascertain its medicinal efficiency, which is measured by the quantity of the peculiar cinchona alkaloids it may contain. The following is Winckler's process, which he prefers to all others. In determining the value of a large quantity of bark, it is necessary first to ascertain whether it may not consist of more than one variety, and, if it do, to assort it, and act on each kind separately. The pieces are to be reduced to a fine powder, of which 1000 grains are to be digested with six ounces of alcohol of 80 per cent., by means of a water-bath, until completely exhausted. The tincture, when cold, is to be strained through thin but close linen; and the residue

* A test of the cinchona barks, containing one or more of their characteristic alkaloids, has been proposed by Grahe. It is founded on the fact, that, when these barks are exposed to destructive distillation, a product is obtained of a bright carmine colour, which is yielded by no other bark under the same circumstances, and not by cinchona unless it contain one or more of its peculiar alkaloids. Nor do the pure alkaloids afford it; but, if mixed with a little acetic, kinic, tannic, citric, or tartaric acid, they exhibit the reaction, showing that in the bark it takes place between the alkaloids and organic acids contained in it. Grahe applies the test by heating a piece of the bark weighing from five to ten grains in an ordinary test-tube, and gradually increasing the heat to redness. Whitish smoke, and watery vapour condensing on the surface of the tube, are first given off, which are soon followed by the appearance of redness in the fumes, and by the deposition, an inch above the heated part, of a red pulverulent film, which is gradually changed into a thick, oily liquid, running down the glass in drops or streaks of a fine carmine colour. (*Chemisches Central Blatt*, Feb. 17, 1858, p. 97.)—*Note to the twelfth edition.*

to be again digested with 3 ounces of alcohol, and strained as before. The residue now obtained is to be once more treated in like manner with alcohol. The tinctures are then to be united, filtered, and treated, at common temperatures, with a mixture of equal parts of fresh-slaked lime and crude well-burnt animal charcoal, of which about 500 grains will be required. The mixture is to be frequently shaken, and the maceration to be continued until the supernatant liquid is rendered colourless. In most of the genuine barks the decolorization is soon effected; but in those containing kinovic acid it is imperfect. The decolorized liquid is to be separated, and the residue to be repeatedly shaken with small quantities of alcohol, washed on a filter with the same liquor, and dried. The alcoholic liquids are to be mixed, and the alcohol distilled off. The whole of the alkaloids is contained in the residue, with a peculiar fatty matter, cinchonic red, and any kinovic acid which may have existed in the bark. To remove these, the matter is to be transferred to a small evaporating basin from the distilling vessel, which is to be washed with a little water acidulated with sulphuric acid, and the liquid thus obtained to be added to the rest. A slight excess of sulphuric acid is now to be dropped into the mixture, which is to be heated, allowed to cool, and then filtered, so as to remove the precipitated kinovic acid and other impurities. From the filtered acidulated solution, the alkaloids are to be precipitated by a slight excess of ammonia, and the mixture evaporated by a gentle heat to dryness. The sulphate of ammonium is to be removed by a small quantity of very cold water, and the residual alkaloid matter dried and weighed. Though not absolutely pure, it is sufficiently so for the purposes of investigation. (*Am. Journ. of Pharm.*, xxv. 343.) Winckler states that the barks will yield to the manufacturer quite as much as is obtained in this way, and generally from one-eighth to one-quarter of one per cent. more, in consequence of the loss in working being less on a large scale.*

The quantity of alkaloid matter obtained by the above process will measure the efficacy of the bark; for all the organic alkaline principles contained in it are efficient as medicines, and in all probability in a nearly equal degree. But, for manufacturing purposes, it is necessary to push the investigation further, and ascertain the proportion of the several alkaloids in the mixture. This is most conveniently done by means of ether. Cinchonia is scarcely soluble in ether, quinidia is soluble in small

* M. Rabourdin has proposed chloroform as an agent for testing the alkaloid richness of barks. The following is the method applied to the Calisaya. Five drachms of the powder, previously passed through a fine hair sieve, are to be exhausted by water, acidulated with hydrochloric acid (2 drachms of acid to a pound of water), in a percolation apparatus, the liquid being added until it passes colourless and tasteless. Five or six ounces of liquid are thus obtained, to which a drachm and a half of caustic potassa and five drachms of chloroform are to be added. These are to be agitated for a short time, and then allowed to stand. A dense whitish deposit forms, consisting of the alkaloids and chloroform. Sometimes the separation is complete and effected in an instant, leaving a red transparent liquid floating on the surface, which is to be immediately poured off. The chloroformic solution is then washed with water, put into a capsule, and allowed to evaporate. The alkaloids remain behind in a pure state.

Red bark is to be treated as the Calisaya; but for the pale or cinchonia barks the process is to be carried further. The matter left after the evaporation of the chloroform contains cinchonic red as well as cinchonia. It is to be treated with water acidulated with hydrochloric acid, which dissolves all the alkaloid, and a portion of the cinchonic red. The liquid is to be filtered, and solution of ammonia, diluted with 15 or 20 parts of water, added drop by drop, with constant stirring, until a white cloud appears which is not removed by the agitation. The cinchonic red is thus precipitated without the alkaloid. It is easy to know when to stop this part of the process; as the cinchonic red is precipitated in reddish-brown flakes, the cinchonia in white curdled flakes. The liquid is now to be filtered, the filter washed with a little distilled water, and the united liquors precipitated by an excess of ammonia. The precipitate is the pure alkaloid. (See *Am. Journ. of Pharm.*, xxiii. 249.)

M. Guillermond employs another test, which, as last improved by himself, is as follows. Take 20 grammes (about ʒv) of yellow bark, powder it without residue, pour on the powder sufficient alcohol of 76° (sp. gr. 0·872) to form a soft paste, which is to be heated for some minutes on a salt-water bath, so that the particles may be thoroughly penetrated by the liquid; then add 10 grammes of hydrated lime, finely powdered, mix it thoroughly with the paste, and dry the mixture on a plate till quite free from moisture. Introduce the resulting powder into a percolator, pack it firmly, and pour upon it 100 grammes of rectified ether. This, in passing, carries with it all the quinia. The filtered liquid, rapidly evaporated at the temperature of boiling water, leaves a residue consisting of quinia, with a little colouring matter, which is altogether insignificant. The weight of this residue, when entirely dried, will represent the quinia strength of the bark employed. By afterwards passing alcohol through the mass remaining in the percolator, the cinchonia may also be obtained. (*Annuaire de Thérap.*, A.D. 1859, p. 149.)—*Note to the twelfth edition.*

proportion, quinia is freely soluble. When, therefore, a mixture of these alkaloids is treated with that menstruum, quinia and quinidia are dissolved, and cinchonia left. The two former may be separated by allowing the ethereal solution to evaporate. Quinidia crystallizes from the solution, and quinia is obtained uncrystallized, as the last product of the evaporation of the ether. These remarks apply to quinidia, as it was understood before the investigations of Pasteur.*

* Mr. Robert Howard employs the following method of ascertaining the presence or absence of these alkaloids, severally, in any mixture of their sulphates, founded on the fact, that ten grains of sulphate of quinia dissolve in sixty drops of ether, but only one grain of sulphate of quinidia. Ten grains of the salt are put into a strong test-tube, ten drops of dilute sulphuric acid (one of acid and five of water) with fifteen drops of water are added, and a moderate heat applied till the salt is dissolved. When the solution has quite cooled, sixty drops of officinal ether with twenty of spirit of ammonia are added, and the mixture is well shaken, the tube being closed by the thumb. After this the tube is closely stopped with a well-fitting cork, and gently shaken from time to time. If the salt contain only quinia, or not more than 10 per cent. of quinidia, it will be completely dissolved, while, at the surface of contact of the two clear liquids, only mechanical impurities will be seen. After some time the layer of ether becomes gelatinous, and then no further observation can be made. Ten grains of the salt examined may contain one grain of quinidia, and yet be completely dissolved by the ether and ammonia: but in this case the quinidia will soon begin to crystallize in the layer of ether. The least trace of quinidia may be detected by employing, instead of ordinary ether, the same fluid previously saturated with quinidia, in which case all the quinidia must remain undissolved. It is necessary, in the last experiment, to observe, after the shaking, whether or not all has dissolved; for, owing to the great tendency of quinidia to crystallize, it may again separate, and thus become a source of error. If more than a tenth of quinidia, or if cinchonia be present in the salt, an insoluble precipitate will be seen between the layers of the two fluids. If it be quinidia, it will be dissolved on the addition of proportionately more ether; while, if cinchonia, it will remain unaffected. (*Pharm. Journ.*, xi. 394.)

Dr. J. E. De Vrij uses the following method of ascertaining the alkaloid strength of cinchona, and of obtaining the several alkaloids separate. Having dried a portion of powdered bark at 212° F., and weighed it, mix with it one-fourth of slaked lime, and boil for five minutes with ten times its weight of alcohol of sp. gr. 0·85. Put the whole on a filter, and exhaust by adding successively portions of boiling alcohol, until the whole weight of the spirit used equals twenty times that of the bark. Acidulate the tincture with dilute acetic acid so that it shall redden litmus, and then evaporate on a water-bath till all the alcohol is expelled. Treat the residue separately with water till the filtered liquid is no longer made turbid by an alkali. The solution thus obtained contains all the alkaloids; the kinovic acid, resin, fat, and other impurities remaining on the filter. If the filter and its contents be treated with milk of lime, the quantity of kinovic acid can be determined. The watery solution is now to be reduced by evaporation on a water-bath to a small bulk, and then mixed with an excess of slaked lime, by which the alkaloids are precipitated. Now throw the whole on the smallest possible filter, and wash with the minimum of cold water. If proper care be taken, the amount of water necessary to remove the colouring matter is so small, that the loss of alkaloids through their slight solubility in lime-water may be disregarded. After the filter has been duly washed, and dried, boil it repeatedly with alcohol of 0·82, till this will dissolve nothing more; then filter, evaporate the slightly coloured alcoholic solution in a weighed platinum vessel, and heat the residue on a water-bath till it ceases to lose weight. The amount of alkaloids is now known. Sometimes a trace of colouring matter is left undissolved. If this is sufficient to be weighed, it must be deducted from the amount of the alkaloids; but generally the quantity is insufficient to merit notice.

To ascertain their character, dissolve in the smallest quantity of very dilute acetic acid. Put the solution in a closed funnel, provided with a cork, agitate with a slight excess of caustic soda, and a quantity of ether equal to fifteen times the weight of the alkaloids, and let the mixture stand for six hours; for, though cinchonidia and quinidia are sparingly soluble in ether, a considerable amount is dissolved on the first agitation, which separates in crystals in a few hours. Now evaporate the ethereal solution, and dry the residue on a water-bath till the weight remains constant. The residue is quinia, with traces of cinchonidia, quinidia, and cinchonia; and in many cases a large amount of a still unknown fusible alkaloid. By the known reactions of chlorine and ammonia, and by the preparation of Herapathite, the real nature of this residue can be ascertained.

The alkaloids which have not been dissolved by the ether are now again to be dissolved in the smallest quantity of dilute acetic acid, and the solution mixed with a few drops of a concentrated solution of iodide of potassium. After stirring with a glass rod, a sandy crystalline precipitate will occur if quinidia is present. In such a case, the hydriodate of quinidia is collected on a filter, dried at 212°, and weighed, and the quantity of quinidia ascertained by calculation: 100 grains of the hydriodate being equivalent to 71·68 of quinidia, according to the formula $C_{40}H_{24}N_2O_4,HI$.

The liquid separated by filtration from the hydriodate is precipitated by caustic soda, and the precipitate will be either cinchonia, or a mixture of this with cinchonidia.

The presence of cinchonia or quinidia among the alkaloids may be conjectured at the time of the treatment with ether; for, if one of these is present, it is partially deposited in a crystalline state after some time.

While the presence of quinidia can easily be ascertained by iodide of potassium even in small quantities, that of cinchonidia can be determined with certainty only by the polarizing apparatus, by which Dr. De Vrij has detected the cinchonidia of Pasteur even in the bark of the C. Pahudiana of Java. (*Pharm. Journ. and Trans.*, vi. 51, July, 1864.)—*Note to the thirteenth edition.*

M. P. Charles, of Paris, proposes the following method of estimating the strength of bark, do

From the most recent and carefully conducted experiments, it appears that the best officinal yellow Calisaya bark, the finest red bark, and the finest fibrous Carthagena bark (*soft Pitaya*) are about equal in their amount of alkaloids, each containing from 3 to 4 per cent.; while between these and the barks of lowest value there is every grade of productiveness, down to a mere trace of alkaline matter.*

Medical Properties and Uses.

This valuable remedy was unknown to the civilized world till about the middle of the seventeenth century, though the natives of Peru are generally supposed to have been long previously acquainted with its febrifuge powers. Humboldt, however, is of a different opinion. In his Memoir on the Cinchona forests, he states that it is unknown as a remedy to the Indians inhabiting the country where it grows; and, as these people adhere pertinaciously to the habits of their ancestors, he concludes that it never was employed by them. They have generally the most violent prejudices against it, considering it poisonous, and in the treatment of fever prefer the milder indigenous remedies. Humboldt is disposed to ascribe the discovery of the febrifuge powers of the bark to the Jesuits, who were sent to Peru as missionaries. As bitters had been chiefly relied on in the treatment of intermittent fevers, and as bitterness was observed to be a predominant property in the bark of certain trees which were felled in clearing the forests, the missionaries were naturally led to give it a trial in the same complaint. They accordingly administered an infusion of the bark in the tertian ague, then prevalent in Peru, and soon ascertained its extraordinary powers. A tradition to this effect is said by Humboldt to be current at Loxa. Ruiz and Pavon, however, ascribe the discovery to the Indians; and Tschudi states, in his Travels in Peru (*Am. ed.*, ii. 280), that the inhabitants of the Peruvian forests drink an infusion of the green bark as a remedy in intermittent fever.† The Countess of Cinchon, wife of the Viceroy of Peru, having in her own person experienced the beneficial effects of the bark, is said, on her return to Spain in the year 1640, to have first introduced the remedy into Europe. Hence the name of *pulvis Commitissæ*, by which it was first known. After its introduction, it was distributed and sold by the Jesuits, who are said to have obtained for it the price of its weight in silver. From this circumstance it was called *Jesuits' powder*, a title

termined by the quantity of sulphate of quinia that can be obtained from it. His plan has some advantages over any other which has been offered, especially in the experience of its author, that it obtains the organic alkalies, and especially quinia, in a greater quantity and purer state. Of a chosen specimen of bark finely powdered and sifted, 20 grammes are intimately mixed in a mortar with eight grammes of slaked lime previously suspended in thirty-five grammes of water. This mixture spread upon a plate, is dried in the free air in the summer, or on a water-bath in colder weather. As soon as deprived of all apparent moisture, it is crushed into powder, and introduced into a broad open tube (*allonge*) furnished at the bottom with a ball of charpie; and chloroform is poured in by repeated affusions. If the process has been well conducted, 150 grammes of chloroform will be sufficient. To remove all that adheres to the powder, it is displaced by water, and received into a capsule. As soon as all the chloroform has passed, the capsule is placed upon a water-bath. To separate the alkaloids from the residue, it is agitated in the cold, and several times, with from a tenth to a twelfth of sulphuric acid. The solution thus formed, thrown on a moistened filter, passes colourless and separated from the resinous matter. It is then raised to the boiling point, and at this moment sufficient ammonia is added to preserve to it a scarcely acid reaction. All the quinia then crystallizes in the form of sulphate. Shortly afterward the mass is put into a double filter, the mother-liquors are displaced by some drops of water, expression and drying between two papers follow, and the residue is weighed. The other alkaloids remain in the mother-liquor, from which they are separated by precipitation. Ether indicates their identity. (*Journ. de Pharm.*, Août, 1870, p. 83.)—*Note to the fourteenth edition.*

* To obviate the disadvantages arising from the variable strength of bark, M. Guillermond recommends to fix on an appropriate strength, as indicated by the percentage of quinia, below the highest yet much above the lowest, and either to select bark of this strength, or to bring that employed to the medium strength, by adding a stronger or weaker bark, as the case may require, in due proportion. He recommends as this standard the yield of 3·2 per cent. of sulphate of quinia. This is to be treated by alcohol till entirely exhausted, and the tincture evaporated so as to yield an extract which shall exactly represent the virtues of the bark, and shall always have the same strength. From this extract all the preparations of bark are to be made, which will thus always be uniform in strength. (*Journ. de Pharm.*, Août, 1863, p. 124.)

† Tschudi also observes that he has found the fresh bark more efficacious than the dried; as, in less than half the usual dose, it not only effects cures in a short time, but ensures the patient against the return of the disease.

which it long retained. It had acquired some reputation in England so early as the year 1658, but, from its high price, and from the prejudice excited against it, was at first little used. At this early period, however, its origin and nature do not seem to have been generally known; for we are told that Sir John Talbot (Sir Robert Talbor, *Pereira*), an Englishman, having employed it with great success in France, in the treatment of intermittents, under the name of the English powder, at length, in the year 1679, sold the secret of its origin and preparation to Louis XIV., by whom it was divulged.

When taken into the stomach, bark usually excites in a short time a sense of warmth in the epigastrium, which often diffuses itself over the abdomen and even the breast, and is sometimes attended with considerable gastric and intestinal irritation. Nausea and vomiting are sometimes produced, especially if the stomach was previously in an inflamed or irritated state. Purging, moreover, is not an unfrequent attendant upon its action. After some time has elapsed, the circulation often experiences its influence, as exhibited in the somewhat increased frequency of pulse; and, if the dose be repeated, the whole system becomes more or less affected, and all the functions undergo a moderate degree of excitement. Its action upon the nervous system is often evinced by a sense of tension, or fulness, or slight pain in the head, singing in the ears, and partial deafness, which are always experienced by many individuals when brought completely under its influence. The effects above mentioned entitle bark to a place among the tonics, and it is usually ranked at the very head of this class of medicines. But, besides the mere excitation of the ordinary functions of health, it produces other effects upon the system, which must be considered peculiar, and independent of its mere tonic operation. The power by which, when administered in the intervals between the paroxysms of intermittent disorders, it interrupts the progress of the disease, is something more than what is usually understood by the tonic property; for no other substance belonging to the class, however powerful or permanent may be the excitement which it produces, exercises a control over intermittents at all comparable to that of the medicine under consideration. As it is probable that, in the intervals of these complaints, a train of morbid actions is going on out of our sight, within the recesses of the nervous system; so it is also probable that bark produces, in the same system, an action equally mysterious, which supersedes that of the malady, and thus accomplishes the restoration of the patient. When taken very largely, especially in the form of its active principles, in which its effects on the system can be obtained with less of the direct irritant influence on the stomach, cinchona has been found, while it produces the effect already adverted to upon the brain, at the same time to lessen considerably the force and frequency of the pulse. This sedative effect is probably secondary, and dependent on an influence upon the nervous centres in the encephalon, interfering with the due performance of their functions, and consequently of the in some degree dependent function of the heart. From the possession of tonic, *anti-intermittent*, and indirect sedative properties, bark is capable of being usefully employed in the treatment of numerous diseases.

It may usually be employed with benefit in all morbid conditions of the system, whatever may be the peculiar modifications, in which a permanent corroborant effect is desirable, provided the stomach be in a proper state for its reception. In low or typhoid forms of disease, in which either no inflammation exists, or that which does exist has been moderated by proper measures, or has passed into the suppurative or the gangrenous stage, this remedy is often of the greatest advantage in supporting the system till the morbid action ceases. Hence its use in the latter stages of typhus gravior; in malignant scarlatina, measles, and smallpox; in carbuncle and gangrenous erysipelas; and in all cases in which the system is exhausted under large purulent discharges, and the tendency of the affection is towards recovery. As a tonic, bark is also advantageously employed in chronic diseases connected with debility; as, for example, in scrofula, dropsy, passive hemorrhages, certain forms of dyspepsia, obstinate cutaneous affections, amenorrhœa, chorea, hysteria; in fact, whenever a corroborant influence is desired, and no contraindicating symptoms exist. But in all these cases it greatly behooves the physician to examine well the condition of the

system, and, before resorting to the tonic, to ascertain the real existence of an enfeebled condition of the functions, and the absence of such local irritations or inflammations, especially of the stomach or bowels, as might be aggravated by its use. In doubtful cases, we have been in the habit of considering the occurrence of profuse sweating during sleep as an indication for its use, and, under these circumstances, have prescribed it very advantageously, in the form of sulphate of quinia, in acute rheumatism, and in the advanced stages of protracted fevers.

But it is in the cure of intermittent diseases that bark displays its most extraordinary powers. It was originally introduced into notice as a remedy in fever and ague, and the reputation which it acquired at an early period it has ever since retained. Very few cases of this disease will be found to resist the judicious use of bark, or some one of its preparations. This is not the place to speak of the precise circumstances under which it is best administered. It will be sufficient to say that physicians generally concur in recommending its early employment, in divided doses, to the extent of one or two ounces, during the intermission, and the repetition of this plan till the disease is subdued, or the remedy is found insufficient for its cure. Other intermittent diseases have been found to yield with almost equal certainty to the remedy, particularly those of a neuralgic character. Hemicrania and violent pains in the eyes, face, and other parts of the body, occurring periodically, are often almost immediately relieved by the use of bark. Some cases of epilepsy, in which the convulsions recurred at regular intervals, have also been cured by it; and even the hectic intermittent is frequently arrested, though, as the cause still generally continues to operate, the relief is too often only temporary. Diarrhœa and dysentery sometimes put on the intermittent form, especially in miasmatic districts; and under these circumstances may often be cured by bark. Nor is it necessary that, in the various diseases which have been mentioned, the intermission should always be complete, in order to justify a resort to the remedy. Remittent fevers, in which the remission is very decided, not unfrequently yield to the use of bark, if preceded by proper depleting measures. But, as a general rule, the less of the diseased action there is in the interval, the better is the chance of success.

In reference to its indirect sedative effects, bark or its alkaloids have been of late considerably used, in large doses, in various febrile and inflammatory affections, as in the early stage of remittent and yellow fevers, typhoid and typhus fevers, and acute rheumatism; but, in this use of the medicine, caution is required lest, in suppressing the general arterial excitement, injurious congestion or inflammation of the brain may be induced. In the form of sulphate of quinia, it has of late been recommended, in large doses, in puerperal fever.

Some observations are requisite as to the choice of the bark, and the forms of administration. In the treatment of intermittents, either the best red or the yellow (Calisaya) bark is decidedly preferable to the pale. The pale bark may, in its finest forms, be superior for the purposes of a general tonic; as it is less liable to offend the stomach, and perhaps to irritate the bowels.

When the object is to obtain the full influence of the bark, it may in some instances be advisable to administer it in substance. We are not absolutely certain that the alkaloids are the only active ingredients; and, even supposing them to be so, we are equally uncertain whether they may not be somewhat modified in their properties, even by the therapeutically inert principles with which they are associated. In fact, bark in substance has been repeatedly known to cure intermittents when sulphate of quinia has failed. It is best administered diffused in water or some aromatic infusion. Experience has proved that its efficacy in intermittents is often greatly promoted by admixture with other substances. A mixture of powdered bark, Virginia snakeroot, and carbonate of sodium was at one time much esteemed in this city; and another, consisting of bark, confection of opium, lemon-juice, and port wine, has proved highly efficacious in obstinate cases of fever and ague.*

But, notwithstanding the supposed superior efficacy of the bark in substance, in

* The following are the formulas for these mixtures.—1. ℞. Cinchon. Pulv. ℥ss; Serpentariæ pulv. ℥j; Sodii Carbonat. ℥ss. Misce et in pulveres quatuor divide, una tertiâ vel quartâ quâque horâ sumenda. 2. ℞. Cinchon. Rub. Pulv. ℥ss; Confect. Opii ℥j; Suc. Limon. recentis f℥ij; Vin. Rub. f℥iv. Misce. Tertia pars tertiâ quâque horâ sumenda.

the same relative dose, it is in the great majority of instances sufficient to resort to some one of its preparations; and in many cases we are compelled to this resort by the inability of the stomach to support the powder, or the unwillingness of the patient to encounter its disagreeable taste. The best substitutes, in intermittent diseases, are the sulphates of its alkaloids. Sulphate of quinia has until recently been used almost to the exclusion of the others; but sulphate of cinchonia is now considerably employed, and with nearly equal effect; and there is every reason to believe that the sulphates of quinidia and cinchonidia will be found not less efficient. In fact any one, or any combination of the cinchona alkaloids, may be used with propriety for obtaining the therapeutic effects of bark. The advantage of these preparations is their facility of administration, and the possibility, by their employment, of introducing a large quantity of the active matter, with less risk of offending the stomach. (See *Quiniæ Sulphas.*)

The anticipation of the preceding paragraph in reference to the alkaloids cinchonia, quinidia, and cinchonidia, has been fully justified by experience in India; all of them having been found entirely effectual, differing only in the quantity required, all in this respect being somewhat inferior to quinia; quinidia being second only to this in strength, and requiring from 31 to 70 grains for a cure; cinchonidia next, requiring 43 to 90 grains; and cinchonia the feeblest, requiring 54 to 90. The relative dose of quinia was found to be two-thirds or three-fourths that of quinidia. (Dr. Joseph Dougall, Surgeon, Madras Army. *Ed. Med. Journ.*, Sept. 1873, p. 193.)

Though the alkaloids possess the anti-intermittent power of bark, they have not been certainly ascertained to exert all the peculiar influence of that medicine as a tonic; but, as bark in powder can seldom be supported, by a delicate stomach, for a sufficient period to ensure the necessary influence of the medicine in chronic disease, it is customary to resort, in this case, to some one of its preparations in which the alkaloids are extracted in connection with the other principles; as the infusion, decoction, tincture, extract, and fluid extract. Each of these will be particularly treated of among the Preparations. It is here only necessary to say that their use is mostly confined to chronic cases, or those of a malignant character, as typhus gravior, &c., in which the whole virtues of the bark are desired, but the stomach is unable to bear the powder. Should bark or its preparations produce purging, as they occasionally do, they ought to be combined with a small portion of laudanum.

It is sometimes desirable to introduce bark into the system by other avenues than the stomach; as it exercises its peculiar influence to whatever part it is applied. Injected into the rectum, in connection with opium to prevent purging, it has been employed successfully in the cure of intermittents; and the use of bark jackets, made by quilting the powder between two pieces of flannel or muslin, and worn next the skin, and of bark baths made by infusing the medicine in water, has proved serviceable in cases of children. But the best preparation of bark for injection, or external use, is sulphate of quinia, which, thrown with a little laudanum into the rectum, or applied to a blistered surface denuded of the cuticle, produces on the system effects scarcely less decided than those which result from it when swallowed.

The medium dose of bark, as administered in intermittents, is a drachm, to be repeated more or less frequently according to circumstances. When given as a tonic in chronic complaints, the dose is usually smaller; from ten to thirty grains being sufficient to commence with.*

Off. Prep. of Yellow Bark. Decoctum Cinchonæ Flavæ; Extractum Cinchonæ, *U. S.;* Extractum Cinchonæ Fluidum, *U. S.;* Extractum Cinchonæ Flavæ Liquidum, *Br.;* Infusum Cinchonæ Flavæ; Quiniæ Sulphas; Tinctura Cinchonæ, *U. S.;* Tinctura Cinchonæ Flavæ, *Br.*

Off. Prep. of Pale Bark. Mistura Ferri Aromatica, *Br.;* Tinctura Cinchonæ Composita, *Br.*

Off. Prep. of Red Bark. Decoctum Cinchonæ Rubræ, *U. S.;* Infusum Cinchonæ Rubræ, *U. S.;* Tinctura Cinchonæ Composita, *U. S.* W.

* A solution of quinia in ether has been proposed for subcutaneous injection; and an elaborate formula for preparing it has been published by Mr. Charles Rice, in the *American Journal of Pharm.* (July, 1871, p. 303), to which reference is made for particulars. The strength of the solution is one grain of quinia to five minims of the liquid. (*Note to the fourteenth edition.*)

CINNAMOMUM. *U. S.*

Cinnamon.

The bark of Cinnamomum Zeylanicum (Nees, *Laurin.*), and of Cinnamomum aromaticum (Nees, *Ibid.*). *U. S.*

Off. Syn. CINNAMOMI CORTEX. *Cinnamon Bark.* The inner bark of shoots from the truncated stocks of Cinnamomum Zeylanicum. *Br.*

CINNAMON.—Canelle, *Fr.;* Brauner Canel, Zimmt, *Germ.;* Canella, *Ital.;* Canela, *Span.;* Kurundu, *Cingalese;* Karua puttay, *Tamul.*

CASSIA.—Cassia lignea; Casse, *Fr.;* Cassienzimmt, *Germ.;* Cannellina, *Ital.;* Casia, *Span.*

The U. S. Pharmacopœia embraces, under the title of cinnamon, not only the bark of that name obtained from the island of Ceylon, which is the only variety recognised in the new British Pharmacopœia, but also the commercial cassia, which is imported from China; and, as the two products, though very different in price, and somewhat in flavour, possess identical medical properties, and are used for the same purposes, there seems to be no necessity for giving them distinct officinal designations. Indeed, the barks of all the species of the genus Cinnamomum, possessing analogous properties, are as much entitled to the common name of cinnamon, as the barks of the Cinchonas are to the name of cinchona, and the juice of different species of Aloe to that of aloes. Varieties may be sufficiently distinguished by an appropriate epithet. Both *cinnamomum* and *cassia* were terms employed by the ancients, but whether exactly as now understood, it is impossible to determine. The term *cassia*, or *cassia lignea*, has been generally used in modern times to designate the coarser barks analogous to cinnamon. It was probably first applied to the barks from Malabar, and afterwards extended to those of China and other parts of Eastern Asia. It has been customary to ascribe *cassia lignea* to the *Laurus Cassia* of Linnæus; but the specific character given by that botanist was so indefinite, and based on such imperfect information, that the species has been almost unanimously abandoned by botanists. The fact appears to be, that the barks sold as cinnamon and cassia in different parts of the world are derived from various species of Cinnamomum. Dr. Wight, who was commissioned by the British Indian Government to inquire into the botanical source of "the common cassia bark of the markets of the world," expresses his belief, that the list of plants yielding this product extends to nearly every species of the genus, including not less than six plants on the Malabar Coast and in Ceylon, and nearly twice as many more in the eastern part of Asia, and in the islands of the Eastern Archipelago. (*Madras Journ. of Literat. and Sci.*, 1839, No. 22.) We shall describe only the two species recognised in the U. S. Pharmacopœia.

CINNAMOMUM. *Sex. Syst.* Enneandria Monogynia.—*Nat. Ord.* Lauraceæ.

Gen. Ch. Flowers hermaphrodite or polygamous, panicled or fascicled, naked. *Calyx* six-cleft, with the limb deciduous. *Fertile stamens* nine, in three rows; the inner three with two sessile glands at the base; *anthers* four-celled, the three inner turned outwards. Three capitate *abortive stamens* next the centre. *Fruit* seated in a cup-like calyx. *Leaves* ribbed. *Leaf-buds* not scaly. *Lindley.*

1. *Cinnamomum Zeylanicum.* Nees, *Laurineæ*, 52; Lindley, *Flor. Med.* 329; Hayne, *Darstel. und Beschreib., &c.* xii. 263.—*Laurus Cinnamomum.* Linn. This is a tree about twenty or thirty feet high, with a trunk from twelve to eighteen inches in diameter, and covered with a thick, scabrous bark. The branches are numerous, strong, horizontal, and declining; and the young shoots are beautifully speckled with dark green and light orange colours. The leaves are opposite for the most part, coriaceous, entire, ovate, or ovate-oblong, obtusely pointed, and three-nerved, with the lateral nerves vanishing as they approach the point. There are also two less obvious nerves, one on each side arising from the base, proceeding towards the border of the leaf, and then quickly vanishing. The footstalks are short and slightly channeled, and, together with the extreme twigs, are smooth and without the least appearance of down. In one variety, the leaves are very broad and somewhat cordate. When mature, they are of a shining green upon their upper surface, and lighter

coloured beneath. The flowers are small, white, and arranged in axillary and terminal panicles. The fruit is an oval berry, which adheres like the acorn to the receptacle, is larger than the black currant, and when ripe has a bluish-brown surface, diversified with numerous white spots.

The tree emits no smell perceptible at any distance. The bark of the root has the odour of cinnamon with the pungency of camphor, and yields this principle upon distillation. The leaves have a spicy odour when rubbed, and a hot taste. A volatile oil distilled from them has been introduced into commerce.* The petiole has the flavour of cinnamon. It is a singular fact that the odour of the flowers is to people in general disagreeable, being compared by some to the scent exhaled from newly sawn bones. The fruit has a terebinthinate odour when opened, and a taste in some degree like that of Juniper berries. A fatty substance, called *cinnamon-suet*, is obtained from it when ripe, by bruising and then boiling it in water, and removing the oleaginous matter which rises to the surface, and concretes upon cooling. It is the prepared bark that constitutes the genuine cinnamon.

This species is a native of Ceylon, where it has long been cultivated. It is said also to be a native of the Malabar Coast, and has at various periods been introduced into Java, the Isle of France, Bourbon, the Cape de Verds, Brazil, Cayenne, several of the West India islands, and Egypt; and in some of these places is at this time highly productive, especially in Cayenne, where the plant was flourishing so early as 1755. It is exceedingly influenced, as regards the aromatic character of its bark, by the circumstances of soil, climate, and mode of culture. Thus we are told by Marshall that in Ceylon, beyond the limits of Negombo and Matura, in the western and southern aspect of the island, the bark is never of good quality, being greatly deficient in the aromatic flavour of the cinnamon; and that even within these limits it is of unequal value, from the various influence of exposure, soil, shade, and other circumstances.

2. *C. aromaticum.* Nees, *Laurineæ*, 52; Lindley, *Flor. Med.* 330.—*C. Cassia.* Blume, Ed. Ph.; Hayne, *Darstel. und Beschreib. &c.* xii. 23.—*Laurus Cassia.* Aiton, *Hort. Kew.* ii. 427.—Not *Laurus Cassia* of Linn. This is of about the same magnitude as the former species, and like it has nearly opposite, shortly petiolate, coriaceous, entire leaves, of a shining green upon the upper surface, lighter coloured beneath, and furnished with three nerves, of which the two latter vanish towards the point. The leaves, however, differ in being oblong-lanceolate and pointed, and in exhibiting, under the microscope, a very fine down upon the under surface. The footstalks and extreme twigs are also downy. The flowers are in narrow, silky panicles. The plant grows in China, Sumatra, and other parts of Eastern Asia, and is said to be cultivated in Java. It is believed to be the species which furnishes, wholly or in part, the Chinese cinnamon or cassia brought from Canton, and is supposed to be the source of the *cassia buds.*

Besides the two species above described, others have been thought to contribute to the cinnamon and cassia of commerce. The opinion of Dr. Wight has been already stated. *C. Loureirii* of Nees, growing in the mountains of Cochin-China near Laos, and in Japan, affords, according to Loureiro, a cinnamon of which the finest kind is superior to that of Ceylon. *C. nitidum*, growing in Ceylon, Java, and on the continent of India, is said to have been the chief source of the drug known formerly by the name of *Folia Malabathri*, and consisting of the leaves of different species of Cinnamomum mixed together. The leaves of *C. Tamala* of Hindostan have been sold under the same name. *C. Culilawan* of the Moluccas yields the aromatic bark called culilawan, noticed in the *third part* of this work; and similar barks are obtained from another species of the same region, named *C. rubrum*, and from *C. Sintoc*

* The *cinnamon leaf oil*, as imported into Great Britain, is of two kinds, one containing a considerable quantity of a fatty fixed oil, perhaps cinnamon-suet from the fruit, the other a pure volatile oil. The oil is said to be obtained by distilling the leaves after maceration in sea-water. It resembles the oil of cloves and pimento in sensible properties, having a brownish colour, a penetrating, fragrant odour, and a very pungent taste. According to Stenhouse, it is of the sp. gr. 1·053, has an acid reaction, and consists essentially of eugenic acid and a neuter substance with the formula $C_{20}H_{16}$, but contains also a minute proportion of benzoic acid. (*Pharm. Journ.*, xiv. 319.)—*Note to the twelfth edition.*

of Java. *Massoy-bark*, from which an aromatic volatile oil is obtained called *oil of massoy*, is the product of *C. Kiamis.* (Gmelin, *Handbook*, xiv. 380.)

Culture, Collection, Commerce, &c. Our remarks under this head will first be directed to the cinnamon of Ceylon, in relation to which we have more precise information than concerning the aromatic obtained from other sources. The bark was originally collected exclusively from the tree in a wild state; but the Dutch introduced the practice of cultivating it, which has been continued since the British came into possession of the island. The principal cinnamon gardens are in the vicinity of Columbo. The seeds are planted in a prepared soil at certain distances; and, as four or five are placed in a spot, the plants usually grow in clusters like the hazel bush. In favourable situations they attain the height of five or six feet in six or seven years; and a healthy bush will then afford two or three shoots fit for peeling, and every second year afterwards from four to seven shoots in a good soil. The cinnamon harvest commences in May, and continues till late in October. The first object is to select shoots proper for decortication, and those are seldom cut which are less than half an inch, or more than two or three inches in diameter. The bark is divided by longitudinal incisions, of which two are made in the smaller shoots, several in the larger, and is then removed in strips by means of a suitable instrument. The pieces are next collected in bundles, and allowed to remain in this state for a short time, so as to undergo a degree of fermentation, which facilitates the separation of the epidermis. This, with the green matter beneath it, is removed by placing the strip of bark upon a convex piece of wood, and scraping its external surface with a curved knife. The bark now dries and contracts, assuming the appearance of a quill. The peeler introduces the smaller tubes into the larger, and connects them also endwise, thus forming a congeries of quills which is about forty inches long. When sufficiently dry, these cylinders are collected into bundles weighing about thirty pounds, and bound together by pieces of split bamboo. The commerce in Ceylon cinnamon was formerly monopolized by the East India Company; but the cultivation is now unrestricted, and the bark may be freely exported upon the payment of a fixed duty. It is assorted in the island into three qualities, distinguished by the designations of *first*, *second*, and *third*. The inferior kinds, which are of insufficient value to pay the duty, are used for the preparation of oil of cinnamon.

Immense quantities of cinnamon are exported from China, the finest of which is little inferior to that of Ceylon, though the mass of it is much coarser. It passes in commerce under the name of *cassia*, and is said by Mr. Reeves to be brought to Canton from the province of Kwangse, where the tree producing it grows very abundantly. (*Trans. Medico-bot. Soc.*, 1828, p. 26.) It has already been stated that this tree is supposed to be the *Cinnamomum aromaticum;* but we have no positive proof of the fact. Travellers inform us that cinnamon is also collected in Cochin-China; but that the best of it is monopolized by the sovereign of the country. It is supposed to be obtained from the *Cinnamomum Loureirii* of Nees, the *Laurus Cinnamomum* of Loureiro. According to Siebold, the bark of the large branches is of inferior quality and is rejected; that from the smallest branches resembles the Ceylon cinnamon in thickness, but has a very pungent taste and smell, and is little esteemed; while the intermediate branches yield an excellent bark, about a line in thickness, which is even more highly valued than the cinnamon of Ceylon, and yields a sweeter and less pungent oil. (*Annal. der Pharm.*, xx. 280.) Cinnamon of good quality is said to be collected in Java; and considerable quantities of inferior quality have been thrown into commerce, as *cassia lignea*, from the Malabar Coast. Manilla and the Isle of France are also mentioned as sources whence this drug is supplied. Little, however, reaches the United States from these places.

Cayenne, and several of the West India islands, yield to commerce considerable quantities of cinnamon of various qualities. That of Cayenne is of two kinds, one of which closely resembles, though it does not quite equal, the aromatic of Ceylon, the other resembles the Chinese. The former is supposed to be derived from plants propagated from a Ceylonese stock, the latter from those which have sprung from a tree introduced from Sumatra.*

* While on a visit, Nov. 1860, to the *Palais d'Industrie*, in Paris, where is kept a noble collection of industrial and natural products from the various French colonies, we noticed specimens of the

By far the greater proportion of cinnamon brought to this country is imported from China. It is entered as *cassia* at the custom house, while the same article brought from other sources is almost uniformly entered as cinnamon. Much of it is afterwards exported.

From what source the ancients derived their cinnamon and cassia is not certainly known. Neither the plants nor their localities, as described by Dioscorides, Pliny, and Theophrastus, correspond precisely with our present knowledge; but in this respect much allowance must be made for the inaccurate geography of the ancients. It is not improbable that the Arabian navigators, at a very early period, conveyed this spice within the limits of Phœnician and Grecian, and subsequently of Roman commerce.

Properties. Ceylon cinnamon is in long cylindrical fasciculi, composed of numerous quills, the larger enclosing the smaller. In the original sticks, which are somewhat more than three feet in length, two or three fasciculi are neatly joined at the end, so as to appear as if the whole were one continuous piece. The finest is of a light brownish-yellow colour, almost as thin as paper, smooth, often somewhat shining, pliable to a considerable extent, with a splintery fracture when broken. It has a pleasant fragrant odour, and a warm, aromatic, pungent, sweetish, slightly astringent, and highly agreeable taste. When distilled it affords but a small quantity of essential oil, which, however, has an exceedingly grateful flavour. It is brought to this country from England; but is very costly, and is not generally kept in the shops. The inferior sorts are browner, thicker, less splintery, and of a less agreeable flavour, and are little if at all superior to the best Chinese. The finer variety of *Cayenne cinnamon* approaches in character to that above described, but is paler and in thicker pieces, being usually collected from older branches. That which is gathered very young is scarcely distinguishable from the cinnamon of Ceylon.

Chinese cinnamon, or *cassia*, is in tubes from the eighth of an inch to an inch in diameter, usually single, sometimes double, but very rarely more than double. In some instances the bark is rolled very much upon itself, in others is not even completely quilled, forming segments more or less extensive of a hollow cylinder. It is of a redder or darker colour than the finest Ceylon cinnamon, thicker, rougher, denser, and breaks with a shorter fracture. It has a stronger, more pungent and astringent, but less sweet and grateful taste; and, though of a similar odour, is less agreeably fragrant. It is the kind almost universally kept in our shops. Of a similar character is the cinnamon imported directly from various parts of the East Indies. But under the name of cassia have also been brought to us very inferior kinds of cinnamon, collected from the trunks or large branches of the trees, or injured by want of care in keeping, or perhaps derived from inferior species. It is said that cinnamon from which the oil has been distilled, is sometimes fraudulently mixed with the genuine. These inferior kinds are detected, independently of their greater thickness, and coarseness of fracture, by their deficiency in the peculiar sensible properties of the spice.

According to the analysis of Vauquelin, cinnamon contains a peculiar volatile oil, tannin, mucilage, a colouring matter, an acid, and lignin. The tannin is of the variety which yields a greenish-black precipitate with the salts of iron. The oil obtained from the Cayenne cinnamon, he found to be more biting than that from the Ceylonese, and at the same time to be somewhat peppery. Bucholz found in 100 parts of *cassia lignea*, 0·8 of volatile oil, 4·0 of resin, 14·6 of gummy extractive (probably including tannin), 64·3 of lignin and bassorin, and 16·3 of water including loss. This aromatic yields its virtues wholly to alcohol, and less readily to water. At the temperature of boiling alcohol very little of the oil rises, and an extract pre-

Ceylon cinnamon (C. Zeylanicum), from the W. India island of Martinique. It was apparently of fine quality, consisting of pieces, singly and doubly quilled, and bearing a close resemblance to the product of Ceylon, except that the quills were single, and not, like the Ceylonese, introduced one into the other, forming a sort of compact cylinder. There were, besides, large flat pieces of the bark from the same source, bearing, in their general aspect, some resemblance to the flat Calisaya bark. These were, no doubt, from the trunk or larger branches. How far they possessed the aromatic properties of the true cinnamon could not be determined; for they were enclosed in cases in such a manner that, though they could be seen, they could not be submitted to the test of taste and smell. (*Note to the twelfth edition.*)

pared from the tincture retains, therefore, the aromatic properties. For an account of the volatile oil, see *Oleum Cinnamomi.*

Medical Properties and Uses. Cinnamon is among the most grateful and efficient of the aromatics. It is warm and cordial to the stomach, carminative, astringent, and, like most other substances of this class, more powerful as a local than general stimulant. It is seldom prescribed alone, though, when given in powder or infusion, it will sometimes allay nausea, check vomiting, and relieve flatulence. It is chiefly used as an adjuvant to other less pleasant medicines, and enters into a great number of officinal preparations. It is often employed in diarrhœa, in connection with chalk and astringents; and has recently been recommended as peculiarly efficacious in uterine hemorrhage. The dose of the powder is from ten grains to a scruple.

Cassia Buds. This spice consists of the calyx of one or more species of Cinnamomum, surrounding the young germ, and, as stated by Dr. Martius, on the authority of the elder Nees, about one-quarter of the normal size. It is produced in China; and Mr. Reeves states that great quantities of it are brought to Canton from the province which affords cassia. The species which yields it is in all probability the same with that which yields the bark, though it has been ascribed by Nees to *Cinnamomum Loureirii.* In favour of the former opinion is the statement of Dr. Christison, that *C. aromaticum*, cultivated in the hot-houses of Europe, bears a flower-bud which closely resembles the cassia bud when at the same period of advancement. Cassia buds have some resemblance to cloves, and are compared to small nails with round heads. The enclosed germen is sometimes removed, and they are then cup-shaped at top. They have a brown colour, with the flavour of cinnamon, and yield an essential oil upon distillation. They may be used for the same purposes as the bark.

Off. Prep. Acidum Sulphuricum Aromaticum; Aqua Cinnamomi, *Br.;* Decoctum Hæmatoxyli, *Br.;* Infusum Catechu, *Br.;* Infus. Catechu Comp., *U. S.;* Pulvis Aromaticus, *U. S.;* Pulvis Catechu Compositus, *Br.;* Pulvis Cinnamomi Comp., *Br.;* Pulvis Cretæ Aromaticus, *Br.;* Pulvis Kino Comp., *Br.;* Spiritus Lavandulæ Comp., *U. S.;* Syrupus Rhei Aromaticus, *U. S.;* Tinctura Cardamomi Comp.; Tinct Catechu; Tinct. Cinnamomi; Tinct. Lavandulæ Comp., *Br.;* Vinum Opii, *U. S.*

W.

COCCUS. *U. S., Br.*

Cochineal.

The female of Coccus cacti. *U. S.* The dried female insect, Coccus Cacti. *Br.* Cochenille, *Fr., Germ.;* Cocciniglia, *Ital.;* Cochinilla, *Span.*

The coccus is a genus of hemipterous insects, having the snout or rostrum in the breast, the antennæ filiform, and the posterior part of the abdomen furnished with bristles. The male has two erect wings, the female is wingless. The *C. Cacti* is characterized by its depressed, downy, transversely wrinkled body, its purplish abdomen, its short and black legs, and its subulate antennæ, which are about one-third of the length of the body. (*Rees's Cyclopædia.*) Another species, *C. Ilicis*, which inhabits a species of oak, is collected in the mountainous parts of the Morea, in Greece, and used as a dye-stuff in the East. (*Landerer.*) The Coccus Cacti is found wild in Mexico and Central America, inhabiting different species of Cactus and allied genera of plants; and is said to have been discovered also in some of the West India islands, and the southern parts of the United States. In Mexico, particularly in the provinces of Oaxaca and Guaxaca, it is an important object of culture. The Indians form plantations of the *nopal* (*Opuntia cochinillifera*), upon which the insect feeds and propagates. During the rainy season, a number of the females are preserved under cover, upon the branches of the plant, and, after the cessation of the rains, are distributed upon the plants without. They perish quickly, after having deposited their eggs. These, hatched by the heat of the sun, give origin to innumerable minute insects, which spread themselves over the plant. The males, of which, according to Mr. Ellis, the proportion is not greater than one to one hundred or two hundred females, being provided with wings and very active, approach and fecundate the latter. After this period, the females, which before moved about,

attach themselves to the leaves, and increase rapidly in size; so that, in the end, their legs, antennæ, and proboscis are scarcely discoverable, and they appear more like excrescences on the plant than distinct animated beings. They are now gathered for use, by detaching them by means of a blunt knife, a quill, or a feather; a few being left to continue the race. They are destroyed either by dipping them enclosed in a bag into boiling water, or by the heat of a stove. In the former case they are subsequently dried in the sun. The males, which are much smaller than the full-grown females, are not collected. It is said that of the wild insect there are six generations every year, furnishing an equal number of crops; but the domestic is collected only three times annually, the propagation being suspended during the rainy season, in consequence of its inability to support the inclemency of the weather. The insect has been taken from Mexico to the Canary Islands; and very large quantities of cochineal have been delivered to commerce from the Island of Teneriffe.* The culture has also been successfully introduced into Java; and attempts have been made to introduce it into Spain, Corsica, and Algiers.†

As kept in the shops, the finer cochineal, *grana fina* of Spanish commerce, is in irregularly circular or oval, somewhat angular grains, about one-eighth of an inch in diameter, convex on one side, concave or flat on the other, and marked with several transverse wrinkles. Two varieties of this kind of cochineal are known to the druggist, distinguished by their external appearance. One is of a reddish-gray colour, formed by an intermixture of the dark colour of the insect with the whiteness of a powder by which it is almost covered, and with patches of a rosy tinge irregularly interspersed. From its diversified appearance, it is called by the Spaniards *cochinilla jaspeada*. It is the variety commonly kept in our shops. The other, *cochinilla renegrida*, or *grana nigra*, is dark-coloured, almost black, with only a minute quantity of the whitish powder between the wrinkles. The two are distinguished in our markets by the names of *silver grains* and *black grains*. Some suppose the difference to arise from the mode of preparation; the gray cochineal consisting of the insects destroyed by a dry heat; the black, of those destroyed by hot water, which removes the external whitish powder. According to Mr. Faber, who derived his information from a merchant residing in the neighbourhood where the cochineal is collected, the silver grains consist of the impregnated female just before she has laid her eggs; the black, of the female after the eggs have been laid and hatched. (*Am. Journ. of Pharm.*, xviii. 47.) There is little or no difference in their quality.‡ Another and much inferior variety is the *grana sylvestra*, or wild cochineal, consisting partly of very small separate insects, partly of roundish or oval masses, which exhibit, under the microscope, minute and apparently new born insects, enclosed in a white or reddish cotton-like substance. It is scarcely known in our drug market.

Cochineal has a faint heavy odour, and a bitter slightly acidulous taste. Its powder is of a purplish carmine colour, tinging the saliva intensely red. According to

* Various species of Opuntia are adapted to the support of the cochineal insect, especially those which are very juicy, with few thorns and a thick skin. It is the *O. Ficus Indica*, which is chiefly cultivated in Teneriffe, the dry but hot climate of which is peculiarly adapted to the growth both of the plant and the insect. In the year 1856, the product of the Canaries is said to have amounted to more than one and a half millions of pounds, having increased to that amount from eight pounds in 1831. (*Neues Repertorium für Pharm.*, viii. 195.) For an account of the mode of rearing the cochineal insect in the Canary Islands, see a report by Mr. Grattan, British consul in the Islands (*Pharmaceutical Journal*, Sept. 1871, p. 268). A detailed account of its cultivation in Central America may be found in the *American Journal of Pharmacy* (Jan. 1873, p. 30), from the *Journal of Applied Science*. (*Note to the twelfth and fourteenth editions.*)

† At the Palais d'Industrie, in Paris, in Nov. 1860, the author noticed considerable quantities of apparently good cochineal, said to be the product of Algiers. In Spain, the cultivation seems to have proved unprofitable. The author observed a small field near Malaga, in 1861, still appropriated to the culture; but was informed that it was now neglected. In Asia Minor, in the vicinity of *Oushak*, are great quantities of an insect, closely resembling the Coccus Cacti, which feed on a species of Cistus; but it is unknown whether any portion has been introduced into general commerce. (*Am. Journ. of Pharm.*, xxxv. 455.)—*Note to the twelfth edition.*

‡ *Cake cochineal* is the name given to a variety of this drug, produced in the Argentine Republic, in South America, a specimen of which was sent by Mr. Black from Cordova, in that country, to London, and was examined by Dr. Stark. It was in flat cakes about a quarter of an inch thick, and, under the microscope, was seen to consist chiefly of the cochineal insect, mixed with small portions of the thorns and epidermis of the cactus, in consequence of careless gathering. It is inferior for dyeing purposes to the ordinary variety. (*Pharm. Journ.*, xiv. 346.)

Pelletier and Caventou, it consists of a peculiar colouring principle, a peculiar animal matter constituting the skeleton of the insect, stearin, olein, an odorous fatty acid, and various salts. Tyrosin, a crystallizable animal principle, has been found by De la Rue. (*Gmelin*, xiii. 358.) It was also analyzed by John, who called the colouring principle *cochinilin*. This is of a brilliant purple-red colour, unalterable in dry air, fusible at 122° F., very soluble in water, soluble in cold, and more so in boiling alcohol, insoluble in ether, and without nitrogen. It is obtained by macerating cochineal in ether, and treating the residue with successive portions of boiling alcohol, which on cooling deposits a part of the cochinilin, and yields the remainder by spontaneous evaporation. It may be freed from a small proportion of adhering fatty matter, by dissolving it in alcohol of 40° Baumé, and then adding an equal quantity of sulphuric ether. The pure cochinilin is deposited in the course of a few days. The watery infusion of cochineal is of a violet-crimson colour, which is brightened by the acids, and deepened by the alkalies. The colouring matter is readily precipitated. The salts of zinc, bismuth, and nickel produce a lilac precipitate, and those of iron a dark-purple approaching to black. The salts of tin, especially the nitrate and chloride, precipitate the colouring matter of a brilliant scarlet, and form the basis of those splendid scarlet and crimson dyes, which have rendered cochineal so valuable in the arts. With alumina the colouring matter forms the pigment called *lake*. The finest *lakes* are obtained by mixing the decoction of cochineal with freshly prepared gelatinous alumina. The pigment called *carmine* is the colouring matter of cochineal precipitated from the decoction by acids, the salts of tin, &c., or by animal gelatin, and when properly made is of the most intense and brilliant scarlet. The colouring principle has been named *carminic acid*, in consequence of its possession of acid properties. The degree of colouring power in cochineal may be approximatively measured by the decolourizing effect produced by solution of permanganate of potassium. For a precise method of applying this process, the reader is referred to a paper by Mr. J. M. Merrick, of Boston, in the *American Journal of Pharmacy*, June, 1871, p. 263, from the *Amer. Chem.* (April, 1871).

Cochineal has been adulterated by causing certain heavy substances, such as powdered talc, carbonate of lead, and sulphate of barium, by shaking in a bag or otherwise, to adhere, by means of some glutinous substance, to the surface of the insects, and thus increase their weight. Cochineal yields 1·5 per cent. of ashes. Five specimens of the drug have been examined, which left in their ashes respectively, 8, 12, 16, 18, and 25 per cent. of the salt of baryta. (*Am. Journ. of Pharm.*, May, 1870, p. 220.) The fraud may be detected by the absence, under the microscope, of a woolly appearance, which characterizes the white powder upon the surface of the unadulterated insect. Metallic lead, which is said frequently to exist in fine particles in the artificial coating, may be discovered by powdering the cochineal, and suspending it in water, when the metal will remain behind. Grains of a substance artificially prepared to imitate the dried insect have been mixed with the genuine in France. A close inspection will serve to detect the difference. (*Journ. de Pharm.*, 3e sér., ix. 110.) Vermilion and chromic-red (dichromate of lead) are said also to have been largely used in the adulteration of carmine, to the extent sometimes of 60 or even 70 per cent. (*Pharm. Journ.*, May, 1860, p. 547.) There can be no difficulty in detecting them by the appropriate tests. Starch has been used, according to Prof. Maisch, for the same purpose in the U. States, and in one specimen he found 57·14 per cent. (*Am. Journ. of Pharm.*, xxxiii. 18.)

Medical Properties, &c. Cochineal is supposed by some to possess anodyne properties, and has been highly recommended in hooping-cough and neuralgic affections. It is frequently associated, in prescription, with carbonate of potassium, especially in the treatment of hooping-cough. In pharmacy it is employed to colour tinctures and ointments. To infants with hooping-cough, cochineal in substance is given in the dose of about one-third of a grain three times a day. The dose of a tincture, prepared by macerating one part of the medicine in eight parts of diluted alcohol, is for an adult from twenty to thirty drops twice a day. In neuralgic paroxysms, Sauter gave half a tablespoonful, with the asserted effect of curing the disease.

Off. Prep. Tinctura Cardamomi Composita; Tinct. Cinchonæ Comp., *Br.;* Tinct. Cocci, *Br.* W.

COLCHICI RADIX. *U. S.*

Colchicum Root.

The Corm of Colchicum autumnale. *U. S.*

Off. Syn. COLCHICI CORMUS. *Colchicum Corm.* The fresh corm of Colchicum autumnale, collected about the end of June; and the same stripped of its coats, sliced transversely, and dried at a temperature not exceeding 150°. *Br.*

COLCHICI SEMEN. *U. S.*

Colchicum Seed.

The seed of Colchicum autumnale. *U. S.*

Off. Syn. COLCHICI SEMINA. *Colchicum Seeds.* The fully ripe seeds of Colchicum autumnale. *Br.*

Colchique, *Fr.;* Zeitlose, Herbst-Zeitlose, *Germ.;* Colchico, *Ital., Span.*

COLCHICUM. *Sex. Syst.* Hexandria Trigynia.—*Nat. Ord.* Melanthaceæ.

Gen. Ch. A *spathe. Corolla* six-parted, with a tube proceeding directly from the root. *Capsules* three, connected, inflated. *Willd.*

Colchicum autumnale. Willd. *Sp. Plant.* ii. 272; Woodv. *Med. Bot.* p. 759, t. 258. This species of Colchicum, often called *meadow-saffron*, is a perennial bulbous plant, the leaves of which appear in spring, and the flowers in autumn. Its manner of growth is peculiar, and deserves notice as connected in some measure with its medicinal efficacy. In the latter part of summer, a new bulb, or *cormus* as the part is now called, begins to form at the lateral inferior portion of the old one, which receives the young offshoot in its bosom, and embraces it half round. The new plant sends out fibres from its base, and is furnished with a radical spathe, which is cylindrical, tubular, cloven at top on one side, and half under ground. In September, from two to six flowers, of a lilac or pale-purple colour, emerge from the spathe, unaccompanied with leaves. The corolla consists of a tube five inches long, concealed for two-thirds of its length in the ground, and of a limb divided into six segments. The flowers perish by the end of October, and the rudiments of the fruit remain under ground till the following spring, when they rise upon a stem above the surface, in the form of a three-lobed, three-celled capsule. The leaves of the new plant appear at the same time; so that in fact they follow the flower instead of preceding it, as might be inferred from the order of the seasons in which they respectively show themselves. The leaves are radical, spear-shaped, erect, numerous, about five inches long, and one inch broad at the base. In the mean time, the new bulb has been increasing at the expense of the old one, which, having performed its appointed office, perishes; while the former, after attaining its full growth, sends forth shoots, and in its turn decays. The old bulb, in its second spring, and a little before it perishes, sometimes puts forth one or more small bulbs, which separate from the parent, and are supposed to be sources of new plants.

C. autumnale is a native of the temperate parts of Europe, where it grows wild in moist meadows. Attempts have been made to introduce its culture into this country, but with no great success; though small quantities of the bulb, of apparently good quality, have been brought into the market. The officinal portions are the bulb or cormus, and the seeds. The root, botanically speaking, consists of the fibres attached to the base of the bulb. The flowers possess similar virtues with the bulb and seeds.

1. Colchici Radix.

The medicinal virtue of the bulb depends much upon the season at which it is collected. Early in the spring, it is too young to have fully developed its peculiar properties; and, late in the fall, it has become exhausted by the nourishment afforded to the new plant. The proper period for its collection is from the early part of June, when it has usually attained perfection, to the middle of August, when the offset

appears.* It may be owing, in part, to this inequality at different seasons, that entirely opposite reports have been given of its powers. Krapf ate whole bulbs without inconvenience; Haller found the bulbs entirely void of taste and acrimony; and we are told that in Carniola the peasants use it as food with impunity in the autumn. On the other hand, there can be no doubt of its highly irritating and poisonous nature, when fully developed, under ordinary circumstances. Perhaps soil and climate may have some influence in modifying its character.

The bulb is often used in the fresh state in the countries where it grows; as it is apt to be injured in drying, unless the process is carefully conducted. The usual plan is to cut the bulb, as soon after it has been dug up as possible, into thin transverse slices, which are spread out separately upon paper or perforated trays, and dried with a moderate heat. The reason for drying it quickly, after removal from the ground, is that it otherwise begins to vegetate, and a change in its chemical nature takes place; and such is its retentiveness of life, that, if not cut in slices, it is liable to undergo a partial vegetation even during the drying process. Dr. Houlton recommends that the bulb should be stripped of its dry coating, carefully deprived of the bud or young bulb, and then dried whole. It is owing to the high vitality of the bud that the bulb is so apt to vegetate. Much loss of weight is sustained by exsiccation. Mr. Bainbridge obtained only two pounds fifteen ounces of dried bulb from eight pounds of the fresh.

Properties. The recent bulb or cormus of *C. autumnale* resembles that of the tulip in shape and size, and is covered with a brown membranous coat. Internally it is solid, white and fleshy; and, when cut transversely, yields, if mature, an acrid milky juice. There is often a small lateral projection from its base, particularly noticed by Dr. J. R. Coxe, which appears to be merely a connecting process between it and the new plant, and is not always present. When dried, and deprived of its external membranous covering, the bulb is of an ash-brown colour, convex on one side, and somewhat flattened on the other, where it is marked by a deep groove, extending from the base to the summit. As found in our shops it is always in the dried state, sometimes in segments made by vertical sections of the bulb, but generally in transverse circular slices, about the eighth or tenth of an inch in thickness, with a notch at one part of their circumference. The cut surface is white, and of an amylaceous aspect. The odour of the recent bulb is said to be *hircine*. It is diminished but not lost by drying. The taste is bitter, hot, and acrid. Its constituents, according to Pelletier and Caventou, are a vegetable alkali combined with an excess of gallic acid; a fatty matter composed of olein, stearin, and a peculiar volatile acid analogous to the cevadic; a yellow colouring matter; gum; starch; inulin in large quantity; and lignin. The active properties are ascribed to the alkaline principle, which was believed by its discoverers to be identical with *veratria*, but has been subsequently found to be peculiar, and has received the appropriate name of *colchicine*, or *colchicia*.† Wine and vinegar extract all the virtues of the bulb.

* Dr. Christison, however, has found the roots collected in April, though shrivelled and less abundant in starch than those gathered in July, to be even more bitter; and conjectures, therefore, that the common opinion of their superior efficacy at the latter season may not be well founded. Prof. Schroff states, as the result of his observation, that the autumn root is much stronger than that dug in summer. (See *Am. Journ. of Pharm.*, xxix. 324.)

† *Colchicia* or *Colchicine*, and *Colchiceine*. The alkaloid of colchicum has been a subject of some controversy. According to Geiger and Hesse, to whom has been ascribed the credit of determining its precise nature, *colchicine* (*colchicia*) is crystallizable, and has a very bitter and sharp taste, but is destitute of the extreme acrimony of veratria, and does not, like that principle, excite violent sneezing when applied to the nostrils. It differs also in being more soluble in water, and less poisonous. To a kitten eight weeks old, one-tenth of a grain was given dissolved in dilute alcohol. Violent purging and vomiting were produced, with apparently severe pain and convulsions, and the animal died at the end of twelve hours. The stomach and bowels were found violently inflamed, with effusion of blood through their whole extent. A kitten somewhat younger was destroyed in ten minutes by only the twentieth of a grain of veratria; and, on examination after death, marks of inflammation were found only in the upper part of the œsophagus. The alkaloid was obtained from the seeds by a process similar to that employed in the preparation of hyoscyamia from hyoscyamus. (See *Hyoscyamus.*) A simpler process is to digest the seeds of meadow-saffron in boiling alcohol, precipitate with magnesia, treat the precipitated matter with boiling alcohol, and finally filter and evaporate.

The nature of the active principle of colchicum subsequently engaged the attention of L. Oberlin. Upon repeating the process of Geiger and Hesse, he was unable to obtain a crystallizable

Dr. A. T. Thomson states that the milky juice of fresh colchicum produces a fine blue colour, if rubbed with the tincture of guaiac; and that the same effect is obtained

product, and came to the conclusion that the substance obtained by them was complex. By acidifying its watery solution by sulphuric or muriatic acid, and concentrating until the liquid became intensely yellow, he obtained, upon the addition of water, a yellowish-white precipitate, which, when well washed and freed from colouring matter, dissolved readily in alcohol or ether, and crystallized with facility. The crystalline product thus obtained he proposed to call *colchiceine*. It is a neuter substance, contains no acid, and is therefore not a salt, crystallizes in pearly lamellæ, is almost insoluble in cold water, to which, however, it imparts a slight bitterness, is more soluble in boiling water, and readily dissolves in alcohol, ether, methylic alcohol, and chloroform. It is dissolved by concentrated sulphuric, muriatic, and nitric acids, becoming yellow, by acetic acid without change of colour, and by ammonia and potassa. It is not altered nor precipitated by acetate or subacetate of lead, nitrate of silver, bichloride of mercury, or infusion of galls, but is rendered green by sesquichloride of iron. It consists of carbon, hydrogen, nitrogen, and oxygen. It was found to be very poisonous to rabbits, killing an animal in 12 hours in the dose of about one-seventh of a grain, and in a few minutes by five times that quantity. (*Comptes Rendus*, Dec. 1856, p. 1199. See also *Am. Journ. of Pharm.*, xxix. 235.)

More recently, Mr. J. E. Carter, of Philadelphia, has made some experiments which appear to invalidate the conclusions of Oberlin as to the nature of colchicia, and to confirm the previous opinion of its alkaloid character. Mr. Carter used the bulb, instead of the seeds, which had previously in general been made the subject of experiment. He employed two processes for the extraction of the alkaloid, but found the following most productive. The dried and powdered bulb was exhausted by alcohol of 0·835 by means of percolation; the tincture thus obtained was evaporated to the consistence of syrup; water acidulated with acetic acid was added, and the liquor, after filtration, was nearly neutralized with ammonia, and then precipitated by solution of tannic acid; the precipitated tannate, after being well washed, was rubbed with five times its weight of freshly prepared hydrated oxide of lead, small quantities of alcohol being added from time to time during the trituration; the whole was then filtered, and the filtered liquid evaporated at a gentle heat. Twenty grains were thus obtained from three pounds of the dried root. Thus obtained *colchicia* was yellowish in mass, nearly white in powder, inodorous, bitter without being acrid, not sternutatory, soluble in water hot or cold, still more so in dilute acids and alkaline solutions, very soluble in alcohol and chloroform, sparingly so in pure ether, and insoluble in benzole. Mr. Carter did not succeed in crystallizing it. It was alkaline to test-paper, neutralized the acids, and with sulphuric acid formed a crystallizable salt. The most delicate test appeared to be that of sulphuric acid and nitre. A piece of nitre, added to its solution in sulphuric acid, produced a beautiful blue colour, changing to green, dark-brown or purple, and finally reddish-yellow. (For a further account of Mr. Carter's experiments, see *Am. Journ. of Pharm.*, May, 1858, p. 209.)—*Note to the eleventh and twelfth editions.*

Since Mr. Carter's experiments, others have engaged in the same inquiry. Ludwig confirms the statements of Oberlin. Hubler, operating on the unbruised seeds by a process similar to that of Mr. Carter with the cormus, for the details of which we refer to the *Am. Journ. of Pharm.* (March, 1866, p. 105), obtained an amorphous substance, soluble without residue in water and in alcohol, of an odour like that of hay, and very bitter. It had no effect on test-paper; its solution was precipitated yellow by chloride of gold, and white by corrosive sublimate; mineral acids and alkalies turned it yellow; at 284° F. it melted, with no other observable change except in colour, which became brown; and its composition was represented by the formula $C_{34}H_{19}NO_{10}$. When treated with acids it yielded crystallizable bodies, but these, instead of salts, were a new product, isomeric with colchicia, but in character resembling if not identical with the colchiceine of Oberlin, which is therefore a result of change in the colchicia. Both these substances are poisonous. Between the substance obtained by Hubler and the one by Carter, there is this apparently irreconcilable difference, that the latter is decidedly though feebly alkaline, while the former is entirely neuter. Either there is some error on the part of one of these experimenters, or the alkaloid obtained from the cormus is different from the active principle of the seeds.

That Mr. Carter's statement was correct has been fully confirmed by Prof. J. M. Maisch, who made a very careful examination of a portion of the colchicia obtained by Mr. Carter, and kept as a specimen, with the following results. It was an amorphous powder; of a light-yellow colour, a faint odour, and intense bitterness; sparingly soluble in ether, and readily in water and alcohol. The aqueous solution was slightly turbid, probably from the decomposition by time and exposure of a portion of the colchicia into resin and colchiceine. Heated on platinum foil, it melted, and at a higher temperature took fire, and burned without residue. It restored the blue colour of reddened litmus, and even neutralized sulphuric acid in very minute proportion. It answered to the best tests of colchicia, namely, 1. the effect on its solution of both acids and alkalies, which cause it to assume a yellow colour, and 2. the violet and blue colour produced by oxidizing agents on the dry colchicia. When treated first with concentrated sulphuric acid, and then with nitric acid or a fragment of a nitrate, it went through a series of changes of colour, ending in yellow. The same effect resulted from sulphuric acid with a trace of chromate or bichromate of potassium, sesquichloride of iron, or binoxide of lead; the first two causing a green colour with the solution, through the intermixture of their yellowishness with the blue developed. The colchicia also answered to the following tests of the alkaloids, giving precipitates with iodohydrargyrate of potassium, phosphomolybdic acid, and tannic acid.

Colchiceine was produced by treating colchicia with diluted sulphuric and muriatic acids, evaporating the solution to dryness, repeating this operation once and again, then dissolving the residue in water, filtering the solution to separate the resin formed, evaporating with an excess of carbonate of lead to remove acid, treating with strong alcohol, and slowly evaporating. Colchiceine was deposited in yellow crystals, the solution of which precipitated, like colchicia, tannic and

from an acetic solution of the dried bulb. He considers the appearance of this colour, when the slices are rubbed with a little distilled vinegar and tincture of guaiac, as a proof that the drug is good and has been well dried. Dr. J. M. Maclagan has shown that this change of colour is produced with the albumen, which is not affected if previously coagulated; so that the value of the test consists simply in proving that the drying has not been effected at a heat above 180°, or the temperature at which albumen coagulates. A very deep or large notch in the circumference of the slices is considered an unfavourable sign; as it indicates that the bulb has been somewhat exhausted in the nourishment of the offset. The decoction yields a deep-blue precipitate with solution of iodine, white precipitates with acetate and subacetate of lead, nitrate of protoxide of mercury, and nitrate of silver, and a slight precipitate with tincture of galls. The value of colchicum is best tested by its bitterness.

Medical Properties and Uses. Colchicum root is believed to act upon the nervous system, allaying pain and producing other sedative effects, even when it exerts no obvious influence over the secretions. Generally speaking, when taken in doses sufficiently large to affect the system, it gives rise to more or less disorder of the stomach or bowels, and sometimes occasions active vomiting and purging, with the most distressing nausea. When not carried off by the bowels, it often produces copious diaphoresis, and occasionally acts as a diuretic and expectorant; and a case is on record of violent salivation, supposed to have resulted from its use. It appears in fact to have the property of stimulating all the secretions, while it somewhat diminishes the action of the heart. In an over-dose, it may produce dangerous and even fatal effects. Excessive nausea and vomiting, abdominal pains, purging and tenesmus, great thirst, sinking of the pulse, coldness of the extremities, and general prostration, with occasional symptoms of nervous derangement, such as headache, delirium, and stupor, are among the results of its poisonous action. It was well known to the ancients as a poison, and is said to have been employed by them as a remedy in gout and other diseases. Störck revived its use among the moderns. He gave it as a diuretic and expectorant in dropsy and humoral asthma; and on the continent of Europe it acquired considerable reputation in these complaints; but the uncertainty of its operation led to its general abandonment, and it had fallen into almost entire neglect, when Dr. Want, of London, again brought it into notice by attempting to prove its identity with the active ingredient of the *eau medicinale d'Husson*, so highly celebrated as a cure for gout. In James's Dispensatory, printed in 1747, it is said to be used in gout as an external application. The chief employment of the meadow-saffron is at present in the treatment of gout and rheumatism, in which experience has abundantly proved it to be a highly valuable remedy. We have, within our own observation, found it especially useful in these affections, when of a shifting or neuralgic character. It sometimes produces relief without obviously affecting the system; but is more efficient when it evinces its influence upon the skin or alimentary canal. Professor Chelius states that it changes the chemical constitution of the urine in arthritic patients, producing an evident increase of the uric acid. Dr. Maclagan has found it greatly to increase the proportion both of urea and uric acid in the urine, and, where these previously existed in the blood, to separate them from it. (*Ed. Monthly Journ. of Med. Sci.*, N. S., v. 23.) Dr. Elliotson successfully

phosphomolybdic acids, and iodohydrargyrate of mercury, but exercised no reaction on litmus paper whether red or blue.

The inference from these experiments is that the active principle of colchicum, known by the name of colchicia, is an alkaloid, but that its salts in solution, on being kept, or evaporated, especially if heat is used, are decomposed, and converted into resin and colchiceine, the latter of which crystallizes; and, as this is isomeric with colchicia, the probability is that the resin has the same composition. In preparing colchicum pharmaceutically, if it be desired to retain the colchicia unchanged, both acids and alkalies should be avoided, especially when heat is employed. Of the officinal preparations, the two fluid extracts contain the colchicia as in nature; the acetic extract has a portion at least of colchiceine in its composition. In the wines, when kept, the colchicia probably passes gradually into colchiceine. (*Am. Journ. of Pharm.*, March, 1867, p. 97.) But it has not been proved that these latter preparations are in any degree less efficacious remedially; and in the absence of all experience to the contrary, the inference is that colchiceine may have all the powers of colchicia; for the acetic extract, and the wines after being long kept, have often been used in practice, without having been found less effectual than other preparations of colchicum (*Note to the thirteenth edition.*)

treated a case of prurigo with the wine of colchicum, given in the dose of half a drachm three times a day, and continued for three weeks; and it has been found useful in urticaria and other cutaneous affections. Dr. Smith, of Port au Prince, employed it advantageously in tetanus both traumatic and idiopathic. He gave it in full doses, repeated every half hour till it produced an emetic or cathartic effect. (*Am. Journ. of the Med. Sci.*, xvii. 66.) Mr. Ritton found the powdered bulb an effectual remedy in numerous cases of leucorrhœa. (*Ibid.*, vi. 527.) Colchicum has also been recommended in inflammatory and febrile diseases as an adjuvant to the lancet, in diseases of the heart with excessive action, in various nervous complaints, as chorea, hysteria, and hypochondriasis, and in chronic bronchial affections. It is generally given in the state of vinous tincture (see *Vinum Colchici Radicis*); but there are various other officinal preparations, any one of which may be used efficiently. The wine has been employed externally in rheumatism. The dose of the dried bulb is from two to eight grains, which may be repeated every four or six hours till its effects are obtained.

2. Colchici Semen.

The seeds of the meadow-saffron ripen in summer, and should be collected about the end of July or beginning of August. They never arrive at maturity in plants cultivated in a dry soil, or in confined gardens. (*Williams.*) They are nearly spherical. about the eighth of an inch in diameter, of a reddish-brown colour externally, white within, and of a bitter acrid taste. Dr. Williams of Ipswich, England, who first brought them into notice, recommends them in the warmest terms in chronic rheumatism, and considers them superior to the bulb, both in the certainty of their effects, and the mildness of their operation. Prof. Schroff, however, has found that their activity is inferior to that of the dried bulb, dug in autumn. (*Am. Journ. of Pharm.*, xxix. 324.) There is no doubt that they possess virtues analogous to those of the bulb, and have this advantage, that they are not liable to become injured by drying; an advantage of peculiar value in a country where the plant is not cultivated, and a fresh bulb cannot be readily procured. A wine, fluid extract, and tincture of the seeds are directed in the U. S. Pharmacopœia. Their dose is about the same with that of the bulb.*

Off. Prep. of the Root. Extractum Colchici, *Br.;* Extractum Colchici Aceticum; Extractum Colchici Radicis Fluidum, *U. S.;* Vinum Colchici, *Br.;* Vinum Colchici Radicis, *U. S.*

Off. Prep. of the Seed. Extractum Colchici Seminis Fluidum, *U. S.;* Tinctura Colchici, *U. S.;* Tinct. Colchici Seminum, *Br.;* Vinum Colchici Seminis, *U. S.*

W.

COLOCYNTHIS. *U. S.*

Colocynth.

The fruit, deprived of its rind, of Citrullus Colocynthis (Royle, *Mat. Med.*). *U. S.*

Off. Syn. COLOCYNTHIDIS PULPA. *Colocynth Pulp.* The dried decorticated fruit, freed from seeds, of Citrullus Colocynthis. *Br.*

Coloquintida; Coloquinte, *Fr.;* Coloquinte, Coloquintenapfel, *Germ.;* Coloquintida, *Ital., Span.*

Cucumis. *Sex. Syst.* Monœcia Monadelphia.—*Nat. Ord.* Cucurbitaceæ.

Gen. Ch. Male. *Calyx* five-toothed. *Corolla* five-parted. *Filaments* three. Fe-

* The following description of the seeds is given by Mr. Gray in the *Lond. Med. Repository* for April, 1821. "*Seeds*, ovate, globose, about one-eighth of an inch in diameter. *Integuments*, simple, soft, spongy, membranaceous, thin, reddish-brown, closely adherent to the perisperm. *Perisperm* or *albumen*, hard, rather cartilaginous, pellucid, pale, not in the least divided, of the same shape as the seed. *Corculum* or *embryo*, very small, ovate-globose, not in the least divided, whitish, placed nearly opposite to the *hylum*, or that part where the seed is affixed to the parent plant, but out of the axis of the seed. Base pointing to the hylum, slender. Apex very obtuse." An acquaintance with the characters of these seeds is the more necessary, as the seeds of other plants have been sold for them.

The *flowers* have been repeatedly employed as a substitute for the root or seeds, and by some have been thought more uniform in their effects, and at the same time less irritating. M. Luskind, of Geneva, Switzerland, prepares them in the following manner. The flowers having been gathered when in full perfection, on a sunny day, are submitted to expression in a silk bag. A dark-brown juice is obtained, which is to be mingled with an equal measure of strong alcohol, allowed to stand for a month, and then filtered. (See *Va. Med. and Surg. Journ.*, March, 1854, p. 486.)

MALE. *Calyx* five-toothed. *Corolla* five-parted. *Pistil* three-cleft. *Seeds* of the *gourd* with a sharp edge. *Willd.*

Cucumis Colocynthis. Willd. *Sp. Plant.* iv. 611; Woodv. *Med. Bot.* p. 189, t. 71.—*Citrullus Colocynthis*, Royle's Mat. Med. The *bitter cucumber* is an annual plant, bearing considerable resemblance to the common watermelon. The stems, which are herbaceous and beset with rough hairs, trail upon the ground, or rise upon neighbouring bodies, to which they attach themselves by their numerous tendrils. The leaves, which stand alternately on long petioles, are triangular, many-cleft, variously sinuated, obtuse, hairy, of a fine green colour on the upper surface, rough and pale on the under. The flowers are yellow, and appear singly at the axils of the leaves. The fruit is a globular pepo, of the size of a small orange, yellow and smooth when ripe; and contains, within a hard, coriaceous rind, a white spongy, medullary matter, enclosing numerous ovate, compressed, white or brownish seeds.

The plant is a native of Turkey, and abounds in the islands of the Archipelago. It grows also in various parts of Africa and Asia. Burkhardt, in his travels across Nubia, found the country covered with it; Thunberg met with it at the Cape of Good Hope; and Ainslie says that it grows in many parts of Lower India, particularly in sandy places near the sea. It is said to be cultivated in Spain. The fruit is gathered in autumn, when it begins to become yellow, and, having been peeled, is dried quickly in a stove or by the sun. Thus prepared, it is imported from the Levant. Small quantities are said to be imported into England from Mogador unpeeled.*

Properties. As kept in the shops, colocynth is in the shape of whitish balls about the size of an orange, very light and spongy, and abounding in seeds which constitute three-fourths of their weight. The seeds are somewhat bitter; but possess little activity, and, according to Captain Lyon, are even used as food in the north of Africa.† When the medicine is prepared for use, they are separated and rejected, the pulpy or medullary matter only being employed. This has a very feeble odour, but a nauseous and intensely bitter taste. Water and alcohol extract its virtues. Vauquelin obtained the bitter principle in a separate state, and called it *colocynthin.* According to Meissner, 100 parts of the dry pulp of colocynth contain 14·4 parts of colocynthin, 10·0 of extractive, 4·2 of fixed oil, 13·2 of a resinous substance insoluble in ether, 9·5 of gum, 3·0 of pectic acid (pectin), 17·6 of gummy extract derived from the lignin by means of potassa, 2·7 of phosphate of calcium, 3·0 of phosphate of magnesium, and 19·0 of lignin, besides water.‡ Colocynthin is obtained by boiling the pulp in water, evaporating the decoction, treating the extract thus procured with alcohol, evaporating the alcoholic solution, and submitting the residue, which consists of the bitter principle and acetate of potassium, to the action of a little cold water, which dissolves the latter, and leaves the greater part of the former untouched. Mr.

* In a letter from Mr. R. W. Pelham, of the Shakers' Village, near New Lebanon, Ohio, the author was informed that a hybrid plant between the colocynth and watermelon had been successfully cultivated in that place, and yielded a bitter fruit having the medical virtues of colocynth. With the letter came also some seeds of the plant, and a portion of extract prepared from the pulp of the fruit. This was found, upon trial, to be actively cathartic. The seeds, planted in the garden of the author, produced vigorous plants, which perfected their fruit. The plant appeared intermediate between the colocynth and watermelon. The fruit was globular, about four inches in diameter, green like the watermelon externally, having the same odour when cut, but of an extremely bitter taste. A portion of the pulp was dried; and an extract prepared from it was found to have the cathartic properties of the extract of colocynth.

† Dr. Nachtigal, who sojourned for a time among the Tibbus, living in the mountainous region of interior Africa, east of Senegambia, confirms this statement of Captain Lyon; but with the qualification, that, before being eaten, the seeds are deprived of their coating by some mechanical means, and the kernels are heated to the boiling point, then washed with cold water, dried, and powdered. Professor Flückeger found a bitter principle in the testa, which accounts for its rejection as food, though rendering improper the rejection of the seed in preparing the extract. He found in the kernels about 45 per cent. of fixed oil and 18 per cent. of albumen, sufficiently accounting for their nutritive value. (*Am. Journ. of Pharm.*, Dec. 1872, p. 538; from *Zeitschr. der Gesellsch. für Erdkunde zu Berlin.*)—*Note to the fourteenth edition.*

‡ Dr. Waltz supposes that he has found another peculiar principle in colocynth, to which he gives the name of *colocynthitin.* It was obtained by treating with ether the alcoholic extract previously exhausted by water, decolorizing the ethereal solution with animal charcoal, evaporating to dryness, and dissolving the residue in anhydrous alcohol, which deposited it in crystals on spontaneous evaporation. It is white and tasteless, and is probably a resin. (*N. Jahrbuch der Pharm.* xvi. 10.)—*Note to the twelfth edition.*

Bastick obtained it by exhausting the pulp with cold water, heating the solution to ebullition, adding subacetate of lead so long as a precipitate was produced, filtering the liquor when cold, adding dilute sulphuric acid gradually until it no longer occasioned a precipitate, boiling to expel free acetic acid, filtering to separate sulphate of lead, evaporating cautiously nearly to dryness, extracting the colocynthin from the residuum by strong alcohol, which left the salts, and finally evaporating the alcoholic solution. The following process, employed by Dr. Waltz, probably yields it in a purer state. Colocynth is exhausted by alcohol of 0·84, the tincture evaporated to dryness, the residue treated with water, and the solution precipitated first with acetate and afterwards with subacetate of lead. The yellow filtered liquor is then treated with sulphuretted hydrogen to separate the lead, and, after filtration, with solution of tannic acid, which throws down a compound of tannic acid and colocynthin. This is dissolved in alcohol, the tannin thrown down by subacetate of lead, the excess of lead separated, and the liquid digested with animal charcoal, filtered, and evaporated. The residue, washed with anhydrous ether, is pure colocynthin. This is yellowish, somewhat translucent, brittle and friable, fusible by a heat below 212°, inflammable, more soluble in alcohol than in water, but capable of rendering the latter intensely bitter. M. Mouchon states that it is insoluble in ether. It is neither acid nor alkaline; but its aqueous solution gives with infusion of galls a copious white precipitate. It consists of carbon, hydrogen, and oxygen, and its formula, according to Dr. Waltz, is $C_{56}H_{42}O_{23}$. Upon the same authority it is a glucoside, being resolved, by the action of sulphuric acid, into sugar and a peculiar resinous substance. An infusion of colocynth, made with boiling water, gelatinizes upon cooling. Neumann obtained from 768 parts of the pulp, treated first with alcohol and then with water, 168 parts of alcoholic and 216 of aqueous extract.

Medical Properties and Uses. The pulp of colocynth is a powerful drastic, hydragogue cathartic, producing, when given in large doses, violent griping, and sometimes bloody discharges, with dangerous inflammation of the bowels. Death has resulted from a teaspoonful and a half of the powder. (*Christison.*) Even in moderate doses, it sometimes acts with much harshness, and is, therefore, seldom prescribed alone. By some writers it is said to be diuretic. It was frequently employed by the ancient Greeks and the Arabians, though its drastic nature was not unknown to them. Among the moderns it is occasionally used in obstinate dropsy, and in various affections depending on disordered action of the brain. In combination with other cathartics it loses much of its violence, but retains its purgative energy; and in this state is extensively employed. The compound extract of colocynth is a favourite preparation with many practitioners; and, combined with calomel, extract of jalap, and gamboge, it forms a highly efficient and safe cathartic, especially useful in congestion of the portal circle and torpidity of the liver. (See *Pilulæ Catharticæ Compositæ.*) The dose of colocynth is from five to ten grains. It is best administered in minute division, effected by trituration with gum or farinaceous matter. The active principle has sometimes been employed; and, in the impure state in which it is prepared by the process of M. Emile Mouchon, may be given in the dose of a grain.*

Thunberg states that the fruit of C. Colocynthis, at the Cape of Good Hope, is rendered so mild by being properly pickled, that it is eaten both by the natives and colonists; but, as it is thus employed before attaining perfect maturity, it is possible that the drastic principle may not have been developed.

Off. Prep. Extractum Colocynthidis, *U. S.;* Extractum Colocynthidis Compositum, *Br.;* Pilula Colocynthidis Composita, *Br.;* Pilula Colocynthidis et Hyoscyami, *Br.*

W.

* The following is the simple process of M. Mouchon. Take 125 parts of colocynth in very fine powder, and 60 parts of purified animal charcoal. Mix the colocynth intimately with half the charcoal; introduce the mixture into a percolator containing the other half of the charcoal; and percolate first with strong alcohol, then with dilute alcohol, and finally with water, so as to displace the previous liquid, until 250 parts of concentrated alcoholic tincture are obtained. Allow this to evaporate spontaneously on flat dishes to dryness. A garnet-coloured pulverizable product is thus obtained, of insupportable bitterness, and powerfully cathartic in the dose of a grain and a half. In this state it is sufficiently pure for use. It may be further purified by dissolving in strong alcohol, and treating with a little animal charcoal. One part of colocynthin is obtained from 32 of the entire fruit. (*Am. Journ. of Pharm.*, xxviii. 166; from *Repert. der Pharm.*, Nov. 1855.) For a process by Prof. Procter, see *Ibid.* (March, 1863, p. 116.)—*Note to the twelfth edition.*

CONII FOLIA. *U.S., Br.*

Conium Leaves.

Conium, *U.S.* 1860.

Syn. Hemlock Leaves. *U.S.*

The leaves of Conium maculatum. *U.S.*, Br.

The fresh leaves and young branches of Spotted Hemlock, Conium maculatum; also the leaves separated from the branches and carefully dried; gathered from wild British plants when the fruit begins to form. *Br.*

CONII FRUCTUS. *U.S., Br.*

Conium Seed.

The full-grown fruit of Conium maculatum, gathered while yet green, and carefully dried. *U.S.* The dried ripe fruit of Conium maculatum, Spotted Hemlock. *Br.*

Ciguë ordinaire, Grand ciguë, *Fr.*; Gefleckter Schierling, *Germ.*; Cicuta, *Ital., Span.*

CONIUM. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Umbelliferæ or Apiaceæ. *Gen. Ch. Partial involucre* halved, usually three-leaved. *Fruit* nearly globular, five-streaked, notched on both sides. *Willd.*

Conium maculatum. Willd. *Sp. Plant.* i. 1395; Bigelow, *Am. Med. Bot.* i. 113; Woodv. *Med. Bot.* p. 104, t. 42. This is an umbelliferous plant, having a biennial spindle-shaped whitish root, and an herbaceous branching stem, from three to six feet high, round, hollow, smooth, shining, slightly striated, and marked with brownish-purple spots. The lower leaves are tripinnate, more than a foot in length, shining, and attached to the joints of the stem by sheathing petioles; the upper are smaller, bipinnate, and inserted at the division of the branches; both have channeled footstalks, and incised leaflets, which are deep-green on their upper surface and paler beneath. The flowers are very small, white, and disposed in compound terminal umbels. The general involucre consists of from three to seven lanceolate, reflected leaflets, whitish at their edges; the partial involucre, of three or four, oval, pointed, spreading, and on one side only. There are five petals, cordate, with their points inflected, and nearly equal. The stamens are spreading, and about as long as the corolla; the styles diverging. The fruit, commonly called seeds, is roundish-ovate, a line and a half or rather less in length by a line in breadth, striated, and composed of two plano-convex, easily separable parts, which have on their outer surface five crenated ribs.

Hemlock is a native of Europe, and has become naturalized in the United States, where it is also cultivated for medicinal purposes. It grows usually in clusters along the roadsides, or in waste grounds, and is found most abundantly near old settlements. It flowers in June and July. The whole plant, especially at this period, exhales a fetid odour, compared by some to that of mice, by others to that of the urine of cats; and narcotic effects result from breathing for a long time air loaded with the effluvia. The plant varies in narcotic power according to the weather and climate, being most active in hot and dry seasons, and in warm countries. The hemlock of Greece, Italy, and Spain is said to be much more energetic than that of the north of Europe. As a general rule, those plants are most active which grow in a sunny exposure. The term *cicuta*, which has often been applied to this plant, belongs to a different genus. The leaves and fruit are officinal

The proper season for gathering the leaves is when the plant is in flower; and Dr. Fothergill asserts, from experiment, that they are most active about the time when the flowers begin to fade. The footstalks* should be rejected, and the leaflets quickly dried, either in the hot sun, on tin plates before a fire, or by a stove-heat not ex-

* The footstalks have long been deemed worthless, probably from their deficiency in the characteristic sensible properties of the leaves; but it was left, we believe, to Dr. Manlius Smith, of Manlius, N. Y., to demonstrate their inferiority in strength to the expanded portion of the leaf; having been found almost destitute of the active alkaline principle. (*Ann. de Thérap.*, 1873, p. 39.)—*Note to the fourteenth edition.*

ceeding 120° F. They should be kept in boxes or tin cases, excluded from the air and light, by exposure to which they lose their fine green colour, and become deteriorated. The same end is answered by pulverizing them, and preserving the powder in opaque and well-stopped bottles. But little reliance can be placed on the dried leaves; as, even when possessed of a strong odour and a fine green colour, they may be destitute of the narcotic principle. When rubbed with caustic potassa they should exhale the odour of conia. The fruit retains its activity much longer than the leaves. Dr. Christison found it to have sustained no diminution of power, after having been kept eight years. Hirtz inferred from experiment that the relative strength of extracts of the seeds and the leaves was as ten to one in favour of the former.

Properties. The dried leaves of the hemlock have a strong, heavy, narcotic odour, less disagreeable than that of the recent plant. Their taste is bitterish and nauseous; their colour a dark-green, which is retained in the powder. A slight degree of acrimony possessed by the fresh leaves is said to be dissipated by drying. The seeds have a yellowish-gray colour, a feeble odour, and a bitterish taste. Their form has already been described. Water distilled from the fresh leaves has the odour of hemlock, and a nauseous taste, but does not produce narcotic effects. The decoction has little taste, and the extract resulting from its evaporation is nearly inert. From these facts it is inferrible that the active principle, as it exists in the plant, is not volatile at 212°, and, if soluble in water, is injured by a boiling heat. Alcohol and ether take up the narcotic properties of the leaves; and the ethereal extract, which is of a rich dark-green colour, is stated by Dr. A. T. Thomson to have the smell and taste of the plant in perfection, and in the dose of half a grain to produce headache and vertigo. Upon destructive distillation, the leaves yield a very poisonous empyreumatic oil. We have no satisfactory analysis of hemlock. Schrader found in the juice of the leaves, resin, extractive, gum, albumen, a green fecula, and various saline substances. Brandes obtained from the plant a very odorous oil, albumen, resin, colouring matter, and salts.

So long ago as 1827, Giseke obtained an alkaline liquid by distilling hemlock leaves with water and caustic lime; but he did not succeed in isolating the substance in which the alkalinity resided. Geiger was the first who obtained the active principle in a separate state, and proved it to be alkaline. It appears that there are two volatile substances in hemlock; one of them an *oil*, which comes over by simple distillation, and upon which the odour of the plant depends, and the other an *alkaline principle*, which, as it exists in the plant, is so combined as not to be volatilizable, but which, when separated by one of the mineral alkalies from its native combination, rises readily in distillation, and may thus be procured separate. The latter substance is the active principle, and has received the name of *conia* or *coniine*. It probably exists in the plant united with an acid, as it is separated by the alkalies. This acid Peschier believed to be peculiar, and named *coniic acid*. Geiger obtained conia by the following process. He distilled fresh hemlock with caustic potassa and water, neutralized with sulphuric acid the alkaline liquid which came over, evaporated this liquid to the consistence of syrup, added anhydrous alcohol so long as a precipitate of sulphate of ammonium was afforded, separated this salt by filtration, distilled off the alcohol, mixed the residue with a strong solution of caustic potassa, and distilled anew. The conia passed over with the water, from which it separated, floating on the surface in the form of a yellowish oil. According to Dr. Christison, an easier process is to distil cautiously a mixture of a strong solution of potassa and the alcoholic extract of the unripe fruit. As obtained by the above process, conia is in the state of a hydrate, containing one-fourth of its weight of water and a little ammonia. From the former, it may be freed by chloride of calcium; from the latter, by exposing it under an exhausted receiver, till it ceases to emit bubbles of gas.

The fresh leaves or seeds should be employed in the preparation of conia; as the alkaloid undergoes decomposition by time and exposure. The seeds contain most of this principle; but even in these it exists in very small proportion. From 6 pounds of the fresh and 9 of the dried seeds, Geiger obtained about an ounce of conia; while from 100 pounds of the fresh herb he got only a drachm, and from the dried

leaves none. Christison recommends the full-grown fruit while yet green, and states that 8 pounds will yield half an ounce of hydrate of conia, and contains much more.*

Conia is in the form of a yellowish oily liquid, lighter than water, of a very acrid taste, and a strong penetrating odour, compared to that of the urine of mice, and recalling the smell of fresh hemlock, though not identical with it. In volatility it resembles the essential oils, readily rising with the vapour of boiling water, but, when unmixed, requiring for ebullition, according to Christison, a temperature of 370°. It is freely soluble in alcohol, ether, the fixed and volatile oils, and slightly so in water. It unites with about one-fourth of its weight of water to form a hydrate. It reddens turmeric, and neutralizes the acids, forming with them soluble salts, some of which are crystallizable. With tannic acid it forms an insoluble compound. Like ammonia it occasions a white cloud, when approached by a rod moistened with muriatic acid; and the resulting muriate, contrary to previous statements, is asserted by Prof. Wertheim to be crystallizable, and not in the least deliquescent. The statement of Wertheim as to the crystallization of the muriate has been confirmed by Geo. C. Close, who prepared it by directly uniting its constituents, and evaporating its solution by means of a water-bath. The salt crystallized from the solution. He did not succeed in obtaining crystallizable salts with sulphuric, citric, or oxalic acids. (*Am. Journ. of Pharm.*, Jany. 1869, p. 62.) It coagulates albumen, and precipitates the salts of aluminium, copper, zinc, manganese, and iron. It also precipitates nitrate of silver, but in excess redissolves the precipitate. Most of its salts are decomposed by evaporation. When exposed to the air, it speedily assumes a deep-brown colour, and is ultimately converted into a resinous matter, and into ammonia which escapes. Under the influence of heat this change takes place with much greater rapidity. The presence of conia may be detected in an extract, or other preparation of hemlock, by rubbing it with potassa, which instantly developes its peculiar odour. It consists of nitrogen, carbon, and hydrogen; its admitted formula being $C_{16}H_{15}N$.† In its effects on the system it closely resembles hemlock

* In relation to the relative strength of different parts of the plant, Dr. Manlius Smith, of N. York, gives, as the result of a series of carefully conducted experiments, that the unripe fruit of the conia is far preferable to the dried leaves, and is even stronger than the full-grown fruit, that it may be dried without serious injury, and that a very active preparation may be made from it. He also found that full-grown fruit, collected in August, and dried in the dark, retained its activity unimpaired for several years. This would appear to contradict in some measure previous opinions of the injurious effects of time. (*Pharm. Journ.*, Feb. 1869, pp. 491–2.)—*Note to the fourteenth edition.*

Methylconia. Ethylconia. From a communication by Drs. A. von Planta and Aug. Kekulé to the *Annal. der Chem. und Pharm.* (lxxxix., s. 129–156), it would appear that commercial conia consists most commonly of at least two homologous bases; one being the proper *conia* ($C_{16}H_{15}N$), which contains one eq. of hydrogen capable of being replaced by radicals, and the other, named *methylconia* ($C_{18}H_{17}N$), having no hydrogen which can be replaced by radicals. A third, *ethylconia* ($C_{20}H_{19}N$), was obtained from a specimen of commercial conia containing no methylconia. In relation to the modes of separating these alkaloids and their distinctive properties, we must content ourselves with referring to the original paper; as no practical advantage has yet accrued from the investigation, and it may be doubted whether the new alkaloïds may not be products of the operation, as they are obtained by the action respectively of iodide of methyl, and iodide of ethyl on conia.

Conhydria. Prof. T. Wertheim has also found a new alkaloid mixed with the conia obtained by distillation from fresh hemlock flowers. It is crystallizable, fusible at a temperature below 212° F., and volatilizable at a higher temperature, diffusing the peculiar odour of conia, or one very much like it. Water dissolves it considerably, ether and alcohol freely; and the solution has a strong alkaline reaction. Its formula is given as $C_{16}H_{15}N,H_2O_2$, or conia with two eqs. of water. Hence it has been named *conhydrine* (*conhydria*). (*Am. Journ. of Pharm.*, xxix. 321.) It may be separated from conia by exposing the mixed alkaloids to a freezing mixture, expressing, and then repeatedly crystallizing from ether. (*Gmelin*, xiii. 169.)—*Note to the eleventh and twelfth editions.*

Artificial Conia, Paraconia. Conia is said to have been artificially produced by Hugo Schiff. From the reaction of *butyric aldehyde* with an alcoholic solution of ammonia, he obtained two bases, one of which, *dibutynaldin*, yielded on distillation, first a neutral oily substance, and afterwards a strong alkaline base, which proved to be conia, having all the physiological properties of natural conia. The amount, however, hitherto produced is small and costly. (*Am. Journ. of Pharm.*, April, 1871, p. 161.) Subsequently, however, the same chemist found it not to be chemically identical with the native alkaloid, though isomeric with it, and he proposes to name it *paraconia*. (*Ibid.*, Dec. 1872, p. 539.)—*Note to the fourteenth edition.*

† Orfila gives the following additional chemical characters of conia. Heated in a capsule, it forms white vapours, *having a strong smell of celery and of the urine of mice.* Weak tincture of iodine gives a white precipitate, becoming olive with excess of the tincture. *Pure concentrated*

itself. Dr. Christison found it, contrary to the experience of Geiger, more active in the saline state than when uncombined. It is a most energetic poison; one drop of it injected into the eye of a rabbit killing the animal in nine minutes, and three drops killing a stout cat in a minute and a half when similarly applied. Dr. Christison (*Trans. Roy. Soc. Ed.*, 1836) thinks that it acts upon the spinal marrow, directly prostrating the nervous power, producing paralysis of the voluntary muscles, and destroying life by arresting respiration. The brain does not seem to be especially attacked; as the animal, when it dies slowly, preserves its senses unimpaired so long as it breathes. In cases of sudden death from the poison, the heart does not cease to act till after apparent death; and its action may be sustained after the animal has ceased to breathe, by keeping up artificial respiration. A recently prepared extract of hemlock acted precisely as conia. Locally the alkali appears to act as an irritant.

Medical Properties and Uses. Hemlock is narcotic, and somewhat sedative to the circulation. Mr. Judd inferred from his experiments that it directly diminishes the action of the heart; and, when it produces death, contrary to the results obtained by Christison, exhausts the contractility of that organ. (*Medico-bot. Trans.*, vol. i. pt. 4.) When given so as fully to affect the system, it produces more or less vertigo, dimness of vision, nausea, faintness, sensations of numbness, and general muscular debility. In larger doses it occasions dilated pupils, difficulty of speech, delirium or stupor, tremors and paralysis, and ultimately convulsions and death. Sometimes it produces fatal effects through paralysis alone, without coma or convulsions. Its operation usually commences in less than half an hour, and if moderate, seldom continues longer than twenty-four hours. It is supposed to be the narcotic used by the Athenians to destroy the life of condemned individuals, and by which Socrates and Phocion died. It was also used by the ancients as a medicine, but fell into entire neglect, and did not again come into notice till the time of Störck, by whom it was much employed and extravagantly praised. Since that time it has been submitted to ample trial, and, though its original reputation has not been fully sustained, it still retains a place in the catalogue of useful medicines. Anodyne, soporific, antispasmodic, antaphrodisiac, deobstruent, and diuretic properties have been ascribed to it. It was highly recommended by Störck as a remedy in scirrhus and cancerous ulcers, but at present is considered only a useful palliative in those affections. In mammary tumours and chronic enlargements of the liver and other abdominal viscera; in painful scrofulous tumours and ulcers; in various diseases of the skin, as lichen, prurigo, acne, eczema, psoriasis, leprosy, and elephantiasis; in the complicated derangements of health attendant upon secondary syphilis; in chronic rheumatism and neuralgic affections; in excessive secretion of milk; in pertussis, asthma, chronic catarrh, and consumption; and in various other disorders connected with nervous derangement, or a general depraved state of the health, it is occasionally employed with the effect of relieving or palliating the symptoms, or favourably modifying the action of other remedies. The late Prof. Gibson considered it efficacious in the cure of goitre.

In the *Bulletin de Thérapeutique* of 1870, an important experimental treatise on the therapeutics of conium has been published by *Martin Damourette* and *Pelvet*, which contains valuable conclusions as to the efficacy of conium as an *alterative*. From their observations it follows that the blood is so altered by it as to be indisposed to hemorrhage, and consequently to calorification and chemical nutritive changes, whether in the normal or pathological order, which express themselves in the production of obstinate cutaneous diseases, rheumatism, scrofula, and perhaps in hypertrophic formations in their early stage. In all these cases conium has yielded incontestible evidence of its efficiency; and one might suppose that, in this respect, the age of Störck has been revived; even tumours of a cancerous appearance being

sulphuric acid does not alter it; but when the mixture is heated, it becomes first brown, then blood red, and finally black. *Nitric acid imparts a topaz colour,* not changed by heat. The chlorides of platinum and of gold give yellow precipitates, and corrosive sublimate a white one. Red permanganate of potassium is immediately decolorized. *Neutral acetate of lead gives no precipitate,* nor does the subacetate. The parts of this note in Italics indicate the means of distinguishing this alkaloid from nicotia. (See *Pharm. Journ.*, xi. 89.)

included among those in which it has shown more or less therapeutic power. (*Ann. de Thérap.*, 1871–2, p. 19.)

The powdered leaves, and the inspissated juice (the extract of the Pharmacopœias) are the forms in which conium has been usually administered; but the juice of the fresh leaves, prepared with the addition of a small proportion of alcohol, has been adopted in the U.S. and Br. Pharmacopœias, and is one of the most efficient of the preparations. Either the leaves or extract may be given in the dose of three or four grains twice a day, gradually increased till the occurrence of slight vertigo or nausea indicates that it has taken effect. To maintain a given impression, it is necessary to increase the dose even more rapidly than is customary with most other narcotics; as the system becomes very speedily habituated to its influence. In some instances, the quantity administered in one day has been augmented to more than two ounces. The strength of the preparations of hemlock is exceedingly unequal; and caution is therefore necessary, when the medicine is given in very large quantities, to employ the same parcel, or, if a change be made, to commence with the new parcel in small doses, so as to obviate any danger which might result from its greater power. Unpleasant consequences have followed a neglect of this precaution. There are also an officinal tincture and alcoholic extract, both of which, when properly made, have been considered as efficient preparations. But some doubt has been thrown upon this point, particularly in reference to the tincture, by Dr. John Harley of London, whose experiments seem to show that this preparation is medically inert. (See *Tinctura* and *Extractum Conii*.) The fresh juice of the plant has been recommended by Hufeland in the dose of from twelve to forty drops. The expressed juice of the fresh plant, with a little alcohol for its preservation, recently introduced into the Pharmacopœias, is one of the most reliable forms in which the leaves can be used. The powdered seeds should be given in a dose considerably smaller than that of the leaves.* The fresh leaves are sometimes used externally as an anodyne cataplasm; and the extract, and an ointment prepared from the leaves, are applied to the same purpose. A plaster made from the extract has also been employed.†

Conia has been occasionally employed, both internally and externally, with asserted advantage, for the same purposes as hemlock itself, or the extract. It has been particularly recommended in hooping-cough. Dr. Spengler, of Herborn, gave it to an infant a year old in the dose of one-sixteenth of a grain every six hours, with the effect of curing the disease in ten days. (*Ann. de Thérap.*, 1853, p. 73.) According to the formula of Fronmüller, two drops are dissolved in twenty-four drops of alcohol, and three drops of the solution are given each on a piece of sugar. (*Arch. Gén.*, 4e sér., xxiii. 226.) From one-quarter of a drop to a drop may be given to an adult, and one or two drops by enema in emulsion of starch. Dr. Harley has prepared an acid benzoate of conia by adding two eqs. of the acid to one of the base; and found the resulting salt effectual in the dose of half a grain. (*Pharm. Journ.*, Jany. 1871, p. 585.) A solution of one part in one hundred of very dilute alcohol has been used with advantage in certain cases of scrofulous ophthalmia with photophobia, applied several times daily by friction about the eyelids. (*Journ. de Pharm.*, 3e sér., xix. 219.) Prof. Mauthner, of Vienna, recommends it especially in the

* From their greater strength, permanency, and uniformity, the seeds might well supersede the leaves for internal use. They should be pulverized, made into pills with syrup, and given in the commencing dose of half a grain, to be gradually increased till their effects are experienced. MM. Devay and Guillermond prepare a *syrup* from the seeds, made by exhausting 10 parts of them with 60 parts of alcohol of 28°, and adding the tincture to 3000 parts of syrup "aromatised *ad libitum*." One or two fluidrachms may be taken at first. (*Ann. de Thérap.*, 1853, p. 54.)—*Note to the tenth edition.*

The root, while containing a small proportion of conia, is too feeble, according to the experiments of Dr. John Harley of London, to be used practically with advantage. Dr. Harley has found in the root three new proximate principles, one a very bitter resin which he names *conamarine*, and the two others, crystallizable bodies, named, respectively, *rhizoconin* and *rhizoconolein*. They are all neuter, and so far as known medicinally inert. For further particulars, the reader is referred to the *Pharm. Journ. and Trans.* (Aug. 1867, p. 53).—*Note to the thirteenth edition.*

† The following formula of Planche has been approved by the Society of Pharmacy, of Paris. Take of extract of hemlock 90 parts, of purified elemi 20 parts, of white wax 10 parts. Melt the resin and wax with a gentle heat, and incorporate the extract with the mixture. (*Journ. de Pharm.*, Juillet, 1862, p. 46.)—*Note to the twelfth edition.*

spasmodic contraction of the orbicularis in scrofulous children, using a solution containing half a grain of conia in a drachm of almond oil, which he applies by a pencil to the eyelids twice or thrice daily. As a collyrium, from one to three drops may be added to six drachms of pure water, and two drachms of mucilage of quince seeds. Introduced into the cavity of a carious tooth, it is said to be very effectual in toothache. For this purpose it should be diluted with ten parts of tincture of cinnamon, and applied by means of a camel's-hair pencil. In diseases of the skin it may be used as an ointment, made with three drops to a drachm of simple ointment. In neuralgia, three or four drops may be applied on linen to the skin, and confined by oiled silk.

The muriate of conia has been recommended for exhibition by Mr. G. C. Close, preferably to the uncombined alkaloid. From half a grain he experienced no sensible effects; but a grain produced the characteristic symptoms of conia in an even unpleasant degree. Mr. Close believes himself much less sensitive to its operation than many persons; so that not more than half a grain should be given as a commencing dose. (*Am. Journ. of Pharm.*, Jany. 1869, p. 62; from *Proceed. of Am. Pharm. Assoc.*, 1868.)

Though fatal to some animals, hemlock is eaten with impunity by others, as horses, goats, and sheep. The best method of relieving its poisonous effects is the speedy evacuation of the stomach.*

Off. Prep. of the Fruit. Extractum Conii Fructus Fluidum, *U. S.;* Tinctura Conii, *Br.*

Off. Prep. of the Leaves. Cataplasma Conii, *Br.;* Extractum Conii; Extractum Conii Alcoholicum, *U. S.;* Succus Conii; Tinctura Conii, *U. S.* W.

COPAIBA. *U. S., Br.*

Copaiba.

The oleo-resin of Copaifera multijuga (Hayne), and of other species of Copaifera. *U. S.*

The oleo-resin obtained from incisions made in the trunk of Copaifera multijuga and other species of Copaifera. *Br.*

Copaiva, *Br.;* Balsam of copaiva; Baume de copahu, *Fr.;* Copaiva-Balsam, *Germ.;* Balsamo di copaiba, *Ital.;* Balsamo de copayva, *Span.*

Copaifera. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Leguminosæ, *Jussieu.* Amyridaceæ, *Lindley.*

* Dr. Harley's experiments on the relative value of the different preparations of conium are based upon their effects on the system; as the alkaloid is so subtle and unstable that observations in regard to its relative quantity in infusion, through the effect of chemical reagents, yield most fallacious results. One acquainted with the physiological effects of conium may determine its amount, acting on a nervous system of known power. The following abstract of Harley's experimental conclusions represents the relative efficiency of the preparations tried by him.

1. The Extractum Conii, *Br. Pharmacopœia*, and Succus Conii, *B. P.*—20 grains of the extract equalled 2 fluidrachms of the juice (10 gr. to f℥j).

4. Succus Conii, *B. P.;* Tincture of the green fruit (London ℥v in ℥xx);—four drachms of the juice equalled fifty minims of the tincture (℥iv to ♏50).

11. Different preparations of Succus, *B. P.*, prepared by different persons, (Buckle's, the plant yielding 75 per cent. of juice)—and (Hanbury's, the plant yielding 35 per cent. of juice);—nine drachms of Buckle's equalled three drachms of Hanbury's—(℥ix to ℥iij).

12. Extract of green fruit, Tincture of green fruit, and Succus, *B. P.*—Three grains of the extract equalled four fluidrachms of the Tincture, and four drachms Succus (gr. iij of extract = f℥iv of Tincture, and ℥iv of Succus).

14. Of *Squibb's fluid extract* 50 minims equal of the *Tinct.* of the *green fruit*, London, ℥iss; of the Succus Conii, *B. P.*, ℥v; of Tincture of the fresh plant, ℥iiiss to ℥iv; and of the Tincture of the dry plant, f℥j.

15. Of Squibb's fluid extract ℥j equals of pale Succus ℥vi, of dark Succus ℥ij; of Tincture of the Green Fruit ℥iss; of the Tincture of Fresh Plant ℥iv; Neutral Benzoate of Conia, gr. ¾.

18. Of Succus Conii, *B. P.* (Buckle's), ℥vj = Benzoate of Conia, gr. ½.

The author draws the following conclusions from his experiments. The green fruit, as the basis of Tinctures and Extracts, is decidedly superior to any other part of the plant; and the spirituous extract of the green fruit should be substituted for the almost worthless Extract of the *B. P.*

The variable strength of the Succus is an objection; but this might be in great measure obviated by cultivating the plant. (*Pharm. Journ.*, January, 1871, p. 585.)—*Note to the fourteenth edition.*

Gen. Ch. Calyx none. *Petals* four. *Legume* ovate. *Seed* one, with an ovate arillus. *Willd.*

The first notice to be found of the copaiba plant is by Marcgrav and Piso in the year 1648. Jacquin in 1763 described a species of Copaifera, growing in Martinique, which he named *C. officinalis.* As this was believed to be the same plant with the one observed by Marcgrav in Brazil, it was adopted in the Pharmacopœias; but their identity was denied; and Desfontaines proposed for Jacquin's species the title of *C. Jacquini*, in honour of that botanist. It is now known that many species of Copaifera exist in Brazil and other parts of South America; and all of them, according to Martius, yield copaiba. Besides C. officinalis or C. Jacquini, the following are described by Hayne;—*C. Guianensis, C. Langsdorffii, C. coriacea, C. Beyrichii, C. Martii, C. bijuga, C. nitida, C. laxa, C. cordifolia, C. Jussieui, C. Sellowii, C. oblongifolia*, and *C. multijuga.* Hayne believed that C. bijuga was the plant seen by Marcgrav and Piso.

Copaifera officinalis. Willd. *Sp. Plant.* ii. 630; Woodv. *Med. Bot.* p. 609, t. 216.— *C. Jacquini*, Desfont. *Mem. du Mus.* vii. 376; Hayne, *Darstel. und Beschreib. &c.* x. 14. This is an elegant tree, with a lofty stem, much branched at the top, and crowned by a thick canopy of foliage. The leaves are alternate, large, and pinnate, composed of from two to five pairs of ovate, entire, obtusely acuminate leaflets, two or three inches in length, rather narrower on one side than the other, smooth, pellucidly punctate, somewhat shining, and on short footstalks. The flowers are whitish, and in terminal branched spikes. The fruit is an oval, two-valved pod, containing a single seed.

This species of Copaifera is a native of Venezuela, and grows in the province of Carthagena, mingled with the trees which afford the balsam of Tolu. It grows also in some of the West India islands, particularly Trinidad and Martinique. Though recognised in former editions of the U.S. Pharmacopœia as a source of copaiba, it probably yields little of that now in use. According to Hayne, the species from which most of the copaiba of commerce is derived is *C. multijuga*, growing in the province of Para; and this is now the one specially recognised by our national standard. Like many other species it was discovered by Martius; and a leaf of it is figured by Hayne (x. t. 17 f. c.). It is specifically characterized by its pinnate leaves, with from six to ten pairs of leaflets, which are somewhat incurved, with unequal sides, acuminate, with pellucid spots, the lower ovate-oblong, the upper lanceolate, and all supported by slightly pubescent petioles. It is probable that *C. Guianensis*, which inhabits the neighbouring province of Guiana, especially in the vicinity of the Rio Negro, affords also considerable quantities; and *C. Langsdorffii* and *C. coriacea*, which are natives of Santo Paulo, are thought to yield most of the juice collected in the latter province. *C. nitida*, inhabiting the province of Minas-Geraes, probably also contributes to the commercial supplies, through Rio Janeiro.

The juice is obtained by making deep incisions into the stems of the trees; and the operation is said to be repeated several times in the same season. As it flows from the wound, it is clear, colourless, and very thin, but soon acquires a thicker consistence, and a yellowish tinge. It is most largely collected in the provinces of Para and Maranham, in Brazil, and is brought to this country from the port of Para, in small casks or barrels. Large quantities of it come from Maracaybo, in Venezuela, and from other ports on the Caribbean sea, whence it is brought in casks, demijohns, cans, jugs, &c. The drug is also exported from Angustura, Cayenne, Rio Janeiro, and some of the West India islands.

Properties. Copaiba is a clear, transparent liquid, usually of the consistence of olive oil, of a pale-yellow colour, a peculiar not unpleasant odour, and a bitterish, hot, nauseous taste. Its sp. gr. varies ordinarily from 0·950 to 1·000; but has been known to be as low as 0·916. (Procter, *Am. J. of Pharm.*, xxii. 292.)* It is insoluble

* The variety of copaiba found by Prof. Procter to have this low sp. gr. was of uncertain origin, but supposed to be from Para. It was of a light straw colour, very fluid, and possessed of the pure copaiba odour. It contained 80 per cent. of volatile oil and 20 of resin, and was not affected by recently calcined magnesia. It appears to be the same with a variety described by Dr. L. Posselt, of which an account is contained in the *Chemical Gazette* for May 1, 1849. The view of Prof. Procter that it is the product of young trees, in which the juice has not become fully elabo-

in water, but entirely soluble in absolute alcohol, ether, and the fixed and volatile oils. Strong alkaline solutions dissolve it perfectly; but the resulting solution becomes turbid when largely diluted with water. With the alkalies and alkaline earths it forms saponaceous compounds, in which the resin of the copaiba acts the part of an acid. It dissolves magnesia, especially with the aid of heat, and even disengages carbonic acid from the carbonate of that earth. If triturated with a sixteenth of its weight of magnesia and set aside, it gradually assumes a solid consistence; and a similar change is produced with hydrate of lime. (See *Pilulæ Copaibæ.*) Its essential constituents are volatile oil and resin, with a minute proportion of an acid which appears to be the acetic. (*Durand.*) As it contains no benzoic acid, it cannot with propriety retain its old title of *balsam of copaiva.* The substances which it most closely resembles, both in composition and properties, are the turpentines. The *volatile oil* will be treated of among the preparations. (See *Oleum Copaibæ.*)

The *resinous* mass which remains after the distillation of the oil is hard, brittle, translucent, greenish-brown, and nearly destitute of smell and taste. By mixing it with the oil in proper proportion, we may obtain a liquid identical or nearly so with the original juice. When treated with the oil of petroleum, it is separated into two distinct resins, one of which is dissolved, and may be obtained separate by evaporation, the other is left behind. The first is yellowish, hard, and brittle, and constitutes by far the largest proportion of the residuum of the distillation. It forms definite compounds with the alkalies; and its alcoholic solution reddens litmus. It is therefore an acid, and has been named *copaivic acid.* The second resin is yellowish-brown, soft, unctuous, and without acid reaction; and is believed to result from the resinification of the volatile oil. Recent copaiba, examined by Gerber, yielded 41 per cent. of volatile oil, 51·38 of the hard and brittle resin, 2·18 of the soft resin, and 5·44 of water; while an older specimen gave 31·07 per cent. of oil, 53·68 of hard resin, 11·15 of soft resin, and 4·10 of water.

Copaiba, upon exposure to the air, acquires a deeper colour, a thicker consistence, and greater density, and, if spread out upon an extended surface, ultimately becomes dry and brittle. This change is owing partly to the volatilization, partly to the oxidation of the essential oil. As it is the soft resin that results from the oxidation of the oil, it follows that the proportion of this resin increases with age. Considerable diversity must, therefore, exist in the drug, both in physical properties and the properties of its ingredients, according to its age and degree of exposure. Similar differences also exist in the copaiba procured from different sources. Thus, that of the *West Indies*, when compared with the *Brazilian*, which is the variety above described, and in common use, is of a thicker consistence, of a deeper or darker yellow colour, less transparent, and of a less agreeable, more terebinthinate odour; and specimens obtained from the ports of Venezuela or New Granada were found, upon examination by M. Vigne, to differ from each other not only in physical properties, but also in their chemical relations. (*Journ. de Pharm.*, N. S. i. 52.) The same is true, as observed by M. Buignet, in their action on polarized light, in which they differ not only in degree, but sometimes also even in direction. (*Journ. de Pharm.*, Oct. 1861, p. 266–7.) It is not impossible that differences may exist in the juice according to the circumstances of its collection. The species of Copaifera from which the juice is collected, as well as the age of the tree, its position, and the season of collection must also have influence over the product. It is highly probable that the resinous matter results from oxidation of the oil in the cells of the plant, and that the less elaborated the juice may be, the larger proportion it will contain of the oil. It is said that a volatile oil flows abundantly from a tree near Bogota, which is employed to adulterate the copaiba collected in that vicinity, and shipped from Maracaybo and other neighbouring ports.

Adulterations. Copaiba is said to be frequently adulterated; but the remark is applicable rather to the markets of Europe than to those of the United States.* The

rated, is highly probable. As the virtues of copaiba depend mainly on the oil, this variety should be more efficacious than the copaiba in common use. (*Note to the ninth edition.*)

* We have a specimen of a substance imported into New York, under the name of *red copaiba*, which has not a single character of the genuine drug. It is of a thick, semifluid consistence, not

fixed oils are the most frequent addition, especially castor oil, which, in consequence of its solubility in alcohol, cannot, like the others, be detected by the agency of that fluid. Various plans have been proposed for detecting the presence of castor oil. The simplest is to boil a drachm of the copaiba in a pint of water, till the liquid is wholly evaporated. If the copaiba contain a fixed oil, the residue will be more or less soft, according to the quantity present; otherwise it will be hard. Another mode, proposed by M. Planche, consists in shaking together in a bottle one part of solution of ammonia of the sp. gr. 0·9212 (22° Baumé) with two and a half parts of copaiba, at a temperature of from 50° to 60° F. The mixture, at first cloudy, quickly becomes transparent if the copaiba is pure, but remains more or less opaque if it is adulterated with castor oil. According to J. E. Simon, however, a variety of genuine copaiba occurs in commerce, in which this test fails. (*Am. Journ. of Pharm.*, xvi. 236); and it does not apply to the variety containing 80 per cent. of volatile oil, described by Prof. Procter. (See *note*, p. 346.) Carbonate of magnesium, caustic potassa, and sulphuric acid have also been proposed as tests. In the late Edinburgh Pharmacopœia, it was stated that copaiba "dissolves a fourth part of its weight of carbonate of magnesium, with the aid of a gentle heat, and continues translucent." The presence of a small proportion of any fixed oil renders the mixture opaque. One part of potassa dissolved in two of water forms a clear solution with nine parts of pure copaiba, and the liquid continues clear when moderately diluted with water or alcohol; but the presence of one-sixth of fixed oil in the copaiba occasions more or less opacity in the liquid, and half the quantity causes the precipitation of white flakes in a few hours. (*Stolze.*) Turpentine, which is said to be sometimes added to copaiba, may be detected by its smell, especially if the copaiba be heated. According to Mr. Redwood, most of the proposed tests of the purity of copaiba are liable to fallacy; and the best measure of its activity is the quantity of volatile oil it affords by distillation.* Specimens of copaiba have recently come under the notice

unlike that of balsam of Tolu, as it often reaches us, a brown colour similar to that of the same balsam, though darker, and an unpleasant yet somewhat aromatic odour, recalling that of liquid-amber, but less agreeable. Its origin is unknown. (*Note to the ninth edition.*)

* *Wood Oil. Gurjun Balsam.* In the *Pharm. Journ. and Trans.* for August, 1854 (p. 65), appeared an account by Mr. Charles Lowe, of Manchester, of a "*new variety of balsam of copaiba*," derived from the East Indies. In a subsequent communication to the same journal (Jan. 1856, p. 321) from Mr. Daniel Hanbury, it appears that this product, though offered for sale in the London market as *balsam of copaiba*, is known in India under the names of *wood oil* and *Gurjun balsam*. Considerable quantities had been imported from Moulmein, in Burmah; and specimens of a similar drug had been received from Canara and Tenasserim; and it appears to be widely diffused in the Indian markets.

According to Roxburgh, this liquid is obtained from *Dipterocarpus turbinatus*, a very large tree, growing in Pegu, and other parts of further India. A large notch is cut in the trunk of the tree, between two and three feet from the ground, and a fire made so as to char the wound. The juice then begins to flow, and is received in suitable vessels. Every 3 or 4 weeks, the charred surface is cut off and burned anew. A single tree sometimes yields 40 gallons during the season. Other species of Dipterocarpus afford a similar product; and hence probably the difference which has been observed in the specimens examined. It is at first turbid, but may be clarified either by filtration or deposition. After filtration, wood oil is a clear, dark-brown liquid, of the sp. gr. 0·964 (*Hanbury*), and, in consistence, smell, and taste, bears a close resemblance to copaiba. It is soluble in two parts of alcohol of the sp. gr. 0·796, with the exception of a very small proportion of darkish flocculent matter, which subsides on standing. According to Lowe, it contains 65 per cent. of volatile oil, 34 of resin, and 1 of acetic acid and water. A characteristic property noticed first by Mr. Lowe, by which it may be distinguished from copaiba, is that, when heated in a closed vial to 266° (230°, Lowe), it becomes slightly turbid and coagulates, so that the vial may be inverted without changing the position of its contents; and this consistence is retained when the liquid cools. By a gentle heat with agitation the fluidity returns; but the liquid again coagulates if heated to 266°. Guibourt states that it does not solidify like copaiba, with one-sixteenth of magnesia; and the two separate on standing. (*Journ. de Pharm.*, xxx. 192.) De Vrij, of Rotterdam, proposes the reaction of benzole with wood oil and copaiba respectively as a test to distinguish them. With an equal volume of the wood oil, benzole forms a turbid mixture, from which, after a long time, a resinous matter is deposited in flocculi; with copaiba it forms a transparent solution. (*Pharm. Journ.*, Jan. 1857, p. 374.) According to De Vrij, the volatile oil obtained by distillation has the sp. gr. 0·928, and boils at 255°. (*Ibid.*)

Roxburgh states that this liquid is much employed in India for painting ships, houses, &c. According to Dr. O'Shaughnessy, it is little inferior to copaiba in the diseases for which that medicine is employed. Dr. T. B. Henderson has found it very successful in gonorrhœa, given in the dose of a teaspoonful two or three times a day, uncombined. He has used it only in cases where copaiba had failed; and in every case it was successful within a week, and no inconvenience occurred in any instance. (*Med. T. and Gaz.*, June, 1865, p. 571.) It probably has a similar remedial

of Prof. E. S. Wayne, of Cincinnati, whose unusual density led to suspicion of their purity, which induced an examination, proving that castor oil was the adulterating material. This was detected by means of "petroleum benzin," which was found to make a perfectly clear solution with pure copaiba, but not with castor oil, and when shaken with one-third of its volume of the suspected substance, formed a milky mixture, which quickly separated into two portions, of which the lower proved to consist mainly of castor oil. (*Am. Journ. of Pharm.*, July, 1873, p. 326.)

Medical Properties and Uses. Copaiba is gently stimulant, diuretic, laxative, and in very large doses often actively purgative. It produces, when swallowed, a sense of heat in the throat and stomach, and extends an irritant action, not only throughout the alimentary canal, but also to the urinary passages, and in fact, in a greater or less degree, to all the mucous membranes, for which it appears to have a strong affinity. The urine acquires a peculiar odour during its use, and its smell may be detected in the breath. It sometimes occasions an eruption upon the skin, resembling that of measles, and attended with disagreeable itching and tingling. A case has been recently recorded, in which an acute attack of pemphigus over the whole body attended its use. (*N. Y. Med. Journ.*, Jany. 1873, p. 416; from *Gaz. des Hôpitaux.*) Nausea and vomiting, painful purgation, strangury and bloody urine, and a general state of fever are among the morbid results of its excessive action. As a remedy it has been found most efficient in diseases of the mucous membranes, particularly those of a chronic character. Thus, it is given with occasional advantage in leucorrhœa, gleet, chronic dysentery and diarrhœa, painful hemorrhoidal affections, and chronic bronchitis, and has recently been used, with great asserted success, in diphtheria and pseudomembranous croup. By the late Dr. La Roche, of Philadelphia, it was highly recommended in catarrh of the bladder, and in chronic irritation of the same organ. (*Am. Journ. of Med. Sci.*, xiv. 13.) It has been given in psoriasis and dropsy, and is said to be used as a vermifuge in Brazil. The complaint, however, in which it is most employed is gonorrhœa. It is given in all stages of the disorder; but caution is requisite when the inflammatory symptoms are high. Even in health, if taken largely, it sometimes produces very unpleasant irritation of the urinary passages, and, by sympathy, of the testicles. It was formerly much esteemed as a vulnerary, and as an application to ulcers; but it is now seldom used externally. Dr. Ruschenberger recommends it locally in chilblains. (*Med. Examiner*, i. 77.) Prof. Marchal, of Strasburg, has employed it with great success in gonorrhœa and leucorrhœa, injecting it in the form of an emulsion made with 5 parts of copaiba, 8 of gum arabic, and 100 of water, and applying it also by means of catheters or tampons smeared with the emulsion.

The dose of copaiba is from twenty drops to a fluidrachm three times a day, or a smaller quantity repeated more frequently. It may be given dropped on sugar; but in this form is often so exceedingly offensive as to render some concealment of its nauseous qualities necessary. It is sometimes given floating on the surface of an aromatic water, or mixed with an equal measure of spirit of nitrous ether. A less disagreeable form is that of emulsion, prepared by rubbing the copaiba first with mucilage or the yolk of an egg, and sugar, and afterwards with some aromatic water, as that of mint or cinnamon. The *volatile oil*, which is generally deemed to be the active ingredient of copaiba, may be given in the dose of ten or fifteen drops, either upon sugar, or in emulsion.

The resin, which has been proposed as a substitute for copaiba, is generally thought to be nearly inert; but Dr. Wilks, of Guy's Hospital, London, speaks of it with great confidence as a diuretic, having employed it in numerous cases with very decided effect. Several cases of obstinate dropsy have yielded to it, given in the dose of fifteen or twenty grains three or four times a day. He is disposed to think that, while the volatile oil has a strong effect on the mucous membranes, it is to the resin that copaiba owes its diuretic property. (*Lancet*, March 22, 1873, p. 410.)

The pills made with magnesia may sometimes be resorted to with advantage; and

influence on diseased mucous membranes with the different turpentines, which it appears to resemble in composition. The juice may be given in emulsion, in doses of from fifteen to forty drops; the volatile oil, from ten to thirty drops. (*Note to the eleventh and thirteenth editions.*)

it is customary to administer copaiba, enclosed in capsules of gelatin, which cover the taste, while they readily dissolve in the stomach. (See *Glue*, in Part III.) Velpeau has found the best effects from copaiba in the form of enema. He gives two drachms made into an emulsion with the yolk of an egg, twenty or thirty drops of laudanum, and eight fluidounces of water. A distilled water of copaiba has recently been recommended by Dr. E. Langlebert both for internal use, in the dose of one or two fluidounces three or four times a day, and as a vehicle in urethral injections.

Off. Prep. Oleum Copaibæ; Pilulæ Copaibæ, *U. S.* W.

COPTIS. *U. S.*

Goldthread.

Coptis trifolia. *U. S.*

Coptis. *Sex. Syst.* Polyandria Polygynia. — *Nat. Ord.* Ranunculaceæ.

Gen. Ch. Calyx none. *Petals* five or six, caducous. *Nectaries* five or six, cucullate. *Capsules* five to eight, stipitate, stellately diverging, and rostrate, many-seeded. *Nuttall.*

Coptis trifolia. Bigelow, *Am. Med. Bot.* i. 60; Barton, *Med. Bot.* ii. 97. This little evergreen has a perennial creeping root, the slenderness and bright-yellow colour of which have given rise to the common name of *goldthread*. The caudex, from which the petioles and flower-stems proceed, is invested with ovate, acuminate, yellowish, imbricated scales. The leaves, which stand on long slender footstalks, are ternate, with firm, rounded or obovate, sessile leaflets, having an acute base, a lobed and acuminately crenate margin, and a smooth veined surface. The flower-stem is slender, round, rather longer than the leaves, and surmounted by one small white flower, with a minute mucronate bracte beneath it. The petals are oblong, concave, and white; the nectaries inversely conical, hollow, and yellow at the top. The stamens have capillary filaments and globose anthers. The germs are from five to eight, stipitate, oblong, compressed, and support short recurved styles, with acute stigmas. The capsules, which diverge in a star-like form, are pedicelled, compressed, beaked, and contain numerous black seeds attached to the inner side.

The goldthread inhabits the northern regions of this continent and of Asia, and is found in Greenland and Iceland. It delights in the dark shady swamps and cold morasses of northern latitudes and Alpine regions, and abounds in Canada, and in the hilly districts of New England. We have seen it growing abundantly in the forests of N. Western Pennsylvania. Its blossoms appear in May. All parts of the plant possess more or less bitterness; but this property is most intense in the root, which was the only officinal portion, until, at the late revision of the Pharmacopœia, the whole plant was adopted.

Dried goldthread, as brought into the market, is in loosely matted masses, consisting of the long, thread-like, orange-yellow roots, frequently interlaced, and mingled with the leaves and stems of the plant. It is without smell and has a purely bitter taste, unattended with aroma or astringency. It imparts a bitterness and yellow colour to water and alcohol, but most perfectly to the latter, with which it forms a bright-yellow tincture. The infusion is precipitated by nitrate of silver and acetate of lead. (*Bigelow.*) It affords no evidence of containing either resin, gum, or tannin.

The fact of the presence of the alkaloid *berberina* in several plants, characterized by bitterness and a yellow colour, naturally suggested its existence in this root; and Professors Maisch and Procter have satisfied themselves of the truth of this conjecture. According to Prof. F. F. Mayer, the berberina is here, as in Hydrastis, associated with a colourless alkaloid, which is not precipitated by muriatic or nitric acid, but the precise nature of which did not appear to have been demonstrated. (*Am. Journ. of Pharm.*, March, 1863, p. 97.) Since the experiments of Professors Maisch and Procter, goldthread has been submitted to analysis by Mr. Edward Z. Gross, the whole plant being used. It was found to contain, besides berberina, albumen, resin, fixed oil, colouring and extractive matters, sugar, lignin, and another alkaloid, which he has named *coptina*. It differs from berberina by its colourless

crystals, and by forming with iodohydrargyrate of potassium a crystalline instead of flocculent precipitate. For further particulars the reader is referred to Mr. Gross's essay. The plant was shown to contain no tannic or gallic acid. (*Am. Journ. of Pharm.*, May, 1873, p. 193.)

Medical Properties and Uses. Goldthread is a simple tonic bitter, bearing a close resemblance to quassia in its mode of action, and applicable to all cases in which that medicine is prescribed, though from its higher price, not likely to come into general use as a substitute. In New England it is employed as a local application in aphthous ulcerations of the mouth; but it probably has no other virtues in this complaint than such as are common to the simple bitters. It may be given in substance, infusion, or tincture. The dose of the powder is from ten to thirty grains, of a tincture made with an ounce of the root to a pint of diluted alcohol, one fluidrachm.

Another species of Coptis has been described by Dr. Wallich, under the name of *Coptis teeta*, which grows in the mountainous regions bordering on Assam, and is much used as a tonic by the natives, and by the Chinese. It appears to be closely analogous in properties to C. trifolia, and like it contains berberina. It has been introduced into use in British India; and Mr. Twining, who employed it largely in the Calcutta General Hospital, speaks very favourably of its effects of improving the appetite and increasing the digestive powers. (*Pharm. Journ.*, Aug. 1870, p. 161.)

W.

CORIANDRUM. *U.S.*

Coriander.

The fruit of Coriandrum sativum. *U.S.*

Off. Syn. CORIANDRI FRUCTUS. *Coriander Fruit.* The dried ripe fruit of Coriandrum sativum, cultivated in Britain. *Br.*

Coriandre, *Fr.;* Koriander, *Germ.;* Coriandro, *Ital.;* Cilantro, *Span.*

CORIANDRUM. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Apiaceæ or Umbelliferæ.

Gen. Ch. Corolla radiate. *Petals* inflex-emarginate. *Universal involucre* one-leafed. *Partial involucres* halved. *Fruit* spherical. *Willd.*

Coriandrum sativum. Willd. *Sp. Plant.* i. 1448; Woodv. *Med. Bot.* p. 137, t. 53. This is an annual plant, with an erect, round, smooth, branching stem, rising about two feet, and furnished with compound leaves, of which the upper are thrice ternate, with linear pointed leaflets, the lower pinnate, with the pinnæ cut into irregular serrated lobes like those of parsley. The flowers are white or rose-coloured, and in compound terminal umbels; the fruit globular, and composed of two concave hemispherical portions.

C. sativum is a native of Italy, but at present grows wild in most parts of Europe, having become naturalized in consequence of its extended cultivation. The flowers appear in June, and the fruit ripens in August. It is a singular fact, that all parts of the fresh plant are extremely fetid when bruised, while the fruit becomes fragrant by drying. This is the officinal portion. It is brought to us from Europe.

The fruit of the coriander is globular, about the eighth of an inch in diameter, obscurely ribbed, of a grayish or brownish-yellow colour, and separable into the two portions (half-fruits) of which it consists. It has the persistent calyx at its base, and is sometimes surmounted by the adhering style. The smell and taste are gratefully aromatic, and depend on a *volatile oil*, which may be obtained separate by distillation, and is said to belong to the camphene family. One pound of the seeds yields forty-two grains of the oil. (*Zeller.*) It is colourless or pale-yellow, with an agreeable odour of coriander, a mild aromatic taste, and a sp. gr. varying from 0·859 to 0·871. It is recognised among the officinals in the Br. Pharmacopœia, which employs it in the Syrup of Senna. The virtues of the fruit are imparted to alcohol by maceration, and less readily to water.

Medical Properties and Uses. Coriander has, in a moderate degree, the ordinary medicinal virtues of the aromatics. It is almost exclusively employed in combination with other medicines, either to cover their taste, to render them acceptable to the

stomach, or to correct their griping qualities. It was well known to the ancients. The dose is from a scruple to a drachm.

Off. Prep. Confectio Sennæ; Infusum Gentianæ Compositum, *U. S.;* Infusum Sennæ, *U. S.;* Oleum Coriandri, *Br.;* Syrupus Rhei, *Br.;* Tinctura Rhei, *Br.;* Tinctura Rhei et Sennæ, *U. S.;* Tinctura Sennæ, *Br.* W.

CORNUS CIRCINATA. *U. S. Secondary.*

Round-Leaved Dogwood.

The bark of Cornus circinata. *U. S.*

Cornus. *Sex. Syst.* Tetandria Monogynia.—*Nat. Ord.* Cornaceæ.

Gen. Ch. Involucre usually four-leaved. *Petals* superior, four. *Drupe* with a two-celled nut. *Willd.*

We have ten indigenous species of Cornus, all supposed to possess similar medical properties; and three—*C. Florida*, *C. circinata*, and *C. sericea*—are noticed in the Pharmacopœia of the United States. The last two are placed in the secondary list, not because they are esteemed less efficient than the first, but because they have hitherto attracted less attention.

Cornus circinata. Willd. *Sp. Plant.* i. 663. This is a shrub from six to ten feet high, with warty branches, large, roundish, pointed leaves, waved on their edges and downy beneath, and white flowers disposed in depressed cymes. The fruit is blue. The plant is a native of the United States, extending from Canada to Virginia, and growing on hill-sides and the banks of rivers. It flowers in June and July.

The bark, when dried, is in quills of a whitish or ash colour, and affords a powder resembling that of ipecacuanha. Its taste is bitter, astringent, and aromatic. In chemical composition, so far as this has been ascertained, it is analogous to Cornus Florida. It possesses also similar medical virtues, and may be employed in the same doses. It has been much used as a tonic and astringent in Connecticut, and was highly extolled by the late Dr. Ives, of New York, who recommended, as the most eligible preparation, an infusion made by pouring a pint of boiling water on an ounce of the coarsely-powdered bark. The dose of this is from one to two fluidounces.

W.

CORNUS FLORIDA. *U. S.*

Dogwood.

The bark of Cornus Florida. *U. S.*

Cornus. See CORNUS CIRCINATA.

Cornus Florida. Willd. *Sp. Plant.* i. 661; Bigelow, *Am. Med. Bot.* ii. 73; Barton, *Med. Bot.* i. 44. This is a small indigenous tree, usually about fifteen or twenty feet in height, though sometimes not less than thirty or thirty-five feet. It is of slow growth; and the stem, which generally attains a diameter of four or five inches, is compact, and covered with a brownish bark, the epidermis of which is minutely divided by numerous superficial cracks or fissures. The branches are spreading, and regularly disposed, sometimes opposite, sometimes in fours nearly in the form of crosses. The leaves are opposite, oval, about three inches long, pointed, dark-green and sulcated on the upper surface, glaucous or whitish beneath, and marked with strong parallel veins. Towards the close of summer they are speckled with black spots, and on the approach of cold weather become red. The proper flowers are small, yellowish, and collected in heads, which are surrounded by a large conspicuous involucre, consisting of four white obcordate leaves, having the notch at their summit tinged with red or purple. This involucre constitutes the chief beauty of the tree when in flower. The calyx is four-toothed, and the corolla composed of four obtuse reflexed petals. The fruit is an oval drupe, of a vivid glossy redness, containing a two-celled and two-seeded nucleus. The drupes are usually associated together to the number of three or four, and remain on the tree till after the early frosts. They ripen in September.

The dogwood is found in all parts of the United States, from Massachusetts to the

Mississippi and the Gulf of Mexico; but is most abundant in the Middle States. In the month of May, it is clothed with a profusion of large white blossoms, which render it one of the most conspicuous ornaments of the American forests. The bark is the officinal portion, and is derived for use both from the stem and branches, and from the root. That from the root is preferred.

As brought into market, the bark is in pieces of various size, usually more or less rolled, sometimes invested with a fawn-coloured epidermis, sometimes partially or wholly deprived of it, of a reddish-gray colour, very brittle, and affording, when pulverized, a grayish powder tinged with red. The odour of dogwood is feeble, its taste bitter, astringent, and slightly aromatic. Water and alcohol extract its virtues. It has not been accurately analyzed; but, from the experiments of Dr. Walker and Mr. James Cockburn (*Am. Journ. of Pharm.*, vii. 109), appears to contain bitter extractive, gum, resin, tannin, gallic acid, fixed oil, wax, red colouring matter, lignin, and salts of potassa and iron. Mr. Cockburn also obtained a crystallized substance, without taste, the characters of which, however, were not sufficiently investigated to authorize an opinion as to its nature. A peculiar bitter principle, for which the name of *cornine* was proposed, was announced as an ingredient by Mr. Carpenter; but his results have not been confirmed. More recently, an examination of the bark, with a view to the isolation of its active principle, has been made by Prof. John M. Maisch, who appears to have obtained the bitter principle pure in solution, but, in consequence of its extreme facility of decomposition, could not succeed in isolating it in the solid state. He inferred, however, that it is a neuter colourless substance, very soluble in water and alcohol, insoluble in ether, not capable of precipitation by chemical reagents, but very easily destroyed on exposure to the air. (*Proceed. of Am. Pharm. Assoc.*, 1859, p. 315.) The flowers of *C. Florida* have the same bitter taste as the bark, and, though not officinal, are sometimes employed for the same purposes.

Medical Properties and Uses. Cornus Florida is tonic and astringent. By Dr. Walker it was found, when taken internally, to increase the force and frequency of the pulse, and the heat of the body. It is thought to possess remedial properties analogous to those of Peruvian bark, for which it has occasionally been successfully substituted in the treatment of intermittent fevers; but the introduction of sulphate of quinia into use has nearly banished this, as well as many other substitutes for cinchona, from regular practice. The dogwood has also been employed in low fevers, and other complaints for which Peruvian bark is usually prescribed.

It may be given in powder, decoction, or extract. The dose of the powder is from a scruple to a drachm, repeated, in cases of intermittent fever, so that from one to two ounces may be taken in the interval between the paroxysms. The decoction is officinal. (See *Decoctum Cornûs Floridæ.*) The dried bark is said to be preferable to the fresh; as it possesses all the activity of the latter, without being equally liable to offend the stomach and bowels. An extract might probably be used with advantage in intermittents in large doses.

Off. Prep. Decoctum Cornûs Floridæ, *U. S.;* Extractum Cornûs Floridæ Fluidum, *U.S.* W.

CORNUS SERICEA. *U. S. Secondary.*

Swamp Dogwood.

The bark of Cornus sericea. *U. S.*

Cornus. See CORNUS CIRCINATA.

Cornus sericea. Willd. *Sp. Plant.* i. 663; Barton, *Med. Bot.* i. 115. This species of Cornus is usually six or eight feet in height, with numerous erect stems, which are covered with a shining reddish bark, and send out opposite spreading branches. The young shoots are more or less pubescent. The leaves are opposite, petiolate, ovate, pointed, entire, and on the under surface covered with soft brownish hairs. The flowers are small, white, and disposed in terminal cymes, which are depressed and woolly. The fruit consists of globular, berry-formed drupes, of a cerulean blue colour, and collected in bunches.

The swamp dogwood inhabits the United States from Canada to Carolina, and is found in moist woods, in swamps, and on the borders of streams. It flowers in June and July. The bark was ascertained by Dr. Walker to have the same medical properties as that of Cornus Florida. It may be given in the same doses, and administered in a similar manner. W.

COTULA. *U. S. Secondary.*

Mayweed.

The herb of Anthemis Cotula, Maruta Cotula (*De Candolle*). *U. S.*

Camomille puante, Maroute, *Fr.;* Hunds-Kamille, Stinkende-Kamille, *Germ.;* Camomilla fetida, Cotula, *Ital.;* Manzanilla loca, *Span.*

ANTHEMIS. See ANTHEMIS.

Anthemis Cotula. Willd. *Sp. Plant.* iii. 2181; Barton, *Med. Bot.* i. 161.—*Maruta Cotula.* De Cand. *Prodrom.* vi. 13. The mayweed is an annual plant, with a fibrous root, and an erect, striated stem, very much branched even to the bottom, from one to two feet in height, and supporting alternate, sessile, flat, doubly pinnated, somewhat hairy leaves, with pointed linear leaflets. The flowers stand singly upon the summits of the branches, and consist of a central, convex, golden-yellow disk, with white radial florets, which spread horizontally during the day, but are reflexed, or bent towards the stem at night. The calyx, which is common to all the florets, is hemispherical, and composed of imbricated hairy scales. The receptacle is conical or nearly cylindrical, and surmounted by rigid, bristle-shaped paleæ, shorter than the florets. The seeds are naked.

This plant grows abundantly both in the United States and Europe. In this country it is found in the vicinity of inhabited places, growing among rubbish, along the sides of roads, and in waste grounds. Notwithstanding its extensive diffusion, it is generally believed to be a naturalized and not an indigenous plant. It is frequently called *wild chamomile.* It flowers from the middle of summer till late in autumn.

Mr. W. H. Warner, from a chemical examination of the flowers, concluded that they contain volatile oil, oxalic, valerianic, and tannic acids, colouring matter, acrid fatty matter, bitter extractive, and salts of potassa, lime, magnesia, and iron. (*Am. Journ. of Pharm.*, Sept. 1858, p. 390.)

The whole plant has a strong, disagreeable smell, and a warm, bitter taste, and imparts these properties to water.

The medical properties of this species of Anthemis are essentially the same as those of chamomile, for which it may be substituted; but its disagreeable odour is an obstacle to its general use. On the continent of Europe, it has been given in nervous diseases, especially in hysteria, under the impression, probably derived from its peculiar smell, that it possesses antispasmodic powers. It has also been thought to be emmenagogue. It is said to have the property of vesicating, if applied to the surface fresh and bruised. In this country it is scarcely employed, except as a domestic remedy. The whole plant is active; but the flowers, being less disagreeable than the leaves, are preferred for internal use. The remedy is best administered in the state of infusion. W.

CREASOTUM. *U. S., Br.*

Creasote.

A peculiar substance obtained from wood-tar. *U. S.* A product of the distillation of wood-tar. *Br.*

This is a substance of the nature of the volatile oils, discovered in 1830 by Reichenbach in the products of the distillation of wood. M. Deville conceives that it is a volatile oil, derived by heat from the resin of wood, and isomeric with the original volatile oil, from which the resin is supposed to have been formed by a slow alteration occurring in the vegetable. It may, therefore, be classed with the volatile oils which are regenerated by distillation.

In the products of the distillation of organic substances generally, whether vegetable or animal, Reichenbach also discovered five other principles, called paraffin, eupion, picamar, capnomor, and pittacal, which, as being associated with creasote, will be here noticed. *Paraffin* is a solid carbohydrogen, most abundantly obtained by distilling cannel-coal, when it comes over with certain isomeric oils, several of the least volatile of which, appearing towards the close of the distillation, form a mixture called *paraffin oil.* It has come so extensively into use in various ways, as to call for a full description in this work. (See Part III.) *Picamar* is a colourless, oily liquid, heavier than water, of a peculiar odour and very bitter taste. It is present in the heaviest portion of the rectified oil of tar, and constitutes the bitter principle of that substance. *Capnomor*, so called from being an ingredient of smoke, is a colourless liquid, lighter than water, having a pleasant odour and pungent taste, and occurring in the heavy oil of tar, and in coal naphtha. It has the property of dissolving caoutchouc. *Pittacal*, also obtained from the heavy oil of tar, is a solid of a beautiful blue colour, differing from the substances above noticed in containing nitrogen as one of its elements.

Preparation. Creasote is obtained either from wood-tar or from crude pyroligneous acid. When wood-tar is used, it is distilled until it has attained the consistence of pitch. The distilled liquid divides itself into three layers, an aqueous between two oily layers. The inferior oily layer, which alone contains the creasote, is separated, and saturated with carbonate of potassium to remove acetic acid. The liquid is allowed to rest, and the new oil which separates is decanted from it. This oil is distilled, and yields products lighter than water, and a liquid heavier. The latter alone is preserved, and, after having been agitated repeatedly with weak phosphoric acid to neutralize ammonia, is allowed to remain at rest for some time. It is next washed as long as acidity is removed, and then distilled with a fresh portion of weak phosphoric acid; care being taken to cohobate from time to time. The oily liquid thus rectified is colourless, and contains much creasote, but also a portion of eupion. To separate the latter, the liquid is mixed with a solution of caustic potassa of the density 1·12, which dissolves the creasote, but not the eupion. The eupion, which swims above from its levity, is then separated; and the alkaline solution of the creasote is exposed to the air, until it becomes brown in consequence of the decomposition of a foreign matter, and is then saturated with sulphuric acid. This sets free the creasote, which is decanted, and again distilled. The treatment by solution of potassa, sulphuric acid, &c. is to be repeated until the creasote no longer becomes brown by exposure to the air, but only slightly reddish. It is then dissolved in a stronger solution of potassa and distilled again, and finally redistilled for the last time, rejecting the first portion which comes over on account of its containing much water, collecting the next portion, and avoiding to push the distillation too far. The product collected in this distillation is creasote.

When creasote is extracted from pyroligneous acid, the first step is to dissolve sulphate of sodium in it to saturation. The oil which separates and swims above is decanted, and, having been allowed to remain at rest for a few days, is saturated by carbonate of potassium with the assistance of heat, and distilled with water. The oleaginous liquid obtained is of a pale-yellow colour, and is to be treated with phosphoric acid, &c., as above detailed, in relation to the treatment of the corresponding oil obtained from wood-tar.

According to M. Koene, the tar of the pine furnishes but little pure creasote; while coal-tar yields nearly five drachms to the pint. This, however, is not properly creasote, but a liquid having analogous properties, consisting chiefly of carbolic or phenylic and of cresylic acid.

At present there is very little genuine creasote in our market, the impure mixture of carbolic and cresylic acids just referred to, as being obtained from coal-tar, having been substituted for it, and often sold under its name.

Properties. Creasote, when pure, is a colourless oleaginous liquid, of the consistence of oil of almonds, slightly greasy to the touch, volatilizable by heat, and having a caustic, burning taste, and a penetrating, disagreeable odour, like that of smoked meat, and analogous to, yet different from that of phenylic acid. As met with in

the shops, it has frequently a brownish tinge. It burns with a sooty flame. Applied in a concentrated state to the skin, it corrugates and then destroys the cuticle, causing a white spot. On paper it leaves a greasy stain, which disappears in a few hours, or in ten minutes when heated to about 212°. Its sp. gr. is 1·057 at 55° (*Gorup-Besanez*), 1·046 (*U. S.*), 1·071 (*Br.*). It boils at 397°, and remains fluid at 17° below zero. It is a non-conductor of electricity, and a powerful refractor of light. It is devoid of acid or alkaline reaction. Mixed with water, it forms two solutions; one consisting of one part of creasote and about eighty of water, the other, of one part of water and ten of creasote. (*Berzelius.*) It unites in all proportions with alcohol, ether, naphtha, and bisulphuret of carbon, and is dissolved wholly and readily by an equal volume of acetic acid. (*U. S.*). It dissolves a large proportion of iodine and phosphorus, and a considerable amount of sulphur, especially when assisted by heat.

Creasote forms two combinations with potassa; one anhydrous, of an oleaginous consistence, the other hydrated, and in the form of small, white, pearly scales. It forms similar compounds with soda. Its formula is $C_{28}H_{16}O_4$ (*Regnault*), or $C_{13}H_{10}O_4$ (*Fownes*); but it is differently given by other authorities; and the probability is that creasote, as ordinarily obtained at least, is not a definite principle. Creasote instantly dissolves ammonia, and retains it with great force. Strong nitric and sulphuric acids decompose it; the former giving rise to reddish vapours, the latter to a red colour, which becomes black on the addition of more of the acid. Dilute nitric acid converts it into a brown resin, which, treated with ammonia, and then dissolved in boiling alcohol, gives, by evaporation, certain salts of ammonia, two of which contain new acids, discovered by Laurent. Muriatic acid produces no change in it. The following tests will distinguish it from carbolic or phenylic acid from coal-tar, which in some respects strongly resembles it. A splinter of pine wood, dipped first into an alkaline solution of carbolic acid and allowed to dry, and subsequently into muriatic acid, will after a time assume a deep-blue colour. Creasote does not produce the same effect. The British Pharmacopœia gives, as one of the characters of its creasote, that a "slip of deal dipped into it, and afterwards into hydrochloric acid, and then allowed to dry in the air, acquires a greenish-blue colour;" and consequently does not consider the presence of phenylic acid as a contamination. The probability is that the creasote upon which the description in the British Pharmacopœia was prepared was not really derived from wood, but from coal-tar. The true creasote differs from carbolic acid in not coagulating collodion. M. Gorup states that with a neutral solution of perchloride of iron, beech-wood creasote, dissolved in alcohol, gives a green colour, whilst a similar solution of the product of coal-tar causes a brown colour; but, dissolved in water, the true creasote produces no change, while coal-tar creasote produces a blue. (*Am. Journ. of Pharm.*, May, 1868, p. 257.) Mr. T. N. R. Morson, of London, who has been long a manufacturer of creasote, and complains of the discredit into which it has fallen in consequence of the substitution for it in the shops of carbolic acid; while he says that the directions of the Pharmacopœia for the distinction of the two are insufficient, gives a test, discovered by his son Mr. Thos. Morson, which is at once simple and satisfactory. It consists in the solvent power of glycerin over carbolic acid, which is dissolved by it in all proportions; while pure creasote is insoluble or nearly so; and, consequently, if any liquid, assumed to be creasote, dissolves largely in glycerin, it probably consists in the whole, or in large part, of carbolic acid. (*Pharm. Journ.*, May, 1872, p. 921.) A still better test, according to Mr. John A. Clark, is an alcoholic solution of perchloride of iron (*Tr. Ferri Perchlor.* B. Ph.), which, with an alcoholic solution of creasote, produces a deep greenish-blue colour, but with carbolic acid a light brown. (*Am. J. of Pharm.*, June, 1873, p. 269.) Creasote dissolves a large number of metallic salts, and reduces a few to the metallic state; as, for example, nitrate and acetate of silver. It powerfully coagulates albumen, and in this way is supposed to act as a hemostatic.

Of all the properties of creasote, the most remarkable is its power of preserving meat. It is this property which has suggested its name, derived from *κρεάς flesh*, and *σώζω I preserve.*

Impurities and Adulterations. Creasote is apt to contain eupion, picamar, and cap

nomor, and is sometimes adulterated with rectified oil of tar, and the fixed and volatile oils. All these substances are detected by strong acetic acid, which dissolves the creasote, and leaves them behind, floating above the creasote solution. Creasote, however, from beech-wood tar, is only partially dissolved by hot acetic acid of ordinary strength. Fixed oils are also discovered by a stain on paper not discharged by heat. Any trace of the matter which produces the brownish tinge (see *page* 355) is detected by the liquid becoming discoloured by exposure to sunshine.

Commercial creasote almost always contains carbolic and cresylic acids, from coal-tar; and, indeed, there is reason to believe that what is now sold for creasote, is generally nothing more than impure carbolic or phenylic acid. (See *Acidum Carbolicum.*) It has been already stated that this acid strongly resembles creasote; and this resemblance probably extends also to their therapeutical effects; so that the substitution is less to be regretted than might otherwise be the case. But as the effects of the two on the system may not be identical, and those from creasote have been verified by a long experience, it is highly desirable to be able to distinguish between them. Tests for this purpose have been given above; and the following observations are to the same effect. The substitution of phenylic acid may be discovered by its lower boiling point (368° F.). Its presence in creasote is detected by the addition of sesquichloride of iron, which causes a violet-blue colour, and afterwards a whitish turbidness, if this impurity is present. According to Mr. E. N. Kent, of New York, phenylic acid from the oil of coal-tar, and creasote from wood-tar are essentially the same; the former being a purer state of the latter. (*N. Y. Journ. of Pharm.*, Oct. 1853.) This view is contradicted by the results of Gorup-Besanez, who obtained creasote which did not respond to the tests of phenylic acid. Still he admits that creasote, as pure as he could get it with a boiling point between 398° and 406°, is not a chemically definite compound. Gmelin considers the creasote from wood-tar, and the carbolic acid from coal-tar, as differing from each other only in the degree of purity; but this opinion is irreconcilable with facts at present known.

Medical Properties, &c. Creasote is irritant, narcotic, styptic, antiseptic, and moderately escharotic. Internally, it has been employed in a number of diseases; externally, for the most part, as an application to eruptions, wounds, and ulcers, and as an injection and gargle. Dr. R. Dick, of Glasgow, recommends it as an internal remedy in chronic gonorrhœa and gleet. Dr. Elliotson, of London, considers it an efficacious remedy in arresting nausea and vomiting, when not dependent on inflammation or structural disease of the stomach, as in hysteria, pregnancy, and sea-sickness. Mr. Kestevan, of England, found it very useful in diarrhœa; and others have confirmed this statement. Dr. D. J. Cain, of Charleston, used it with advantage in cholera morbus and cholera infantum, either alone, or conjoined with charcoal, chalk, or bicarbonate of sodium. It has also been used with benefit in dysentery and malignant cholera; and has been recommended in pectoral affections with purulent expectoration. It is highly recommended in enteric or typhoid fever by M. Pécholier, of Montpellier, in France. (*Med. Record*, July 1, 1862, p. 202.)

The eruptions, to the treatment of which creasote has been supposed to be best suited, are those of a scaly character. In burns its efficacy has been insisted on, especially in those attended with excessive suppuration and fungous granulations. In chilblains also it is stated to be a useful application. Mixed with four parts of lard, it is said to have proved very serviceable in erysipelas. When applied to wounds it acts as a hemostatic, stopping the capillary hemorrhage, but possesses no power to arrest the bleeding from large vessels. Accordingly, creasote water has been applied locally in menorrhagia, and to arrest uterine hemorrhage and the bleeding from leech-bites. The ulcers, in the treatment of which it has been found most useful, are those of an indolent and gangrenous character, in which its several properties of escharotic, stimulant, and antiseptic are usefully brought into play. It is also praised as an application to syphilitic, scrofulous, and cancerous ulcers, and to malignant pustule. In all these cases, should the remedy cause irritation, it must be suspended, or alternated with emollient and soothing applications. Injected into fistulous ulcers, it proves a useful resource, by exciting the callous surfaces, and disposing them to unite. Dr. Hildreth, of Zanesville, Ohio, found it efficacious, mixed with mercurial

ointment, in the proportion of from ten to thirty drops to the ounce, in scrofulous ophthalmia, and scrofulous ulceration of the cornea. A small portion of the ointment is introduced under the upper eyelid, morning and evening, and rubbed over the whole globe. The application should be strong enough to produce a smarting pain for about five minutes. The local must of course be combined with constitutional treatment. In chronic varicose ophthalmia it is a valuable remedy, in the form of collyrium, of the strength of from one to three drops to the fluidounce of water. In putrid sore-throat, requiring the use of a stimulant and antiseptic, a gargle of creasote acts beneficially; and in chronic suppuration of the external meatus of the ear, it is valuable as an injection. It has been much used topically in diphtheria, in which it corrects the fetor, and is said to cure the local affection. In deafness from deficient cerumen, Mr. Curtis has found it useful. The meatus is first well cleansed, and afterwards brushed over, night and morning, by means of a camel's-hair brush, with a mixture formed of a drachm of creasote and four drachms of oil of almonds. The meatus may be cleansed by dropping into the ear at night a few drops of olive oil, and syringing it out the next morning with a weak and warm solution of castile soap, to which a sixth of Cologne water has been added. This may be repeated for five or six days, if required. In leucorrhœa M. Arendt has found creasote very useful in the form of injection, made with two drops to the fluidounce of water, used several times a day. Dr. Mackenzie has derived advantage from it as a vaginal injection in puerperal fever, arising from the absorption of vitiated secretions. It is also efficacious in the destruction of warts, applied freely every day or two, and kept on by adhesive plaster. In toothache, depending on caries of the tooth and exposure of the nerve, creasote often acts promptly and radically in the removal of the pain. One or two drops of the pure substance must be carefully introduced into the hollow of the tooth, on a little cotton, avoiding contact with the tongue or cheek. To render it effectual, the hollow of the tooth must be well cleansed before it is applied. A mixture of 15 parts of creasote and ten of collodion is said to have a jelly-like consistence, and to be usefully applied to carious teeth, which it protects from the air; but as pure creasote does not coagulate collodion, this remark applies properly to the impure carbolic acid, before stated to be commonly sold under the same name.

Creasote is employed in the pure state, in mixture or solution, and in the form of ointment. (See *Mistura Creasoti* and *Unguentum Creasoti.*) In the pure state, it may be brushed over indolent or ill-conditioned ulcers, or applied to them by means of lint. Internally it is given in the dose of from one to two drops or more, repeated several times a day, diluted with weak mucilage in the proportion of half a fluidounce to the drop. When used as a lotion for eruptions, ulcers, or burns, or as a gargle or injection, it is employed in solution, containing two, four, or six drops to the fluidounce of water; the strength being determined by the circumstances of each particular case. In some cases the solution of creasote is used externally mixed with poultices.

Under the name of VAPOR CREASOTI (*Inhalation of Creasote*), the British Pharmacopœia directs a preparation consisting of 12 minims of creasote and 8 fluidounces of boiling water, which are to be mixed in an inhaling apparatus, so arranged that the air shall be made to pass through the solution and then inhaled. It may be used in chronic inflammation of the air-passages.

Creasote, in an over-dose, acts as a poison. It produces giddiness, obscurity of vision, depressed action of the heart, convulsions, and coma. No antidote is known. The medical treatment consists in the evacuation of the poison, and the administration of ammonia and other stimulants.

The addition of three or four drops of creasote to a pint of ink effectually prevents it from becoming mouldy. Dr. Christison finds that creasote water is as good a preservative of some anatomical preparations as spirit, with the advantage of not hardening the parts. It is probably to creasote that the antiseptic properties of wood-smoke and of pyroligneous acid are owing.

Off. Prep. Aqua Creasoti, *U. S.;* Mistura Creasoti, *Br.;* Unguentum Creasoti; Vapor Creasoti, *Br.* B.

CRETA. *U.S., Br.*

Chalk.

Native friable carbonate of calcium. *U.S.* Native friable carbonate of lime. *Br.*
Craie, *Fr.;* Kreide, *Germ.;* Creta, *Ital.;* Greda, *Span., Port.*

Carbonate of calcium, in the extended meaning of the term, is the most abundant of simple minerals, constituting, according to its state of aggregation and other peculiarities, the different varieties of calcareous spar, common and shell limestone, marble, marl, and chalk. It occurs also in the animal kingdom, forming the principal part of shells, and a small proportion of the bones of the higher orders of animals. It is present in small quantity in most natural waters, being held in solution by the carbonic acid which they contain. In the waters of limestone districts it is a very common impregnation, and causes purging in those not accustomed to their use. In all such cases, boiling the water by expelling the carbonic acid, causes the carbonate to be deposited. It has been shown, however, that carbonate of calcium is itself in a slight degree soluble in water; so that a small proportion remains in limestone water, which has been long exposed to boiling. Hofmann estimated the quantity remaining in solution at 34 thousandths of a gramme in a litre. That the carbonate is not held in solution by free carbonic acid is shown by the fact that lime-water causes no precipitation. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 147.) Besides being officinal in the state of chalk, carbonate of calcium is also ordered as it exists in marble and oyster-shell, and as obtained by precipitation. (See *Marmor*, *Testa*, and *Calcii Carbonas Præcipitata.*) In the present article we shall confine our observations to chalk. This occurs abundantly in the south of England and north of France. It exists massive in beds, and very frequently contains nodules of flint, and fossil remains of land and marine animals. Until recently it was not known to exist in the United States; but Prof. F. V. Hayden states that he observed it in great abundance in Dakota Territory, constituting beds which extend for 400 miles along the Missouri river. He considers this deposit as identical in character with the chalk beds of Europe, and applicable to the same useful purposes. (*Am. Journ. of Sci. and Arts*, xliii. 16, A.D. 1867.)

Properties. Chalk is an insipid, inodorous, insoluble, opaque, soft solid, generally white, but grayish-white when impure. It is rough to the touch, easily pulverized, and breaks with an earthy fracture. It soils the fingers, yields a white trace when drawn across an unyielding surface, and when applied to the tongue adheres slightly. Its sp. gr. varies from 2·3 to 2·6. It is never a perfectly pure carbonate of calcium; but contains, besides gritty silicious particles, small portions of alumina and of oxidized iron. If pure it is entirely soluble in muriatic acid; but usually a little silica is left. If the muriatic solution is not precipitated by ammonia, it is free from alumina and iron. Like all carbonates, it effervesces with acids. Though insoluble in water, it dissolves in an excess of carbonic acid. It consists, like the other varieties of carbonate of calcium, of one eq. of carbonic acid 22, and one of lime 28 = 50.

Chalk, on account of the gritty particles which it contains, is unfit for medicinal use, until it has undergone levigation, when it is called *prepared chalk.* (See *Creta Præparata.*)*

Pharm. Use. In preparing carbonic acid gas, *Br.*

Off. Prep. Creta Præparata. B.

* *Chalk as a ferment.* That chalk consists mainly of the mineral remains of extremely minute organized beings has been for years a recognised fact. M. A. Bechamp states that these were so minute that the remains of more than two millions of them are contained in 100 grammes of chalk. Another important fact in relation to chalk, familiar to chemists, is that it has the power, under certain circumstances, of promoting fermentation. In relation to this point, M. Bechamp has made some highly interesting statements in a communication to the Academy of Sciences of Paris, reported in the *Journal de Pharmacie et de Chimie* (4e sér., iv. 279, A.D. 1866), from which the following abstract has been made.

According to M. Bechamp, there are in chalk, besides the remains of former organized beings, innumerable organisms, smaller than any hitherto known, smaller than any of the infusoria or microphytes now studied in connection with fermentation. These are still living, though doubtless very old. They act powerfully as fermenting agents, the most powerful that M. Bechamp has ever

CROCUS. *U.S., Br.*

Saffron.

The stigmas of Crocus sativus. *U.S.* The dried stigma, and part of the style, of Crocus sativus. *Br.*

Safran, *Fr., Germ.;* Zafferano, *Ital.;* Azafran, *Span.*

Crocus. *Sex. Syst.* Triandria Monogynia.—*Nat. Ord.* Iridaceæ.

Gen. Ch. Corolla six-parted, equal. *Stigmas* convoluted. *Willd.*

Crocus sativus. Willd. *Sp. Plant.* i. 194; Woodv. *Med. Bot.* p. 763, t. 259. The common cultivated saffron is a perennial plant, with a rounded and depressed bulb or cormus, from which the flower rises a little above the ground, upon a long, slender, white, and succulent tube. The flower is large, of a beautiful lilac or bluish-purple colour, and appears in September or October. The leaves are radical, linear, slightly revolute, dark-green upon their upper surface with a white longitudinal furrow in the centre, paler underneath with a prominent flattened midrib, and enclosed at their base, together with the tube of the corolla, in a membranous sheath, from which they emerge soon after the appearance of the flower. The style hangs out on one side between the two segments of the corolla, and terminates in three long convoluted stigmas, which are of a rich orange colour, highly odorous, rolled in at the edges, and notched at the summit. These stigmas are the officinal part of the plant.

C. sativus, or *autumnal crocus*, is a native of Greece and Asia Minor, where it has been cultivated from the earliest ages. It is also cultivated for medicinal use in Sicily, Spain, France, England, and other temperate countries of Europe. Large quantities of saffron are raised in Egypt, Persia, and Cashmere, whence it is sent to India. Much of the drug reaches the market of Constantinople from the neighbourhood of Tifflis and the Caucasus. We cultivate the plant in this country chiefly, if not solely, as a garden flower. It is liable to two diseases, which interfere with its culture; one dependent on a parasitic fungus which attaches itself to the bulb, the other called by the cultivators in France *tacon*, by which the bulb is converted into a blackish powder. (*Journ. de Pharm.*, xviii. 41.)

In England the flowers appear in October, and the leaves continue green through

met with, and are capable of nourishing themselves on the most diversified organic substances. Powdered chalk, taken from the centre of masses immediately from the quarry far beneath the surface, so that it could have derived nothing from the air, and rubbed with distilled water, exhibits, under a powerful microscope, numerous shining points, agitated with a lively movement of trepidation. M. Bechamp considers them as living organisms, the smallest yet known; and in support of this opinion advances these two proofs; first, that chalk acts as a ferment without the presence of albuminoid matter, and, secondly, that these bodies can be isolated, and shown by analysis to consist of carbon, hydrogen, oxygen, and nitrogen. If chalk is mixed with starch and a little creasote, and another mixture of a similar kind be made with pure carbonate of calcium, on the second day no change will have occurred in the latter mixture; while the former will show evident signs of fermentation, notwithstanding the repressive force of the creasote, which checks other fermentations. The results of the fermentation thus produced are alcohol, butyric acid, acetic acid largely, and signs of lactic acid; and sugar, under similar circumstances, undergoes similar changes. To prevent the chalk from thus acting, its temperature must be raised to 300° Cent. With due precaution, assurance may be had that no other ferment is present; while that of the chalk is increased in quantity. To prove by analysis the organic nature of these bodies, if chalk be treated with dilute muriatic acid, 1·15 per cent. will be left undissolved, of which 7·17 per cent. may be shown to be organic, by yielding on decomposition, carbon, hydrogen, and nitrogen. M. Bechamp proposes for these newly discovered beings the name of *Microzyma cretæ*. The Microzyma is found everywhere, accompanying several other ferments, in certain mineral waters, and in cultivated earth. (*Note to the thirteenth edition.*)

In contradiction of the statements of M. Bechamp, it is maintained by M. O. Loew that the pieces of chalk taken by him from the interior of great masses possessed none of the ferment-producing organisms ascribed to them; but that these were absorbed from the atmosphere during the pulverization of the chalk. In support of this opinion, it is stated that a solution of sugar which ferments with the presence of chalk, will not do so if the mixture be previously exposed to a boiling heat, and then kept in an air-tight vessel; showing that the chalk has lost its power by the destruction of the living organisms contained in it; but if now the mixture be exposed to the air from time to time, unmistakable evidences of fermentation will show themselves; proving that new spores had been derived from the atmosphere. So the writer maintains that chalk, deprived of all fermenting power by a heat of 250° C., will reacquire the power by a short exposure to the air after cooling. The inference is deemed fair that the chalk of M. Bechamp had acquired its power from the atmosphere. (*Chem. News*, March 3, 1871.)—*Note to the fourteenth edition.*

the winter; but the plant does not ripen its seed, and is propagated by offsets from the bulb. These are planted in grounds prepared for the purpose, and are arranged either in rows, or in small patches at certain distances. The flowers are gathered soon after they show themselves, as the period of flowering is very short. The stigmas, or summits of the pistils, together with a portion of the style, are separated from the remainder of the flower, and carefully dried by artificial heat, or in the sun. During this process, they are sometimes made to assume the form of a cake by pressure; but the finest saffron is that which has been dried loosely. The two forms are distinguished by the names of *cake-saffron* and *hay-saffron*. Five pounds of the fresh stigmas are said to yield one pound of the dried.

The English saffron, formerly most highly esteemed in this country, has disappeared from our market. What may be sold under the name is probably derived from other sources. Much of the drug is imported from Gibraltar, packed in canisters. Parcels of it are also brought from Trieste, and other ports of the Mediterranean. The Spanish saffron is generally considered the best. Genuine *cake-saffron* is at present seldom found in commerce. According to Landerer, the stigmas of several other species besides those of C. sativus are gathered and sold as saffron in Greece and Turkey.*

Properties. Saffron has a peculiar, sweetish, aromatic odour, a warm, pungent, bitter taste, and a rich deep-orange colour, which it imparts to the saliva when chewed. The stigmas of which it consists are an inch or more in length, expanded and notched at the upper extremity, and narrowing towards the lower, where they terminate in a slender, capillary, yellowish portion, forming a part of the style. Analyzed by Vogel and Bouillon-Lagrange, it afforded 65·0 per cent. of a peculiar extractive matter, and 7·5 of an odorous volatile oil, together with wax, gum, albumen, saline matter, water, and lignin. The extractive was named *polychroïte*, from the changes of colour which it undergoes by the action of reagents. They prepared it by evaporating the watery infusion to the consistence of honey, digesting the residue in alcohol, filtering the tincture, and evaporating it to dryness. Thus obtained, it is in the form of a reddish-yellow mass, of an agreeable smell, slightly bitter, soluble in water and alcohol, and somewhat deliquescent. Its solution becomes grass-green by the action of nitric acid, blue and then violet by that of sulphuric acid, and loses its colour altogether on exposure to light, and by chlorine. M. Henry, sen., found it to contain about 20 per cent. of volatile oil, which could be separated only by an alkali. M. Quadrat obtained it pure by exhausting saffron with ether, then treating it with boiling water, precipitating with subacetate of lead, decomposing the compound of oxide of lead and colouring matter thus obtained with sulphuretted hydrogen, treating the precipitate with boiling alcohol, evaporating the solution, dissolving the residue in water, and lastly evaporating by means of a water-bath. Thus procured, it is of a brilliant

*At the International Exhibition, in London, in the year 1862, the author noticed a specimen of saffron, from the Island of Ceylon, closely resembling that of the Crocus sativus. It consisted of the stigmas of the *Crocus orientalis*. (*Note to the twelfth edition.*)

In a communication by Mr. Charles A. Heinitsh, to the American Pharmaceutical Association, A.D. 1866, it is stated that until within a few years, saffron was cultivated to a considerable extent in Lancaster Co., Pennsylvania. The plant requires a rich soil, which should be deeply dug and heavily manured. The bulbs are planted in August, eight inches apart, and the growing plant should be kept free from weeds. The flowering period begins about the middle of September, and continues till the beginning of October. The flowers are picked early in the morning, and the stigmas separated and dried in the shade. This is done every day during the period of flowering. He thinks the cultivation can be profitably conducted. A plot of 72 square feet will produce 9000 stigmas, weighing 420 grains, or from 33 to 36 lbs. to the acre; and at present prices this would be remunerative to the grower. (*Am. Journ. of Pharm.*, Jan. 1867, p. 38.)

M. Monthus, an experienced cultivator in France, prefers a dry calcareous soil; plants the bulbs 3 or 4 inches deep; after the harvest in October manures the ground; and renews the planting every three years. He thus prevents the diseases peculiar to the plant.

M. Monthus recommends the *petals* of the flower as applicable to the same purposes as the stigmas, having found them to be possessed of aromatic properties. They demand no peculiar caution in drying; but to preserve them it is necessary to exclude light and moisture. Acids redden them with extreme facility, and alkalies turn them green. He, therefore, recommends a tincture to be made from them, as a substitute for syrup of violets. He prepares the tincture by macerating 10 parts of the dried flowers in 100 parts of alcohol of 40°, for 48 hours. A longer maceration would destroy the colour. Paper may be stained with the tincture, and kept green or red, the former for acids, the latter for alkalies. (*Journ. de Pharm.*, Juillet, 1867, p. 54.)—*Note to the thirteenth edition.*

red colour, inodorous, slightly soluble in water which it renders yellow, much more soluble by the least addition of an alkali, readily soluble in alcohol, but sparingly in ether. Its formula is $C_{20}H_{13}O_{11}$. M. Quadrat found also, in saffron, a fatty matter, glucose, and a peculiar acid. (*Ann. der Chem. und Pharm.*, lxxx. 340.) According to M. Henry, the colouring principle constitutes 42 per cent. of saffron, and the essential oil 10 per cent. It is to the latter that the medicine owes its activity. It may be partially separated by distillation. It is yellow, of a hot, acrid, bitterish taste, and heavier than water, in which it is slightly soluble. According to B. Huss, polychroïte appears to be a glucoside, splitting, when treated with sulphuric acid, into sugar, a volatile oil, and a secondary colouring matter, which he calls *crocin*. (*Chem. News*, Jan. 3, 1868, p. 9.)

Adulterations. The high price of this medicine gives rise to frequent adulterations. Water is said to be very often added in order to increase its weight. Oil is also added for the same purpose, or to improve the appearance. Sometimes the flowers of other plants, particularly *Carthamus tinctorius* or safflower, *Calendula officinalis* or officinal marygold, and *arnica*, are fraudulently mixed with the genuine stigmas. They may be known by their shape, which is rendered obvious by throwing a portion of the suspected mass into hot water, which causes them to expand (See *Carthamus.*) A specimen of this adulteration has been introduced into the American market, by the name of *African saffron.* (Maisch, *Am. Journ. of Pharm.*, March, 1872, p. 110.) Other adulterations are the fibres of dried beef, the stamens of the Crocus distinguishable by their yellow colour, the stigmas previously exhausted in the preparation of the infusion or tincture, and various mineral substances easily detected upon close examination. The flowers of a Brazilian plant, named *Fuminella*, have, according to M. J. L. Soubeiran, been recently employed for the adulteration of saffron. They may be detected by shaking gently but repeatedly a large pinch of the suspected saffron over a piece of paper. The flowers of Fuminella being smaller and heavier, separate and fall, and may be seen to consist of very short fragments, with a colour like that of saffron, but a rusty tint which the latter does not possess. (*Journ. de Pharm.*, Avril, 1855, p. 267.) J. Müller recommends concentrated sulphuric acid as the most certain test of saffron. It instantly changes the colour of pure saffron to indigo blue. (*Chem. Gaz.*, May, 1845, p. 197.)

An article was, a few years since, introduced into the French market, so neatly adulterated as to escape ordinary observation. The added matter consisted of yellow-coloured chalk, made into a thin paste probably with honey, which was attached along the stigmas, sometimes isolated, sometimes in groups of five or six, enveloping them almost completely. If this saffron is kept in a dry place, and often handled, the paste becomes partly broken up, and the coloured powder spreads itself in the mass and the envelope. To separate the chalk, it is sufficient to put some saffron in a cup with water enough to cover it. In a few seconds, the powder detaches itself, and falls to the bottom of the vessel. After shaking frequently, remove the filaments, decant, and treat the precipitate with acetic or muriatic acid. Carbonic acid escapes with brisk effervescence. All that remains to be done, is to treat the calcareous solution with the ordinary tests for lime. A less than the ordinary brightness of colour in the saffron should lead to suspicion of this adulteration. It was estimated that 20 per cent. of the saffron examined was of foreign matter. (M. Amédée Blachez, *Journ. de Pharm.*, Avril, 1869, p. 291.)* About 12 per cent. of gypsum has been found in another instance of adulteration.

* The same adulteration has been noticed by Mr. Daniel Hanbury, who also makes the observation that it would be apt to escape attention. It was discovered by scattering a very small pinch on the surface of warm water; the heavy powder separating and falling to the bottom of the glass. He recommends this as one of the best methods of detecting ordinary adulteration, as with parts of other flowers, for example. The stigmas comprising the true saffron spread out and display their proper form, which can hardly be mistaken. For other observations on this adulteration the reader is referred to Mr. Hanbury's communication in the *Pharm. Journ.* (Sept. 24, 1870, p. 241).

A similar fraud was brought to light by Prof. Maisch, in some saffron imported into the U. States, by a short notice in the *American Journal of Pharmacy* (Sept. 1870, p. 390). The chalk fraud has also been noticed in saffron sold in Germany; so that the sophistication, though, from the skill employed, probably practised by some particular artist in some unknown locality, is so well done as to have deceived ordinary mercantile observation, and to have caused a wide diffusion of the spurious drug. (*Note to the fourteenth edition.*)

Attention has been called to a product of the Cape of Good Hope, named *Cape saffron*, which has a remarkable resemblance to genuine saffron, having a similar odour, and yielding a similar colour to water, though the flowers themselves are differently coloured. It is the flower of a small plant very abundant at the Cape, belonging to the family of *Scrophulariaceæ*, and is said by Dr. Pappé, of Cape Town, to possess medical virtues closely resembling those of the proper saffron. The flowers have been used successfully in the convulsions of children. (*Pharm. Journ. and Trans.*, N. S., vi. 462, A.D. 1865.)

Choice of Saffron. Saffron should not be very moist, nor very dry, nor easily pulverized; nor should it emit an offensive smell when thrown upon live coals. The freshest is the best, and that which is less than a year old should, if possible, be selected. It should possess in a high degree the characteristic properties of colour, taste, and smell. If it do not colour the fingers when rubbed between them, or if it have an oily feel, or a musty flavour, or a black, yellow, or whitish colour, it should be rejected. In the purchase of this medicine in cakes, those should be selected which are close, tough, and firm in tearing; and care should be taken to avoid *cakes of safflower*.

As its activity depends, partly at least, on a volatile ingredient, saffron should be kept in well-stopped vessels. Some recommend that it should be enclosed in a bladder, and introduced into a tin case.

Medical Properties and Uses. Saffron was formerly considered highly stimulant and antispasmodic. It has been alleged that, in small doses, it moderately excites the different functions, exhilarates the spirits, relieves pain, and produces sleep; in large doses, gives rise to headache, intoxication, delirium, stupor, and other alarming symptoms; and Shröder asserts that, in the quantity of two or three drachms, it proves fatal. It was thought also to act powerfully on the uterine system, promoting menstruation. The ancients employed it extensively, both as a medicine and condiment, under the name of *crocus*. It was also highly esteemed by the Arabians, and enjoyed considerable reputation among the physicians of modern Europe, till within a comparatively recent period. On the continent it is still much used as a stimulant and emmenagogue. But the experiments of Dr. Alexander have proved it to possess little activity; and in Great Britain and the United States it is seldom prescribed. In domestic practice saffron tea is occasionally used in exanthematous diseases, to promote the eruption. At present the chief use of the drug is to impart colour and flavour to officinal tinctures. The dose is from ten to thirty grains.*

Off. Prep. Decoctum Aloës Compositum, *Br.;* Pilulæ Aloës et Myrrhæ, *Br.;* Pulvis Cretæ Aromaticus, *Br.;* Tinct. Cinchonæ Comp., *Br.;* Tinct. Croci, *Br.;* Tinct. Opii Ammoniata, *Br.;* Tinct. Rhei, *Br.* W.

CUBEBA. *U.S., Br.*

Cubeb.

The unripe fruit of Cubeba officinalis (*Miquel*), Piper Cubeba (*Linn.*). *U.S.* The dried unripe fruit of Cubeba officinalis. *Br.*

Cubebs, *Br.;* Cubebe, *Fr.;* Kubeben, *Germ.;* Cubebe, *Ital.;* Cubebas, *Span.;* Kebabeh, *Arab.*

PIPER. *Sex. Syst.* Diandria Trigynia.—*Nat. Ord.* Piperaceæ.

Gen. Ch. Calyx none. *Corolla* none. *Berry* one-seeded. *Willd.*

Piper Cubeba. Willd. *Sp. Plant.* i. 159; Woodv. *Med. Bot.*, 3d ed., v. 95.—*Cubeba officinalis. Miquel.* This is a climbing perennial plant, with a smooth, flexuous, jointed stem, and entire, petiolate, oblong or ovate-oblong, acuminate leaves, rounded or obliquely cordate at the base, strongly nerved, coriaceous, and very smooth.

* *Syrupus Croci.* A *Syrup of Saffron* is sometimes called for, and would seem to be an appropriate preparation. The following formula is recommended by Mr. Geo. W. Kennedy, of Pottsville, as producing excellent results. Take of saffron ℥ss, glycerin ℥ij, water ℥vi. Macerate for a week, filter into a pint bottle, and add sufficient water through the filter to make ℥viij; then add 14 avoird. oz. of sugar, and dissolve without heat, frequently shaking. (*Am. Journ. of Pharm.*, Feb. 1871, p. 54.)—*Note to the fourteenth edition.*

The flowers are diœcious and in spikes, with peduncles about as long as the petioles. The fruit is a globose, pedicelled berry.

This species of Piper is a native of Java, Penang, and probably other parts of the East Indies. It grows wild in the woods, and does not appear to be cultivated. The dried unripe fruit is the officinal portion. Dr. Blume thinks it probable that the drug is derived chiefly from another species, the *P. caninum*, inhabiting the same countries; but Dr. Lindley could discover no difference between the fruit of *P. Cubeba* and ordinary cubebs.*

Properties. Cubebs are round, about the size of a small pea, of a blackish or grayish-brown colour, and furnished with a short stalk, which is continuous with raised veins that run over the surface of the berry, and embrace it like a net-work. The shell is hard, almost ligneous, and contains within it a single loose seed, covered with a blackish coat, and internally white and oleaginous. The odour of the berry is agreeably aromatic; the taste warm, bitterish, and camphorous, leaving in the mouth a peculiar sensation of coolness, like that produced by oil of peppermint. The powder is dark-coloured and of an oily aspect. From 1000 parts of cubebs M. Monheim obtained 30 parts of a ceruminous substance, 25 of a green volatile oil, 10 of a yellow volatile oil, 45 of cubebin, 15 of a balsamic resin, 10 of chloride of sodium, 60 of extractive, and 650 of lignin, with 155 parts lost. Vauquelin found two resins, the *hard* and the *soft*, the former of which is left behind when cubebs are treated with ether, the latter is dissolved by that liquid, and yielded upon the separation of the volatile oil. It is green, liquid, acrid, and analogous in smell and taste to copaiba. From the experiments of Bernatzike, made in 1863, it appears that this soft resin is possessed of acid properties; and it is therefore called by him *cubebic acid*. Like copaivic acid, though itself amorphous, it forms crystallizable salts with baryta. (*Lehrb. der Pharmak. des Pflanzenreiches.*) By practical trial Bernatzike has satisfied himself that the peculiar virtues of cubebs, as a remedy in gonorrhœa, depend not on the cubebin or the volatile oil, but on the cubebic acid. (See *Am. Journ. of Med. Sci.*, Oct. 1867, p. 534.) According to MM. Capitaine and Soubeiran, *cubebin* is best obtained by expressing cubebs from which the oil has been distilled, preparing with them an alcoholic extract, treating this with a solution of potassa, washing the residue with water, and purifying it by repeated crystallizations in alcohol. Thus prepared, it is white, inodorous, and insipid, not volatilizable by heat, almost insoluble in water, slightly soluble in cold alcohol, freely so in that liquid when hot, and soluble also in ether, acetic acid, and the fixed and volatile oils. It bears a close resemblance to piperin, but materially differs from it in composition, as it contains no nitrogen. (*Journ. de Pharm.*, xxv. 355.) In the officinal oleoresin

* Cubebs were exhibited, at the great London Exhibition of 1862, among the products of Ceylon. It was at one time supposed that cubebs were also produced in Western Africa; but this was a mistake, originating probably in the fact, that a peculiar pepper growing in that region has, like cubebs, the stalk attached. It is, however, a different product, being, as shown by Dr. W. F. Daniell, the fruit of a distinct species, the *Piper Afzelii* of Lindley, *Cubeba Clusii* of Miquel, figured in the *Pharm. Journ.* (xiv. 201). This *Guinea pepper*, or *African black pepper*, was formerly taken to Europe in considerable quantities by the Portuguese, but has been superseded by the more agreeable products of the E. Indies. The fruit is one-third smaller than the officinal cubebs, is more compact, and has a taste more analogous to that of ordinary black pepper. Dr. Stenhouse has also shown that it is chemically more analogous to black pepper than to cubebs, as it contains piperin and not cubebin. (*Ibid.*, xiv. 364.)

Under the name of cubebs, a product has been introduced into commerce from the Dutch E. Indies, which is probably the fruit of a different species of Piper, as it differs essentially from genuine cubebs, being somewhat larger, with less distinct veins and somewhat flattened footstalks, of a less agreeable odour, and a less hot and pungent taste. It has been ascribed to *Piper anisatum*. (See *Am. Journ. of Pharm.*, xxxv. 511; from *Journ. de Chim. Med.*)—*Note to the eleventh and twelfth editions.*

African Cubebs. From French Africa, a variety of cubebs is said to have been received in France, which it is thought might replace the Indian, as it has similar properties. It is only about half as large as the common, and has long footstalks attached. Its composition is said to be nearly the same. (*Ann. de Thérap.*, 1866, p. 88.) It is possibly the same as that described in the preceding note as the product of P. Afzelii. A product with the name of African cubebs has recently been sent to London, from Cape Coast Castle, in Africa, which, however, has no botanical relation to Cubeba, nor to the fruit of any other Piperacea; the plant producing it belonging to the *Xanthoxylaceæ*, and is probably either a *Toddalia* or *Vepris*. According to Prof. Archer, it is simply aromatic and stimulant, without any of the special virtues of cubebs. (*Pharm. Journ. & Trans.*, March, 1865, p. 463.)—*Note to the thirteenth edition.*

of cubebs a deposit takes place consisting chiefly of cubebin, which may be obtained by washing the deposit with a small quantity of cold alcohol to remove adhering resin and oil, and then dissolving repeatedly in boiling alcohol, and crystallizing until the product is white. The volatile oil is officinal. (See *Oleum Cubebæ.*) When the ethereal extract of cubebs is deprived of its volatile oil by evaporation on a water-bath, and of cubebin and wax by deposition, a soft resin is left, the cubebic acid of Bernatzike, in which, according to Mr. F. V. Heydenreich, who experimented with it as a physiological agent, the diuretic properties reside; the cubebin being without apparent effect, and the volatile oil, though stimulant and carminative, having no diuretic action. The soft resin, which was of the consistence of honey, of a dark olive-green colour, and some remaining odour of cubebs, when taken in the dose of 10 grains every two hours, for six hours, acted as a laxative, and gave the urine a peculiar odour, without increasing its quantity; but in the dose of a drachm, once repeated at an interval of three hours, while it produced the same effects as the smaller dose, considerably augmented the urine. In still larger doses it produced decided irritation of the urinary passages. (*Am. Journ. of Pharm.*, Jan. 1868.) Mr. Heydenreich's experiments are confirmatory of Bernatzike's conclusion as to the peculiar active principles of cubebs. Cubebs gradually deteriorate by age, and in powder become rapidly weaker, in consequence of the escape of their volatile oil. They should be kept whole, and pulverized when dispensed. The powder is said to be sometimes adulterated with that of pimento.

Medical Properties and Uses. Cubebs are gently stimulant, with a special direction to the urinary organs. In considerable quantities they excite the circulation, increase the heat of the body, and sometimes occasion headache and giddiness. At the same time they frequently produce an augmented flow of the urine, to which they impart a peculiar odour. Among their effects are also occasionally nausea and moderate purging; and they are said to cause a sense of coolness in the rectum during the passage of the feces. We have no evidence that they were known to the ancients. They were probably first brought into Europe by the Arabians, and were formerly employed for similar purposes with black pepper; but they were found much less powerful and fell into disuse. Some years since they were again brought into notice in England as a remedy in gonorrhœa. This application of cubebs was derived from India, where they have long been used in gonorrhœa and gleet, and as a grateful stomachic and carminative in disorders of the digestive organs. They are said to have sometimes produced swelled testicles when given in gonorrhœa; and, though recommended in all its stages, will probably be found most safe and effectual in cases where the inflammation is confined to the mucous membrane of the urethra. If not speedily useful they should be discontinued. They have been given also in leucorrhœa, cystirrhœa, the urethritis of women and female children, abscess of the prostate gland, piles, chronic bronchial inflammation, and, with great asserted advantage, in connection with copaiba, in pseudomembranous croup, and diphtheric affections of the fauces. In connection with copaiba they have been especially recommended in affections of the neck of the bladder and the prostatic portion of the urethra. They have also been found very effectual in tympanites. They are best administered in powder, of which the dose in gonorrhœa is from one to three drachms three or four times a day. For other affections, the dose is sometimes reduced to ten grains. The volatile oil may be substituted, in the dose of ten or twelve drops, suspended in water by means of sugar; though, if the experiments of Bernatzike and Heydenreich are to be relied on, the oil is much less efficient than the soft resin as a remedy in gonorrhœa, and diseases of the urinary passages generally. An ethereal extract is directed by the U. S. Pharmacopœia, and considerably used; and, as it contains the soft resin or cubebic acid, it is no doubt a very efficient preparation. (See *Oleoresina Cubebæ.*) An infusion, made in the proportion of an ounce of cubebs to a pint of water, has been employed as an injection in discharges from the vagina, with asserted advantage.

Off. Prep. Oleoresina Cubebæ, *U. S.;* Oleum Cubebæ; Tinctura Cubebæ.

W.

CUPRUM. *U. S., Br.*

Copper.

Copper wire. *U. S.* Fine Copper wire, about No. 25. *Br.*

Cuivre, *Fr.;* Kupfer, *Germ.;* Rame, *Ital.;* Cobre, *Span.*

This metal is very generally diffused in nature, and exists principally in four states; as native copper, as an oxide, as a sulphuret, and as a salt. Its principal native salts are the sulphate, carbonate, arseniate, and phosphate. In the United States it occurs in various localities, but especially in the neighbourhood of Lake Superior. The principal copper mines of Europe are those of the Pyrenees in France, Cornwall in England, and Fahlun in Sweden.

Properties. Copper is a brilliant, sonorous metal, of a reddish colour, and very ductile, malleable, and tenacious. It has a slightly nauseous taste, and emits a disagreeable smell when rubbed. Its texture is granular, and its fracture hackly. Its sp. gr. is 8·89, and its fusing point 1996°, according to Daniell, being intermediate between the fusing points of silver and gold. Its equivalent number is 31·75. Exposed to the air it undergoes a slight tarnish. Its combinations are numerous and important. With oxygen it forms two well characterized oxides, a red suboxide or dioxide, consisting of two eqs. of copper and one of oxygen, and a black protoxide formed of one eq. of metal and one of oxygen. The latter oxide, which alone is salifiable, forms with acids several salts, important in medicine and the arts. With metals, copper forms numerous alloys, of which that with zinc, called brass, is the most useful.

Characteristics. Copper is recognised by its colour, and the effects of tests on its nitric solution. This solution, with potassa, soda, and ammonia, yields a blue precipitate, soluble in excess of the latter alkali, with which it forms a deep-blue liquid. Ferrocyanide of potassium occasions a brown precipitate of ferrocyanide of copper; and a bright plate of iron, immersed in the solution, immediately becomes covered with a film of metallic copper. The ferrocyanide of potassium is a very delicate test for minute portions of copper in solution. Another test, proposed by M. Verguin, is to precipitate the copper in the metallic state on platinum by electro-chemical action. For this purpose a drop of the liquid to be examined is placed on a slip of platinum foil, and a slip of bright iron is brought in contact with the platinum and the liquid. If copper be present it will be instantly precipitated on the surface of the platinum.

Action on the Animal Economy. Copper, in its pure state, is perfectly inert, but in combination it is highly deleterious. Nevertheless a minute portion of the metal has been found in the human body. According to Millon, copper, when it exists in the blood, is, like the iron, attached to the red corpuscles. To bring the copper into a state favourable for ready detection, he advises that the blood, as it escapes from a vein, be received in about three times its bulk of water, and the mixture poured into a bottle of chlorine and agitated. The whole, upon being rapidly filtered, furnishes a liquid in which copper is readily detected. Wackenroder found copper in the blood of man, but does not consider it a constant and normal constituent. He also detected this metal in the blood of domestic animals living on a mixed diet, but not in their blood when nourished on vegetable food only. (*Chem. Gaz.*, May 1, 1854.) It has been found in the feathers of certain birds, as of a grass-green paroquet from Australia, which is said to frequent districts of the country where copper is found. (*Ibid.*, Oct. 24, 1873, p. 212.) The combinations of copper, when taken in poisonous doses, produce a coppery taste in the mouth; nausea and vomiting; violent pain in the stomach and bowels; frequent black and bloody stools; small, irregular, sharp, and frequent pulse; faintings; burning thirst; difficulty of breathing; cold sweats; paucity of urine, and burning pain in voiding it; violent headache; cramps, convulsions, and finally death. The best antidote, according to Dr. Schrader, of Göttingen, is the ferrocyanide of potassium, given freely, which forms, with the poison, the very insoluble ferrocyanide of copper. Before the antidote can be procured, large quantities should be given of milk, and white of eggs mixed with water,

which act favourably by forming the caseate and albuminate of copper; but these compounds should be evacuated as soon as possible by vomiting and purging. Should vomiting not take place, the stomach-pump may be employed. Magnesia was proposed as an antidote by M. Roucher; but Dr. Schrader says it is not to be depended on (*Med. Times and Gaz.*, May, 1855.) The symptoms of slow poisoning by copper are, according to Dr. Corrigan, of Dublin, a cachectic appearance, emaciation, loss of muscular strength, colicky pains, cough without physical signs, and retraction of the gum, with a persistent purple edge, quite distinct from the blue edge produced by lead. (*Braithwaite's Retrospect*, Am. ed., xxx. 303.)

Dr. Horsley has detected sulphate of copper in bread and flour used in London, and presumes that it was added with the view of improving the appearance of the flour. (*Chem. News*, No. 63, p. 111, and No. 65, p. 142.)

In medico-legal examinations, where cupreous poisoning is suspected, Orfila recommends that the viscera be boiled in distilled water for an hour, and that the matter obtained by evaporating the filtered decoction to dryness be carbonized by nitric acid. The carbonized product will contain the copper. By proceeding in this way, there is no risk of obtaining the copper which may happen to pre-exist in the animal tissues. This method of search is preferable to that of examining the contents of the stomach and intestines, from which copper may be absent; while it may have penetrated the different organs by absorption, especially the abdominal viscera.

Vessels of copper should be discontinued in all operations connected with pharmacy and domestic economy; for, although the metal uncombined is inert, yet the risk is great that the vessels may be acted on; in which event, whatever may be contained in them would be rendered deleterious.

The U. S. and Br. Pharmacopœias use copper in preparing Spiritus Ætheris Nitrosi.

The following is a list of the preparations containing copper in the two Pharmacopœias.

Cupri Subacetas, *U. S.*—*Subacetate of Copper.*
Cupri Sulphas, *U. S., Br.*—*Sulphate of Copper. Blue Vitriol.*
Cuprum Ammoniatum, *U. S.*—*Ammoniated Copper.* B.

CUPRI SUBACETAS. *U. S.*

Subacetate of Copper.

Impure subacetate of Copper. *U. S.*

Verdigris; Ærugo, *Lat.;* Acetate de cuivre brut, Vert-de-gris, *Fr.;* Grünspan, *Germ.;* Verde rame, *Ital.;* Cardenillo, *Span.*

Preparation. Verdigris is prepared in large quantities in the south of France, more particularly in the neighbourhood of Montpellier. It is also manufactured in Great Britain and Sweden. In France the process is conducted in the following manner. Sheets of copper are stratified with the residue of the grape after the expression of the juice in making wine, and are allowed to remain in this state for a month or six weeks. At the end of this time the plates are found coated with a considerable quantity of verdigris. This is scraped off, and the plates are then replaced as at first, to be further acted on. The scrapings thus obtained form a paste, which is afterwards well beaten with wooden mallets, and packed in oblong leathern sacks, about ten inches in length by eight in breadth, in which it is dried in the sun, until the loaf of verdigris, as it is called, attains the proper degree of hardness. The rationale of the process is easily understood. The grape-refuse contains a considerable quantity of juice, which, by contact with the air, undergoes the acetous fermentation. The copper becomes oxidized, and the resulting oxide, by combination with the acetic acid generated during the fermentation, forms the subacetate of copper, or verdigris. In England a purer verdigris is prepared by alternating copper plates with pieces of woollen cloth, steeped in pyroligneous acid.

Verdigris comes to this country exclusively from France, being imported principally from Bordeaux and Marseilles. The leathern packages in which it is put up, called sacks of verdigris, weigh generally from twenty-five to thirty pounds, and arrive in casks, each containing from thirty to forty sacks.

Properties. Verdigris is in masses of a pale-green colour, and composed of a multitude of minute silky crystals. Sometimes, however, it occurs of a bright-blue colour. Its taste is coppery. It is insoluble in alcohol, and, by the action of water, a portion of it is resolved into the neutral acetate which dissolves, and the trisacetate which remains behind in the form of a dark-green powder, gradually becoming black. It is hence evident that, when verdigris is prepared by levigation with water, it is altered in its nature. The neutral acetate is the crystallized acetate of copper, or *Crystals of Venus.* (See *Part Third.*) When verdigris is acted on by sulphuric acid, it is decomposed, vapours of acetic acid being evolved, easily recognised by their vinegar odour. It is soluble almost entirely in ammonia, and dissolves in muriatic and dilute sulphuric acid, with the exception of impurities, which should not exceed 5 per cent. When of good quality, it has a lively green colour, is free from black or white spots, and is dry and difficult to break. The green rust, called in popular language verdigris, which copper vessels are apt to contract when not kept clean, is a carbonate of copper, and should not be confounded with true verdigris.

Composition. Verdigris, apart from its impurities, is a variable mixture of the subacetates of copper; the basic sesquiacetate predominating in the green variety, the diacetate in the blue. When acted on by water, two eqs. of the portion consisting of diacetate are converted into one eq. of soluble neutral acetate, and one of insoluble trisacetate.

Medical Properties. Verdigris is used externally as a detergent and escharotic, and is occasionally applied to chronic eruptions, foul and indolent ulcers, and venereal warts. For its effects as a poison, see *Cuprum.** B.

CUPRI SULPHAS. *U.S., Br.*

Sulphate of Copper.

"$CuO,SO_3 + 5HO$. May be obtained by heating sulphuric acid and copper together, dissolving the soluble product in hot water, and evaporating the solution until crystallization takes place on cooling." *Br.*

Blue vitriol, Roman vitriol, Blue stone; Sulfate de cuivre, Vitriol bleu, Couperose blue, *Fr.;* Schwefelsaures Kupfer, Kupfervitriol, Blauervitriol, Blauer Galitzenstein, *Germ.;* Rame solfato, Vitriolo di rame, *Ital.;* Sulfato de cobre, Vitriolo azul, *Span.*

Preparation, &c. Sulphate of copper occasionally exists in nature, in solution in the water which flows through copper mines. In this case the salt is procured by merely evaporating the waters which naturally contain it. Another method for obtaining it is to roast the native sulphuret in a reverberatory furnace, whereby it is made to pass, by absorbing oxygen, into the state of sulphate. The roasted mass is lixiviated, and the solution obtained evaporated that crystals may form. The salt procured by either of these methods, contains a little tersulphate of the sesquioxide of iron, from which it may be freed by adding either an excess of protoxide of copper, which precipitates the sesquioxide of iron, or recently precipitated subcarbonate of copper, which causes the deposition of the iron as a carbonate. (*Am. Journ. of*

* *Linimentum Æruginis.* This is a very old preparation, formerly recognised as officinal in Great Britain, though abandoned in the British Pharmacopœia. The following is the process for it given in the late *London* Pharmacopœia. "Take of Verdigris (Subacetate of Copper), in powder, *an ounce;* Vinegar *seven fluidounces;* Honey *fourteen ounces.* Dissolve the Verdigris in the Vinegar, and strain through linen; then gradually add the Honey, and boil down to a proper consistence." The ounces used here are Troyounces. It sometimes happens during the boiling of the acetic solution of the verdigris, that a red deposit rapidly forms, consisting of the red or suboxide of copper; and that, at the end of the process, little or none of the metallic salt remains in the preparation. This happens especially when granular honey is employed. (Harley, *Pharm. Journ. and Trans.*, xi. 357.) The change is owing to the decomposition of the protoxide of copper by the grape sugar of the honey, converting it into the suboxide. The inference is that, in making the preparation, so as to fulfil the objects of the original prescription, fresh liquid honey should be used, which contains comparatively little glucose.

This is an external stimulant and escharotic, and was formerly called *Mel Ægyptiacum.* It is employed, either undiluted, or mixed with some mild ointment, to destroy fungous granulations, or to repress their growth. In the latter state, it is a useful stimulant to flabby, indolent, and ill-conditioned ulcers; and, largely diluted with water, it has been used as a gargle in venereal ulcerations of the mouth and throat. It is sometimes also applied undiluted to such ulcers in the fauces, by means of a camel's-hair brush. (*Note to the thirteenth edition.*)

Pharm., xxxiv. 507.) A third method consists in wetting, and then sprinkling with sulphur, sheets of copper, which are next heated to redness, and while hot plunged into water. The same operation is repeated until the sheets are entirely corroded. At first a sulphuret of the metal is formed, which, by the action of heat and air, gradually passes into the state of sulphate of the oxide. This is dissolved by the water, and obtained in crystals by evaporation. A fourth method is to dissolve copper scales to saturation in sulphuric acid, contained in a wooden vessel, lined with sheet lead. The scales consist of metallic copper, mixed with oxide, and are produced in the process for annealing sheet copper.

Sometimes sulphate of copper is obtained in pursuing one of the methods for separating silver from gold. The silver is dissolved by boiling the alloy in sulphuric acid. The sulphate of silver formed is then decomposed by the immersion of copper plates in its solution, with the effect of forming sulphate of copper and precipitating the silver.

In the *U. S. Pharmacopœia*, sulphate of copper is presumed to be obtained pure from the manufacturer; the *British* suggests the method in which it may be prepared, without entering into the details of the process.

Properties. Sulphate of copper has a rich deep-blue colour, and strong metallic styptic taste. It reddens vegetable blues, and crystallizes in large, transparent, rhomboidal prisms, which effloresce slightly in the air, and are soluble in four parts of cold, and two of boiling water, but insoluble in alcohol. When heated it first melts in its water of crystallization, and then dries and becomes white. If the heat is increased, it next undergoes the igneous fusion, and finally, at a high temperature, loses its acid, protoxide of copper being left. Potassa, soda, and ammonia throw down from it a bluish-white precipitate of hydrated protoxide of copper, which is immediately dissolved by an excess of the last-mentioned alkali, forming a rich deep-blue solution, called *aqua saphirina*. It is decomposed by the alkaline carbonates, and by borax, acetate and subacetate of lead, acetate of iron, nitrate of silver, corrosive chloride of mercury, tartrate of potassium, and chloride of calcium; and it is precipitated by all astringent vegetable infusions. If it becomes very green on the surface by the action of the air, it contains sesquioxide of iron. This oxide may also be detected by ammonia, which will throw it down along with the oxide of copper, without taking it up when added in excess. When sulphate of copper is obtained from the dipping liquid of manufacturers of brass or German silver ware, it is always contaminated with sulphate of zinc, as pointed out by Mr. S. Piesse. This liquid is at first a mixture of sulphuric and nitric acids, but becomes, at last, nearly saturated with copper. When zinc is present in sulphate of copper, it will be taken up by solution of potassa, added in excess, from which it may be thrown down, in white flocks, by a solution of bicarbonated alkali.

Sulphate of copper consists of one eq. of sulphuric acid 40, one of protoxide of copper 39·75, and five of water 45 = 124·75.

Medical Properties. Sulphate of copper, in small doses, is astringent and tonic; in large ones a prompt emetic. With a view to its tonic effect, it has been given in intermittent fever, as well as in epilepsy and other spasmodic diseases; and as an emetic, for discharging poisons from the stomach, especially opium. In croup it has been employed as an emetic with encouraging success. M. Hönerkopf, a German practitioner, speaks warmly of his success with it in this disease. He uses the salt freely, especially in severe cases, in which great insensibility of the stomach is usually manifested. Out of ninety cases, half of which he estimates to have been pseudomembranous croup, he reports the cure of seventy-seven. (*Journ. de Pharm.*, Oct. 1855.) Sulphate of copper has also been highly recommended in chronic diarrhœa, and is said to have been very successfully used in cholera.* Externally it is

* M. Lisle, of Marseilles, having been induced by representations from M. Burq as to the extraordinary efficiency of *acetate of copper* in cholera, gave the *sulphate* a trial in that disease, with very satisfactory results. Of a solution of 5 parts of sulphate of copper in 100 parts of water, he added 1·5 grammes to 10 drops of Sydenham's laudanum and 150 grammes of sweetened water, and of this potion gave, as near the commencement of the attack as possible, a teaspoonful every 15 minutes in the severest cases, a dessertspoonful every half hour in the cases of mean severity, and the same quantity every hour in the lighter cases. With these doses he continued till the skin and

employed in solution as a stimulant to ill-conditioned ulcers, as an escharotic for destroying warts, fungous granulations, and callous edges, and as a styptic to bleeding surfaces. It is found, in not a few instances, to promote the cicatrization of ulcers, and is not unfrequently employed, with that view, as a wash for chancres. In weak solution, either alone or associated with other substances, it forms a useful collyrium in the chronic stages of some forms of ophthalmia. Eight grains of it, with an equal weight of Armenian bole, and two grains of camphor, added to half a pint of boiling water, form, after becoming limpid by rest, a collyrium strongly recommended by Mr. Ware in the purulent ophthalmia of infants. The preparation called *cuprum aluminatum* (*lapis divinus—pierre divine*) is made, according to the French Codex, by mixing, in powder, three ounces, each, of sulphate of copper, nitrate of potassium, and alum, heating the mixture in a crucible, so as to produce watery fusion, then mixing in a drachm of powdered camphor, and, finally, pouring out the whole on an oiled stone to congeal. The mass, when cold, is broken into pieces, and kept in a well-stopped bottle. When this preparation is used as a collyrium, a filtered solution is made of the average strength of thirty grains to the pint of water. It is employed in various affections of the eyes, in which astringent applications are admissible. It is often desirable to employ sulphate of copper, as a caustic, in the form of pencil. Its tendency to effloresce interferes with its use in this way in the pure state. M. Llovet recommends for the purpose a mixture of one part of potassa-alum and two of sulphate of copper, which are to be first powdered, and then gradually melted together in a porcelain vessel, and poured into moulds made of bronze. (*Gaz. des Hôp.*, Juillet 28, 1863.) Another mode of preparing pencils of sulphate of copper is to rub briskly together four parts of that salt and one of borax, and to mould the plastic mass which results into the desired form. (*Am. Journ. of Pharm.*, March, 1864, p. 106.) A remarkable case, in an old man, of what was considered as ichthyosis, occupying the cartilaginous parts of the nose, and extending down the cheeks, after resisting for a long time all remedies, both local and constitutional, yielded speedily to an ointment of sulphate of copper directed by Dr. E. Dermesnil, made in the proportion of four parts of the sulphate to thirty parts of benzinated ointment, so applied as to keep the affected part constantly covered with it. The scales fell completely in ten or twelve days, and in the end a complete cure was effected. (*Ann. de Thérap.*, 1873, p. 202.)

The dose of sulphate of copper, as an astringent or tonic, is a quarter of a grain, gradually increased; as an emetic, from two to five grains. As a stimulant wash, the solution may be made of the strength of two, four, or eight grains to the fluidounce of water. Orfila cautions against giving large doses of this salt as an emetic in cases of poisoning; as it is apt, from its poisonous effects, to increase the mischief when not expelled by vomiting. Upon the whole, such is the activity of sulphate of copper, that it should always be exhibited with caution. For its effects as a poison, see *Cuprum*.

Off. Prep. Cuprum Ammoniatum, *U. S.* B.

CURCUMA. *U. S. Secondary.*

Turmeric.

The rhizome of Curcuma longa. *U. S.*

Safran des Indes, *Fr.*; Kurkuma, Gelbwurz, *Germ.*; Curcuma, *Ital., Span.*, Zirsood, *Arab.*; Huldie, *Hindoo*.

CURCUMA. *Sex. Syst.* Monandria Monogynia.—*Nat. Ord.* Zingiberaceæ.

Gen. Ch. Both limbs of the corolla three-partite. *Anther* with two spurs at the base. *Seeds* with an arillus. *Loudon's Encyc.*

Curcuma longa. Willd. *Sp. Plant.* i. 14; Woodv. *Med. Bot.* p. 737, t. 252. The root of this plant is perennial, tuberous, palmate, and internally of a deep-yellow or

tongue began to become warm, and the pulse a little raised, when he repeated the dose only every 3 or 5 hours, ceasing altogether when the algid period had passed. Of 68 cases under his notice, 36 were treated in the ordinary mode, and of these 28 proved fatal; while of 31 treated with sulphate of copper only 7 died. (*Ann. de Thérap.*, 1866, p. 271.)—*Note to the thirteenth edition.*

orange colour. The leaves are radical, large, lanceolate, obliquely nerved, sheathing at their base, and closely embrace each other. The scape or flower-stem, which rises from the midst of the leaves, is short, thick, smooth, and constitutes a spike of numerous imbricated bracteal scales, between which the flowers successively make their appearance. The plant is a native of the East Indies and Cochin-China, and is cultivated in various parts of southern Asia, particularly in China, Bengal, and Java, whence the root is exported. The best is said to come from China.

The dried root is in cylindrical or oblong pieces, about as thick but not as long as the finger, tuberculated, somewhat contorted, externally yellowish-brown or greenish-yellow, internally deep orange-yellow, hard, compact, breaking with a fracture like that of wax, and yielding a yellow or orange-yellow powder. Another variety, comparatively rare, is round or oval, about the size of a pigeon's egg, and marked externally with numerous annular wrinkles. Sometimes it comes cut into two transverse segments. It is distinguished by the name of *curcuma rotunda*, the former being called *curcuma longa*. The two varieties have a close resemblance in sensible properties, and are thought to be derived from the same plant, though formerly ascribed to different species of Curcuma. The odour of turmeric is peculiar; the taste warm, bitterish, and feebly aromatic. It tinges the saliva yellow. Analyzed by Pelletier and Vogel, it was found to contain lignin, starch, a peculiar yellow colouring matter called *curcumin*, a brown colouring matter, gum, an odorous and very acrid volatile oil, and a small quantity of chloride of calcium. Curcumin is obtained, mixed with a little volatile oil, by digesting the alcoholic extract of turmeric in ether, and evaporating the ethereal tincture. It may be procured perfectly pure by separating it from its combination with oxide of lead. M. Lepage procures it by exhausting turmeric with sulphuret of carbon, which does not dissolve curcumin, drying the residue, and treating it with 8 times its weight of distilled water, containing 2 or 3 per cent. of caustic potassa or soda, then filtering, and precipitating with a slight excess of dilute muriatic acid, which takes the alkali, and throws down the curcumin. To obtain it quite pure, the precipitate is washed, dried, and treated with ether, which dissolves only the curcumin, and yields it by spontaneous evaporation. (*Rev. Pharmaceut.*, A.D. 1857, p. 8.)* It is brown in mass, but yellow in the state of powder, without odour or taste, insoluble in benzine, scarcely soluble in water, but very soluble in alcohol, ether, and the oils. The alkalies rapidly change its colour to a reddish-brown; and paper tinged with tincture of turmeric is employed as a test of their presence. Berzelius, however, states that its colour is changed to red or brownish-red by the concentrated mineral acids, by pure boracic acid, especially when dissolved in alcohol, and by numerous metallic salts; so that its indications cannot be certainly relied on. Its alcoholic solution produces coloured precipitates with acetate of lead, nitrate of silver, and other salts. Turmeric is used for dyeing yellow; but the colour is not permanent.† Mr. James Cook has found in turmeric an alkaloid altogether independent of the colouring principle, which forms crystallizable salts with sulphuric and nitric acids, and, separated from these acids by ammonia, yields a semi-crystalline precipitate. He observed also indications of a second base; but further particulars in relation to the subject are wanted. (*Pharm. Journ.*, Nov. 1870, p. 415.)

Medical Properties, &c. This root is a stimulant aromatic, bearing some resemblance to ginger in its operation, and is much used in India as a condiment. It is a constant ingredient in the curries so generally employed in the East. In former times it had some reputation in Europe as a remedy in jaundice and other visceral diseases; but at present it is employed only to impart colour to ointments and other pharmaceutic preparations.

* Curcumin has been obtained, by F. A. Daube, in deep yellow crystals, of a diamond lustre, by a process which may be found in the *Am. Journ. of Pharm.* (July, 1871, p. 308), from the *Proceedings of the Chemical Society of Berlin*, 1870, p. 609. (*Note to the fourteenth edition.*)

† *African Turmeric.* Dr. Wm. F. Daniell has brought into notice a product, much used by the native Africans of Sierra Leone in dyeing, consisting of rhizomes, closely resembling the E. Indian turmeric, having a similar odour and taste, and in like manner tinging the saliva yellow, and imparting their colouring matter readily to alcohol and water. He found it to be derived from a species of Canna, supposed to be the *C. speciosa* of Roscoe. (*Pharm. Journ.*, Nov. 1859, p. 258.)—*Note to the twelfth edition.*

Turmeric paper, used as a test, is prepared by tinging white unsized paper with a tincture or decoction of turmeric. The tincture may be made with one part of turmeric to six parts of proof spirit; the decoction, with one part of the root to ten or twelve of water. The access of acid or alkaline vapours should be carefully avoided. W.

CYDONIUM. *U. S. Secondary.*

Quince Seed.

The seed of Cydonia vulgaris (Persoon, *Enchir.* ii. 40.). *U. S.*

Semences de coings, *Fr.;* Quittenkerne, *Germ.;* Semi di cotogno, *Ital.;* Semiente de membrillo, *Span.*

The quince-tree has been separated from the genus *Pyrus*, and erected into a new one called *Cydonia*, which differs in the circumstance that the cells of its fruit contain many seeds, instead of two only as in Pyrus.

Cydonia. *Sex. Syst.* Icosandria Pentagynia.—*Nat. Ord.* Pomaceæ.

Gen. Ch. Calyx five-parted, with leafy divisions. *Apple* closed, many-seeded. *Testa* mucilaginous. *Loudon's Encyc.*

Cydonia vulgaris. Persoon, *Enchir.* ii. 40.—*Pyrus Cydonia.* Willd. *Sp. Plant.* ii. 1020; Woodv. *Med. Bot.* p. 505, t. 182. The common quince-tree is characterized as a species by its downy deciduous leaves. It is supposed to be a native of Crete, but grows wild in Austria, on the banks of the Danube. It is abundantly cultivated in this country. The fruit is about the size of a pear, yellow, downy, of an agreeable odour, and a rough, astringent, acidulous taste; and in each of its five cells contains from eight to fourteen seeds. Though not eaten raw, it forms a very pleasant confection; and a syrup prepared from it may be used as a grateful addition to drinks in sickness, especially in looseness of the bowels, which it is supposed to restrain by its astringency. The seeds are the officinal portion.

They are ovate, angled, reddish-brown externally, white within, inodorous, and nearly insipid, being slightly bitter when long chewed. Their coriaseous envelope abounds in mucilage, which is extracted by boiling water. Two drachms of the seeds will render a pint of water thick and ropy. It has been proposed to evaporate the decoction to dryness, and powder the residue. Three grains of this powder form a sufficiently consistent mucilage with an ounce of water. According to M. Garot, one part communicates to a thousand parts of water a semi-syrupy consistence. (*Journ. de Pharm.*, 3e sér., iii. 298.) Dr. Pereira considers the mucilage as peculiar, and proposes to call it *cydonin*. It differs from arabin in not yielding a precipitate with silicate of potassium, and from bassorin and cerasin, in being soluble in water both hot and cold.

Medical Properties, &c. The mucilage of quince seeds may be used for the same purposes as other mucilaginous liquids. It is preferred by some practitioners as a local application in conjunctival ophthalmia, but in this country is less used for that purpose than the infusion of sassafras pith. W.

CYPRIPEDIUM. *U. S. Secondary.*

Cypripedium.

The root of Cypripedium pubescens, and of Cypripedium parviflorum. *U. S.*

Cypripedium. *Sex. Syst.* Gynandria Diandria.—*Nat. Ord.* Orchidaceæ.

Gen. Ch. Sepals spreading; the two anterior generally united into one under the lip. *Petals* similar but usually narrower, spreading. *Lip* a large inflated sac, somewhat slipper-shaped. *Column* short, three-lobed; the lateral lobes bearing an anther under each, the middle dilated and petal-like. *Gray.*

Under the common name of *ladies' slipper*, or *moccasin plant*, several species of Cypripedium inhabit the woods in different parts of the United States. They are small plants, with large many-nerved, plaited leaves, sheathing at the base, and large often beautiful flowers, of a shape not unlike the Indian moccasin, whence they derive one of their common names. Their generic name of Cypripedium (*Κύπρις*, Venus,

and πόδιον, sock) had a similar origin. Several of them have been used by American physicians, the root being the part employed. Dr. R. P. Stevens, of Ceres, Pennsylvania, says of them, that he has found the *C. spectabile* and *C. acaule*, especially when growing in dark swamps, to be possessed of narcotic properties, and to be less safe than the *C. parviflorum*, which is gently stimulant with a tendency to the nervous system, and is quite equal to valerian. He has employed it advantageously in hysteria, and in the pains of the joints following scarlet fever. (*N. Y. Journ. of Med.*, iv. 359.) Dr. E. Ives considers *C. pubescens*, *spectabile*, and *humile* identical in their effects, but *C. pubescens* the most powerful. (*Trans. of Amer. Med. Assoc.*, iii. 312.) C. pubescens and C. parviflorum are the only species designated in the U. S. Pharmacopœia; the latter having been admitted for the first time at the late revision. The roots of the two species are indiscriminately kept in the shops, and sold by the same name.

Cypripedium pubescens. Willd. *Sp. Plant.* iv. 142; Darlington, *Flor. Cestric.* p. 514. The *yellow ladies' slipper*, as this plant is called from the colour of its flowers, has a simple often flexuous, pubescent, leafy stem, from one to two feet high. The leaves are pubescent, ovate-lanceolate, acuminate, narrowing at the base, about four or five inches long by two in breadth, alternate, sessile, and sheathing. The flower is usually solitary and terminal; with four divisions of the perianth, the two outer cohering nearly to the apex, the inner longer, narrower, undulatory or twisted, and the lip an inch or two in length, swelling sac-like, and of a yellow colour. The fruit is an oblong capsule, tapering at each end, recurved, pubescent, and peduncled. (*Darlington.*) The plant is indigenous, growing abundantly in rich, moist woods throughout the United States.

Cypripedium parviflorum. (Salisbury.) *Common Ladies' Slipper. Small-flowered Ladies' Slipper.* This is a perennial plant with a leafy stem, a foot or two in height, and comparatively small yellowish-green flowers, appearing in May. The specific character of the flower, which is that also of the plant, is, that the lobe of the style is triangular and acute; the outer petals are oblong-ovate and acuminate; the inner linear and contorted; the lips shorter than the petals and compressed. (*Eaton.*) This species grows extensively through the U. States south of the Potomac, east and west of the Alleghanies, and in several of the Northern States, particularly New York, Michigan, Connecticut, and Vermont. In Pennsylvania, especially near Philadelphia, it does not appear to prevail, and it is not mentioned in Darlington's *Flora* as among the plants of Chester County.

The root, in both species, is the officinal portion. This consists of a rhizome, from two to four inches long, with numerous rootlets attached. Prof. Maisch gives a distinctive description of the roots of the two species, of which the following is a condensed account. Of *C. pubescens* the rhizome is almost horizontal, in its greatest length nearly four inches, slightly bent with a shallow downward curve, from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch thick, with numerous deeply concave scars left by the stems, having fully the width of the rhizome. The rootlets are numerous, several inches in length, sometimes even nine inches or more, about $\frac{1}{14}$ of an inch thick, without branches, somewhat undulate, and, though attached to the rhizome on all sides, are abruptly turned downward, owing to its horizontal position in the ground. Their colour is yellowish-brown, becoming much darker on drying, which causes longitudinal wrinkles. The cortical part is coloured blue by indigo. The rhizome of *C. parviflorum* is altogether different from the former, being bent nearly at right angles, three or four times, each section about $\frac{3}{4}$ of an inch long; and the whole length, while only about two inches in a straight line, from end to end, is yet actually three inches along the course of the rhizome. This is about $\frac{1}{8}$ of an inch thick, and has stem-scars, about the same in width, with about three in each bend. The rootlets, which are attached to all sides of the rhizome, are numerous, four to six inches long, less undular than those of C. pubescens, and differing also by their brighter colour, which is a decided orange-brown when fresh, and changes little on drying. In the effect of iodine on their colours, the two species are alike. (*Am. Journ. of Pharm.*, July, 1872, p. 297.)

The roots of the Cypripedia are sometimes mixed, as brought into the market, with that of *Hydrastis Canadensis*, from the plants occasionally growing in close con-

tiguity. (See *Hydrastis*, in Part I. of this work.) Roots of seneka have also been noticed in specimens of Cypripedium; but there can be no difficulty in distinguishing this impurity.

Properties. Cypripedium has a somewhat aromatic odour which diminishes by time, and a bitter, sweetish, peculiar, and in the end somewhat pungent taste. It yields its virtues to water and alcohol. The root has been analyzed by Mr. Henry C. Blair, who found it to contain a volatile oil, a volatile acid, tannic and gallic acids, two resins, gum, glucose, starch, and lignin. (*Am. Journ. of Pharm.*, Nov. 1866, p. 494.) The so-called eclectics prepare what they improperly call *cypripedin* by precipitating with water a concentrated tincture of the root. The substance thus obtained is complex, and has no claim to the name given it, which ought to be reserved for the active principle when discovered. It is probable that the virtues of the root reside in a volatile oil and bitter principle.

Medical Uses. Cypripedium appears to be a gentle nervous stimulant or antispasmodic, and has been used for the same purposes as valerian, though less powerful Dr. E. Ives, of New Haven, Conn., has employed the remedy in a variety of nervous diseases with advantage, and has known it even to cure epilepsy. The other complaints mentioned by him are hypochondriasis, neuralgia, and morbid sensitiveness of the nervous system generally, and especially of the eye. The medicine may be used in powder, infusion, or tincture. The dose of the powder given by Dr. Ives was fifteen grains three times a day. The oleoresin, obtained by precipitating the tincture, has been given in doses varying from half a grain to three grains. W.

DELPHINIUM. *U.S. Secondary.*

Larkspur.

The seed of Delphinium Consolida. *U.S.*

Pied d'allouette, *Fr.;* Feld Rittersporn, *Germ.*

DELPHINIUM. *Sex. Syst.* Polyandria Trigynia.—*Nat. Ord.* Ranunculaceæ.

Gen. Ch. Calyx none. *Petals* five. *Nectary* bifid, horned behind. *Pods* three or one. *Willd.*

Delphinium Consolida. Willd. *Sp. Plant.* ii. 1226; Loudon's *Encyc. of Plants*, p. 473, 7832. The larkspur is a showy annual plant, with an erect, branched, slightly pubescent stem. Its leaves are divided into linear segments, widely separated, and forked at the summit. The flowers are usually of a beautiful azure-blue colour, and disposed in loose terminal racemes, with peduncles longer than the bractes. The nectary is one-leaved, with an ascending horn nearly equalling the corolla. The seeds are contained in smooth, solitary capsules. This species of larkspur has been introduced from Europe into the United States, where it has become naturalized, growing in the woods and fields, and flowering in June and July.

Various parts of the larkspur have been employed in medicine; and the plant is said to have properties closely analogous to those of *Delphinium Staphisagria.* (See *Staphisagria.*) The flowers are bitter and acrid, and, having formerly been supposed to possess the power of healing wounds, gave the name of *consolida* to the species. *Aconitic acid* has been obtained from the expressed juice by W. Wicke. (*Journ. de Pharm.*, Juillet, 1854, p. 79.) The seeds are the officinal portion. They were analyzed by Mr. Thomas C. Hopkins, of Baltimore, and found to contain *delphinia*, volatile oil, fixed oil, gum, resin, chlorophyll, gallic acid, and salts of potassa, lime, and iron. (*Am. Journ. of Pharm.*, xi. 8.)

The flowers were formerly considered diuretic, emmenagogue, and vermifuge; but are not now used. The seeds are very acrid, are esteemed diuretic, and in large doses produce vomiting and purging. A tincture, prepared by macerating an ounce of them in a pint of diluted alcohol, has been found useful in spasmodic asthma and dropsy. The dose is ten drops, to be gradually increased till some effect upon the system is evinced. The remedy has been employed both in America and England; and the seeds of an indigenous species, *D. exaltatum*, have been applied to a similar purpose. The root probably possesses the same properties as other parts of the plant; but, though formerly designated in the Pharmacopœia, is little if at all used. W.

DIGITALIS. *U.S.*

Digitalis. Foxglove.

The leaves of Digitalis purpurea, from plants of the second year's growth. *U.S. Off. Syn.* DIGITALIS FOLIA. *Digitalis Leaf.* The dried leaf of Digitalis purpurea, Purple Foxglove. Collected from the wild indigenous plant, when about two-thirds of the flowers are expanded. *Br.*

Digitale pourprée, Doightier, *Fr.;* Purpurrother Fingerhut, *Germ.;* Digitale purpurea, *Ital.;* Dedalera, *Span.*

DIGITALIS. *Sex. Syst.* Didynamia Angiosperma.—*Nat. Ord.* Scrophulariaceæ.

Gen. Ch. Calyx five-parted. *Corolla* bell-shaped, five-cleft, ventricose. *Capsule* ovate, two-celled. *Willd.*

Digitalis purpurea. Willd. *Sp. Plant.* iii. 383; Woodv. *Med. Bot.* p. 218, t. 78. The foxglove is a beautiful plant, with a biennial or perennial fibrous root, which, in the first year, sends forth large tufted leaves, and in the following summer, a single erect, downy, and leafy stem, rising from two to five feet, and terminating in an elegant spike of purple flowers. The lower leaves are ovate, pointed, about eight inches in length and three in breadth, and stand upon short, winged footstalks; the upper are alternate, sparse, and lanceolate; both are obtusely serrate, and have wrinkled velvety surfaces, of which the upper is of a fine deep green, the under paler and more downy. The flowers are numerous, and attached to the upper part of the stem by short peduncles, in such a manner as generally to hang down upon one side. At the base of each peduncle is a floral leaf, which is sessile, ovate, and pointed. The calyx is divided into five segments, of which the uppermost is narrower than the others. The corolla is monopetalous, bell-form, swelling on the lower side, irregularly divided at the margin into short obtuse lobes, and in shape and size not unlike the end of the finger of a glove, a circumstance which has suggested most of the names by which the plant is designated in different languages. Its mouth is guarded by long soft hairs. Externally, it is in general of a bright purple; internally, is sprinkled with black spots upon a white ground. There is a variety with white flowers. The filaments are white, curved, and surmounted by large yellow anthers. The style is simple, and supports a bifid stigma. The seeds are numerous, very small, grayish-brown, and contained in a pyramidal two-celled capsule.

The foxglove grows wild in the temperate parts of Europe, where it flowers in the middle of summer. In this country it is cultivated both for ornament and for medical use. The leaves are the part generally employed. Much care is requisite in selecting, preparing, and preserving them, in order to ensure their activity. They should be gathered in the second year, immediately before or during the period of inflorescence, and those only chosen which are full-grown and perfectly fresh (*Geiger*); but the recent observations of F. Schneider would lead to the conclusion that they are much stronger when not gathered before the latter part of summer, or beginning of autumn. (*Am. J. of Pharm.*, May, 1870, p. 221.) It is said that those plants are preferable which grow spontaneously in elevated places, exposed to the sun. (*Duncan.*) As the leafstalk and midrib are comparatively inactive, they may be rejected. Withering recommends that the leaves should be dried either in the sunshine, or by a gentle heat before the fire; and care should be taken to keep them separate while drying. Pereira states that a more common, and, in his opinion, a preferable mode, is to dry them in a basket, in a dark place in a drying stove. It is probably owing, in part, to the want of proper attention in preparing digitalis for the market, that it is so often inefficient. Much of the medicine kept in our shops is obtained from the Shakers,* and is in oblong compact masses, into which the leaves have been compressed. In some of these cakes the digitalis is of good quality; but we have seen

* A portion of the Shakers' digitalis, purchased in the market, with parcels from England and Germany, being chemically examined by Dr. S. P. Duffield, of Detroit, with the view of determining the relative powers of the several varieties as measured by their yield of digitalin, was found superior to the others, the English giving 63·60 grains to the pound; the German 56·50 grains, and the American 65·01 grains. (*Am. Journ. of Pharm.*, Jany. 1869, p. 57.)—*Note to the fourteenth edition.*

others in which it was quite the reverse, and some which were mouldy in the interior; and, upon the whole, cannot but consider this mode of preparing the drug as objectionable. The dried leaves should be kept in tin canisters, well closed so as to exclude light and moisture; or they may be pulverized, and the powder preserved in well-stopped and opaque bottles. As foxglove deteriorates by time, it should be frequently renewed, as often, if possible, as once a year. Its quality must be judged of by the degree in which it possesses the characteristic properties of colour, smell, and especially taste. It is said to be sometimes adulterated; but if it be bought in leaf, there can be little difficulty, with one acquainted with the characters of the genuine leaves, in detecting the sophistication.

The seeds contain more of the active principle than the leaves, are less apt to suffer in drying, and keep better; but are little used. So far as the relative strength of these two parts can be determined from that of their alcoholic extracts, it would appear, from the experiments of Prof. Hirtz, that the seeds are ten times stronger than the leaves. (See *Am. Journ. of Pharm.*, xxxiii. 414.)

Properties. Foxglove is without smell in the recent state, but acquires a faint narcotic odour when dried. Its taste is bitter and nauseous. The colour of the dried leaf is a dull pale green, modified by the whitish down upon the under surface; that of the powder is a fine deep green. Digitalis yields its virtues both to water and alcohol. These virtues reside in a peculiar bitter principle, which was first isolated by M. Homolle. In the extraction of this principle, called *digitaline*, he employed the agency of tannic acid, as originally proposed by M. O. Henry. The latter chemist has somewhat simplified the process of M. Homolle. An alcoholic extract is first prepared. This is treated with distilled water acidulated with acetic acid, and heated to about 110° F., a little animal charcoal being added. To the liquor, filtered, and partially neutralized by ammonia, a fresh concentrated infusion of galls is gradually added, so long as a precipitate is produced. This precipitate, which is tannate of digitaline, is obtained separate by decanting the liquid, is washed with pure water mixed with a little alcohol, and then rubbed in a mortar with one-third of its weight of very finely powdered litharge. The mixture is heated gently, and submitted to the action of twice its volume of alcohol at about 90°. The alcoholic solution is treated with a little animal charcoal, filtered, and evaporated at a very gentle heat. The residue is acted on twice or three times with cold and very pure sulphuric ether, which removes impurities, and leaves the digitaline. This may be powdered, or obtained in small scales by dissolving it in the least quantity of alcohol, and allowing the concentrated solution to evaporate in a stove upon plates of glass. From 1000 parts of the leaves, M. Henry obtained between 9 and 10 parts of digitaline. (*Journ. de Pharm.*, 3e sér., vii. 462.) This substance is white, inodorous, crystallizable with difficulty, intensely bitter, sternutatory when powdered, slightly decomposed at a boiling heat, soluble in about 2000 parts of cold water, more soluble in boiling water, which retains one part in 1000 when it cools, very soluble in alcohol cold or hot, very slightly soluble in ether, incapable of precipitating salts, without alkaline or acid reaction, and destitute of nitrogen. According to Mr. Guy, it is fusible at 310° F., and volatilizable at the same temperature. (*Pharm. Journ. and Trans.*, Feb. 1868, p. 374.) It forms an insoluble compound with tannic acid. It has the characteristic property of giving a fine emerald-green colour to concentrated muriatic acid. In the plant, it is rendered soluble in water by means of saline or extractive matters. It has all the effects of digitalis on the system, at least upon the heart. Besides the bitter principle, digitalis contains a volatile oil, a fatty matter, a red colouring substance analogous to extractive, chlorophyll, albumen, starch, sugar, gum, lignin, and salts of potassa and lime, among which, according to Rein and Haase, is superoxalate of potassium. M. Morin, of Geneva, has discovered in the leaves two acids; one fixed, called *digitalic acid*, the other volatile and resembling valerianic acid, which he proposes to name *antirrhinic acid*. (*Ibid.*, vii. 294.) Dr. Morries obtained a narcotic empyreumatic oil by the destructive distillation of the leaves.

It appears, from the experiments of M. Kosmann, that digitaline must be ranked among the glucosides; as, when boiled with dilute sulphuric acid, it is resolved into glucose (grape sugar) and a peculiar substance to which he gives the name of *digi-*

taliretin, a compound of carbon, hydrogen, and oxygen, having feeble acid properties, and somewhat bitter in solution, though much less so than digitaline itself. Under the influence of caustic soda digitaline is converted into a substance decidedly acid, which M. Kosmann names *digitalinic acid*. The same chemist has shown that digitaline exists in two states, hydrous and anhydrous, the former being converted into the latter at 212° F., with the loss of eight eqs. of water; the formula of the hydrous being, according to Kosmann, $C_{54}H_{53}O_{38} = 681$, that of the anhydrous $C_{54}H_{45}O_{30} = 609$. It is always the anhydrous which is used in medicine. Digitalinic acid is somewhat bitter, but less so than its original. Like digitaline, it is converted by diluted sulphuric acid and heat into glucose and digitaliretin. (*Journ. de Pharm.*, Juillet, 1860, p. 6, and Août, p. 87.)

From more recent researches by Waltz, and by MM. Homolle and Quevenne themselves, it has been determined that the digitaline of Homolle, though sufficiently pure for practical use, yet contains more or less of two other principles, from which it may be separated by the agency of ether and alcohol.*

Several years since it was announced that a *volatile alkaloid* had been obtained by W. Englehardt from the leaves of digitalis, by a process similar to that by which conia is extracted from hemlock. It is described as an exceedingly volatile liquid, of an oily consistence, a very penetrating odour, an alkaline reaction, soluble with difficulty in water, readily dissolved by alcohol, soluble in pure ether, and but slightly so in chloroform. Should this discovery be confirmed, and the alkaloid prove to be one of the active principles of digitalis, it should receive the name of *digitalia*. In the meantime, the discoverer calls it *digitalinum fluidum*. (See *Am. Journ. of Pharm.*, March, 1864, p. 126.)

From recent observations of M. Homolle and of M. Lefort, there would appear to be two forms of digitaline, or perhaps two principles to which the same name is attached, differing from each other, as the several cinchona alkaloids differ, and probably one a derivative of the other. The chief difference between them is in their degree of solu-

* The following are the results of the chemical examination of digitalis, as given by MM. Homolle and Quevenne, in Bouchardat's *Archives de Physiologie, &c.*, for January, 1854. Unfortunately these authors employ the very similar names *digitaline* and *digitalin* to designate different substances; the former being applied by them to the bitter active principle, the latter to a tasteless and probably inert constituent. In conformity with their example, and to prevent confusion, we employ the term digitaline as the name of the active principle, though digitalin would be in accordance with our general usage. Besides the proper active constituents, digitalis contains, according to MM. Homolle and Quevenne, three peculiar neuter principles, *digitalin*, *digitalose*, and *digitalide*; four organic acids, the *digitalic*, *antirrhinic*, *digitaleic*, and *tannic*; various other neuter organic substances, *viz.*, starch, sugar, pectin, an albuminoid substance, an orange-red crystallizable colouring matter, chlorophyll, volatile oil, and lignin; and, lastly, various inorganic salts and earthy matters. It is to the digitaleic acid, which is a fatty substance, that M. Homolle ascribes the nauseating and emetic properties and effects on vision, from which pure digitaline is exempt. (*Ann. de Thérap.*, A. D. 1862, p. 71.)

Digitalin (*digitasolin* of Waltz) is a white, imperfectly crystalline powder, tasteless or very slightly acrid, soluble in water and alcohol, and insoluble in ether. *Digitalose* (*digitalierin* of Walz) is of a white, crystalline, almost micaceous appearance, tasteless, insoluble in water, and soluble in alcohol and ether. These two principles are often contained in the digitaline procured as directed in the text. To separate them, advantage may be taken of the fact, that, though but slightly soluble in perfectly pure ether, digitaline is readily dissolved by that liquid containing but a very small proportion of alcohol. If the impure digitaline be submitted to the action of ether, brought by the addition of alcohol to the sp. gr. 0·780, the digitaline and digitalose will be dissolved, and digitalin left; and, by a repetition of the treatment, almost the whole of the bitter principle may be extracted. If the ethereal solutions thus obtained be mixed, the ether distilled off until the residue has a pap-like consistence, and this residue be treated with boiling alcohol of 60°, the digitaline will be taken up, and most of the digitalose remain undissolved. The former may now be obtained by a gentle evaporation of the alcohol; and by repetitions of the process, may be rendered very nearly free from digitalose, though not perfectly so.

In its purest state, digitaline, instead of being white, has a pale-yellow tint, and is crystallizable with even greater difficulty than in its ordinary condition. Indeed MM. Homolle and Quevenne are disposed to consider it quite uncrystallizable when perfectly pure. One of its peculiarities is a disposition to assume a globular form when deposited from its solution. If its alcoholic or ethereal solution be concentrated until it becomes turbid, and then examined with a microscope, innumerable globules will be seen of variable size, closely resembling those of milk. These coalesce, and, when deposited, adhere to the bottom of the vessel in grains or masses of a resinoid appearance. (*Op. cit.*, pp. 21 and 22.) As a test of the sufficient purity of digitaline, the authors state that its bitterness should be such as to require, in order to be rendered imperceptible, the addition of 10 litres (about 21 pints) of water to 5 centigrammes (about 0·77 gr.) of the digitaline. (*Ibid.*, p. 126.)—*Note to the eleventh and twelfth editions.*

bility in water; one being almost insoluble, the other freely soluble. The former is represented in the market by the French digitaline, the latter by the German. More will be said on this subject under the head of *Digitalinum*, in Part II. of this work.

Medical Properties and Uses. Digitalis is narcotic, sedative, and diuretic. Administered in quantities sufficient to bring the system decidedly under its influence, it is apt to produce a sense of tightness or weight with dull pain in the head, vertigo, dimness or other disorder of vision, and more or less confusion of thought. At the same time it occasionally gives rise to irritation in the pharynx and œsophagus, which extends to the larynx and trachea, producing hoarseness; and, in more than one instance, ptyalism has been observed to result. It sometimes also disturbs the bowels, and excites nausea, or even vomiting. Another and highly important effect is an augmented flow of urine. This has been ascribed by some to increased absorption; and, in support of this opinion, it is stated that its diuretic operation is observable only when dropsical effusion exists; but the fact seems to be, that it is capable of augmenting the quantity of urine in health, and it probably exerts a directly stimulating influence upon the secretory function of the kidneys. This influence is said sometimes to extend to the genital organs. Besides the effects above detailed, digitalis has a remarkably sedative action upon the heart. This is exhibited in the reduction both of the force and frequency of the pulse, which sometimes sinks to 50, 40, or even 30 strokes in the minute. In some instances, however, it undergoes little change; in others only becomes irregular; and we are told that it is even occasionally increased in frequency. It was observed by Dr. Baildon that the effects of digitalis upon the circulation were much influenced by posture. Thus, in his own case the pulse, which had been reduced from 110 to 40 in the recumbent position, was increased to 72 when he sat, and to 100 when he stood. We do not discover anything remarkable in this circumstance. It is well known that the pulse is always more frequent in the erect than in the horizontal posture, and the difference is greater in a state of debility than in health. Digitalis diminishes the frequency of the pulsations of the heart by a directly depressing power; and this very depression, when any exertion is made which calls for increased action in that organ, causes it to attempt, by an increase in the number of its contractions, to meet the demand which it is unable to supply by an increase in their force. The probability, however, is that its depressing effect on the heart's action arises not from an immediate influence on the cardiac substance, but to a sedative influence on the nervous centres, which control the action of that organ, so that the heart, while its actions are diminished and possibly enfeebled, may possibly retain its inherent vital force unimpaired, or even somewhat augmented by a previous comparative rest. According to Dr. Traube, it directly diminishes animal temperature in febrile and inflammatory diseases, without antecedent effect on the circulation. (See *Archives Gén.*, 4e sér., xxviii. 338.) It is said also to have a powerful sedative influence on the generative organs. This statement is not altogether incompatible with that already made, that the medicine sometimes stimulates these organs. The normal depressing effect may be experienced through the nervous centres; while the occasional irritation may proceed, either from the direct action of the medicine through the blood on the tissues affected, or a sympathetic influence extended from the urinary organs. Dr. A. Buchner states that digitaline arrests vinous fermentation, and consequently poisons the yeast plant. (See *Am. Journ. of Pharm.*, xxiv. 154.)

The effects above detailed may result from digitalis given in remediate doses. In larger quantities its operation is more violent. Nausea and vomiting, stupor or delirium, cold sweats, extreme prostration of strength, hiccough, convulsions, and syncope are among the alarming symptoms which indicate its poisonous character. These effects are best counteracted by stimulants, such as brandy, the volatile alkali, opium, and strong coffee. Should any of the poison be suspected to remain, it would be proper, before employing other measures, to evacuate the stomach by the free use of warm liquids. From the experiments of M. Bonjean, it appears that powdered digitalis may be given to fowls, in large quantities, with entire impunity. (*Journ. de Pharm.*, 3e sér., iv. 21.)

A peculiarity of digitalis is that, after having been given in moderate doses for

several days without apparent effect, it sometimes acts suddenly with an accumulated influence, even endangering life. It is, moreover, very permanent in its operation, which, having once commenced, is maintained for a considerable period without fresh accessions of the medicine. The practical inferences deducible from these properties of digitalis are, first, that, after it has been given for some time without effect, care should be taken not to increase the dose too greatly; and, secondly, that after its effects have begun to appear, it should be suspended for a time, or exhibited in smaller doses, lest a dangerous accumulation should be experienced. In numerous instances death has resulted from its incautious employment.

Digitalis has been long known to possess medicinal powers; but it was never regarded as a standard remedy till after its application by Withering to the treatment of dropsy, about the year 1775. It is at present employed very extensively, both for its diuretic power, and for its sedative influence over the circulation. The former renders it highly useful in dropsical diseases, though, like all other remedies it frequently fails; the latter adapts it to cases in which the action of the heart requires to be controlled. The idea was at one period entertained, that it might serve as a substitute for the lancet in febrile and inflammatory complaints; and it has been much employed for this purpose by the advocates of the *contra-stimulant* doctrine in Italy; but experience has proved that it is a very frail support where the symptoms of inflammation are such as to call for the loss of blood. Nevertheless, it is even at present highly valued by some practitioners in febrile diseases, and in acute inflammatory rheumatism has been recommended as a most efficient remedy, being itself capable of effecting cures in many cases, sometimes as early as in five or six days, but more frequently by the twelfth or fifteenth. (*Arch Gén.*, 6e sér., ix. 733.) As an adjuvant to the lancet, and when circumstances forbid the employment of that remedy, it is often useful. Good may be expected from it in all fevers where one of the chief indications is to reduce the frequency of the pulse. We have ourselves employed it with this view in scarlet fever with apparent advantage. Though it certainly has not the power, at one time ascribed to it by some, of curing phthisis, it acts beneficially as a palliative in that complaint by depressing the excited movements of the heart. In the same way it proves advantageous in aneurism, hypertrophy and dilatation of the heart, palpitations from rheumatic or gouty irritation, and in various forms of hemorrhage, after action has been sufficiently reduced by the lancet. Some consider it especially efficient in menorrhagia. It has also been prescribed in nervous headache, mania, epilepsy, pertussis, and spasmodic asthma; and highly respectable testimony can be adduced in favour of its occasional efficacy in these complaints. In delirium tremens it has been recommended as a specific, given in infusion, in the full dose, repeated every two hours till symptoms of narcotism are induced; but the practice is somewhat hazardous, unless the patient is carefully watched. (*Am. Journ. of Med. Sci.*, xvii. 501.) Much testimony has recently been given in favour of large doses of digitalis in this affection; the tincture having been taken in doses of from half a fluidrachm to half a fluidounce, and repeated afterwards in smaller quantities, at intervals of two, four, or six hours till sleep was obtained. (*Ibid.*, Jan. 1861, p. 257.) The same practice has been recommended in acute mania. But we would reiterate the necessity of caution; for, though the tincture, as found in the shops, may no doubt often be administered safely in large doses, yet, if the medicine is of good quality, they cannot but be hazardous. Digitalis is said to be a very efficient remedy in spermatorrhœa. Externally applied, it sometimes acts speedily and powerfully as a diuretic, and has proved useful in dropsy. For this purpose the fresh leaves bruised, or the tincture, may be rubbed over the abdomen and on the inside of the thighs. (*Revue Médicale*, May, 1834.) Ch. Hoffman has shown by experiments on himself that the active matter of digitalis is capable of being absorbed through the skin, and that its effects on the system may be obtained by means of baths.* A case is recorded in which a cataplasm of the leaves

* M. Hoffman, during a period of 44 days, took 16 baths prepared with 300 litres of water and 250 grammes of digitalis leaves. After the third bath he began to feel the effects of the medicine; a peculiar uneasiness, namely, and a reduction of the pulse 4 or 5 pulsations per minute; and this condition persisted several hours. At the eighth bath the uneasiness was increased, and the pulse decreased from 68 to 51. After the sixteenth bath, the pulse fell to 48. (*Journ. de Pharm. et de Chim.*, Juillet, 1867, p. 37.)—*Note to the thirteenth edition.*

applied to the abdomen for the relief of obstinate and dangerous suppression of urine, and repeated in six hours, brought on excessive diuresis, with a discharge amounting to probably 8 gallons in less than 24 hours, producing fatal exhaustion. (*Med. Times and Gaz.*, Jan. 1868, p. 86.)

Digitalis is administered in substance. The dose of the powder is one grain, repeated twice or three times a day, and gradually increased till some effect is produced upon the head, stomach, pulse, or kidneys, when it should be omitted or reduced. The infusion and tincture are officinal preparations often resorted to. (See *Infusum Digitalis* and *Tinctura Digitalis.*) The extract has also been employed; and Orfila found it, whether prepared with water or alcohol, more powerful than the powder. Enormous doses of this medicine have been given with asserted impunity; and, when they occasion full vomiting, it is possible that they may sometimes prove harmless; but, when the alarming effects sometimes experienced from comparatively moderate doses are considered, the practice must be condemned as exceedingly hazardous.

Digitaline has been used internally; but its employment requires caution. With all the powers of digitalis, it possesses the advantage of more equable strength, and consequently greater precision and certainty in regard to the dose. It may be used for any of the purposes to which the leaves are applicable; and may be administered in pill, or alcoholic solution. The dose to begin with should not exceed the fiftieth or sixtieth of a grain, and should not be carried beyond the twelfth. It is much administered in the form of granules, made by saturating small globules of sugar with an alcoholic solution of digitaline. The granules of Homolle, which are commonly used in Europe, contain each a milligramme, or about the seventieth of a grain; equivalent, on the average, to perhaps a grain and a half of digitalis of medium strength. One of these globules may be given as a commencing dose. Forty of them taken with a view to suicide, though followed by copious vomiting, so that most of the poison was probably discharged, produced the most alarming prostration, with a pulse weak, 46 to 48 in a minute, intermittent, and sometimes scarcely perceptible. The patient, however, ultimately recovered. (*Ann. de Thérap.*, A.D. 1858, p. 103.)

Off. Prep. Digitalinum, *U.S.*, *Br.;* Extractum Digitalis, *U.S.;* Extract. Digitalis Fluidum, *U.S.;* Infusum Digitalis; Tinctura Digitalis. W.

DIOSPYROS. *U.S. Secondary.*

Persimmon.

The unripe fruit of Diospyros Virginiana. *U.S.*

Diospyros. *Sex. Syst.* Dicœcia Octandria. — *Nat. Ord.* Ebenaceæ.

Gen. Ch. Male. *Calyx* four to six-cleft. *Corolla* urceolate, four to six-cleft. *Stamens* eight to sixteen; filaments often producing two anthers. Female. *Flower* as the male. *Stigmas* four to five. *Berry* eight to twelve-seeded. *Nuttall.*

Diospyros Virginiana. Willd. *Sp. Plant.* iv. 1107; Michaux, *N. Am. Sylv.* ii. 219. The persimmon is an indigenous tree, rising sometimes in the Southern States to the height of sixty feet, with a trunk twenty inches in diameter; but seldom attaining more than half that size near its northern limits, and often not higher than fifteen or twenty feet. The stem is straight, and in the old tree covered with a furrowed blackish bark. The branches are spreading; the leaves ovate-oblong, acuminate, entire, smooth, reticulately veined, alternate, and supported on pubescent footstalks. The buds are smooth. The male and female flowers are on different trees. They are lateral, axillary, solitary, nearly sessile, of a pale-orange colour, and not conspicuous. The fruit is a globular berry, dark-yellow when ripe, and containing numerous seeds in a soft yellow pulp. These seeds are said to be preferred, in some parts of the State of Georgia, for drink at meals to the proper coffee. The fruit is prepared by digesting it for half an hour, then crushing and throwing it into a basin of water, when, the pulp having been washed off, the seeds are spread out in the sun for three or four weeks, to dry, and treated like proper coffee. (*Med. and S. Reporter*, Dec. 13, 1873, p. 437.)

This tree is very common in the Middle and Southern States, but, according to

Michaux, does not flourish beyond the forty-second degree of north latitude. The flowers appear in May or June; but the fruit is not ripe till the middle of autumn. While green, the fruit is excessively astringent, and, we presume, will retain its astringency if carefully sliced and dried in this state; but, when perfectly mature, and after having been touched by the frost, it is sweet and palatable. Michaux states that, in the Southern and Western States, it is made into cakes with bran, and used for preparing beer with the addition of water, hops, and yeast. A spirituous liquor may be obtained by the distillation of the fermented infusion. The unripe fruit was examined by Mr. B. R. Smith, of Philadelphia, and found to contain tannic acid, sugar, malic acid, colouring matter, and lignin. (*Am. Journ. of Pharm.*, xviii. 167.) The tannic acid has been ascertained by Mr. John E. Bryan not to be of the kind existing in galls and oak-bark. (*Ibid.*, xxxii. 215.) The fact that tannin is a glucoside may throw some light on the rapid and complete change which the fruit undergoes from astringency to sweetness during maturation. It has been used by Dr. Mettauer, of Virginia, in diarrhœa, chronic dysentery, and uterine hemorrhage. He gave it in infusion, syrup, and vinous tincture, prepared in the proportion of about an ounce of the bruised fresh fruit to two fluidounces of the vehicle, and administered in the dose of a fluidrachm or more for infants, and half a fluidounce or more for adults. The bark is astringent and very bitter, and is said to have been used advantageously in intermittents, and in the form of a gargle in ulcerated sore-throat. W.

DRACONTIUM. *U. S. Secondary.*

Skunk Cabbage.

The root of Dracontium fœtidum, Ictodes fœtidus (*Bigelow*), Symplocarpus fœtidus (*Salisbury*). *U. S.*

Botanists have had some difficulty in arranging this plant. It was attached by Willdenow to the genus *Dracontium*, by Michaux and Pursh was considered a *Pothos*, and by American botanists has been erected into a new genus, which Nuttall calls *Symplocarpus* after Salisbury, and Dr. Bigelow proposes to name *Ictodes*, expressive of the odour of the plant. The term *Symplocarpus*, though erroneous in its origin, was first proposed, and, having been adopted by several botanists, should be retained.

Symplocarpus. *Sex. Syst.* Tetrandria Monogynia.—*Nat. Ord.* Araceæ.

Gen. Ch. Spathe hooded. *Spadix* covered with perfect flowers. *Calyx* with four segments. *Petals* none. *Style* pyramidal. *Seeds* immersed in the spadix.

Symplocarpus fœtida. Barton, *Med. Bot.* i. 123.—*Ictodes fœtidus.* Bigelow, *Am. Med. Bot.* ii. 41. The *skunk cabbage* is a very curious plant, and the only one of the genus. The root is perennial, large, abrupt, and furnished with numerous fleshy fibres, which penetrate to the depth of two feet or more. The spathe which first appears, is ovate, acuminate, obliquely depressed at the apex, auriculated at the base, folded inwards at the edges, and of a brownish-purple colour, varied with spots of red, yellow, and green. Within the spathe, the flowers, which resemble it in colour, are placed in great numbers upon a globose peduncled spadix, for which they form a compact covering. After the spathe has decayed, the spadix continues to grow, and when the fruit is mature, has attained a size exceeding several times its original dimensions. At the base of each style is a roundish seed, immersed in the spadix, about the size of a pea, and speckled with purple and yellow. The leaves, which appear after the flowers, are numerous and crowded, oblong-cordate, acute, smooth, strongly veined, and attached to the root by long petioles, which are hollowed in front, and furnished with coloured sheathing stipules. At the beginning of May, when the leaves are fully developed, they are very large, being from one to two feet in length, and from nine inches to a foot in breadth.

The plant is indigenous, growing abundantly in meadows, swamps, and other wet places throughout the northern and middle sections of the Union. Its flowers appear in March and April, and in the lower latitudes often so early as February. The fruit is usually quite ripe, and the leaves are decayed before the end of August. The plant is very conspicuous from its abundance, and the magnitude of its leaves

All parts of it have a fetid odour, thought to resemble that of the offensive animal after which it is named. This odour resides in an extremely volatile principle, which is rapidly dissipated by heat, and diminished by desiccation. The root is the part employed. It should be collected in autumn, or early in spring, and dried with care.

The root, as found in the shops, consists of two portions; the body either whole or in transverse slices, and the separated radicles. The former, when entire, is cylindrical or in the shape of a truncated cone, two or three inches long by about an inch in thickness, externally dark-brown and very rough from the insertion of the radicles, internally white and amylaceous. The latter are of various lengths, about as thick as a hen's quill, very much flattened and wrinkled, white within, and covered by a yellowish reddish-brown epidermis, considerably lighter coloured than the body of the root. More or less of the fetid odour remains for a considerable period in the dried root. The taste, though less decided than in the fresh, is still acrid, manifesting itself, after the root has been chewed for a short time, by a pricking and smarting sensation in the mouth and throat. The acrimony, however, is dissipated by heat, and is quite lost in decoction. It is also diminished by time and exposure; and the root should not be kept longer than a single season. The radicles are said to have less acrimony than the caudex. The seeds are very acrid, and, though inodorous when whole, give out strongly, when bruised, the peculiar odour of the plant.

Medical Properties and Uses. The root is stimulant, antispasmodic, and narcotic. In large doses it occasions nausea and vomiting, with headache, vertigo, and dimness of vision. Dr. Bigelow has witnessed these effects from thirty grains of the recently dried root. The medicine was introduced into notice by the Rev. Dr. Cutler, who recommended it highly in asthma; and it has been subsequently employed with apparent advantage in chronic catarrh, chronic rheumatism, hysteria, and dropsy. Dr. Heintzelman thinks it expectorant as well as antispasmodic, and has used it beneficially in hooping-cough and pulmonary consumption. (*N. J. Med. Reporter*, iv. 310.)

It is best given in powder, of which the dose is from ten to twenty grains, to be repeated three or four times a day, and gradually increased till some evidence of its action is afforded. A strong infusion is sometimes employed, and the people in the country prepare a syrup from the fresh root; but the latter preparation is very unequal. The root itself, as kept in the shops, is of uncertain strength, in consequence of its deterioration by age. W.

DULCAMARA. *U.S.*, *Br.*

Bittersweet.

The young branches of Solanum Dulcamara. *U.S.* The dried young branches of Solanum Dulcamara, Bittersweet, from indigenous plants which have shed their leaves. *Br.*

Douce-amère, *Fr.*; Bittersüss, Alpranken, *Germ.*; Dulcamara, *Ital.*, *Span.*

SOLANUM. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Solanaceæ.

Gen. Ch. Corolla wheel-shaped. *Anthers* somewhat coalescing, opening by two pores at the apex. *Berry* two-celled. *Willd.*

This genus includes numerous species, of which several have been used in medicine. Besides *S. Dulcamara*, which is the only officinal species, a few others merit notice. 1. *Solanum nigrum*, the *common garden* or *black nightshade*, is an annual plant from one to two feet high, with an unarmed herbaceous stem, ovate, angular-dentate leaves, and white or pale-violet flowers, arranged in peduncled nodding umbel-like racemes, and followed by clusters of spherical black berries, about the size of peas. There are numerous varieties of this species, one of which is a native of the United States. The leaves are the part employed. They are said to produce diaphoresis, sometimes diuresis and moderate purging, and in large doses nausea and giddiness. As a medicine they have been used in cancerous, scrofulous, and scorbutic diseases, and other painful ulcerous affections, being given internally, and applied at the same time to the parts affected in the form of poultice, ointment, or decoction. A grain of the dried leaves may be given every night, and gradually increased to ten or twelve grains, or till some sensible effect is experienced. The medicine, however,

is scarcely used at present. By some persons the poisonous properties ascribed to the common nightshade are doubted. M. Dunal, of Montpellier, states, as the result of numerous experiments, that the berries are not poisonous to man or the inferior animals; and the leaves are said to be consumed in large quantities in the Isles of France and Bourbon as food, having been previously boiled in water. In the latter case, the active principle of the plant must have been extracted by decoction. 2. The leaves, stalks, and unripe berries of *Solanum tuberosum*, or the *common potato*, are asserted to be narcotic; and an extract prepared from the leaves has been employed in cough and spasmodic affections, in which it is said to act like opium. (*Geiger.*) From half a grain to two grains may be given as a dose. Dr. Latham, of London, found the extract to produce favourable effects in protracted cough, chronic rheumatism, angina pectoris, cancer of the uterus, &c. Its influence upon the nervous system was strongly marked, and, in many instances, the dose could not be increased above a few grains without giving rise to threatening symptoms. It appeared to Dr. Latham to be analogous in its operation to digitalis. His experiments were repeated in Philadelphia by Dr. Worsham with different results. The extract was found, in the quantity of nearly one hundred grains, to produce no sensible effect. (*Philad. Journ. of the Med. and Phys. Sciences*, vi. 22.) We can reconcile these opposite statements only upon the supposition that the properties of the plant vary with the season, or with the place and circumstances of culture. Dr. Julius Otto found *solania* in the germs of the potato. He was induced to make the investigation by observing that cattle were destroyed by feeding on the residue of germinating potatoes, used for the manufacture of brandy. A case of death in a girl of fourteen, from eating the unripe fruit of the potato, is recorded in the *British Med. Journ.* for Sept. 3, 1859. The prominent symptoms were partial stupor, speechlessness, jactitation, hurried breathing, lividness of the skin, cold sweats, very frequent and feeble pulse, and a constant spitting through the closed teeth of viscid frothy phlegm. Death occurred on the second day. C. Haaf has found the same alkaloid in old potatoes which had begun to germinate, in the proportion of 0·16 to 500 parts; and in very young potatoes, deprived of their coating, precisely the same quantity. Fully ripe potatoes, which had not begun to sprout, gave a negative result. (*Neues Repert. für Pharm.*, A. D. 1864, p. 559.) 3. The well-known *tomato*, so much used as a vegetable at the table, and so advantageous through its nutritive, laxative, and antiscorbutic properties, is the fruit of a species of Solanum, denominated *S. Lycopersicum.* The juice of the fruit is free from solania, and contains several acids, of which the presence of citric, malic, and oxalic acids has been demonstrated by Mr. T. D. McElhenie. (*Am. J. of Pharm.*, May, 1872, p. 198.) The seeds probably contain the alkaloid, as their alcoholic extract has a bitter, pungent taste. (See *Am. Journ. of Pharm.*, xxxiv. 519.) Solania has been obtained from the leaves and herbaceous part of the plant generally, by Mr. Geo. W. Kennedy. (*Pharm. Journ.*, Feb. 1873, p. 606.) An infusion of the leaves is strongly recommended by M. Stanislaus Martin as a diuretic. (*Am. J. of Med. Sci.*, July, 1873, p. 246.) 4. Several instances of poisoning are on record from the fruit of *S. pseudocapsicum*, or *Jerusalem cherry*, which, from its resemblance to the common cherry, is liable to be eaten by children. 5. In the *Edin. Med. Journ.* (Nov. 1867, p. 398), several cases are recorded by Dr. Manners, of Jamaica, W. I., of poisoning by the *susumber berries*, of which one proved fatal, and several others recovered, probably in consequence of the early evacuation of the stomach by a mustard emetic. The symptoms recorded were anxious countenance, dilated pupil, cold skin, and difficult articulation. The fatal case was not seen by Dr. Manners till after death. The susumber berries are the fruit of a species of Solanum, denominated by Lunnan, in his "Hortus Jamaicensis," *S. bacciferum*, of which there are two varieties, one relatively innocent, as its fruit is habitually used by the natives, the other poisonous, as would be inferred from the cases here noticed. 6. The *Solanum paniculatum*, called *jurubeba* in Brazil, is said to be largely used in S. America, in affections of the liver and spleen, catarrh of the bladder, anæmia, and amenorrhœa. The plant is thought to be one of the most powerful deobstruents. The leaves, fruit, and root are used, externally in the form of a plaster, internally in the form of syrup, wine, and extract. (*London Lancet*, Feb. 1866, p. 158.)

Solanum Dulcamara. Willd. *Sp. Plant.* i. 1028; Woodv. *Med. Bot.* p. 237, t. 84; Bigelow, *Am. Med. Bot.* i. 169. The *bittersweet* or *woody nightshade* is a climbing shrub, with a slender, roundish, branching, woody stem, which, in favourable situations, rises six or eight feet in height. The leaves are alternate, petiolate, ovate, pointed, veined, soft, smooth, and of a dull-green colour. Many near the top of the stem are furnished with lateral projections at their base, giving them a hastate form. Some have the projection only on one side. Most of them are quite entire, some cordate at the base. The flowers are disposed in elegant clusters, somewhat analogous to cymes, and standing opposite to the leaves. The calyx is very small, purplish, and divided into five blunt persistent segments. The corolla is wheel-shaped, with five pointed, reflected segments, which are of a violet-blue colour, with a darker purple vein running longitudinally through their centre, and two shining greenish spots at the base of each. The filaments are very short, and support large, erect, lemon-yellow anthers, which cohere in the form of a cone around the style. The berries are of an oval shape and a bright scarlet colour, and continue to hang in beautiful bunches after the leaves have fallen.

This plant is common to Europe and North America. It flourishes most luxuriantly in damp and sheltered places, as on the banks of rivulets, and among the thickets which border our natural meadows. It is also found in higher and more exposed situations, and is frequently cultivated in gardens. In the United States it extends from New England to Ohio, and is in bloom from June to August. The root and stalk have medicinal properties, though the latter only is officinal. The berries, which were formerly esteemed poisonous, and thought to act with great severity on the stomach and bowels, have of late been said to be innoxious. A case, however, of death from their use in a child has been recorded. (See *Pharm. Journ.*, Feb. 1861, p. 436.) Bittersweet should be gathered in autumn, after the fall of the leaf; and the extreme twigs should be selected. That grown in high and dry situations is said to be the best.

The dried twigs, as brought to the shops, are of various lengths, cylindrical, about as thick as a goose-quill, externally wrinkled, and of a grayish-ash colour, consisting of a thin bark, an interior ligneous portion, and a central pith. They are inodorous, though the stalk in the recent state emits, when bruised, a peculiar, rather nauseous smell. Their taste, which is at first bitter and afterwards sweetish, has given origin to the name of the plant. Boiling water extracts all their virtues. These are supposed to depend, at least in part, upon a peculiar alkaline principle called *solanin* or *solania*, which was originally discovered by M. Desfosses, of Besançon, in the berries of *Solanum nigrum*, and has subsequently been found in the stalks, leaves, and berries of *S. Dulcamara* and *S. tuberosum*. It is supposed to exist in the bittersweet combined with malic acid.* *Solania* is in the form of a white opaque powder,

* Solania is most conveniently obtained from the sprouts of the common potato. The following is Wackenroder's process for extracting it. The sprouts, collected in the beginning of June, and pressed down in a suitable vessel by means of pebbles, are macerated for twelve or eighteen hours in water enough to cover them, previously acidulated with sulphuric acid, so as to have a strongly acid reaction during the maceration. They are then expressed by the hand; and the liquor, with the addition of fresh portions of sulphuric acid, is added twice successively, as at first, to fresh portions of sprouts, and in like manner separated by expression. After standing for some days, it is filtered, and treated with powdered hydrate of lime in slight excess. The precipitate which forms is separated by straining, dried in a warm air, and boiled several times with alcohol. The alcoholic solution, having been filtered while hot, will, upon cooling, deposit the solania in flocculent crystals. An additional quantity of the alkaloid may be obtained by evaporating the mother-liquor to one-quarter, and then allowing it to cool. The whole residuary liquor will assume a gelatinous consistence, and, upon being dried, will leave the solania in the form of a translucent, horny, amorphous mass. (*Pharm. Central Blatt*, 1843, p. 174.)

Opinion at present seems to be unsettled as to the nature of solanin or solania; and the results obtained by different chemists vary so much as almost to necessitate the conclusion that they have operated on different substances. Indeed, M. Moitessier states expressly that the alkaloids obtained from different species of Solanum differ perceptibly in their physical properties. By this chemist the alkaloid, as obtained from dulcamara, was found, after a careful examination, to have the formula $C_{42}H_{35}NO_{14}$, though M. Blanchet had previously given it as $C_{84}H_{68}NO_{28}$. It appears to have very feeble alkaline properties, and forms amorphous compounds with the acids. (*Comptes Rendus*, Nov. 17, 1856.) Mr. Guy found it to have the same point of fusion and volatilization, which he states to be 350° F. (*Pharm. Journ. and Trans.*, Feb. 1868, p. 374.) As obtained from the potato and black nightshade, Dr. Fronmüller describes it as a white crystalline substance,

or of delicate acicular crystals, somewhat like those of sulphate of quinia, though finer and shorter. It is inodorous, of a bitter taste, fusible at a little above 212°, scarcely soluble in water, soluble in alcohol and ether, and capable of neutralizing the acids. It is distinguished by the deep-brown, or brownish-yellow colour which iodine imparts to its solution, and by its reaction with sulphuric acid, which becomes first reddish-yellow, then purplish-violet, then brown, and lastly, again colourless, with the deposition of a brown powder. (*Pharm. Cent. Blatt*, A.D. 1843, p. 177.) Given to a cat, it was found by M. Desfosses to operate at first as an emetic, and afterwards as a narcotic. Dr. J. Otto observed, among its most striking effects, a paralytic condition of the posterior limbs of animals. One grain of the sulphate of solania was sufficient to destroy a rabbit in six hours. Dr. Frass did not observe paralysis of the lower limbs of animals as one of its effects. Given to different animals, he found it to occasion loss of appetite, vomiting, sometimes diarrhœa, excitement of the circulation, dilatation of the pupils, and, in large doses, heaviness, apathy, slowness of movement, and sometimes convulsions. Injected into the jugular vein, it caused accelerated circulation, difficult and even spasmodic respiration, convulsions, tetanic spasms, and death. Two grains of the acetate, injected into the rectum of a rabbit, killed it in six hours. Ten grains given to a dog, and confined by a ligature round the œsophagus, though it occasioned great disturbance, did not prove fatal. Twenty grammes (℥v) produced no effect on a hog. (*B. & F. Medico-chirurg. Rev.*, Am. ed., July, 1854, p. 189.) Besides solania, the stalks of S. Dulcamara contain, according to Pfaff, a peculiar principle to which he gave the name of *picroglycion*, indicative of the taste, at once bitter and sweet, which it is said to possess. This was obtained by Blitz, in the following manner. The watery extract was treated with alcohol, the tincture evaporated, the residue dissolved in water, the solution precipitated with subacetate of lead, the excess of this salt decomposed by sulphuretted hydrogen, the liquor then evaporated to dryness, and the residue treated with acetic ether, which yielded the principle in small isolated crystals by spontaneous evaporation. Pfaff found also in dulcamara a vegeto-animal substance, gummy extractive, gluten, green wax, resin, benzoic acid, starch, lignin, and various salts of lime.

Medical Properties and Uses. Dulcamara possesses feeble narcotic properties, with the power of increasing the secretions, particularly those of the kidneys and skin. We have observed, in several instances, when the system was under its influence, a dark-purplish colour of the face and hands, and at the same time considerable languor of the circulation. Its narcotic effects do not become obvious, unless when it is taken in large quantities. In over-doses it produces nausea, vomiting, faintness, vertigo, and convulsive muscular movements. A case is recorded in Casper's *Wochenschrift*,

having when moist an acrid smell like that of potatoes, and a nauseous taste. With sulphuric acid it gives a blood-red colour passing into brown. In doses of from one to four grammes, it caused a slight burning in the throat and eructation, and the pupil was dilated in one instance. In larger doses it caused vomiting, loss of appetite, giddiness, &c., but produced no decided soporific effect. (*B. & F. Med.-chir. Rev.*, April, 1867, p. 527.) It would, we think, be hazardous to begin with any specimen of solania which may be under observation, in doses so large as the smallest of those mentioned.

Zwenger and Kind ascertained that, when boiled with sulphuric or muriatic acid, solania is resolved into grape sugar and a much stronger alkaloid, which they name *solanidin* (*solanidia*). This has a decided alkaline reaction and a bitter taste, and forms crystallizable salts. According to this statement, solania ranks among the glucosides. (*Liebig's Annalen*, cix.) The reaction between solania and sulphuric acid, resulting in the production of a red colour, is said by these chemists actually to take place between the acid and solanidin, which has been first produced by it.

Still more recently, the astonishing information is given, on the basis of experiments by Otto Gmelin, that not only are solanin and solanidin glucosides, but that neither of them contains nitrogen, the formula of the former being $C_{88}H_{72}O_{30}$, that of the latter $C_{52}H_{42}O_4$. (*Ibid.*, ex. p. 167.) To us it seems impossible that the many experienced chemists who have found nitrogen in solania should have been mistaken; and the inference is that Gmelin has probably operated on a different substance. (*Note to the twelfth and thirteenth editions.*)

The following reaction is proposed as a test for solania. Equal measures of concentrated sulphuric acid and alcohol are mixed. A trace of solania added to the mixture, while warm, produces a rose-red colour; larger quantities, a cherry-red colour, which disappears after five or six hours, and the intensity of which is not affected by the presence of morphia even in large quantities. (*Am. Journ. of Pharm.*, Nov. 1873, p. 484.)—*Note to the fourteenth edition.*

in which a man took, in one forenoon, from three to four quarts of a decoction made from a peck of the stalks, and was attacked with pain in the joints, numbness of the limbs, dryness of the mouth, and palsy of the tongue, with consciousness unimpaired, the pulse quiet, but small and rather hard, and the skin cool. The symptoms disappeared under the use of stimulants. (*Lond. Med. Gaz.*, Sept. 1850, p. 548.)* Dulcamara has been recommended in various diseases, but is now chiefly employed in the treatment of cutaneous eruptions, particularly those of a scaly character, as lepra, psoriasis, and pityriasis. In these complaints it is often beneficial, especially in combination with minute doses of the antimonials. Its influence upon the secretions is insufficient to account for its favourable effects. Perhaps they may be ascribed to its sedative influence on the capillary circulation. It is said to have been beneficially employed in chronic rheumatism and chronic catarrh. Antaphrodisiac properties have been ascribed to it. We have seen it apparently useful in mania connected with strong venereal propensities. The usual form of administration is that of decoction, of which two fluidounces may be taken four times a day, and gradually increased till some slight disorder of the head indicates the activity of the medicine. (See *Decoctum Dulcamaræ.*) An extract and fluid extract are officinal. The dose of the former is from five to ten grains, of the latter from thirty minims to a fluidrachm. That of the powder would be from thirty grains to a drachm. In cutaneous affections, a strong decoction is often applied to the skin at the same time that the medicine is taken internally.

Off. Prep. Decoctum Dulcamaræ, *U. S.;* Extractum Dulcamaræ, *U. S.;* Extractum Dulcamaræ Fluidum, *U. S.;* Infusum Dulcamaræ, *Br.* W.

ELATERIUM. *U. S., Br.*

Elaterium.

A substance deposited by the juice of the fruit of Momordica Elaterium, Ecbalium agreste (*Richard*). *U. S.* A sediment from the juice of the Squirting Cucumber fruit. *Br.*

The British Pharmacopœia recognises the fruit under the name of *Ecbalii Fructus, Squirting Cucumber Fruit*, and defines it as the fruit, very nearly ripe, of Ecbalium officinarum.

Elaterion. *Fr.;* Elaterium, *Germ.;* Elaterio, *Ital., Span.*

MOMORDICA. *Sex. Syst.* Monœcia Monadelphia.—*Nat. Ord.* Cucurbitaceæ.

Gen. Ch. MALE. *Calyx* five-cleft. *Corolla* five-parted. *Filaments* three. FEMALE. *Calyx* five-cleft. *Corolla* five-parted. *Style* trifid. *Gourd* bursting elastically. *Willd.*

Momordica Elaterium. Willd. *Sp. Plant.* iv. 605; Woodv. *Med. Bot.* p. 192, t. 72.—*Ecbalium agreste.* Richard; Lindley, *Med. and Œcon. Bot.* p. 95.—*Ecbalium officinarum.* Br.—*Ecbalium Elaterium.* French Codex, A.D. 1837. The *wild* or *squirting cucumber* is a perennial plant, with a large fleshy root, from which rise several round, thick, rough stems, branching and trailing like the common cucumber, but without tendrils. The leaves are petiolate, large, rough, irregularly

* Prof. Caylus, of Leipsic, has made numerous experiments upon man and animals, in relation to the physiological effects and relative strength of dulcamara, and its preparations, including solania, with the following results. 1. They are poisonous, and may prove fatal in over-doses. 2. In the character of their operation they are identical. 3. The extract of the twigs is from five to ten times stronger than the twigs themselves, that of solania 30 times stronger than the extract. 4. They produce congestion of the kidneys, and sometimes an increased flow of urine, which, in that case, is always albuminous. 5. They cause a constant and remarkable diminution in the frequency of respiration, and death from their action is ascribed to a paralyzing influence on the respiratory nerve-centres. 6. In the last period of their operation, they weaken while they accelerate the action of the heart. 7. Prof. Caylus thinks that they act especially on the spinal marrow and medulla oblongata, as evinced not only by their influence on the breathing, but also by the tetanic contraction they occasioned in the muscles of the chest and extremities. 8. They produce little direct effect on the brain, and cause but a feeble contraction of the pupil. 9. They increase the sensibility of the skin, and have no direct irritant influence on the stomach and bowels.

They are applicable, the Professor thinks, to spasmodic and irritative affections of the respiratory organs: and inflammation either of the lungs or bowels constitutes no contraindication to them. He recommends solania in the form of acetate, in the dose of from one-sixth of a grain to a grain. He prefers the alcoholic extract to the aqueous. (*Ann. de Thérap.*, A.D. 1859, p. 24, and *Arch. Gén.*, Mars, 1859, p. 350.)—*Note to the twelfth edition.*

cordate, and of a grayish-green colour. The flowers are yellow, and proceed from the axils of the leaves. The fruit has the shape of a small oval cucumber, about an inch and a half long, an inch thick, of a greenish or grayish colour, and covered with stiff hairs or prickles. When fully ripe, it separates from the peduncle, and throws out its juice and seeds with considerable force through an opening at the base, where it was attached to the footstalk. The name of squirting cucumber was derived from this circumstance, and the scientific and officinal title is supposed to have had a similar origin; though some authors maintain that the term *elaterium* was applied to the medicine, rather from the mode of its operation upon the bowels, than from the projectile property of the fruit.*

This species of Momordica is a native of the south of Europe, and is cultivated in Great Britain, where, however, it perishes in the winter.† Elaterium is the substance spontaneously deposited by the juice of the fruit, when separated and allowed to stand. From the experiments of Dr. Clutterbuck, it has been supposed that only the free juice about the seeds, which is obtained without expression, affords the product. The substance of the fruit itself, the seeds, as well as other parts of the plant, have been thought to be nearly or quite inert. From the statements made by Mr. Bell (see *note* below), these opinions must be somewhat modified; but there is no doubt that strong expression injures the product. When the fruit is sliced and placed upon a sieve, a perfectly limpid and colourless juice flows out, which soon becomes turbid, and in the course of a few hours begins to deposit a sediment. This, when collected and carefully dried, is very light and pulverulent, of a yellowish-white colour, slightly tinged with green. It is the genuine elaterium, and was found by Clutterbuck to purge violently in the dose of one-eighth of a grain. But the quantity contained in the fruit is very small. Clutterbuck obtained only six grains from forty cucumbers. Commercial elaterium is often a weaker medicine, owing in part, perhaps, to adulteration, but much more to the mode in which it is prepared. In order to increase the product, the juice of the fruit is often expressed with great force; and there is reason to believe that it is sometimes evaporated so as to form an extract, instead of being allowed to deposit the active matter. The French elaterium is prepared by expressing the juice, clarifying it by rest and filtration, and then evaporating to a suitable consistence. As the liquid remaining after the deposition of the sediment is comparatively inert, it will be perceived that the preparation of the French Codex must be relatively feeble. The following are the directions of the British Pharmacopœia. "Cut the fruit lengthwise, and lightly press out the juice. Strain it through a hair sieve, and set aside to deposit. Carefully pour off the supernatant liquor; pour the sediment on a linen filter, and dry it on porous tiles, with a gentle heat. The decanted fluid may deposit a second portion of sediment, which can be dried in the same way." The latter portion deposited is of a lighter colour. (*Pereira.*) The slight pressure directed is necessary for the separation of the juice from the somewhat immature fruit employed. The perfectly ripe fruit is not used; as, in consequence of its disposition to part with its contents, it cannot be carried to market. In the British Pharmacopœia, the former name of Extractum Elaterii of the London College has been very properly abandoned; as the preparation is in no correct sense of the word an extract. As the plant is not cultivated in this country for medicinal purposes, our Pharmacopœia very properly adopts, as officinal, the medicine as found in commerce. It is brought chiefly from England; but it is probable that a portion of the elaterium, of which Dr. Pereira speaks as coming from Malta, reaches our market also.‡

* From the Greek ελαννω I drive, or ελατηρ driver. The word elaterium was used by Hippocrates to signify any active purge. Dioscorides applied it to the medicine of which we are treating.

† On a visit to Spain in the year 1861, the author noticed the plant growing abundantly in different localities upon the Rock of Gibraltar, especially on its southern declivity, which faces Africa, where in some spots it almost covered the ground. (*Note to the twelfth edition.*)

‡ The following notice of the cultivation of the elaterium plant, and the preparation of the drug at Mitcham, in Surrey, England, condensed from a paper by Mr. Jacob Bell in the *Pharm. Journ.* for October, 1850, may have some interest for the American reader. The seeds are sown in March, and the seedlings planted in June. In luxuriant plants the stem sometimes acquires an extraordinary breadth. In one instance, though not thicker than the forefinger where it issued from

Properties. The *best elaterium* is in thin flat or slightly curled cakes or fragments, often bearing the impression of the muslin upon which it was dried, of a greenish-gray colour becoming yellowish by exposure, of a feeble odour, and a bitter somewhat acrid taste. It is pulverulent and inflammable, and so light that it swims when thrown upon water. When of *inferior quality*, it is sometimes dark-coloured, much curled, and rather hard, breaking with difficulty, or presenting a resinous fracture. The *Maltese elaterium* is in larger pieces, of a pale colour, sometimes without the least tinge of green, destitute of odour, soft, and friable; and not unfrequently gives evidence of having been mixed with chalk or starch. It sinks in water.

Dr. Clutterbuck first observed that the activity of elaterium resided in the portion of it soluble in alcohol and not in water. This fact was afterwards confirmed by Dr. Paris, who found that the alcoholic extract, treated with boiling distilled water, and afterwards dried, had the property of purging in minute doses, while the remaining portion of the elaterium was inactive. The subsequent experiments of Mr. Hennell, of London, and Mr. Morries, of Edinburgh, which were nearly simultaneous, demonstrated the existence of a crystallizable matter in elaterium, which is the active principle, and has been named *elaterin*. According to Mr. Hennell, 100 parts of elaterium contain 44 of elaterin, 17 of a green resin (*chlorophyll*), 6 of starch, 27 of lignin, and 6 of saline matters. The alcoholic extract which Dr. Paris called *elatin*, is probably a mixture of elaterin and the green resin or chlorophyll.*

the earth, it was in its broadest part four inches wide and half an inch thick. A wet season interferes with the productiveness of the plant. At the spontaneous separation of the fruit, it throws out its juice sometimes to the distance of twenty yards; and hazard of injury to the eyes is incurred by walking among the plants at their period of maturity. A bushel of the fruit weighs 40 pounds, and the price varies from 7 to 10 shillings sterling. In the manufacture of elaterium, which begins early in September, the fruit, having been washed, if necessary, to cleanse it from earthy matters, is sliced longitudinally into halves, and then submitted to expression, wrapped in a hempen cloth, in a common screw-press. Considerable force is used in the expression. The juice is then strained through hair, cypress, or wire sieves, and set aside for deposition. The deposit usually takes place in three or four hours. When this part of the process is completed, the supernatant liquor is carefully poured off, the deposit is placed on calico cloths resting on hair sieves, and allowed to drain for about twelve hours, after which it is removed by a knife, spread over small cloths, and dried on canvas frames in the drying stove. About half an ounce of fine elaterium is obtained from a bushel of fruit. Some obtain more; but the product is inferior, in consequence of the use of too much force in the expression. Good elaterium has a pale pea-green tint; that of inferior quality is of a duller hue. The juice expelled in bursting is said to undergo very little change in the air, while that expressed from the ripe fruit immediately afterwards becomes milky, and deposits elaterium. The recently burst fruit, therefore, is nearly if not quite as good for the preparation of the drug as that collected before perfect maturity. For a paper on the cultivation of the elaterium plant at Hitchin, Herts, England, taken from the *Pharmaceutical Journal*, see the *American Journal of Pharmacy*, March, 1860, p. 163. (*Note to the ninth and twelfth editions.*)

* *Chlorophyll.* The substance to which Pelletier gave this name, under the impression that it was a peculiar proximate principle, was subsequently supposed by that chemist to be a mixture of wax and a green fixed oil. (*Journ. de Pharm.*, xix. 109.) Afterwards, M. Frémy succeeded, by the joint action of a menstruum composed of two parts of ether and one of muriatic acid diluted with a little water, in separating chlorophyll into two colouring principles, one yellow and the other blue; the former being dissolved by the ether, and the latter by the muriatic acid. The yellow, M. Frémy proposed to name *phylloxanthin*, the blue *phyllocyanin*. (*Ibid.*, Avril, 1860, p. 241.) More recently MM. Frémy and Filhol have separately made further very interesting investigations into the subject. The following is a brief abstract of the proceedings of the former of these chemists. Those of the latter, which do not differ materially in their results, may be seen in the *Journ. de Pharm. et de Chim.* (4e sér., ii. 304). Chlorophyll, treated either with the alkaline bases or acids, is resolved into the two principles above mentioned, which, however, cannot be readily separated. The bases act in three different modes, according to the nature of the base itself. 1. The earthy bases, and especially alumina, shaken with an alcoholic solution of chlorophyll, form true lakes; being thrown down in combination with the green matter, and leaving a little yellow matter, and a fixed oil which always accompanies chlorophyll, and renders it so difficult to be obtained pure. But this lake with baryta is easily decomposed, and yields the green principle readily to boiling alcohol, from which it may be obtained by evaporation; and this is the easiest mode of preparing pure chlorophyll. 2. The alkalies, as potassa and soda, if boiled with chlorophyll, saponify the fatty matter, and resolve the pure chlorophyll into the two principles already referred to; but these cannot be separated. 3. The alkaline earths, as lime and baryta, and especially the latter, act in a very remarkable manner. By long boiling with chlorophyll, baryta resolves it into phylloxanthin and phyllocyanin. The former being insoluble in water is precipitated; and along with it is also precipitated an insoluble compound of the latter with baryta, constituting a true salt, in which the phyllocyanin acts the part of an acid; and, as it acts in like manner with other bases, Frémy considers it as a true acid, and changes its name accordingly to *phyllocyanic acid*. Chlorophyll may, therefore, be considered as a peculiar principle, analogous to the natural fats, which, under the action of energetic bases, undergoes a kind of saponification; the phylloxanthin representing the glycerin, and the phyllo-

Elaterin, according to Mr. Morries, crystallizes when pure in colourless microscopic rhombic prisms, having a silky appearance when in mass. It is extremely bitter and somewhat acrid, insoluble in water and alkaline solutions, soluble in alcohol, ether, and hot olive oil, and sparingly soluble in dilute acids. At a temperature between 300° and 400° it melts, and at a higher heat is dissipated in thick, whitish, pungent vapour, of an ammoniacal odour. It has no alkaline reaction. It may be procured by evaporating an alcoholic tincture of elaterium to the consistence of thin oil, and throwing the residue while yet warm into a weak boiling solution of potassa. The potassa holds the green resin in solution, and the elaterin crystallizes as the liquor cools. Mr. Hennell obtained it by treating with ether the alcoholic extract procured by the spontaneous evaporation of the tincture. This consists of elaterin and the green resin, the latter of which, being much more soluble in ether than the former, is completely extracted by this fluid, leaving the elaterin pure. But, as elaterin is also slightly soluble in ether, a portion of this principle is wasted by Mr. Hennell's method. By evaporating the ethereal solution, the green resin is obtained separate. Mr. Hennell says that this was found to possess the purgative property of elaterium, as it acted powerfully in a dose less than one-third of a grain. But the effect was probably owing to the presence of a portion of elaterin which had been dissolved by the ether. The late Dr. Duncan, of Edinburgh, ascertained that the crystalline principle or elaterin produced, in the quantity of $\frac{1}{12}$ or $\frac{1}{16}$ of a grain, all the effects of a dose of elaterium. The proportion of elaterin varies exceedingly in different parcels of the drug. Mr. Morries obtained 26 per cent. from the best British elaterium, 15 per cent. from the worst, and only 5 or 6 per cent. from the French; while a portion, procured according to the directions of the London College, yielded to Mr. Hennell upwards of 40 per cent. The Br. Pharmacopœia directs that the proportion of elaterin should not be less than 20 per cent. Experiments by Mr. John Williams satisfactorily prove that the fruit, exhausted of the free juice from which elaterium is obtained, contains very little if any elaterin, certainly not enough to compensate for the cost of its extraction. (*Chem. News*, Feb. 18, 1860, p. 124.) Mr. Williams substitutes the name of *ecbalin* for that of elaterin; a change which, we think, is uncalled for, at least so long as that of elaterium is retained for the medicine.

Choice of Elaterium. The inequality of elaterium depends probably more on diversities in the mode of preparation than on adulteration. Sometimes, however, it is greatly sophisticated; and large quantities are said to have been imported into this country, consisting mainly of chalk, and coloured green artificially. (B. Canavan, *N. Y. Journ. of Pharm.*, iii. 385.) It should possess the sensible properties above indicated as characterizing good elaterium, should not effervesce with acids, and should yield from one-sixth to one-fourth of elaterin.

Medical Properties and Uses. Elaterium is a powerful hydragogue cathartic, and in a large dose generally excites nausea and vomiting. If too freely administered, it operates with great violence both upon the stomach and bowels, producing in-

cyanic acid a fatty acid coloured bluish-green. By treating the mass thus obtained with alcohol, we obtain a solution of the phylloxanthin, which, as the alcohol evaporates, separates in a crystalline form. By treating with sulphuric acid the phyllocyanate of barium left behind, we obtain the phyllocyanic acid, which is soluble in alcohol and ether. Thus the two principles may be isolated.

Phylloxanthin is neuter, insoluble in water, soluble in alcohol and ether, and crystallizable, sometimes in yellow plates, sometimes in reddish prisms, resembling bichromate of potassium, and possessing dyeing powers analogous to those of chromic acid.

Phyllocyanic acid is soluble in water, alcohol, and ether, giving to these an olive-like colour, with bronze-red, or violet reflections. All its salts are brown or green; but only the alkaline are soluble in water. This acid dissolves in sulphuric and muriatic acid, giving rise to solutions which, according to their strength, are green, reddish, violaceous, or beautifully blue. This M. Frémy considers the important fact of the investigation, as it explains the various tints which chlorophyll offers in vegetation.

It follows, from all that has been said, that chlorophyll is an immediate proximate principle, of great motility, which undergoes diversified changes of colour in the progress of vegetation, and other changes, such as have been mentioned, under the influence of different reagents. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 185, A.D. 1865.)—*Note to the twelfth and thirteenth editions.*

An interesting fact in relation to chlorophyll is the part it plays in vegetable growth. By its presence in the vegetable cells, carbon is assimilated through the agency of light; while, in its absence, light alone is not able to effect such assimilation. (*Chem. News*, Sept. 13, 1872, p. 132.)—*Note to the fourteenth edition.*

flammation of these organs, which has in some instances eventuated fatally. It also increases the flow of urine. The fruit was employed by the ancients, and is recommended in the writings of Dioscorides as a remedy in mania and melancholy. Sydenham and his contemporaries considered elaterium highly useful in dropsy; but, in consequence of some fatal results from its incautious employment, it fell into disrepute, and was generally neglected till again brought into notice by Dr. Ferriar. It is now considered one of the most efficient hydragogue cathartics in the treatment of dropsical diseases, in which it has sometimes proved successful after all other remedies have failed. The full dose of commercial elaterium, as formerly kept in the shops, was often from one to two grains; but, as the quality has greatly improved, this dose might now be much too large, and the best plan is to give it in the dose of a sixth to a quarter of a grain, repeated every hour till it operates, and increased if necessary. It should be observed by young practitioners that these doses are inapplicable to the very old and feeble and those prostrated by disease. A case is recorded in which two-fifths of a grain proved fatal by excessive purging in an old lady of 70 years, in the last stage of liver and heart disease, complicated with dropsy; a result which a very little consideration would have anticipated. (*Am. J. of Pharm.*, July, 1868, p. 373.) The dose of Clutterbuck's elaterium is the eighth of a grain. That of elaterin is from the sixteenth to the twelfth of a grain, and is best given in solution. One grain may be dissolved in a fluidounce of alcohol with four drops of nitric acid, and from 30 to 40 minims may be given diluted with water.

W.

ELEMI. *Br.*

Elemi.

Botanical source undetermined, probably from Canarium commune. A concrete resinous exudation. *Br.*

Résine élemi, *Fr.;* Oelbaumharz, Elemi, *Germ.;* Elemi, *Ital.;* Goma de limon, *Span.*

Amyris. *Sex. Syst.* Octandria Monogynia.—*Nat. Ord.* Terebintaceæ, *Juss.;* Amyrideæ, *R. Brown, Lindley.*

Gen. Ch. Calyx four-toothed. *Petals* four, oblong. *Stigma* four-cornered. *Berry* drupaceous. *Willd.*

Some botanists separate from this genus the species which have their fruit in the form of a capsule instead of a nut, and associate them together in a distinct genus with the name of *Icica.* This is recognised by De Candolle.

Most of the trees belonging to these two genera yield, when wounded, a resinous juice analogous to the turpentines. It is not improbable that the drug, usually known by the name of *elemi*, is derived from several different trees. That known to the ancients is said to have been obtained from Ethiopia, and all the elemi of commerce was originally brought from the Levant. The tree which afforded it was not accurately known, but was supposed to be a species of Amyris. At present the drug is said to be derived from three sources, namely, Brazil, Mexico, and Manilla. The Brazilian is believed to be the product of a plant mentioned by Marcgrav under the name of *icicariba*, and called by De Candolle *Icica Icicariba.* It is a lofty tree, with pinnate leaves, consisting of three or five pointed, perforated leaflets, smooth on their upper surface and woolly beneath. It is erroneously stated in some works to be a native of Carolina. The elemi is obtained by incisions into the trees, through which the juice flows and concretes upon the bark. The Mexican is said by Dr. Royle to be obtained from a species of Elaphrium, which that author has described from dried specimens, and proposes to name *E. elemiferum.* (*Mat. Med.*, Am. ed., p. 339.) The Manilla elemi is conjecturally referred to *Canarium commune.* (*Ibid.*, p. 340.)

Elemi is in masses of various consistence, sometimes solid and heavy like wax, sometimes light and porous; unctuous to the touch; diaphanous; of diversified colours, generally greenish with intermingled points of white or yellow, sometimes greenish-white with brown stains, sometimes yellow like sulphur; fragile and friable when cold; softening by the heat of the hand; of a terebinthinate somewhat aromatic odour, diminishing with age, and said, in some varieties, to resemble that of

fennel; of a warm, slightly bitter, disagreeable taste; entirely soluble, with the exception of impurities, in boiling alcohol; and affording a volatile oil by distillation A variety examined by M. Bonastre was found to consist of 60 parts of resin, 24 of a resinous matter soluble in boiling alcohol, but deposited when the liquid cools, 12·5 of volatile oil, 2 of extractive, and 1·5 of acid and impurities. M. Baup found the resin to be of two kinds, one amorphous, the other crystallizable; the latter of which he proposes to call *elemin*. (*Journ. de Pharm.*, 3e sér., xx. 331.) Elemi is sometimes adulterated with colophony and turpentine. The Manilla elemi is in masses of a light-yellowish colour, internally soft, and of a strong odour of fennel. (*Royle.*) We have been told that a considerable amount of elemi is used in this country by the hatters. Dr. Emil Mannkoff obtained from Brazilian elemi about 6 per cent. of a colourless volatile oil, insoluble in water, but easily dissolved both by alcohol and ether, of a not unpleasant odour, and a somewhat acrid and bitter taste, and of a composition represented, according to Stenhouse and Deville, by the formula C_5H_6. Dr. Mannkoff considers the oil as coinciding in medical properties with oil of turpentine, for which it may be substituted, with the advantage of a less disagreeable taste. (*B. & F. Medico-chir. Rev.*, July, 1859, p. 170, from *Virchow's Archiv.*)

Medical Properties and Uses. Elemi has properties analogous to those of the turpentines; but is exclusively applied to external use. In the United States it is rarely employed even in this way. In the Pharmacy of Europe it enters into the composition of numerous plasters and ointments. We are told that it is occasionally brought to this country in small fragments, mixed with the coarser kinds of gum arabic from the Levant and India.

Off. Prep. Unguentum Elemi, *Br.* W.

ERGOTA. *U.S., Br.*

Ergot.

The sclerotium of Claviceps purpurea (*Tulasne*), replacing the grain of Secale cereale. *U.S.* The sclerotium (compact mycelium or spawn of Claviceps purpurea, *Tulasne*), produced within the paleæ of the common rye, Secale cereale. *Br.*

Spurred rye; Secale cornutum; Siegle ergoté, *Fr.*; Mutterkorn, *Germ.*

In all the *Graminaceæ* or grass tribe, and in some of the *Cyperaceæ*, the place of the seeds is sometimes occupied by a morbid growth, which, from its resemblance to the spur of a cock, has received the name of *ergot*, adopted from the French. This product is most frequent in the rye, *Secale cereale*, and, having been found, as occurring in that plant, to possess valuable medicinal properties, was adopted in the first edition of the U. S. Pharmacopœia, under the name of *secale cornutum* or *spurred rye*. In the edition of 1840, this name was changed for *ergota*, in conformity with the nomenclature of the London and Edinburgh colleges. It is probable that this morbid growth has similar properties from whatever plant derived; and the fact has been proved in relation to the ergot of wheat. (See *Am. Journ. of Med. Sci.*, N. S., xxxii. 479.) Indeed, in a case reported by Dr. D. L. McGugin (*Iowa Med. Journ.*, iv. 93), this variety of ergot is said to have succeeded promptly, when that of rye, previously tried, had failed.*

Different opinions have been held in relation to the nature of this singular sub-

* *Ergot of Wheat.* M. Leperdriel, jun., of Montpellier, in France, recommends this product as preferable to the ergot of rye, on the grounds that it is destitute of the poisonous properties of the latter, and is more certain as a remedy, in consequence of being less liable to change. The former point is, to say the least, very uncertain; but in relation to the latter there is some reason to think that M. Leperdriel is right; for Prof. Bentley, of London, found that of two specimens, one of the ergot of rye, the other of wheat, which had been kept under similar circumstances for ten years, the former was quite destroyed, while the latter was apparently unchanged. Ergot is rarer in wheat than in rye; and, in the head of the former, there is generally but one and very rarely more than two of the diseased grains. It is produced usually in wheat in wet seasons, and on that side of the head most exposed to the dampness. It is shorter and much thicker than the ergot of rye, being about half an inch long and three-quarters of an inch or more in circumference, and cleft into two or three divisions. In colour and smell it resembles the spurred rye. (*Pharm. Journ. and Trans.*, March and April, 1863, pp. 423 and 442.)—*Note to the twelfth edition.*

stance. In a note below are contained the observations made on the subject in former editions of the Dispensatory. More recent investigations by M. L.-R. Tulasne, while they confirm the opinion of De Candolle that the ergot is a new product, altogether distinct from the grain of the rye, have developed, in an apparently quite satisfactory manner, the whole history of this mushroom, which, if only for the curious and highly interesting stages of its progress, merits a brief notice here.* The chief source of failure in the investigation of this subject has been, that observers have fixed their attention on some one stage in the development of the fungus, and ceased to push their inquiries further. There are three successive stages, in each of which the plant presents a peculiar form. It has already been largely developed, when it begins to project beyond the glume, which has protected its early growth; but there are usually other flowers at the same time which present it in a rudimentary state. It begins with a structure which M. Tulasne calls the *sphacelia*. This appears on the outside of the ovary of the flower, and is intimately attached to it. Its development commences with that of the pistil, which serves as a soil for it. The ovary of the rye consists of a cellular membrane of two coats, the outer of which has a thick parenchyma, white and gorged with juice, the inner is very delicate and green. The *sphacelia*, when it takes possession of the ovary, identifies itself with the outer parenchyma, and in some measure replaces it, being as it were borne by the inner membrane. It rapidly increases, taking the form of the ovary, and almost obliterating its cavity. The ovule is either entirely wanting, or may be seen, on a careful examination, in an imperfect form. For some time the parasite is represented entirely by the *sphacelia*, which is an oblong, fungous mass, almost homogeneous, soft and tender, marked on its surface by numerous sinuous furrows, and having within many irregular cavities, which, as well as the outer coat, are uniformly covered with linear parallel cells. From the summits of these peripheric

* Ergot was at one time thought to be merely the seed altered by disease; the morbid condition being ascribed by some to the agency of an insect, by others to excess of heat and moisture. A second opinion considered it a parasitic fungus, occupying the place of the seed. This was entertained by De Candolle, who called the fungus *Sclerotium Clavus*. According to a third and intermediate opinion, the ergot is the seed, diseased and entirely perverted in its nature by the influence of a parasitic fungus, attached to it from the very beginning of its development. This view was put forth by M. Léveillé, in a memoir published in the *Annals of the Linnæan Society of Paris* for the year 1826. He gave to the supposed fungus the name of *Sphacelia segetum;* but his observations as to its characters have not been sustained. Until within a very few years, the credit was ascribed to the late Mr. E. J. Quekett, of London, of having fully investigated this subject, and established the last-mentioned view of the nature of ergot. According to Mr. Quekett, the beginning of the growth of the ergot is marked by the appearance, about the young grain and its appendages, of multitudes of minute filaments like cobwebs, which run over all its parts, cementing anthers and stigmas together, and of a white coating upon the surface of the grain, from which, upon immersion in water, innumerable minute particles separate, which after a time sink in the fluid. These particles, when examined by the microscope, prove to be the germs or *sporidia* of a species of fungus, and may be observed to sprout and propagate in various ways under favourable circumstances. Their length, upon the average, is about the four-thousandth of an inch. The filaments are the results of the growth of these singular germs. The sporidia and filaments do not increase with the increase of the ergot; and, when this has projected beyond the paleæ and become visible, it has lost a portion of its white coating, and presents a dark-violet colour. It now increases with great rapidity, and attains its full size in a few days. When completely developed, it exhibits very few of the filaments or sporidia upon its surface. But Mr. Quekett believed that the germs of the fungus emit their filaments through the tissue of the ergot when young and tender, and that, as this increases, it is made up partly of the diseased structure of the grain, and partly of the fungus. The plant was named by Mr. Quekett *Ergotætia abortifaciens;* for which title Dr. Pereira, at the suggestion of the Rev. M. J. Berkeley, substituted that of *Oidium abortifaciens*. This view of the nature and cause of ergot is supported by the asserted facts, that the microscopic fungus has an existence independent of the morbid grain, being found in various other parts of the plant, and growing even when entirely separated from it; and that the sporidia or white dust upon the surface of ergot, if applied to the seeds of certain Graminaceæ before germination, or sprinkled on the soil at the roots of the plants after they have begun to grow, will give rise to ergotized fruit. That the ergot is not itself a peculiar fungus, but the perverted grain, was supposed to be evinced by the frequent remains of the stigma upon its summit, by the scales at its base, and by the circumstance that in some instances only a portion of the seed is ergotized. (See *Am. Journ. of Pharm.*, xi. 116 and 237.) It is a curious fact, that the observations of Mr. Quekett were generally correct, and have been verified by M. Tulasne himself; yet the plant is only accidentally present, and is wholly distinct from the true ergot fungus. The fact noted that the sporidia of Mr. Quekett's fungus are apparently capable, if applied to the seeds of certain Graminaceæ, or sprinkled on the soil where they grow, of giving rise to ergot in these plants, is readily explicable on the supposition, that the sporidia might have been mixed with those of the proper ergot.

cells, internal as well as external, issue oval corpuscles, from the 5 to the 7 thousandths of a millimeter in length, which spread upon neighbouring objects, and especially the glumes of the flowers they inhabit. They are a kind of reproductive cells, called conidia, which are produced by many fungi, long before the perfect plant is developed. M. Tulasne calls them "*spermatie.*" In the early stage, the *sphacelia* respects the top of the ovary and the stigmas attached. The stamens often abort; but the filaments and anthers may sometimes be seen buried in the tissue of the sphacelia, and altered by its action. Sometimes the ovule is not completely aborted, but is certainly never developed into a monster grain. In all ergotted plants, the top of the pistils and stigmas, when they remain, are often covered with a mouldiness, consisting of spores and entangled filaments, which end by covering the parts with an abundant ashy or sooty powder. This is a different fungus, and was confounded by Mr. Quekett with the ergot plant. It is found as well in the non-ergotted as the ergotted flowers, and in those of plants which do not bear ergot. At a somewhat advanced period of the development of the sphacelia, there exudes, especially from the summit, a very adhesive juice, which spreads over that structure, bearing along with it an immense number of the seedlets or "*spermaties.*" This leaves on the surface when dry an oily appearance, and afterwards the spots, where it remains, become brownish or blackish. But this exudation does not appear until the *sphacelia* has ceased to constitute the whole plant.

At the base of the sphacelia is produced a compact body, violet-black without and white within, which is the ergot in a rudimentary state. With this commences the second stage in the development of the fungus. The young ergot is everywhere invested by the tissue of the *sphacelia* (which Tulasne calls also *spermagonia*, from its office); but, as it increases, it seems to be placed below the *spermatopherous apparatus*, and raises it steadily out of the floral bractes which concealed it, ending by supporting it wholly at its summit. Sometimes are carried with it the atrophied ovary, which still shows the hairs that crowned it, and some remains of the stigmas. It results that the ergot, which is technically the *sclerotium* of the fungus, remains for some time concealed in the sphacelia, so that this seems to constitute the whole plant. But, when the function belonging to this has been fulfilled, which is apparently to impregnate the sclerotium, it begins to become dry, and is much deformed. The ergot, on the contrary, increases in all directions, and soon appears above the glume. As it augments, the thin coating which it has received from the spermatopherous tissue, especially below, gradually becomes thinner, and seems to disappear; so that its surface, instead of being uniformly violet-black, is only here and there covered with the remains of the tissue, or by a deposit of the conidia or "*spermatie.*" Nevertheless, the sphacelia, deformed, shrunken, and worn away by rains and other causes, remains long at the top of the ergot, along with the abortive ovary, &c., and may even continue to adhere when the ergot is detached from the plant.

The time required for the full development of the sphacelia and the ergot or sclerotium varies, no doubt; but a rapidity of growth has been claimed for it which the truth will not warrant. The period has even been estimated at three days; but this is much too short. In an example under the observation of M. Tulasne, at least a month elapsed after the appearance of the sphacelia, before the growth was completed.

Apart from an obscure resemblance to the seed of the plant supporting it, the ergot has absolutely nothing in common with the normal grain, and it is surprising how it should have come, after investigation, to be considered as the hypertrophied seed. The anatomical structure and all the physical characters of ergot are those of the mushrooms, or rather of a sclerotic mycelium. The parenchyma, which is white, dry, and brittle, consists in all its parts of minute utricles, globular or polyhedric, with rather thick walls, intimately united, and filled with a limpid oil, but feebly coloured by iodine. The superficial utricles, which alone are coloured, have an outer wall thicker than the inner, and the colour of these is what gives its characteristic hue to ergot. Not the least trace of starch is to be detected.

The germination of the ergot, and the growth of a minute mushroom, are the last stage in the development of this fungus. About three months after ergot has been planted in a suitable soil, evidences of germination are seen in the sprouting of little

globular prominences at points on its surface, which gradually enlarge, and raise themselves from the surface upon cylindrical stems, imitating in a diminutive way the growth of ordinary mushrooms. These little fungi belong to the genus *Sphæria.* As they increase, the interior of the ergot becomes exhausted, no doubt by contributing to their growth; so that this product seems to act the part of certain tubers, in the higher forms of vegetation, containing germs, and nourishment for their development. Falling to the ground, in its natural course, the ergot in the soil germinates, and produces mushrooms, the spores of which, carried up with the juices of rye, become lodged in the ovary, where they begin the course of life and progress which has been delineated. Tulasne has given the name of *Claviceps purpurea* to the whole fungus. There may be other species of Claviceps, giving rise to ergot in other plants. Thus M. Tulasne believes that the ergot of the reed is a different species; but there is no reason to think that any other species is concerned in the product of any variety of ergot that has been in medical use. (*Annales des Sciences Naturelles*, 3e sér., xx. 5, A.D. 1853.)

The ergot usually projects out of the glume or husk beyond the ordinary outline of the spike or ear. In some spikes the place of the seeds is wholly occupied by the ergot, in others only two or three spurs are observed. It is said to be much more energetic when collected before than after harvest. Rye has generally been thought to be most subject to the disease in poor and wet soils, and in rainy seasons; and intense heat succeeding continued rains has been said to favour its development, especially if these circumstances occur at the time the flower is forming. It is now, however, asserted that moisture has little or nothing to do with its production.* It should not be collected until some days after it has begun to form; as, according to M. Bonjean, if gathered on the first day of its formation, it does not possess the poisonous properties which it exhibits when taken on the sixth day. (See *Pharm. Journ.*, Jan. 1842.)

Properties. Ergot is in solid, brittle yet somewhat flexible grains, from a third of an inch to an inch and a half long, from half a line to three lines in thickness, cylindrical or obscurely triangular, tapering towards each end, obtuse at the extremities, usually curved like the spur of a cock, marked with one or two longitudinal furrows, often irregularly cracked or fissured, of a violet-brown colour and often somewhat glaucous externally, yellowish-white or violet-white within, of an unpleasant smell when in mass resembling that of putrid fish, and of a taste which is at first scarcely perceptible, but ultimately disagreeable and slightly acrid. Under the microscope the surface appears more or less covered with sporidia, which occasion its glaucous aspect; and the interior structure is found to be composed of minute roundish cells, containing, according to Quekett, particles of oil. Ergot yields its virtues to water and alcohol. The aqueous infusion or decoction is claret-coloured, and has an acid reaction. It is precipitated by acetate and subacetate of lead, nitrate of silver, and tincture of galls; but affords with iodine no evidence of the presence of starch. Long boiling impairs the virtues of the medicine.

Ergot has been analyzed by Vauquelin, Winckler, Wiggers, Wright, Legrip, and several others. The analysis by M. Legrip is among the most complete. That chemist obtained from 100 parts of ergot 34·50 parts of a thick, fluid, fixed oil, of a fine yellow colour; 2·75 of starch; 1·00 of albumen; 2·25 of inulin; 2·50 of gum; 1·25 of uncrystallizable sugar; 2·75 of a brown resin; 3·50 of *fungin;* 13·50 of vegeto-animal matter; 0·75 of osmazome; 0·50 of a fatty acid; 24·50 of lignin; 0·50 of colouring principles; an odorous principle not isolated; 2·25 of fungate of potassium; 0·50 of chloride of sodium; 0·50 of sulphate of calcium and magnesium; 1·25 of subphosphate of calcium; 0·25 of oxide of iron; 0·15 of silica; and 2·50 of water, with 2·35 loss. (*Ann. de Thérap.*, 1845, p. 44.) Crystals of sulphate of potassium were obtained in considerable quantity on one occasion in carrying out the British officinal process for liquid extract of ergot, which may possibly have pre-existed in the ergot, but were more probably formed during the process

* Mr. J. Price Wetherill informed the author that, in two seasons, he had found rye, sown very late, so as scarcely to come up before spring, to be almost universally ergotized; while neighbouring rye, sown at the proper season, in the same kind of soil precisely, had nothing of the disease, though the seed was the same in both cases. (*Note to the sixth edition.*)

out of constituents pre-existing. (Attfield, *Pharm. Journ.*, March, 1869, p. 513.) Wiggers obtained a substance which he denominated *ergotin*, under the impression that it was the active ingredient. It was reddish-brown, of a peculiar nauseous odour and bitter slightly acrid taste, soluble in alcohol, but insoluble in water or ether. It was obtained by digesting ergot in ether and afterwards in alcohol, evaporating the alcoholic solution, and treating the extract thus obtained with water, which left the ergotin undissolved. It was given with fatal effects to a hen. But, though the ergotin of Wiggers may exercise some influence on the system, it is very obvious that it cannot be the active principle of ergot, which yields its virtues to water, and partially at least to ether. Dr. Wright supposed the virtues of ergot to reside in the fixed oil, which he therefore recommended as a substitute for the medicine. The *oil of ergot*, when obtained from grains recently collected, is, according to Dr. Wright, often quite free from colour; but, as usually prepared, is reddish-brown. It has a disagreeable, somewhat acrid taste, is lighter than water, and is soluble in alcohol and alkaline solutions. It is prepared by forming an ethereal tincture of ergot by the process of displacement, and evaporating the ether with a gentle heat. Experience has shown that, though the oil thus prepared with ether may have produced effects analogous to those of ergot, they were to be ascribed rather to some principle extracted along with the oil by the menstruum than to the oil itself; for, when procured by expression, this has been found to be inactive. Indeed, Prof. Procter has ascertained that it contains a little secalin, one at least of the active principles of ergot, which may be separated from it by washing with acidulated water. According to Mr. T. R. Baker, the oil has a taste and smell similar to those of castor oil, with which it also agrees in ultimate composition, and yields analogous results in saponification. (*Am. Journ. of Pharm.*, xxiv. 101–2.) Dr. T. C. Herrmann investigated specially the chemical constitution of the oil of ergot. As obtained by means of ether, it was brownish-yellow, of an aromatic smell and acrid taste, viscid, of the sp. gr. ·9249, and without the drying property. It consists of 22·703 per cent. of palmitic acid, 69·205 of oleic acid, and 8·091 of glycerin. (*New Remedies*, Jan. 1872, p. 238; from *Buchner's Repertorium*, 1871, p. 283.) The *sugar of ergot* was found by Mitscherlich to be peculiar, and was named by him *mycose*. He described it as crystallizable, very soluble in water, almost insoluble in cold but dissolved by about 100 parts of boiling alcohol, quite insoluble in ether, and without the action of glucose on the salts of copper. Its formula is $C_{12}H_{11}O_{11}+2HO$. (*Am. Journ. of Pharm.*, xxx. 346.) Dr. F. L. Winckler discovered a *peculiar colouring matter* in ergot, which he considered, if not identical with hæmatin, as closely resembling it. (*Pharm. Journ.*, xii. 86.)

Secalia. Propylamia. By the same chemist a volatile alkaloid was detected in ergot, which he named *secalin* (*secalia*), and believed to exist in the drug in the form of *ergotate of secalin*, being combined with the ergotin of Wiggers, to which he ascribed acid properties, and therefore gave the name of *ergotic acid*. This alkaloid has been ascertained to be identical with *propylamin* (*propylamia*), the odorous principle of herring pickle. Winckler obtained it by distilling the watery extract of ergot with potassa. The following process, employed by Prof. Procter, yields it with facility. Ergot, having been exhausted by ether, is submitted to percolation with water; the aqueous solution, after the addition of four times its bulk of alcohol, which precipitates the gummy and albuminous matter, is filtered; the liquid is concentrated and mixed with milk of lime, and the mixture distilled into a receiver containing water acidulated with sulphuric acid. The secalia escapes freely, and is condensed in the receiver, forming a sulphate with the acid present. If to a little of this liquid a drop of solution of potassa is added, the odour of ergot is perceived; and the presence of a rod moistened with muriatic acid produces visible vapours of muriate of secalia. (*Proceed. of the Am. Pharm. Assoc.*, A.D. 1857.) It can scarcely be doubted that the virtues of ergot are connected in some degree with this alkaloid; and the conjecture of Winckler that the ergotate of secalia is the active principle of ergot, if wrong, is so probably only by its exclusiveness.*

* *Ergotina. Ecbolina.* Experiments were a few years since made on ergot by Mr. Wm T. Wenzell, of La Crosse, Wisconsin, which, if confirmed by future observation, will throw new and most

The odour of ergot is no doubt owing to the liberation of its volatile alkaloid, probably in consequence of a slow decomposition of the native salt. A method of detecting ergot in a mixed powder, rye flour for example, is thus afforded. If, on the addition of solution of potassa, the odour of ergot is perceived, its presence is sufficiently proved.

Ergot, when perfectly dry and kept in well-stopped bottles, will retain its virtues for a considerable time; but, exposed to air and moisture, it speedily undergoes chemical change and deteriorates. M. Gobley kept for more than ten years, perfectly sound, some ergot which he had selected from the year's harvest, carefully sifted, wiped with linen, then exposed to a heat of from 50° to 60° C. for three or four hours, and finally put into small boxes, holding each about 30 grammes (a troyounce), previously heated with the ergot, and finally closed air-tight with pitch. (*Journ. de Pharm.*, Mar. 1873, p. 216.) It is, moreover, apt to be attacked by a minute worm, which consumes the interior of the grain, leaving merely the exterior shell and an excrementitious powder. This insect is sometimes found in the ergot before removal from the plant. In the state of powder, the medicine still more readily deteriorates. It is best, as a general rule, to renew it every year or two. M. Viel recommends that it should be well dried at a gentle heat, and incorporated with double its weight of loaf sugar, by means of which, if protected from moisture, it will retain its virtues for many years. According to M. Zanon, the same result is obtained by stratifying it with well washed and perfectly dried sand, in a bottle from which air and light are excluded. Camphor is said to prevent injury from worms.

Medical Properties and Uses. Given in small doses, ergot produces, in the system of the male, no obvious effect; but, in the female, exhibits a strong tendency to the uterus, upon the contractile property of which it operates with great energy. In the quantity of half a drachm or a drachm it often occasions nausea or vomiting, and in still larger doses produces a sense of weight and pain in the head, giddiness,

valuable light upon the intricate subject of the composition of that drug. Mr. Wenzell claims to have discovered in it two new fixed alkaloids, which he proposes to name respectively ecbolina and ergotina, and in which, along with the volatile alkaloid propylamia, the virtues of the medicine reside. Mr. Wenzell claims also to have ascertained that ergotic acid, the peculiar acid of ergot, with which the alkaloids are probably combined, is volatile. The acid reaction, however, which is evinced by an infusion of ergot, is not, he thinks, owing to this acid, but to an acid phosphate of magnesium.

Ecbolina was obtained by precipitating a cold infusion of ergot with acetate of lead, throwing down the lead with sulphuretted hydrogen, filtering and concentrating the liquid, adding gradually bichloride of mercury so long as a precipitate was produced, washing the precipitate, treating it with sulphuretted hydrogen, and filtering. The chloride (muriate) of ecbolina thus obtained was treated with an excess of phosphate of silver, the chloride of silver formed and the excess of the phosphate were removed by filtration, the phosphoric acid was separated by hydrate of lime, the liquid was again filtered, lime was removed by a stream of carbonic acid, and the gas expelled by a gentle heat. The liquid now contained the pure alkaloid, which was obtained by evaporation at a low temperature.

Ergotina was obtained by filtering the liquid which remained after precipitation with bichloride of mercury, treating it with phospho-molybdic acid, washing the precipitate obtained, suspending it in water with an excess of carbonate of barium, and digesting until the yellowish colour of the mixture was exchanged for a pure white, with the evolution of carbonic acid. Nothing now remained but to filter and carefully evaporate the solution, which yielded the ergotina.

The alkaloids thus obtained are brownish, apparently uncrystallizable, slightly bitter, alkaline in their reaction on litmus and turmeric, soluble in alcohol and water, and insoluble in pure ether and chloroform. They form salts with the acids, which are uncrystallizable and generally deliquescent. Ignited, they are entirely consumed, leaving no residue. As they yield ammonia when heated with lime, they contain nitrogen.

With ecbolina in solution bichloride of platinum produces a deep orange-coloured, and cyanide of potassium a white precipitate, while a solution of ergotina is affected by neither of these reagents.

As to their operation upon the system, ecbolina in the dose of half a grain, supposed to be equivalent to 30 grains of ergot, produced decided effects on the brain and spinal marrow, with involuntary contractions of the muscles, followed by nausea and general depression, with little change in the pulse, and is believed by Mr. Wenzell to be the ingredient which causes uterine contraction in women. Ergotina was found less active, but produced some cerebral disturbance with reduction of the pulse.

Ergotic acid was obtained by distilling ergot with sulphuric acid. It is supposed by Mr. Wenzell to be combined naturally with ecbolina, ergotina, and potassa; while the propylamia exists in ergot as a phosphate. (*Am. Journ. of Pharm.*, May, 1864, p. 193.)—*Note to the twelfth edition.*

The existence of *ecbolina*, as discovered by Mr. Wenzell, has been confirmed by T. C. Herrmann of Germany.—*Note to the fourteenth edition.*

dilatation of the pupils, delirium, and even stupor, proving that it possesses narcotic properties. It is said also to excite febrile symptoms; but our own observation coincides with that of authors who ascribe to it the power of reducing the frequency of the pulse. We have seen this effect produced by it in a remarkable degree, even without nausea. A case is recorded in which it produced great prostration, with an almost absent pulse, paleness and coldness of the surface, partial palsy, with pricking of the limbs, and great restlessness, without stupor or delirium. (*Gazette Med. de Paris*, Juillet 25, 1857.) Dr. Hardy, of the Dublin Lying-in Hospital, found it to diminish the pulsations of the fœtal heart. Its long-continued and free use is highly dangerous, even when no immediate effects are perceptible. Fatal epidemics in different parts of the continent of Europe, particularly in certain provinces of France, have long been ascribed to the use of bread made from rye contaminated with this fungus. Dry gangrene, typhus fever, and disorder of the nervous system attended with convulsions, are the forms of disease which have followed the use of this unwholesome food. It is true that ergot has been denied to be the cause; but accurate investigations, made by competent men upon the spot where the epidemics have prevailed, together with the result of experiments made upon inferior animals, leave no room for reasonable doubt that at least the gangrenous affection alluded to may result from it. Very large quantities are required for immediate poisonous effects. From two to eight drachms have been given at one dose to a man without very serious results; and three ounces, according to Dr. Wright, were required to kill a small dog. Death from single doses, in inferior animals, is preceded by symptoms indicating irritation of the stomach and bowels, great muscular prostration, loss of sensation, and sometimes slight spasms. A case of acute poisoning from ergot is recorded by Dr. Pratschke, in which uneasiness in the head, oppression of stomach, diarrhœa, urgent thirst, burning pains in the feet, tetanic spasms, violent convulsions, and death ensued upon eating freely of ergotized grain. (*Lond. Med. Gaz.*, Oct. 1850, p. 579.)

Ergot has been much used for promoting the contraction of the uterus. On the continent of Europe, in Germany, France, and Italy, it has long been empirically employed by midwives for this purpose; and its German name of *mutterkorn* implies a popular acquaintance with its peculiar powers. But the attention of the medical profession was first called to it by a letter from Dr. Stearns, of Saratoga County, N. Y., addressed to Dr. Ackerly, in 1807, and published in the eleventh volume of the *New York Medical Repository*. The journals afterwards teemed with communications attesting its efficacy in facilitating parturition; and, though it sometimes failed, the general opinion was so much in its favour, that it soon took a place among the established articles of the materia medica. When it proves wholly inefficient, the result is ascribable to peculiarity of constitution in the individual, or inferiority in the ergot used. In its operation upon the pregnant uterus, it produces a constant unremitting contraction and rigidity, rather than that alternation of spasmodic effort and relaxation which is observable in the natural process of labour. Hence, unless the os uteri and external parts are sufficiently relaxed, the medicine is apt to produce injury to the fœtus by the incessant pressure which it maintains; and the death of the child is thought not unfrequently to have resulted from its injudicious employment. The cases to which it is thought to be especially adapted are those of lingering labour, when the os uteri is sufficiently dilated, and the external parts sufficiently relaxed, when no mechanical impediment is offered to the passage of the child, and the delay is ascribable solely to want of energy in the uterus. Other cases are those in which the death of the fœtus has been ascertained, and when great exhaustion, or dangerous constitutional irritation, imperiously calls for speedy delivery. The medicine may also be given to promote the expulsion of the placenta, to restrain inordinate hemorrhage after delivery, and to hasten the discharge of the fœtus in protracted cases of abortion. It should be borne in mind, in the application of ergot to the induction of labour, that it sometimes causes spasm of the neck of the bladder so as to cause a retention of urine, demanding the interference of the practitioner; and it is stated that the bladder, after relief, becomes again rapidly distended, owing, according to Wernich, to an energetic action of ergot as a diuretic. (*Philad. Med. Times*, Aug. 9, 1873, p. 711.) In women subject to dangerous flooding, a dose of

ergot given immediately before delivery is said to have the happiest effects. It has also been recommended for the expulsion of coagula of blood, polypi, and hydatids from the uterine cavity. It has been accused of producing puerperal convulsions, hour-glass contraction of the uterus, and hydrocephalus in the new-born infant. In uterine hemorrhage, unconnected with pregnancy, the medicine is deemed very useful; and it has been employed in other hemorrhages with asserted advantage. We have seen it promptly effectual in pulmonary hemorrhage, after all the usual means had failed. Dr. Andrew H. Smith, of New York, found it promptly successful in a case of frequently recurring epistaxis, in which local remedies had proved ineffectual. He prescribed twenty drops of the fluid extract, three times a day. The hemorrhage ceased after the first dose. The treatment was continued for ten days, when it was omitted. The hemorrhage returned in a short time, but yielded again to the same treatment, and did not return. (*Med. Record*, Oct. 15, 1873, p. 502.) A case of severe and dangerous hæmatemesis was checked at once, after the use of other means without effect, by the injection of three grains of ergotine dissolved in water beneath the skin over the deltoid of the left arm. The patient was a woman of 28 years. (*Ed. Med. Journ.*, Dec. 1871, p. 511.) Under the idea that it produces contraction of the cerebral capillaries, as suggested by Dr. Brown-Séquard, Dr. J. Crichton Brown has used it in various forms of mania, with decided advantage in reducing excitement in the paroxysms, shortening their duration, and lengthening the intervals. (*Am. J. of Med. Sci.*, Oct. 1871, p. 549; from the *Practitioner*, June, 1871.) May it not have the power of producing contraction of the capillaries in general, or of interfering in some other way with the circulation of the blood in these vessels, as by the exertion of a direct sedative or paralyzing influence upon them? We might in this way account for the dry gangrene which results from its abuse, as well as for its influence in restraining hemorrhage. This early conjecture may now be considered as established fact. One of the most striking properties of ergot is apparently the power of promoting capillary contraction, probably through the nervous centres. One of the obvious inferences is that the medicine would prove useful in purpura, both simple and hemorrhagic. It has been employed in amenorrhœa, but not with encouraging success. Gonorrhœa, gleet, leucorrhœa, dysmenorrhœa, chronic dysentery and diarrhœa, inordinate thirst, excessive sensitiveness of the eyes with pain upon use, paraplegia, paralysis or debility of the bladder and of the rectum, spermatorrhœa, hooping-cough, hysteria, intermittent fever, chorea, and phthisis are among the complaints in which it has been recommended. It has also been used with supposed advantage in cancer of the womb, in which it may act by diminishing the afflux of blood, and, as maintained by Dr. Milne, by producing atrophy of the organ. (*Bost. Med. and Surg. Journ.*, July 24, 1873, p. 91; from *Obstet. Journ. of G. Brit., &c.*)

Ergot is usually given in substance, infusion, or decoction. The dose of the powder to a woman in labour is fifteen or twenty grains, to be repeated every twenty minutes till its peculiar effects are experienced, or till the amount of a drachm has been taken. Of an infusion made with a drachm of ergot and four fluidounces of water, one-third may be given for a dose, and repeated with the same interval. For other purposes the dose of the medicine is ten or fifteen grains, repeated three times a day, and gradually increased, but not continued for a great length of time. In urgent cases of hemorrhage, the dose may be repeated every two hours, or oftener if necessary. A wine and fluid extract of ergot are directed in the U. S. Pharmacopœia. (See *Vinum Ergotæ* and *Extractum Ergotæ Fluidum.*) The *oil of ergot*, prepared by means of ether, as already described (*page* 395), was given by Dr. Wright in the dose of from twenty to fifty drops, diffused in cold water, warm tea, or weak spirit and water.

Under the name of *ergotin*, Bonjean's purified extract is sometimes used in the dose of from five to ten grains. It is made by exhausting ergot with water, evaporating to the consistence of syrup, precipitating the albumen, gum, &c., by a large excess of alcohol, decanting the clear liquid, and evaporating to the consistence of a soft extract.

Ergot is sometimes used locally. Dr. Müller found it to check the bleeding from divided arteries; and Dr. Wright states that in powder or infusion it acts promptly in arresting hemorrhage. It is recommended by the latter as an injection in uterine

hemorrhage. It should be used, however, with caution, as the powder applied to abraded surfaces has produced sloughing in the lower animals.

Ergot should be powdered only when wanted for use.*

A mode of employing ergot which promises to be efficient in many instances is by subcutaneous injection. For this purpose the preparation above referred to as ergotine, or Bonjéan's purified extract, may be used. Of nine cases of hæmoptysis, in persons of different ages, sexes, and states of health, recorded by Dr. Currie Ritchie, of Manchester, England, in nearly all, the hemorrhage was almost instantly arrested by the injection of a watery solution of ergotine beneath the skin. Five grains of ergotine were used on each occasion, dissolved in water, except in one, in which, in consequence of considerable local irritation, three grains were injected dissolved in a mixture of equal parts of glycerin and alcohol. This apparently arrested the hemorrhage without causing irritation. The place selected for the injection, in the only case where mentioned, was the left arm. Dr. Ritchie states that ergot is not nearly so efficacious in any mode of administration as when used subcutaneously. (*Ed. Med. Journ.*, Feb. 1872, p. 750; from the *Practitioner*, Dec. 1871.) Another application of the medicine in this manner has been in the cure of varicose veins. Two grains of ergotine, in watery solution, were injected into the subcutaneous tissue in the immediate vicinity of the veins, and the operation repeated daily. In one of these cases a vein of considerable size disappeared under this treatment in the course of eight days. The effect may be ascribed to contraction of the arterial capillaries and of the veins themselves, probably produced through the action of the medicine on the nervous centres. (*New Rem.*, Oct. 1872, p. 106; from *Berlin Klin. Wochenschrift.*) Professor Langenbeck employed the medicine successfully in the same way in a case of aneurism of the radial artery. (*Am. J. of Med. Sci.*, July, 1869, p. 256.) Dr. Fred. D. Lente applied it similarly in a threatening case of post-partum hemorrhage, with remarkable success; for the bleeding which had resisted other measures, yielded immediately to this. He injected twenty-five drops of Squibb's fluid extract under the skin of the thigh. (*Med. Record*, Nov. 15, 1869, p. 411.)

Off. Prep. Extractum Ergotæ Fluidum, *U. S.;* Extractum Ergotæ Liquidum, *Br.;* Infusum Ergotæ, *Br.;* Tinctura Ergotæ, *Br.;* Vinum Ergotæ, *U. S.* W.

ERIGERON. *U. S.*

Fleabane.

The leaves and tops of Erigeron heterophyllum and of Erigeron Philadelphicum. *U. S.*

Erigeron. *Sex. Syst.* Syngenesia Superflua.—*Nat. Ord.* Compositæ-Asteroideæ. *De Cand.* Asteraceæ. *Lindley.*

Gen. Ch. Calyx imbricated, sub-hemispherical, in fruit often reflected. *Florets of the ray* linear, very narrow, numerous. *Receptacle* naked. *Pappus* double, exterior minute, interior pilose, of few rays. *Nuttall.*

1. *Erigeron heterophyllum.* Willd. *Sp. Plant.* iii. 1956; Barton, *Am. Med. Bot.* i. 231.—*E. annuum.* Persoon, *Synop.* ii. 431; Torrey and Gray, *Flor. of N. Am.* ii. 175. This is a biennial herbaceous plant, belonging both to North America and Europe. It has a branching root, with several erect, roundish, striated, pubescent stems, much divided near the top, and two or three feet high. The lower leaves are

* It is said that, in Germany, persons sleeping upon grain which contained much ergot have been attacked with disease in consequence; and the case is related of a gentleman who, having gathered some fine specimens of ergot fresh from the plant, and put them in his trowsers-pocket, found himself, about half a day afterwards, incommoded by a tensive spasmodic pain on the skin of the inside of the thigh against which the pocket lay. Ascribing this to a long walk, he did not think of the real cause, until, the pain having returned on the following day, and for several days afterwards, he at length recalled to mind the forgotten ergot, and, supposing that this might be the source of inconvenience, removed it. After a time he found much, though not entire, relief, and did not succeed in wholly removing his trouble, until he had caused the offending pocket to be well washed, after which the affection ceased. He afterwards tried the experiment with other specimens of ergot, with the same results. Perhaps it is only the fresh ergot, yet moist, that is capable of producing this effect. The skin was not reddened, but covered with minute wrinkles, as in cholera patients. (*Neues Repert.*, band x. p. 439, A.D. 1863.)—*Note to the thirteenth edition.*

ovate, acute, deeply toothed, with long winged footstalks; the upper are lanceolate, acute, deeply serrate in the middle, and sessile; the floral leaves are lanceolate and entire; all, except the radical, are ciliate at the base. The flowers are in terminal corymbs. The florets of the disk are yellow; those of the ray numerous, very slender, and of a white, pale-blue, or pale-purple colour. The flowering period is from June to October.

2. *Erigeron Philadelphicum.* Barton, *Med. Bot.* i. 227.—*E. strigosum.* Willd. *Sp. Plant.* iii. 1956; Torrey and Gray, *Flor. of N. Am.* ii. 176. The Philadelphia fleabane is perennial and herbaceous, with a branching yellowish root, and from one to five erect stems, which rise two or three feet in height, and are much branched at top. The whole plant is pubescent. The lower leaves are ovate-lanceolate, nearly obtuse, ciliate on the margin, entire or marked with a few serratures, and supported on very long footstalks; the upper are narrow, oblong, somewhat wedge-shaped, obtuse, entire, sessile, and slightly embrace the stem; the floral leaves are small and lanceolate. The flowers are numerous, radiate, and disposed in a panicled corymb, with long peduncles bearing from one to three flowers. They resemble those of the preceding species in colour, and make their appearance about the same period.

We include these two species under one head because they grow together, possess identical medical properties, and are indiscriminately employed. They are found in various parts of the United States, and abound in the fields about Philadelphia, where they are known and used under the common though inaccurate name of *scabious*. The whole herb is used, and should be collected while the plants are in flower. It has a feebly aromatic odour and bitterish taste, and imparts its properties to boiling water. Mr. F. L. John, of Philadelphia, obtained from E. Philadelphicum a volatile oil by distillation, but in exceedingly small proportion; 45 pounds of the herb having yielded only half a drachm of the oil. As described by Prof. Procter, this is of a greenish-yellow colour, a powerful, penetrating, aromatic odour, and a bitterish, pungent, disagreeable taste. It is more viscid than the oil of E. Canadense, has a higher sp. gr. (0·946), and contains more oxygen. (*Am. Journ. of Pharm.*, xxvii. 105.)

Medical Properties and Uses. Fleabane is diuretic, without being offensive to the stomach. It has been a favourite remedy, with some highly respectable practitioners of Philadelphia, in gravel and other nephritic diseases, and has been used advantageously in dropsy. By the late Prof. Wistar it was recommended in hydrothorax complicated with gout. It cannot be relied on for the cure of dropsy; but may be employed as an adjuvant to more efficient medicines. It is most conveniently given in infusion or decoction, of which a pint, containing the virtues of an ounce of the herb, may be taken in twenty-four hours.

In a communication by Dr. Wilson, of Philadelphia, to the College of Physicians, Nov. 1, 1854, it is stated that the *oil of Philadelphia fleabane* had been employed with great advantage by Dr. Bournonville and himself in uterine hemorrhage, in the dose of five drops every two hours. (*Transact. of Col. of Phys.*, N. S., ii. 330.) There can be little doubt, from the account of the oil at the same time given, that it was the *oil of E. Canadense*, and not that of E. Philadelphicum, which was really used. W.

ERIGERON CANADENSE. *U. S.*

Canada Fleabane.

The leaves and tops of Erigeron Canadense. *U. S.*

ERIGERON. See ERIGERON.

Erigeron Canadense. Willd. *Sp. Plant.* iii. 1954. This is an indigenous annual plant, with a stem from two to six feet high, covered with stiff hairs, and divided into many branches. The leaves are linear-lanceolate, and edged with hairs; those at the root are dentate. The flowers are very small, numerous, white, and arranged in terminal panicles. They differ from those of the other species of Erigeron in having an oblong calyx, the rays very minute and more numerous than the florets of the disk, and the seed-down simple. Hence by some botanists the plant is placed in a sub-genus with the title *Cænotus*. Another variety of *E. Canadense*, which Mr.

Nuttall makes a distinct species, with the title *E. pusilum*, is not more than from four to six inches high, and has an erect smooth stem, less branched than the preceding, with all its leaves entire, and scabrous on the margin. The panicle is simple, and the peduncles filiform, nearly naked, divaricate, each bearing two or three flowers.

Canada fleabane is very common throughout the northern and middle sections of the United States, and has become naturalized in many parts of Europe. It abounds in neglected fields, and blooms in July and August. The plant, all parts of which are medicinal, should be collected while in flower. The leaves and flowers are said to possess its peculiar virtues in greatest perfection.

This species of Erigeron has an agreeable odour, and a bitterish, acrid, somewhat astringent taste. Among its constituents, according to Dr. De Puy, are bitter extractive, tannin, gallic acid, and volatile oil. Both alcohol and water extract its virtues. Its acrimony is diminished by decoction, in consequence, probably, of the escape of the oil, upon which its virtues in part depend. The oil is included among the Preparations in the U. S. Pharmacopœia, and will be described in *Part II.* of this work. (See *Oleum Erigerontis Canadensis.*)

Medical Properties and Uses. From the observations of Dr. De Puy, Canada fleabane appears to be diuretic, tonic, and astringent; and has proved useful in dropsical complaints and diarrhœa. It may be given in substance, infusion, tincture, or extract. The dose of the powder is from thirty grains to a drachm; of an infusion, prepared with an ounce of the plant and a pint of boiling water, from two to four fluidounces; of the aqueous extract, from five to ten grains; each repeated every two or three hours. A tincture has been recommended in hemorrhages. (*Med. and Surg. Reporter*, March 13, 1869, p. 217.) The oil has been employed for arresting hemorrhage, in the dose of five drops every two hours.

Off. Prep. Extractum Erigerontis Canadensis Fluidum, *U. S.;* Oleum Erigerontis Canadensis, *U. S.* W.

EUONYMUS. *U. S. Secondary.*

Wahoo.

The bark of Euonymus atropurpureus. *U. S.*

Euonymus. *Sex. Syst.* Pentandria Monogynia. — *Nat. Ord.* Celastraceæ. *Lindley. Gen. Ch. Calyx* four or five-parted, flat. *Corolla* four or five-petaled, inferior, flat. *Capsule* three to five-valved, three to five-celled, coloured, each cell containing one or two seeds, surrounded by a red arillus.

The plants belonging to this genus are shrubs or small trees, presenting in the autumn a striking appearance from the rich red colour of their fruit, which has obtained for them the name of *burning-bush*. *E. Americanus* and *E. Europæus* have been cultivated in gardens as ornamental plants. Two or more of the species have been used in medicine. Their properties are probably similar, if not identical. Grundner, who experimented with the fruit of E. Europæus, found it to have no other effect than that of a diuretic. (*Pharm. Cent. Blatt*, A. D. 1847, p. 873.) An oil expressed from the seeds is used in Europe for the destruction of vermin in the hair, and sometimes also as an application to old sores. (*Ibid.*, A. D. 1851, p. 641.) Dr. Griffith says that the seeds of this and other species are purgative and emetic, and that the leaves are poisonous to sheep and other animals feeding on them. He states also that the inner bark of *E. tingens* is beautifully yellow, and used in India for dyeing, and in diseases of the eye. (*Med. Bot.*, p. 220.) About twenty years since, a bark was introduced into notice in this city, as a remedy for dropsy, under the name of Wahoo, by Mr. George W. Carpenter, who had obtained a knowledge of its virtues in the Western States. On a journey in the North West in the year 1845, the author made some inquiries into the source of this medicine, and, having had the opportunity of examining the plant producing it, found it to be *E. atropurpureus;* and this is recognised in the present edition of the U. S. Pharmacopœia. The name of wahoo (pronounced *wawhoo*) was given to it by the Indians. The same name has also been applied to *Ulmus alata*, of the Southern States, and has thus led to mistakes. It is probable that the product of *E. Americanus* has been indiscriminately used with that of the officinal species.

Euonymus Atropurpureus. Willd. *Sp. Plant.* i. 1132; Gray's *Manual*, p. 81; figured in Griffith's *Med. Bot.* p. 219. This plant has been named variously *wahoo*, *spindletree*, and *burning-bush*. It is a tall, erect shrub, with quadrangular branchlets, and opposite, petiolate, oval-oblong, pointed, serrate leaves. The flowers, which stand in loose cymes on axillary peduncles, are small and dark-purple, with sepals and petals commonly in fours. The capsule or pod is smooth and deeply lobed. The plant is indigenous, growing throughout the Northern and Western States, and sometimes cultivated for the beauty of its crimson fruit. The bark is the part used.

Properties. The dried bark is in thin pieces, whitish with a darker grayish epidermis, brittle, of a feeble, peculiar, not disagreeable odour, and a bitterish slightly sweetish taste, and somewhat pungent after-taste. It imparts its virtues to water and alcohol. Analyzed by Mr. Wm. T. Wenzell, it was found to contain a bitter principle which he named *euonymin*, asparagin, a soft resin, a crystallizable resin, a yellow resin, a brown resin, fixed oil, wax, starch, albumen, glucose, pectin, and various salts of organic and inorganic acids. Euonymin was obtained by agitating with chloroform a tincture made with diluted alcohol, separating the chloroformic solution and allowing it to evaporate spontaneously, treating the residue with ether, dissolving what was left in alcohol, adding acetate of lead to the solution, filtering, precipitating the lead with hydrosulphuric acid, and evaporating. The euonymin obtained was uncrystallizable, intensely bitter, soluble in water and alcohol, and neuter in its reactions. It was abundantly precipitated from its solution by subacetate of lead and phospho-molybdic acid. (*Am. Journ. of Pharm.*, Sept. 1862, p. 387.) Mr. W. P. Clothier found the bark to yield no volatile oil on distillation. According to the same writer, if a concentrated tincture is poured into water, a dark-yellow bitter substance is thrown down, containing resin and fixed oil, which is the euonymine of the Eclectics, very improperly so named, as, though it contains a portion of the active principle, it is a very complex substance. Mr. Clothier found it to purge actively without griping. (*Ibid.*, Nov. 1861, p. 491.) Kubel has discovered in the fresh inner bark of E. Europæus a saccharine, crystallizable substance, closely resembling mannite, but differing in its crystalline form, and melting point. He calls it *euonymite*. (*Journ. de Pharm.*, Dec. 1862, p. 523.)

Medical Properties and Uses. The precise virtues of wahoo have not been determined. Mr. C. A. Santos, in a dissertation upon the American species, published in the *American Journal of Pharmacy* (xx. 80), speaks of the bark as tonic, hydragogue cathartic, diuretic, and antiperiodic. Dr. Twyman, of Westport, Missouri, informed the author that he had found it as a cathartic rather to resemble rhubarb, than to possess hydragogue properties, and thought he had obtained useful effects from it as an alterative to the hepatic function. Similar information was obtained from other sources. Dr. C. Richmond speaks favourably of it in chronic intermittents, especially when attended with enlarged spleen and dropsy. He uses the fresh bark in the proportion of two ounces to a pint of boiling-hot water, of which, after a period of digestion, from half a pint to a pint is given daily. According to Dr. Richmond, two ounces, repeated every hour or two, will generally cause several large watery stools. In half the quantity, he says it will act as a diuretic. (*New Remedies*, Oct. 1872, p. 134; from *Indiana Journ. of Med.*) On the whole, the character of its action must be considered as somewhat uncertain; and it might well form a subject of further examination. As a diuretic in dropsy it may be used in the form of decoction or infusion, made in the proportion of an ounce to a pint of water, and given in the dose of a wineglassful several times a day. A fluid extract, prepared with diluted alcohol, would no doubt be an efficient, and would probably be found a convenient preparation. W.

EUPATORIUM. *U.S.*

Thoroughwort.

The leaves and tops of Eupatorium perfoliatum, gathered after flowering has commenced. *U.S.*

Eupatorium. *Sex. Syst.* Syngenesia Æqualis.—*Nat. Ord.* Compositæ Eupatoriaceæ, *De Cand.*; Asteraceæ, *Lindley.*

Gen. Ch. Calyx simple or imbricate, oblong. *Style* long and semi-bifid. *Receptacle* naked. *Pappus* pilose, or more commonly scabrous. *Seed* smooth and glandular, quinquestriate. *Nuttall.*

Of this numerous genus, comprising not less than thirty species within the limits of the United States, most of which probably possess analogous medical properties, *E. perfoliatum* alone now holds a place in our national Pharmacopœia. *E. purpureum* and *E. teucrifolium* were originally in the *Secondary List*, but were discarded at the revision of 1840. They merit, however, a brief notice, if only from their former officinal rank.

Eupatorium purpureum or *gravel root*, is a perennial herbaceous plant, with a purple stem, five or six feet in height, and furnished with ovate-lanceolate, serrate, rugosely veined, slightly scabrous, petiolate leaves, placed four or five together in the form of whorls. The flowers are purple, and consist of numerous florets contained in an eight-leaved calyx. It grows in swamps and other low grounds, from Canada to Virginia, and flowers in August and September. The root has, according to Dr. Bigelow, a bitter aromatic and astringent taste, and is said to operate as a diuretic. Its vulgar name of gravel root indicates the popular estimation of its virtues.

Eupatorium teucrifolium (Willd. *Sp. Plant.* iii. 1753), *E. pilosum* (Walt. *Flor. Car.* 199), *E. verbenæfolium* (Mich. *Flor. Am.* ii. 98), commonly called *wild horehound*, is also an indigenous perennial, with an herbaceous stem, which is about two feet high, and supports sessile, distinct, ovate, acute, scabrous leaves, of which the lower are coarsely serrate at the base, the uppermost entire. The flowers are small, white, composed of five florets within each calyx, and arranged in the form of a corymb. The plant grows in low wet places from New England to Georgia, and abounds in the Southern States. It is in flower from August to November. The whole herb is used. In sensible properties it corresponds with *E. perfoliatum*, though less bitter and disagreeable. It is said to be tonic, diaphoretic, diuretic, and aperient; and has been employed as a domestic remedy in intermittent and remittent fevers. Dr. Jones, formerly president of the Georgia Medical Society, first made its properties known to the profession. It is usually given in the form of infusion, made with an ounce to a quart of water, the whole to be taken during the day.

Other species, natives of this continent, are noticed in an article on the American Eupatoria, by Dr. J. M. Bigelow, published in the *Pharm. Journ. and Trans.*, Oct. 1874, p. 303, among which the *E. incarnatum* and *E. aromaticum* are said to contain an aromatic principle similar to if not identical with coumarin, obtained by Guibourt from *Coumarouna odorata*, or Tonka bean.

E. Cannabinum, of Europe, the root of which was formerly used as a purgative, and *E. Aya-pana*, of Brazil, the leaves of which at one time enjoyed a very high reputation, have fallen into entire neglect. The *aya-pana* is an aromatic bitter, like *E. perfoliatum*, but weaker. A species of Eupatorium, probably *E. nervosum*, is said to be a favourite with the medical profession in Jamaica, where it is known by the name of *bitter bush*. It is thought to have proved very efficacious in cholera, and, being actively stimulant, is much used in typhus and typhoid fevers, and small-pox. Cholagogue properties have been ascribed to it. Decoction and tincture are the forms in which it is given. (*Pharm. Journ. and Trans.*, Oct. 1866, p. 222.)

Eupatorium perfoliatum. Willd. *Sp. Plant.* iii. 1761; Bigelow, *Am. Med. Bot.* i. 33; Barton, *Med. Bot.* ii. 125. *Thoroughwort*, or *boneset*, is an indigenous perennial plant, with numerous herbaceous stems, which are erect, round, hairy, from two to five feet high, simple below, and trichotomously branched near the summit. The leaves serve to distinguish the species at the first glance. They may be considered either as perforated by the stem, *perfoliate*, or as consisting each of two leaves, joined at the base, *connate*. In the latter point of view, they are opposite and in pairs, which decussate each other at regular distances upon the stem; in other words, the direction of each pair is at right angles with that of the pair immediately above or beneath it. They are narrow in proportion to their length, broadest at the base where they coalesce, gradually tapering to a point, serrate, much wrinkled, paler on the under than the upper surface, and beset with whitish hairs, which give them a grayish-green colour. The uppermost pairs are

sessile, not joined at the base. The flowers are white, numerous, supported on hairy peduncles, in dense corymbs, forming a flattened summit. The calyx, which is cylindrical and composed of imbricated, lanceolate, hairy scales, encloses from twelve to fifteen tubular florets, having their border divided into five spreading segments. The anthers are five, black, and united into a tube, through which the bifid filiform style projects.

This species of Eupatorium inhabits meadows, the banks of streams, and other moist places, growing generally in bunches, and abounding in almost all parts of the United States. It flowers from the middle of summer to the end of October. All parts of it are active; but the herb only is officinal.

It has a faint odour, and a strongly bitter, somewhat peculiar taste. The virtues of the plant are readily imparted to water and alcohol. Mr. W. Peterson found it to contain a peculiar bitter principle, chlorophyll, resin, a crystalline matter of undetermined character, gum, tannin, yellow colouring matter, extractive, lignin, and salts. (*Am. Journ. of Pharm.*, xxiii. 210.) Mr. Bickley found also albumen, gallic acid, and signs of volatile oil. (*Ibid.*, xxvi. 495.) *Eupatorin* will be the proper name to apply to the bitter principle, when isolated and satisfactorily determined; but is wholly inapplicable to any complex substance, consisting of different proximate principles, however concentrated, and whether possessing or not the virtues of the leaves.

Medical Properties and Uses. Thoroughwort is tonic, diaphoretic, and in large doses emetic and aperient. It is said to have been employed by the Indians in intermittent fever, and has proved successful in the hands of several regular practitioners. The general experience, however, is not in its favour in that complaint. We have seen it arrest intermittents when given freely in warm decoction, immediately before the expected recurrence of the paroxysm; but it operated in this instance by its emetic rather than its tonic power. The medicine has also been used as a tonic and diaphoretic in remittent and typhoid fevers, and is said to have been productive of advantage in yellow fever. Given in warm infusion, so as to produce vomiting or copious perspiration, at the commencement of catarrh, it will frequently arrest that complaint: and has been especially recommended in influenza. It has also been recommended as a diaphoretic in acute rheumatism; and may prove serviceable in the absence of high arterial excitement. As a tonic it is given with advantage in dyspepsia, general debility, and other cases in which the simple bitters are employed. Dr. H. S. Wilkins has found the infusion useful in the expulsion of tapeworm. (*Am. Journ. of Pharm.*, June, 1874, p. 295.)

With a view to its tonic effects, it is best administered in substance, or cold infusion. The dose of the powder is twenty or thirty grains, that of the infusion a fluidounce, frequently repeated. (See *Infusum Eupatorii.*) The aqueous extract has been used with advantage. When the diaphoretic operation is required in addition to the tonic, the infusion should be administered warm, and the patient remain covered in bed. As an emetic and cathartic, a strong decoction, prepared by boiling an ounce with three half pints of water to a pint, may be given in doses of one or two gills, or more.

Off. Prep. Infusum Eupatorii, *U. S.* W.

EUPHORBIA COROLLATA. *U. S. Secondary.*

Large-flowering Spurge.

The root of Euphorbia corollata. *U. S.*

EUPHORBIA. *Sex. Syst.* Dodecandria Trigynia, *Linn.;* Monœcia Monadelphia, *Michaux.* — *Nat. Ord.* Euphorbiaceæ.

Gen. Ch. Involucrum caliciform, eight to ten-toothed, exterior alternate dentures glanduloid or petaloid. *Stamina* indefinite, twelve or more, rarely less; *filaments* articulated. *Receptacle* squamose. *Female flower* solitary, stipitate, naked. *Capsule* three-grained. *Nuttall.*

In the flower of the Euphorbiæ, the stamina are arranged two or more together

in distinct parcels, corresponding in number with the inner segments of the calyx. These parcels were considered by Michaux as distinct male florets; while the central stipitate germ, with its three bifid styles, was considered as a distinct female floret, and the calyx as an involucre. He accordingly placed the genus in the class and order *Monœcia Monadelphia*, and in this respect has been followed by most American botanists. The genus Euphorbia contains numerous species, having the common property of yielding a milky juice. They are herbaceous or shrubby, with or without leaves; and the leafless species, which are chiefly confined to the African deserts, have fleshy, naked, or spiny stems, like those of the Cactus. They nearly all afford products which act powerfully as emetics and cathartics, and in overdoses occasion dangerous if not fatal prostration, with symptoms of inflamed gastro-intestinal mucous membrane. Their milky juice, which concretes on exposure, usually possesses these properties in a high degree, and, in addition, that of powerfully irritating the skin when applied to it. Two species are acknowledged in our national Pharmacopœia, *E. corollata* and *E. Ipecacuanha*, which are both indigenous. *E. hypericifolia*, which is also indigenous, has been highly commended as a remedy in dysentery after due depletion, diarrhœa, menorrhagia, and leucorrhœa by Dr. W. Zollickoffer. He infuses half an ounce of the dried leaves in a pint of boiling water, and gives half a fluidounce every hour in dysentery till the symptoms begin to yield, the same quantity after every evacuation in diarrhœa, and two fluidounces morning, noon, and night, in menorrhagia and fluor albus. The herb is at first sweetish, afterwards harsh and astringent to the taste, and appears to contain tannin. Its effects upon the system are those of an astringent and feeble narcotic. It differs, therefore, considerably, both in sensible and medicinal properties, from most of the other species. (*Am. Journ. of Med. Sci.*, xi. 22.) In a subsequent communication, it is stated that *E. maculata* possesses similar properties. (*Ibid.*, N.S., iii. 125.) Dr. B. J. D. Irwin, of the U. S. Army, having heard much, while in New Mexico and Arizona, of the efficacy, among the native Mexicans, of a certain plant called by them *gollindrinera*, as an antidote to the poison of serpents, was induced to make trials of it, which convinced him that its reputation was not unmerited. A specimen of the plant having been sent to Prof. Torrey, it was pronounced by him to be *Euphorbia prostrata*, which is abundant in the Southwestern parts of the U. States and Mexico. Dr. Irwin thinks that the virtues reside in the milky juice of the plant, but the liquid obtained by bruising the herb is commonly used. Like other Euphorbiæ, it is emetic and cathartic in large quantities, but he has heard of no injurious effects from its use. (*Ibid.*, Jan. 1861, p. 89.) In Chili, the juice of the *Euphorbia Chilensis* is said to be used as a drastic purgative. (*Am. Journ. of Pharm.*, March, 1866, p. 102; from the *Revista Farmaceutica*, of Buenos Ayres.)

Euphorbia corollata. Willd. *Sp. Plant.* ii. 916; Bigelow, *Am. Med. Bot.* iii. 119. The *blooming* or *large-flowering spurge*, frequently called *milk-weed*, is an erect plant, with a large, perennial, branching, yellowish root, which sends up several stems from two to five feet in height, round and generally simple. The leaves, which stand irregularly upon the stem, and without footstalks, are oblong-obovate, wedge-form or linear, flat or revolute at the margin, smooth in some plants, and hairy in others. The flowers are disposed upon a large terminal umbel, with a five-leaved involucrum, and five trifid and dichotomous rays, at each fork of which are two oblong bractes. The calyx is large, rotate, white, with five obtuse segments closely resembling a corolla, from which the species has been named. At the base of these divisions are five interior smaller segments, which are described as nectaries by many systematic writers, while the larger are considered as belonging to a real corolla. The stamens are twelve, evolving gradually, with double anthers. Many flowers have only stamens. The pistil, when existing, is stipitate, nodding, rounded, with three bifid styles. The fruit is a smooth, three-celled, three-seeded capsule.

The plant grows in various parts of the United States, from Canada to Florida, and abounds in Western Pennsylvania, Maryland, and Virginia. It prefers a dry, barren, and sandy soil, seldom growing in woods or on the borders of streams. Its flowers appear in July and August. The root is the only part used.

This, when full grown, is sometimes an inch in thickness, and two feet in length.

It is without unpleasant taste, producing only a sense of heat a short time after it has been taken. The medical virtues are said to reside in the cortical portion, which is thick, and constitutes two-thirds of the whole root. They are taken up by water and alcohol, and remain in the extract formed by the evaporation of the decoction or tincture.

Medical Properties and Uses. In a full dose, the root of *E. corollata* operates actively and with sufficient certainty as an emetic, producing ordinarily several discharges from the stomach, and sometimes acting with considerable energy upon the bowels. In quantities insufficient to vomit, it excites nausea, almost always followed by brisk purging. In still smaller doses it is diaphoretic and expectorant. It cannot, however, like ipecacuanha, be given largely in cases of insensibility of stomach, without endangering hypercatharsis with inflammation of the mucous coat of the stomach and bowels. It is in fact greatly inferior to this emetic in mildness, while it is no less inferior to the tartarized antimony in certainty. It is objectionable as a purge, in consequence of the nausea which it occasions when given in cathartic doses. Dr. Zollickoffer was the first to introduce it to the particular notice of the medical profession. It is little prescribed, and seldom kept in the shops. The dose of the dried root as an emetic is from ten to twenty grains, as a cathartic from three to ten grains. The recent root, bruised and applied to the skin, produces vesication. W.

EUPHORBIA IPECACUANHA. *U. S. Secondary.*

Ipecacuanha Spurge.

The root of Euphorbia Ipecacuanha. *U. S.*

Euphorbia. See EUPHORBIA COROLLATA.

Euphorbia Ipecacuanha. Willd. *Sp. Plant.* ii. 900; Barton, *Med. Bot.* i. 211; Bigelow, *Am. Med. Bot.* iii. 108. *Ipecacuanha spurge*, or *American ipecacuanha*, is a singular plant, varying so much in the shape and colour of its leaves, and in its whole aspect, that mere individual peculiarities might without care be attributed to a specific difference. The root is perennial, yellowish, irregular, and very large, penetrating sometimes to the depth of six or seven feet in the sand, and in its thickest part, when full grown, from three-quarters of an inch to an inch and a half in diameter. The stems are numerous, herbaceous, erect or procumbent, smooth, dichotomous, jointed at the forks, white under the ground, red, pale-green, or yellow above, sometimes almost buried in the sand, usually forming thick low bunches upon its surface. The leaves are opposite, sessile, entire, smooth, generally oval, but sometimes round, obovate, or even lanceolate or linear. They are small early in the spring, and increase in size with the age of the plant. Their colour varies from green to crimson. The flowers are solitary, on long axillary peduncles. The calyx is spreading, with five exterior obtuse segments, and the same number of inner, smaller segments. The fertile flowers have a roundish drooping pedicilled germ, crowned with six revolute stigmas. The capsule is three-celled, and contains three seeds.

E. Ipecacuanha is indigenous, growing in pine-barrens and other sandy places in the Middle and Southern States, especially along the sea-board, and abundantly in New Jersey, on the banks of the Delaware. It blooms from May to August. The root, which is the officinal portion, is, according to Dr. Barton, equally efficacious at whatever period collected.

The dry root is light and brittle, of a grayish colour externally, white within, inodorous, and of a sweetish not unpleasant taste. Its active principle has not been isolated. Dr. Bigelow inferred from his experiments that it contained caoutchouc, resin, gum, and probably starch. Mr. C. Petzelt has found, as the result of a recent examination, wax, fixed oil, resin, starch, glucose, and various salts, among which was sulphate of calcium. The resinous matter, as obtained by him, was a dark mass, of a taste slight at first but after a time nauseous and pungent, readily dissolved by alcohol, but insoluble in ether and benzine, and, when swallowed, producing in half a grain doses watery stools, and in one and a half or two grains, nausea and vomiting. It gave no evidence of the presence of an alkaloid. Though com-

plex in composition, and therefore not the pure active principle of the root, it no doubt contains it. (*Am. Journ. of Pharm.*, June, 1873, p. 255.)

Medical Properties and Uses. Ipecacuanha spurge is an active, tolerably certain emetic, rather milder than *E. corollata*, but, like it, disposed to affect the bowels, and liable, if given in overdoses, to produce excessive nausea and vomiting, general prostration, and alarming hypercatharsis. It is, therefore, unfit to supersede ipecacuanha. In small doses it is diaphoretic. The specific name of the plant indicates that the emetic property of the root has been long known. The late Professor Barton alluded to it in his "Collections;" but it did not come into general notice till after the publication of Dr. W. P. C. Barton's Medical Botany. The late Dr. Hewson, of Philadelphia, informed us that this emetic was the subject of an inaugural essay by Dr. Royal, and that experiments, conducted with it among the convicts in the Walnut Street prison, proved it to be advantageously available for all the purposes of an emetic; while, in consequence of its want of nauseous taste, it seemed to answer even better than ipecacuanha as an expectorant and diaphoretic. The dose of the powdered root is from ten to fifteen grains. W.

EXTRACTUM GLYCYRRHIZÆ. *U.S., Br.*

Liquorice.

The extract of the root of Glycyrrhiza glabra. *U. S.*

Extrait de reglisse, *Fr.;* Süssholzsaft, *Germ.;* Sugo di liquirizia, *Ital.;* Regaliza en bollos, *Span.*

For an account of *Glycyrrhiza glabra*, see article GLYCYRRHIZA.

The British Pharmacopœia gives directions for preparing this extract; but, as it is seldom made in this country by the apothecary, it is very properly placed, in the U. S. Pharmacopœia, in the catalogue of the Materia Medica.

The *British* directions are to macerate *an avoirdupois pound* of liquorice root, in coarse powder, for twelve hours, in *two pints* of distilled water, strain and press; again to macerate the pressed marc with distilled water for six hours, strain and press; then to mix the strained liquors, heat to 212°, strain through flannel; and finally evaporate, by means of a water-bath, to a proper consistence for forming pills. The object in heating the infusion to 212° is to coagulate the albumen, and thus exclude it from the extract.

Liquorice is an article of export from the north of Spain, particularly Catalonia, where it is obtained in the following manner. The roots of the *G. glabra*, having been dug up, thoroughly cleansed, and half dried by exposure to the air, are cut into small pieces, and boiled in water till the liquid is saturated. The decoction is then allowed to rest, and, after the dregs have subsided, is decanted, and evaporated to the proper consistence. The extract, thus prepared, is formed into rolls from five to six inches long by an inch in diameter, which are dried in the air, and wrapped in laurel leaves.

Much liquorice is also prepared in Calabria, according to M. Fée, from the *G. echinata*, which abounds in that country. The process is essentially the same as that just described, but conducted with greater care; and the Italian liquorice is purer and more valuable than the Spanish. We have been informed that most of the extract brought to this country comes from the ports of Leghorn and Messina. It is in cylinders, generally somewhat smaller than the Spanish, and sometimes stamped with the manufacturer's name.* Perhaps in no part of the world is more liquorice consumed than in this country; from four to five thousand tons having

* Much liquorice is prepared in this country, chiefly at the laboratory of the Messrs. Tilden, at New Lebanon, Columbia Co., New York. The best roots being selected, are ground into a coarse powder, which is submitted to the action of condensing steam, so as to make a concentrated infusion, which is then evaporated without access of air. The extract is prepared in three forms: 1, in boxes containing 25 lbs. in which it solidifies in mass; 2, in small rolls of 80 to the pound; and 3, in lozenges like those of the Pontefract liquorice. (See *page* 409.) In the two latter forms, the addition of gum arabic is necessary to give the extract a proper consistence; as, without this, it softens in warm weather, so as not to retain its form. It is much lighter-colored than the imported liquorice, but darkens on exposure. (*Am. Journ. of Pharm.*, xxvii. 311.)—*Note to the eleventh edition.*

been imported annually before the war. Much of it is used in the manufacture of tobacco. (*Am. Journ. of Pharm.*, Sept. 1862, p. 449.)

Crude liquorice is in cylindrical rolls, somewhat flattened, and often covered with bay leaves. We have seen it in the London market in large cubical masses. When good, it is very black, dry, brittle, breaking with a shining fracture, of a very sweet, peculiar, slightly acrid or bitterish taste, and almost entirely soluble when pure in boiling water. Neumann obtained 460 parts of aqueous extract from 480 parts of Spanish liquorice. It is, however, considerably less soluble in cold water. It is often impure from accidental or fraudulent addition, or careless preparation. Starch, sand, the juice of prunes, &c. are sometimes added; and carbonaceous matter, and even particles of copper are found in it, the latter arising from the boilers in which the decoction is evaporated. Four pounds of the extract have yielded two drachms and a half of metallic copper. (*Fée.*) In different commercial specimens examined by Chevallier, he found from 9 to 50 per cent. of insoluble matter. (*Journ. de Pharm.*, xxx. 429.) This is by no means, however, always impurity. In the preparation of the extract by decoction, a portion of matter originally insoluble, or rendered so by decoction, is taken up, and is, in fact, necessary to the proper constitution of the liquorice. When this is prepared with cold water, or even with hot water by simple displacement, the extract attracts moisture from the air, becomes soft, and loses the characteristic brittleness of the drug. The additional substances taken up in decoction serve to protect the extract against this change. M. Delondre has obtained the same result by using steam as the solvent. He prepares from the root an excellent liquorice, having all the requisite qualities of colour, taste, and permanence, by passing steam, in suitable vessels, through the coarse powder of the root. The vapour thoroughly penetrates the powder, and is drawn off as it condenses. With about 500 lbs. of the root, this treatment is continued for 12 hours, and repeated at the end of 5 days. The liquors are collected, decanted, clarified with about 4 lbs. of gelatin, and quickly evaporated. After being put into the form of cylinders, the extract is kept for ten days in a drying room, at a temperature of 77°. (*Ibid.*, p. 433.) A bitter or empyreumatic taste is a sign of inferior quality in liquorice. As ordinarily found in commerce it requires to be purified.*

The *refined liquorice*, kept in the shops in small cylindrical pieces not thicker than a pipe stem, is prepared by dissolving the impure extract in water without boiling, straining the solution, and evaporating. The object of this process is to separate not only the insoluble impurities, but also the acrid oleo-resinous substance, which is extracted by long boiling from the liquorice root, and is necessarily mixed with the unrefined extract. It is customary to add, during the process, a portion of sugar, gum, flour, starch, or perhaps glue. These additions, or something equivalent, are necessary to obviate the deliquescent property of the pure liquorice. According to M. Delondre, 15 per cent. of gum is the proper proportion, when this substance is used; Dr. Geisler has found sugar of milk to lessen the disposition of the extract to absorb moisture; but he considers the best addition, on the whole, to be very finely powdered liquorice root, which should be used in the proportion of one part to 16 of the purified extract. (*Amer. Journ. of Pharm.*, xxviii. 225.) The preparation is sometimes attacked by small worms, probably in consequence of the farinaceous additions. Excellent liquorice is prepared in some parts of England,

* The following results of an examination of different brands of liquorice in the market in relation to the proportion of matters soluble and those insoluble in cold water contained in them respectively, by Mr. Wm. N. Martindell, is published in the *Am. Journ. of Pharm.* (April, 1873, p. 151).

Brands.	Insoluble.	Soluble.	Loss.	Brands.	Insoluble.	Soluble.	Loss.
Corigliano, Guzzolini, P. & S. } Calabrian.	218 grs. 175 " 248 "	280 grs. 284 " 248 "	2 grs. 41 " 27 "	G. H. Noel & Co. } Spanish, M. & E. American,	233 grs. 253 " 116 "	210 grs. 176 " 317 "	57 grs. 71 " 67 "

It will be seen from the above table that the American exceeds all the brands in solubility, and it excels them all in the brilliancy of its fracture, which is also a highly valued indication of purity, and excellence of preparation. (*Note to the fourteenth edition.*)

from the root cultivated in that country. The *Pontefract cakes* are small lozenges of liquorice of superior quality, made in the vicinity of Pomfret.

Medical Properties and Uses. Liquorice is a useful demulcent, much employed in cough mixtures, and frequently added to infusions or decoctions, in order to cover the taste or obtund the acrimony of the principal medicine. A piece of it, held in the mouth and allowed slowly to dissolve, is often found to allay cough by sheathing the irritated membrane of the fauces. It is used in pharmacy to impart consistence to pills and troches, and to modify the taste of other medicines. Much is also used in the preparation of tobacco for chewing.

Off. Prep. Confectio Sennæ, *Br.;* Decoctum Aloës Compositum, *Br.;* Mistura Glycyrrhizæ Composita, *U. S.;* Mistura Sennæ Composita, *Br.;* Pilulæ Ferri Iodidi, *U. S.;* Tinctura Aloës; Tinctura Rhei et Sennæ, *U. S.;* Trochisci Glycyrrhizæ et Opii, *U. S.;* Trochisci Cubebæ, *U. S.;* Trochisci Opii, *Br.* W.

FARINA.

Wheat Flour.

Off. Syn. FARINA TRITICI. *Wheaten Flour.* The grain of wheat, Triticum vulgare, ground and sifted. *Br.*

Farine de Froment, *Fr.;* Waizenmehl, *Germ.;* Farina di frumento, *Ital.;* Flor del trigo, Acemite, *Span.*

TRITICUM. *Sex. Syst.* Triandria Digynia.—*Nat. Ord.* Graminaceæ.

Gen. Ch. Calyx two-valved, solitary, transverse, many-flowered, on a flexuose, toothed receptacle. *Rees's Cyclopædia.*

Triticum hybernum. Willd. *Sp. Plant.* i. 477.—*T. vulgare*, var. *β. hybernum.* Kunth, *Gramin.* 438. The *common winter wheat* has a fibrous root and one or more erect, round, smooth, jointed, stems, which rise from three to five feet in height, and are furnished with linear, pointed, entire, flat, many-ribbed, rough, somewhat glaucous leaves, and jagged bearded stipules. The flowers are in a solitary, terminal, dense, smooth spike, two or three inches long. The calyx is four-flowered, tumid, imbricated, abrupt, with a short compressed point. In the upper part of the spike it is more elongated; and in this situation the corolla is more or less awned. The grain is imbricated in four rows.

The native country of wheat is unknown; but its cultivation is supposed to have spread from Sicily over Europe. It is now an object of culture in almost all countries having a temperate climate. Sown in the autumn, it stands the winter, and ripens its seeds in the following summer. Numerous varieties have been produced by cultivation, some of which are usually described as distinct species. Among these may perhaps be ranked *T. æstivum*, or spring wheat, distinguished by its long beards, and *T. compositum*, or Egyptian wheat, by its compound spikes. The seeds are too well known to need description. They are prepared for use by grinding and sifting, by which the interior farinaceous part is separated from the husk. The former is divided according to its fineness into different portions, but so far as regards its medical relations may be considered under one head, that of *farina* or *flour.* The latter is called *bran*, and constitutes from 25 to 33 per cent.

Flour is white, inodorous, and nearly insipid. Its chief constituents are starch, gluten, albumen, saccharine matter, and gum, the proportions of which are not constant. Vauquelin obtained, as an average product, from eight varieties of flour which he examined, 10·25 per cent. of water, 10·80 of gluten (including coagulated albumen), 68·08 of starch, 5·61 of sugar, and 4·11 of gum. According to Christison, subsequent experiments have given an average of 16 or 17 per cent. of gluten and albumen. The ashes of wheat, which amount only to about 0·15 per cent., contain, according to Henry, superphosphates of sodium, calcium, and magnesium.*

* A very elaborate investigation into the phosphates in wheat grain, as to their bases, the relative proportion of the soluble and insoluble phosphates, the relative quantity in which they exist in different parts of the grains, and other interesting points, has been made by F. Crace Calvert, and published in the *Chemical News* (Sept. 10, 1869, p. 121), to which the reader is referred. We have space for a very few only of the facts developed. One of the facts, which had been previously shown by Fersenius, is that almost the whole of the ashes of wheat consists of phosphates.

The gummy substance found in wheat flour is not precisely identical with ordinary gum; as it contains nitrogen, and does not yield mucic acid by the action of nitric acid. The starch, which is by far the most abundant ingredient, is much employed in a separate state. (See *Amylum.*) The gluten, however, is not less important; as it is to the large proportion of this principle in wheat flour, that it owes its superiority over that from other grains for the preparation of bread. The gluten here alluded to is the substance first noticed as a distinct principle by Beccaria. It is the soft, viscid, fibrous mass which remains, when wheat flour, enclosed in a linen bag, is exposed to the action of a stream of water, and at the same time pressed with the fingers till the liquor comes away colourless. But this has been ascertained to consist, in fact, of two different substances. When boiled in alcohol, one portion of it is dissolved, while another remains unaffected. Einhof ascertained that the part of the glutinous mass left behind by alcohol is identical with *vegetable albumen*, while the dissolved portion only is strictly entitled to the name of *gluten*, which had been previously applied to the whole mass. As these two principles are contained in numerous vegetable products, and as they are frequently referred to in this work, it is proper that they should be briefly noticed. They both contain nitrogen, and both, when left to themselves in a moist state, undergo putrefaction. From these circumstances, and from close resemblance to certain proximate animal principles in chemical habitudes and relations, they are sometimes called, in works on chemistry, *vegeto-animal substances.* They are separated from each other by boiling the gluten of Beccaria, above referred to, with successive portions of alcohol, till the liquid, filtered while yet hot, ceases to become turbid on cooling. The proper gluten dissolves, and may be obtained by adding water to the solution, and distilling off the alcohol. Large cohering flakes float in the liquor, which, when removed, form a viscid elastic mass, consisting of the substance in question with slight impurity. The part left behind by the alcohol is coagulated albumen.

Pure *gluten*, sometimes called *vegetable fibrin*, is a pale-yellow, adhesive, elastic substance, which, by drying, becomes more deeply yellow and translucent. It is almost insoluble in water, and quite insoluble in ether, and in the oils both fixed and volatile. Hot alcohol dissolves it much more readily than cold; and from its solution in boiling alcohol it separates unchanged when the liquor cools. It is soluble in the dilute acids, and in caustic alkaline solutions, in consequence of forming soluble compounds with the acids and alkalies. With the earths and metallic oxides it forms nearly insoluble compounds, which are precipitated when earthy or metallic salts are added to the solution of gluten in liquid potassa. Corrosive sublimate precipitates it from its acid as well as alkaline solutions, and, added in solution to moist gluten, forms a compound with it, which, when dry, is hard, opaque, and incorruptible. Gluten is precipitated by infusion of galls. Its name originated in its adhesive property. It exists in most farinaceous grains, and in the seeds of some leguminous plants.

Vegetable albumen is destitute of adhesiveness, and, when dried, is opaque, and of a white, gray, or brown colour. Before coagulation, it is soluble in water, but insoluble in alcohol. By heat it coagulates and becomes insoluble in water. It is dissolved by solutions of the caustic alkalies. Most of the acids, if added to its solution in excess, precipitate compounds of the acids respectively with the albumen, which, though soluble in pure water, are insoluble in that liquid when acidulated. It is not, however, precipitated by an excess of phosphoric or acetic acid. Its relations to the earthy and metallic salts are similar to those of gluten. Corrosive sublimate precipitates it from its solutions, except from those in phosphoric and acetic acids, and, when added in a state of solution to moist albumen, forms with it a hard,

Of these, nearly two-thirds are soluble in water, and are mainly phosphates of potassium and magnesium; the insoluble salts being phosphates of calcium and iron, with a little of the insoluble magnesian phosphate ($3MgO,PO_5$). Another highly important fact is that by far the larger portion of the phosphates exists in the parts separated in the sifting of the flour; and our fine white bread is, therefore, greatly deficient in one of the most essential elements of nutrition. Besides this reason for preferring brown or bran-bread to the whitest, is that, in the inner cortical part of the wheat, which is rejected in the fine white flour, there is a peculiar ferment, discovered by M. Mige Morries (*Comptes Rendus*), which rapidly changes starch into sugar, and thus greatly promotes the pannary fermentation. (*Note to the fourteenth edition.*)

opaque compound. It is also precipitated by infusion of galls. This principle derived its name from its very close resemblance to animal albumen. It is associated with gluten in most of the farinaceous grains, is a constituent of all the seeds which form a milky emulsion with water, and exists in all the vegetable juices which coagulate by heat.

The mixture of vegetable fibrin and albumen which constitutes the gluten of Beccaria, exercises an important influence over starch, which, with the presence of water, and the aid of a moderate heat, it converts partly into gum and partly into sugar. The production of saccharine matter in the germination of seeds and in malting, which is an example of germination, is thus explained. The gluten becomes acid in the process, and loses the property of reacting on starch.

It is thought by many chemists that *vegetable albumen* is identical in all respects with *animal albumen*, and the *gluten* of vegetables with animal *fibrin;* and that both these principles, as well as another named *casein*, found also both in the animal and vegetable kingdoms, consist of a principle named *protein*, combined with a very small proportion of mineral substances, such as sulphur and phosphorus. *Protein* consists of nitrogen, carbon, hydrogen, and oxygen; and its formula, according to Liebig, is $C_{48}H_{36}N_6O_{14}$. It is procured by dissolving any one of the substances above named in a strong solution of potassa, keeping the solution for some time at a heat of 120°, and precipitating with acetic acid.

It is scarcely necessary to state that bread is formed by making flour into a paste with water, with the addition of yeast, setting it aside to ferment, and then exposing it to the heat of an oven. The fermentation excited by the yeast is accompanied with the extrication of carbonic acid gas, which, being retained by the tenacity of the gluten, forms innumerable little cells throughout the mass, and thus renders the bread light.* Alcohol is also generated during the fermentation, most of which is driven off from the bread in baking; but a small portion remains, averaging, according to Mr. Thos. Polas, 0·314 per cent. (*Chem. News*, May 30, 1873, p. 271.)

Medical Properties and Uses. Wheat flour in its unaltered state is seldom used in medicine. It is sometimes sprinkled on the skin in erysipelatous inflammation, and various itching or burning eruptions, particularly the nettlerash; though rye flour is generally preferred for this purpose.

Bread is more employed. An infusion of toasted bread in water is a nutritive drink, well adapted to febrile complaints. Within our experience, no drink has been found more grateful in such cases than this infusion, sweetened with a little molasses, and flavored by lemon-juice. Boiled with milk, bread forms a good emol-

* *Purity of flour.* So early as the year 1847, M. Bessner, a French pharmaceutist, ascertained that, while pure white flour remains unaffected, as to its colour, by the action of alkalies, the meal of Indian-corn or maize becomes of a fine sulphur-yellow under the same circumstances, whether the alkali employed be ammoniacal vapour, or watery solution of caustic ammonia, potassa, or soda. It was thought that a test had thus been discovered of the adulteration of wheat flour with maize; but subsequent experiments by MM. Pierre and Lepetit, professors at Caen, have shown that while the pure flour of wheat, as well as of rye, barley, and buckwheat, remains unaffected by the alkalies, these same flours are rendered yellow by the alkalies, when mixed with the refuse of the siftings of the several flours ground over again; so that it is not the impurity of maize meal that is indicated by yellow colouration caused by the alkalies, but also the powdered bran and other siftings of the flours mentioned. (*Journ. de Pharm.*, Sept. 1868, p. 184.)—*Note to the fourteenth edition.*

Adulteration of bread. Among the adulterations of bread practised by the bakers, alum, employed to cause whiteness, and thus cover defects in the flour, is perhaps the one which has most attracted notice, and which, being sometimes noxious, it is most important to be able to test. One of the means of detection recommended, is that of incineration, by which the bread is consumed, while the alum, if there be any, is left behind. But this method is somewhat tedious; and logwood has been recommended as being at once most convenient, and, according to Mr. John Horsley, "*perfectly reliable*," if applied as he directs. The following is Mr. Horsley's method, by which in the county of Gloucester, England, alone, in the course of two surveys, he succeeded in obtaining 200 convictions out of some thousands of cases examined by him. He first makes a tincture of logwood by digesting, for 8 hours, two drachms of freshly cut chips in 5 oz. of methylated spirit and filtering; next makes a saturated solution of carbonate of ammonium in distilled water; then mixes a teaspoonful of each solution with a wineglass of water in a white-ware dish, thus forming a pink-coloured liquid; and lastly immerses a portion of the suspected bread "for five minutes or so," in the mixed fluids. If alum be present, the bread, placed on a plate to drain, will in the course of an hour or two, assume a blue colour; if not present, the pink colour fades away. The appearance of a greenish colour on drying will indicate the presence of copper. (*Chem. News*, May 17, 1872, p. 1872.)—*Note to the fourteenth edition.*

lient poultice, which may be improved by the addition of a little perfectly fresh lard. Slices of it steeped in lead-water, and the crumb mixed with the fluid and confined within gauze, afford convenient modes of applying this preparation to local inflammations. The crumb (*mica panis*) is, moreover, frequently used to give bulk to minute doses of very active medicines, administered in the form of pill. It should be recollected that it always contains common salt, which is incompatible with certain substances, as, for example, nitrate of silver.

Bran is sometimes used in decoction, as a demulcent in catarrhal affections and complaints of the bowels. When taken in substance, it is laxative, and may be used with advantage to prevent costiveness. Bran bread, made from the unsifted flour, is an excellent laxative article of diet in some dyspeptic cases. The action of the bran is probably mechanical, consisting in the irritation produced upon the mucous membrane of the bowels by its coarse particles. Bran also forms an excellent demulcent bath.

Off. Prep. Cataplasma Fermenti, *Br.* W.

FERMENTUM. *U.S.*

Yeast.

A peculiar insoluble product of the fermentation of malt liquors. *U.S.*

Off. Syn. CEREVISIÆ FERMENTUM. *Beer Yeast.* The ferment obtained in brewing beer. *Br.*

Levure, *Fr.;* Bierhefen, *Germ.;* Fermento di cervogia, *Ital.;* Espuma de cerveza, *Span.*

This is the substance which rises, in the form of froth, to the surface of beer, and subsides, during the process of fermentation. A similar substance is produced during the fermentation of other saccharine liquids.

It is flocculent, frothy, somewhat viscid, semifluid, of a dirty yellowish colour, a sour vinous odour, and a bitter taste. At the temperature of 60° or 70°, in a close vessel or damp atmosphere, it soon undergoes putrefaction. Exposed to a moderate heat it loses its liquid portion, becomes dry, hard, and brittle; and may in this state be preserved for a long time, though with the loss of much of its peculiar power. In France it is brought to the solid state by introducing it into sacks, washing it with water, then submitting it to pressure, and ultimately drying it.*

* M. C. Gutkind, of Paris, recommends the following process for preparing bakers' yeast. Barley, having been slightly malted, is dried in a rapid current of heated air, then reduced to fine flour without bolting, and placed in a vat, where it is made into dough with water of 104° F., and afterwards brought with water at the same temperature to the consistence of porridge. For each pound of flour about a pint and a half of water is required. The porridge is heated in a boiler to 178° F., beyond which degree the temperature is not to be raised, and introduced into canvas bags, in which it is submitted to expression. The expressed liquid is put into large vats, where it cools. The solid matter is again put into a vat, mixed with 2 pints of water at 114° F. for each pound, and stirred into a porridge, which is then heated to 201° F., and kept so for an hour. The mass is put into bags and expressed; and the two expressed liquids are mixed, and exposed to the air in large vats for a period of time varying from two to ten days according to the atmospheric temperature. To cause the liquid to ferment, it is heated to 90° F., and a little fresh yeast added. During the whole period of fermentation, which may be conducted in vats or vessels, an exterior temperature of at least 59° F. must be maintained. The yeast thus obtained is free from bitterness or acidity, is extremely white, and consequently does not require washing, and is superior in raising power to all others. The residuary liquid after fermentation may be used for making vinegar. (*Lond. Pharm. Journ.*, xiv. 331.)—*Note to the eleventh edition.*

Dried Yeast. For keeping, and for transmission from place to place, it is often desirable to have yeast in the dried state. Yeast cakes have appeared in commerce. They may be prepared by washing the ordinary yeast with water, expressing the liquid portion, and spreading out the residue, in thin layers, on linen or cotton cloth, in order to dry, in the sun, or in heated chambers, or on porous bricks to absorb the moisture. The layers may be cut in pieces of convenient shape, which may be occasionally turned to facilitate drying.

The following plan is recommended in the *Chemical News* (Aug. 29th, 1863, p. 109). To every pound of the yeast, previously washed and drained, a drachm of pure carbonate of potassium or sodium, and three drachms of officinal alcohol are to be added, the whole to be thoroughly mixed by stirring, and the mass thus prepared to be allowed to stand for half an hour, and then put into bags and expressed. Two drachms of solution of gelatin, in the form of a nearly cold jelly, are now to be thoroughly incorporated by kneading with the mixture, which is to be exposed for twelve hours in a cold place, for the complete solidification of the gelatin. The mass is, finally, to be cut into slices of the desired shape and size, and dried on muslin at ordinary temperatures. (*Note to the twelfth edition.*)

Yeast is insoluble in alcohol or water. It was analyzed by Westrumb, and found to contain, in 15,142 parts, 13 of potassa, 15 of carbonic acid, 10 of acetic acid, 45 of malic acid, 69 of lime, 240 of alcohol, 120 of extractive, 240 of mucilage, 315 of saccharine matter, 480 of gluten, 13,595 of water, besides traces of silica and phosphoric acid.* Its bitterness is attributable to a principle derived from the hops. The property for which it is chiefly valued is that of exciting the vinous fermentation in saccharine liquids, and in various farinaceous substances. This property it owes to its azotized ingredient; for, if separated from this, it loses its powers as a ferment, and reacquires them upon its subsequent addition. It is also rendered ineffective by strong alcohol, by several of the acids, as sulphuric and concentrated acetic acids, by various other substances, and by a heat of 212°.† At a high temperature the yeast is decomposed, affording products similar to those which result from the decomposition of animal matters. From experiments by Mr. Horace T. Brown, it would appear that the degree of atmospheric pressure has much influence upon the progress of the alcoholic fermentation, which is considerably retarded by a diminution of that pressure. (*Pharm. Journ.*, Jan. 1874, p. 615.)

Besides alcohol and carbonic acid, which are the characteristic products of the vinous fermentation, various other substances are generated in smaller or larger proportions, and, among the rest, an organic alkaloid, which, according to M. Oser, is always produced when solutions of sugar ferment under the influence of yeast, and is always present in fermented liquors, either in the pure state, or that of saline combination. Its formula is $C_{26}H_{20}N_4$. Its muriate is in hygroscopic tables, which become brown on exposure to the air, and have a bitter taste. (*Journ. de Pharm.*, Oct. 1869, p. 305.)

Examined with a microscope, yeast is seen to abound in minute transparent vesicles, which appear to contain one or more granules. These are now believed to be a fungous plant, which has the power of propagating itself at the expense of organic proximate principles with which it may be brought into contact; and attempts have been made to solve the mysteries of fermentation by the conjecture, that the sugar or other fermenting substance, while contributing to the nourishment of the fungus, undergoes a decomposition resulting in the formation of new products. Another theory, originally put forth by Liebig, is that fermentation is merely a chemical movement, excited by a movement of decomposition going on in the ferment. Mulder considers the cell-wall of the yeast plant to consist of a substance analogous to cellulose, and its contents to be a protein body, differing in some respects from gluten and albumen, and probably a superoxide of protein. During fermentation, this pro-

* In an extract of fresh yeast, obtained by digestion after first washing with cold water, Schutzenberger found: 1. a notable quantity of phosphates; 2. a large proportion of pure gum or arabin; 3. *leucine* and *tyrosine*, in small yet notable proportion; 4. and, besides these, the following nitrogenous bases, viz.: *carnine*, discovered by Weidel in the extract of flesh, *xanthine*, *guanine*, and *hypoxanthine* or *sarcine*. The author supposes that the last-mentioned principle results from the oxidation of the carnine, which is the predominant one of these bases. He believes that all these nitrogenous substances are produced by chemical changes in the insoluble protein materials of the yeast, analogous to the action which takes place in animal tissues. (*Journ. de Pharm.*, Mai, 1874, p. 372.)

† M. Petit has examined a long list of substances in reference to their influence on this process, and found many which have no effect, many others which retard it more or less, while a comparatively few suspend or prevent it altogether. We must content ourselves with referring to his paper for an account of the two former; confining ourselves here to the third division, with a few of the more energetic of those the action of which is not complete. Iodine, bromine, and chlorine retard the process, and, when in sufficiently concentrated solution, arrest it completely. The mineral acids in general retard it, and nitric and muriatic acids sometimes entirely prevent it. Of the vegetable acids, the action of the acetic is very decided; that of lactic acid is less so; that of the sulphurous, iodic, picric, carbolic, oxalic, hydrocyanic, and hydrosulphuric very energetically opposed to it; and of the sulphurous acid in solution, one two-thousandth part completely obstructs it. Of the bases, most of which have a manifest action, lime-water and baryta-water completely arrest fermentation. Among the saline compounds mono-sulphuret of sodium much retards it, and the polysulphurets reduce it almost to nothing. The arseniates and arsenites notably retard it; the silicates and borates have little effect, though, on account of their bases, not entirely inert; the permanganate of potassium, in sufficient quantity, completely prevents the process; and, of the metallic salts, sulphate of cadmium and acetate of lead have considerable effect, and the salts of copper, bichloride of mercury with the red and yellow oxides of that metal, the nitrate of silver, and the double chloride of gold and sodium completely prevent it. Creasote has the same effect; and with chloral and chloroform the process is feeble. (*Journ. de Pharm.*, Juin, 1874, pp. 423-427.)—*Note to the fourteenth edition.*

tein body makes its way through the vesicular coat, undergoes decomposition by the agency of heat, and, in the act of decomposition, sets on foot the changes in sugar which result in the formation of alcohol and carbonic acid.*

Medical Properties and Uses. Yeast has been highly extolled as a remedy in low fevers of a typhoid character, and is said to have been given with advantage in hectic. It is, however, little employed; as its somewhat tonic and stimulating effects, ascribable to the bitter principle of hops, the alcohol, and the carbonic acid, which are among its constituents, may be obtained with equal certainty from more convenient medicines. The late Dr. Hewson, of Philadelphia, informed the authors that, in a case of typhoid fever, attended with great irritability of the stomach, the patient was benefited and sustained by taking a pint of yeast daily for five days, during which period no other remedy was employed. We have used it with apparent advantage in diabetes. (See *Trans. of Col. of Phys. of Phil.*, N. S., i. 390.) It has also been recommended internally in boils. When largely taken, it generally proves laxative; and it may sometimes be necessary to obviate this effect by opium. Externally applied, it is very useful in foul and sloughing ulcers, the fetor of which it corrects while it affords a gentle stimulus to the debilitated tissue. It is usually employed mixed with farinaceous substances in the form of a cataplasm. The dose is from half a fluidounce to two fluidounces every two or three hours.

Pharm. Use. In preparing Acidum Citricum, *Br.*

Off. Prep. Cataplasma Fermenti, *Br.* W.

* There can, we think, scarcely be a doubt, at present, that fermentation and the reproduction of yeast are best explained upon the basis of an organic process. The germs of various microscopic plants, *mucedineæ*, as they are called, are always floating in the air, which, incorporated with certain nitrogenous substances, such as albumen, gluten, &c., essential to their nutrition, constitute what are called ferments. These have the property, when mixed with other substances, of producing certain chemical changes, accompanied with phenomena called fermentation, and resulting in the decomposition of these substances, and the production of new ones. Different plants produce different results, each giving rise to a peculiar fermentation, characterized by its own peculiar product. The *vinous fermentation* is one of these. Yeast, containing its proper plant, *Torula cerevisiæ*, mixed with a solution of sugar and water at a sufficient temperature, causes a decomposition of the sugar, and the generation of alcohol and carbonic acid, with the phenomena of vinous fermentation, while the yeast itself, instead of being destroyed, is in fact greatly increased. The plants, by abstracting, in the process of their growth and reproduction, a portion of the constituents of the sugar, decompose this substance, the remaining constituents of which enter into new combinations, forming alcohol and carbonic acid. Thus the yeast is augmented by the growth of the old and the abundant generation of new plants; and in this way, much better than in any other, is explained the singular phenomenon of the generation of the new yeast. Pasteur has given a strong evidence of the truth of this explanation by the discovery, that, though the yeast plant, when exposed to the air, will grow freely, yet it has comparatively little effect on the sugar, while, with the air excluded, it operates on this substance energetically. In the former case, it derives the oxygen necessary to its respiration from the air, in the latter, exclusively from the sugar. Opposed to this view is the asserted fact, that the alcohol and carbonic acid produced exactly represent the sugar lost, which could not be if a part of the sugar were consumed as food by the plant. But this difficulty is removed by the consideration, that, as the plant exposed to the air, while absorbing oxygen, gives out carbonic acid, so, when it derives oxygen from the sugar, it yields an equivalent product of carbonic acid, the surplus carbon of the sugar being probably appropriated in the nutritive process. (*Note to the twelfth edition.*)

One of the most recent and interesting results obtained by M. Pasteur is a generalization of the fact noticed in the above note in relation to the operation of the yeast plant. According to this highly ingenious author, there are many organized microscopic bodies, which, though supporting life through the agency of atmospheric oxygen, when exposed to it, will live and carry on the vital processes, respiration among them, in the absence of free oxygen, if put in contact with organic liquids or solids containing oxygen, and capable of yielding it to the body in question. Thus every one of these bodies capable of living in the absence of all oxygen, by obtaining it from other bodies, is capable of acting as a ferment by causing the decomposition of the substances whose oxygen they appropriate, each one of them giving rise to a special and peculiar fermentation. (*Journ. de Pharm.*, Janv. 1873, p. 5.)

Liebig has opposed to the views of Pasteur the statement that the pure yeast does not in any degree develop itself in a perfectly pure saccharine metallic solution; but Pasteur has satisfactorily shown that this is not the case: and that the minutest quantity of yeast sets on foot an active fermentation in such liquids, attended with a copious production of very white and pure yeast. (*Journ. de Pharm.*, Avril, 1874, pp. 281–3.)

At present the weight of evidence is decidedly in favour of the physiological theory; and the experiments of M. Pasteur seem to us to have established it incontestably. Of course chemical action is not excluded in the process. The living organism of the ferment operates through its vital properties upon the body to be changed, the constituents of which, having been disturbed, rearrange themselves under the influence of chemical laws, while other bodies are forming.—*Note to the fourteenth edition.*

FERRUM. *U.S., Br.*

Iron.

Wrought iron in the form of wire or nails, free from oxide. *Br.*

Fer, *Fr.*; Eisen, *Germ.*; Ferro, *Ital.*; Hierro, *Span.*

In the U. S. Pharmacopœia, this metal is employed in different preparations, in the form either of wire or filings; and each of these forms, therefore, will be briefly noticed in the following article; the general properties of the metal having been first considered.

Iron is the most abundant and useful of the metals, and so interwoven with the wants of mankind, that the extent of its consumption by a nation may be taken as an index of its progress in civilization. It is universally diffused in nature, not only in the mineral, but also in the vegetable and animal kingdoms. There are very few minerals in which traces of it are not to be found, and it is an essential constituent in many parts of animals, but particularly in the blood. It is one of the few metals which are not deleterious to the animal economy.

Iron occurs, 1. native; 2. sulphuretted, forming magnetic and cubic pyrites; 3. oxidized, embracing the magnetic, specular, red, brown, and argillaceous oxides of iron; 4. in saline combination, forming carbonate, sulphate, phosphate, and arseniate of iron. Those minerals of iron which admit of being worked to advantage are called iron ores. These include the different native oxides, and the carbonate (sparry iron). The best iron is obtained from varieties of the native oxide, usually called magnetic iron ore and specular iron ore. These occur abundantly in Sweden, and furnish the superior iron of that country. As a general rule, those ores yield the best iron which occur in primitive formations.

Extraction. The mode of extracting iron from its ores varies somewhat with the nature of the ore; but the general principles of the operation are the same for all. The ore, previously broken into small pieces and roasted, is exposed to the action of an intense heat, in contact with carbonaceous matter, such as charcoal, coke, or anthracite, and in connection with some flux, capable of fusing with the impurities of the ore. The flux varies with the nature of the ore, and is generally either limestone or clay; limestone being employed when the ore is argillaceous, clay when it is calcareous. The flux, whatever it may be, enters into fusion with the impurities, and forms what is called the slag; while the carbonaceous matter, acting on the oxide of iron, reduces it to the metallic state. The reduced metal, from its density occupies the lower part of the furnace, and is protected from the action of the air by the melted slag which floats on its surface. When the reduction is completed, the slag is allowed to run out by a hole in the side of the furnace, and the melted metal by an aperture at the bottom, the latter being received into long triangular moulds, where it solidifies in masses, known in commerce by the name of *pig* or *cast iron*. In this state the metal is brittle and far from being pure; as it contains about 10 per cent. of carbon, with silicon, phosphorus, sulphur, calcium, aluminium, and sometimes manganese. It is purified, and brought to the state of malleable iron, by being fused and subjected, while stirred, to the action of a current of air on its surface. By these means the carbon is nearly burnt out, and the other impurities are oxidized and made to rise to the surface as a slag. As the metal approaches to purity, it becomes tough and less liquid, and its particles agglutinate so as to form semi-fused lumps, though the temperature of the furnace continues the same. These lumps are then taken out of the furnace, and their particles, by means of ponderous hammers moved by steam or water power, or by great pressure, are forced together so as to form one tenacious mass. The metal is finally rolled out into bars of a convenient size, when it constitutes the malleable iron of commerce.

Very pure malleable iron is now manufactured by the new process of Mr. W. Bessemer, from the crude metal while still in a state of fusion, by running it into a separate vessel, and there subjecting it to a blast of atmospheric air. The carbon is thus burnt out; and by the heat generated the temperature of the fused metal is

increased, with the effect of dissipating the volatile impurities, such as sulphur, &c., and of burning some of the iron into oxide, which, fusing with the earthy impurities, separates them in the form of slag. The loss of weight is 18 per cent., against 28 per cent. by the old process. (*Pharm. Jour.*, Sept. 1856.)

Iron mines occur in most countries, but more particularly in northern ones. In Spain, the principal mines furnish sparry iron, and the red and brown oxides. The chief iron ores of France are the sparry iron, and the specular brown, and argillaceous oxides; of Germany, the sparry iron and brown oxide. The island of Elba is celebrated for its rich and abundant specular iron ore.

In the United States iron is abundant. The principal ores that are worked are the magnetic, brown, and argillaceous oxides. They occur in the greatest abundance in the States of New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania. The ores of the three last-mentioned States rival the best Swedish in quality.

Properties. Iron is a hard, malleable, ductile, and tenacious metal, of a grayish-white colour and fibrous texture, a slightly styptic taste, and a sensible odour when rubbed. In tenacity it yields only to nickel and cobalt. (*Deville.*) Its sp. gr. is about 7·7 (7·8, *U. S.*), and its fusing point very high. It possesses the magnetic and welding properties. It is combustible, and, when heated to whiteness, burns in atmospheric air, and with brilliant scintillations in oxygen gas. At a red heat, its surface is converted into black oxide, and at common temperatures, by the combined agency of air and moisture, it becomes covered with a reddish matter, called *rust*, which is the hydrated sesquioxide. It combines with all the non-metallic elements, except hydrogen and nitrogen, and with most of the metals. Its eq. is 28 and symbol Fe. It forms three principal compounds with oxygen, a protoxide and sesquioxide, which, by their union, form the native black oxide, and a teroxide, possessing acid properties, called ferric acid. The *protoxide* is of a dark-blue colour attracted by the magnet, and spontaneously combustible in the air, being converted into sesquioxide. It is the base of green vitriol, and of the green salts of iron generally. It is very prone to absorb oxygen; and hence the salts which contain it are soon partially converted, when in solution, into salts of the sesquioxide. It consists of one eq. of iron 28, and one of oxygen 8 = 36. The *sesquioxide* is readily obtained by dissolving iron in nitromuriatic acid, precipitating by ammonia, and igniting the precipitate. It is of a red colour, not attracted by the magnet, and forms salts, which for the most part have a reddish colour. It is composed of two eqs. of iron 56, and three of oxygen 24 = 80. An allotropic variety of the sesquioxide, soluble in water, and not responding to the ordinary tests of iron, has been discovered by M. Péan de Saint-Gilles. The *native black oxide*, the magnetic oxide of mineralogists, consists of one eq. of protoxide 36, and one of sesquioxide 80 = 116. Under the name of *Ferri Oxidum Magneticum*, the British Pharmacopœia has a preparation consisting of this oxide with three eqs. of water. The *teroxide* or *ferric acid*, discovered by Frémy, may be obtained, in union with potassa, by passing chlorine through a very concentrated solution of the alkali, holding the hydrated sesquioxide in suspension. This acid consists of one eq. of iron 28, and three of oxygen 24 = 52. Iron, combined with a minute proportion of carbon, and perhaps of silicon and aluminium, forms *steel*, a modification of iron formerly used in medicine. It also forms a number of important salts, several of which are officinal.

Iron is readily detected, even in minute quantities, by bringing it to the state of sesquioxide in solution, and adding ferrocyanide of potassium or tincture of galls; the former of which will strike a deep-blue, the latter a black colour. The object of bringing it to the state of sesquioxide is readily effected by boiling the solution containing it with a little nitric acid.

General Therapeutic Effects of Iron. The preparations of iron are pre-eminently tonic, and peculiarly well fitted to improve the quality of the blood, when impoverished from any cause. Hence they are useful in diseases characterized by debility, especially when the consequence of inordinate discharges. The diseases in which they are usually employed are chronic anæmia or chlorosis, hysteria, fluor albus, scrofula, rickets, passive hemorrhages, dyspepsia when dependent on deficient energy

of the digestive function, and neuralgia. They are contraindicated in all inflammatory diseases, producing, when injudiciously employed, heat, thirst, headache, difficulty of breathing, and other symptoms of an excited circulation. In order to understand their effect in improving the blood, it must be borne in mind that this fluid always contains iron, as an essential constituent of the red corpuscles. The amount in ten thousand parts of blood, according to different authorities, is 2·3 parts (Le Canu), 2·4 (Denis), 5·5 (Becquerel and Rodier), 8·7 (Poggiale), mean 4·7. In anæmia the blood is deficient in iron, not because the red corpuscles contain less of the metal, for they, individually considered, always contain the normal quantity; but because there are fewer of them. (*Becquerel and Rodier.*) The question here arises, which are the preparations of iron best adapted to promote the formation of the red constituent of the blood, and what are the conditions of their administration most favourable to their efficient action? According to M. Bouchardat, the preparations most easily assimilated are metallic iron and the protoxide; and, when the latter is in saline combination, it should be united either with carbonic acid, or with some organic acid. He holds that, when the iron is combined with a mineral acid, such as the sulphuric or phosphoric, the preparation acts solely as an astringent. Quevenne did not go so far as this, but believed that the mineral acid salts were not well adapted for assimilation, and that they were less so in pro portion to their astringent power.

Quevenne laid it down as a rule, that, when the iron preparations are given with the view of improving the blood, they should be taken with the meals, and not on an empty stomach. Doses, thus given, are well borne, which often cause uneasiness and pain, when taken fasting. The gastric juice of the empty stomach is usually alkaline; and Quevenne proved that reduced iron, introduced, through a fistulous opening, into the stomach of fasting dogs, was not acted on, and was without effect in exciting the secretion. The juice, during digestion, is acid, and has been shown by the experiments of Quevenne to be in a favourable state for dissolving iron. The ferruginous preparations, it is true, were found to be unequally soluble; for, while iron filings were freely soluble, the subcarbonate of iron was but slightly attacked. It was observed that the acidity of the gastric juice was but little diminished by the solution of the iron; which fact can be explained only by supposing that the presence of the metal caused a nearly proportional increase of the acid secretion. Assuming these observations to be accurate, it is easy to perceive why the ferruginous preparations should be taken with the food, selecting of course those most soluble in the gastric juice. The digested iron, being intimately blended with the digested food, is in a favourable state to fulfil its indispensable agency in sanguification.

In the use of ferruginous preparations, it is often necessary to persevere for several months, in order to reap the fullest benefit. Even after the cure appears to be accomplished, it is safest to continue them, in diminishing doses, for a considerable time. For further information on the properties of iron, the reader is referred to the able memoir of the late T. A. Quevenne, entitled *Mémoir sur l'Action Physiologique et Thérapeutique des Ferrugineux* (Paris, 1854).

The following table embraces all the preparations of iron to be found in the United States and British Pharmacopœias, together with their synonymes.

Iron is officinal—

I. In the metallic state.

Ferrum, *U. S.*, *Br.* — *Iron.*

Mistura Ferri Aromatica, *Br.* — *Aromatic Mixture of Iron.*

Vinum Ferri, *Br.* — *Wine of Iron.*

Ferrum Redactum, *U. S.*, *Br.* — *Reduced Iron. Powder of Iron.*

Trochisci Ferri Redacti, *Br.* — *Reduced Iron Lozenges.*

II. Oxidized.

Ferri Oxidum Hydratum, *U. S.;* Ferri Peroxidum Humidum, *Br.* — *Hydrated Oxide of Iron. Moist Peroxide of Iron.*

Ferri Oxidum Magneticum, *Br.* — *Magnetic Oxide of Iron.*
Ferri Peroxidum Hydratum, *Br.* — *Hydrated Peroxide of Iron.*
Emplastrum Ferri, *Br.* — *Chalybeate Plaster.*

III. Sulphuretted.
Ferri Sulphuretum, *U. S.* — *Sulphuret of Iron.*

IV. In saline combination.
Tinctura Ferri Acetatis, *Br.* — *Tincture of Acetate of Iron.*
Ferri Arsenias, *Br.* — *Arseniate of Iron.*
Ferri Carbonas Saccharata, *Br.* — *Saccharated Carbonate of Iron.*
Pilula Ferri Carbonatis, *Br.* — *Pill of Carbonate of Iron.*
Pilula Ferri Carbonatis, *U. S.* — *Pill of Carbonate of Iron. Vallet's Ferruginous Pills.*
Pilulæ Ferri Compositæ, *U. S.* — *Compound Pills of Iron.*
Ferri Chloridum, *U. S.* — *Chloride of Iron.*
Liquor Ferri Chloridi, *U. S.* — *Solution of Chloride of Iron.*
Tinctura Ferri Chloridi, *U. S.* — *Tincture of Chloride of Iron.*
Ferri Citras, *U. S.* — *Citrate of Iron.*
Liquor Ferri Citratis, *U. S.* — *Solution of Citrate of Iron.*
Vinum Ferri Citratis, *Br.* — *Wine of Citrate of Iron.*
Ferri et Ammonii Citras, *U. S.*; Ferri et Ammoniæ Citras, *Br.* — *Citrate of Iron and Ammonium.*
Ferri et Ammonii Sulphas, *U. S.* — *Sulphate of Iron and Ammonium. Ammonio-ferric Alum.*
Ferri et Ammonii Tartras, *U. S.* — *Tartrate of Iron and Ammonium.*
Ferri et Potassii Tartras, *U. S.*; Ferrum Tartaratum, *Br.* — *Tartrate of Iron and Potassium. Tartarated Iron.*
Ferri et Quiniæ Citras, *Br.* — *Citrate of Iron and Quinia.*
Ferri et Strychniæ Citras, *U. S.* — *Citrate of Iron and Strychnia.*
Ferri Ferrocyanidum, *U. S.* — *Ferrocyanide of Iron. Pure Prussian Blue.*
Ferri Hypophosphis, *U. S.* — *Hypophosphite of Iron.*
Potassii Ferrocyanidum, *U. S.*; Potassæ Prussias Flava, *Br.* — *Ferrocyanide of Potassium. Yellow Prussiate of Potassa.*
Pilula Ferri Iodidi, *Br.* — *Pill of Iodide of Iron.*
Pilulæ Ferri Iodidi, *U. S.* — *Pills of Iodide of Iron.*
Syrupus Ferri Iodidi, *U. S.*, *Br.* — *Syrup of Iodide of Iron.*
Ferri Iodidum, *Br.* — *Iodide of Iron.*
Ferri Lactas, *U. S.* — *Lactate of Iron.*
Liquor Ferri Nitratis, *U. S.*; Liquor Ferri Pernitratis, *Br.* — *Solution of Nitrate of Iron.*
Ferri Oxalas, *U. S.* — *Oxalate of Iron.*
Liquor Ferri Perchloridi Fortior, *Br.* — *Strong Solution of Perchloride of Iron.*
Liquor Ferri Perchloridi, *Br.* — *Solution of Perchloride of Iron.*
Tinctura Ferri Perchloridi, *Br.* — *Tincture of Perchloride of Iron.*
Ferri Phosphas, *U. S.*, *Br.* — *Phosphate of Iron.*
Syrupus Ferri Phosphatis, *Br.* — *Syrup of Phosphate of Iron.*
Ferri Pyrophosphas, *U. S.* — *Pyrophosphate of Iron.*
Ferri Subcarbonas, *U. S.* — *Subcarbonate of Iron.*
Emplastrum Ferri, *U. S.* — *Plaster of Iron. Strengthening Plaster.*
Trochisci Ferri Subcarbonatis, *U. S.* — *Troches of Subcarbonate of Iron.*
Liquor Ferri Subsulphatis, *U. S.* — *Solution of Subsulphate of Iron.*
Ferri Sulphas, *U. S.*, *Br.* — *Sulphate of Iron.*
Ferri Sulphas Exsiccata, *U. S.*, *Br.* — *Dried Sulphate of Iron.*
Mistura Ferri Composita, *U. S.*, *Br.* — *Compound Mixture of Iron.*
Ferri Sulphas Granulata, *Br.* — *Granulated Sulphate of Iron.*
Liquor Ferri Tersulphatis, *U. S.*; Liquor Ferri Persulphatis, *Br.* — *Solution of Tersulphate of Iron. Solution of Persulphate of Iron.*

IRON WIRE. *Ferri Filum. U. S.* 1850.

Fil de fer, *Fr.;* Eisendraht, *Germ.;* Fil di ferro, *Ital.;* Hilo de hierro, *Span.*

IRON FILINGS. *Ferri Ramenta. U. S.* 1850. *Limatura Ferri.*

Limailles de fer, *Fr.;* Eisenfeilicht, *Germ.;* Limatura di ferro, *Ital.;* Limatura de hierro, *Span.*

Iron, when employed in pharmaceutical operations, should be of the purest kind; and hence the Pharmacopœias generally direct it, when wanted in small masses, to be in the form of *iron wire*, which is necessarily made from the purest, because the softest and most ductile iron, and is readily cut into pieces. The wire is very flexible and without elasticity. *U. S.*

Iron filings are usually obtained from the workshops of the blacksmith; but, as furnished from this source, they are generally very impure, and unfit for medicinal use. M. Gobley, upon examining thirty-six samples of iron filings, found but three exempt from copper. The rest, besides wood, sand, and oxide of iron, contained as high as 2 per cent. of this metal. Iron filings cannot be completely purified by the magnet; as they often have adhering to them bits of foreign matter, which are carried up with them. The only way to obtain them pure, is to file a piece of pure iron with a clean file. The French Codex directs iron in an *impalpable powder*, prepared by porphyrizing bright and clean iron filings without water. A dull black powder is formed, which must be carefully preserved from moisture. An impalpable powder of the metal, *Ferrum Redactum*, obtained by reducing the sesquioxide by hydrogen, is officinal.

Medical Uses. In the form of wire, iron is never used internally; in that of filings, it was formerly much employed. Though undoubtedly an efficacious remedy, iron filings have been entirely superseded by one of the forms of powdered iron which have lately been brought into use, and which have the great advantages of more entire purity and more ready solubility in the liquids of the stomach, while exempt, by their impalpable character, from the liability to produce irritation mechanically, which was objected against the filings.

Pharm. Use. In preparing Potassii Bromidum, *U. S.;* Ammonii Bromidum, *U. S.*

Off. Prep. Ferri Chloridum, *U. S.;* Ferri Iodidum, *Br.;* Ferri Lactas, *U. S.;* Ferri Sulphas; Ferri Sulphas Granulata, *Br.;* Liquor Ferri Chloridi, *U.S.;* Liquor Ferri Nitratis, *U. S.;* Liquor Ferri Perchloridi Fortior, *Br.;* Liquor Ferri Pernitratis, *Br.;* Pilulæ Ferri Iodidi, *Br.;* Pilulæ Ferri Iodidi, *U. S.;* Syrupus Ferri Iodidi, *U. S.*

B.

FERRI HYPOPHOSPHIS. *U. S.*

Hypophosphite of Iron.

This is among the hypophosphites brought into notice, in consequence of their recommendation by Dr. Churchill in the treatment of phthisis, in which they were thought to be useful by the introduction of phosphorus into the system. This particular salt may be considered preferable to others, when a marked condition of anæmia indicates a deficiency of iron in the tissues. It may be made by the action of hypophosphorous acid on carbonate of iron formed by precipitation from the sulphate; but as some difficulty has been found in obtaining this acid perfectly pure, Mr. C. H. Wood, of London, prefers the plan of double decomposition. He proposes that sulphate of iron and hypophosphite of calcium be made to react on each other in atomic proportions, represented by 480 grains of crystallized sulphate of iron and 326 grains of commercial hypophosphite; in the latter an allowance of 10 per cent. being made for impurities ordinarily found in that salt. These quantities will yield 320 grains of the hypophosphite of iron; and the reaction will be represented by the following formula:— $CaO,(2HO,PO)_2 + FeOSO_3 = FeO(2HO,PO)_2 + CaO,SO_3$. Sulphate of calcium is precipitated, and hypophosphite of iron is held in solution. (*Pharm. Jour.*, July, 1868, p. 342.) In this condition the ferruginous salt contains the protoxide of iron; but on evaporation the protoxide becomes sesquioxide, and acquires the properties of the salt directed in the Pharmacopœia. Of this the following description is given in the late edition of that work.

"A white amorphous powder, insoluble in cold water, soluble in hydrochloric acid,

and when dry, sparingly soluble in hypophosphorous acid, but in the moist hydrated condition, readily soluble. With solution of potassa it becomes reddish-brown. Heated, it evolves spontaneously inflammable phosphoretted hydrogen."

This salt may be given in states of system where deficient powers of the cerebral centres are attended with an anemic state of the blood. The phosphorus is supposed to serve as a nutrient to the brain, and the iron supplies red-corpuscles to the circulation. It may be given in pill or powder in the dose of from five to ten grains; but a more eligible form, and one generally preferred, is that of syrup.

Syrup of hypophosphite of iron may be prepared by simply adding syrup to the solution of the hypophosphite, remaining after the separation of the sulphate of calcium, in the process of Mr. Wood above given. If two and a half ounces of water are used in the process, and the paste resulting from the precipitation of the sulphate of calcium be pressed out, the remaining liquid, after filtration, will form with seven times its volume of syrup, a liquid containing two grains of the hypophosphite in a fluidrachm. (*Pharm. Jour.*, April, 1868.) But in this form, if the syrup be not thoroughly enclosed it quickly absorbs oxygen, and in a few hours begins to exhibit the formation of a precipitate, rendering it in a short time unfit for use. A little phosphoric or citric acid added to the syrup will obviate this result; but it is better perhaps at once to form a syrup from materials which will not be liable to this objection. Mr. Wood employs the following process. "Take of granulated sulphate of iron 480 grs., hypophosphite of lime 326 grs., diluted phosphoric acid f℥i, water f℥iss, syrup q.s. Dissolve, without heat, the sulphate of iron in the phosphoric acid, previously mixed with the water. Rub the hypophosphite to fine powder, and pour on it the solution of the sulphate. Triturate together for two or three minutes, then pour the mixture onto a piece of damp calico, and squeeze out the liquid as far as possible with the hands. Filter this solution into a measure glass, and add to it seven times its volume of strong syrup. The resulting syrup will contain two grains of the hypophosphite of iron in each fluidrachm." The dose may be from 2 to 6 fluidrachms. W.

FERRI SULPHURETUM. *U.S.*

Sulphuret of Iron.

"Protosulphuret of Iron, prepared by melting together Iron, in small pieces, and Sublimed Sulphur." *U.S.*

This has been introduced into the U. S. Pharmacopœia as the material from which sulphuretted hydrogen may be obtained, which, though not officinal, is in constant use as a reagent, and is often employed with great advantage in processes for isolating the active principles of medicinal substances.

The officinal sulphuret of iron is best prepared by bringing iron and sulphur into contact at a red or white heat. The following are the processes of the late Dublin and Edinburgh Pharmacopœias.

"Take of rods of Iron, of the size employed in the manufacture of nails, *any convenient number*. Having raised them to a strong red or white heat, apply them in succession by their heated extremities to sticks of Sulphur, operating so that the melted Sulphuret, as it is formed, may drop into a stone cistern filled with water, and be thus protected from oxidation. The water being poured off, let the product be separated from the Sulphur with which it is mixed, and, when dried, let it be enclosed in a well-stopped bottle." *Dub.*

"An inferior sort, good enough, however, for pharmaceutic purposes, is obtained by heating one part of Sublimed Sulphur and three of Iron Filings, in a crucible, in a common fire till the mixture begins to glow, and then removing the crucible, and covering it until the action, which at first increases considerably, shall come to an end." *Ed.*

Iron and sulphur form a number of sulphurets, among which the most important are the protosulphuret and sesquisulphuret, corresponding with the protoxide and sesquioxide of iron, the bisulphuret or *cubic pyrites*, and *magnetic pyrites*, which is a compound of five eqs. of protosulphuret, and one of bisulphuret. When the sulphuret

is obtained by the application of solid sulphur to white-hot iron, the product corresponds with magnetic pyrites; but, when procured by heating flowers of sulphur with an excess of iron filings, as directed in the above Edinburgh process, a protosulphuret is formed mixed with metallic iron. When sulphur is applied to white-hot iron over water, the metal appears to become hotter, burns with scintillations in the vapour of the sulphur, and forms instantly the sulphuret, which, being comparatively fusible, melts into globules, and drops into the water, which serves to extinguish them.

Properties, &c. The officinal sulphuret of iron has a yellowish colour and the metallic lustre. When obtained over water it is in the form of brownish-yellow globules, having a somewhat crystalline texture. When pure it furnishes a yellow powder, and dissolves in dilute sulphuric or muriatic acid without leaving a residue of sulphur, and with the production of hydrosulphuric acid gas (sulphuretted hydrogen), free from admixture of hydrogen. As prepared, however, by the officinal processes, it is not entirely soluble in dilute sulphuric acid, a portion of uncombined sulphur being left. The fused globules have the composition $5FeS + FeS_2$, or according to some, $5FeS + Fe_2S_3$. This sulphuret is employed solely as a pharmaceutical agent for the production of hydrosulphuric acid. It yields this gas by reaction with diluted sulphuric acid. Water is decomposed; its hydrogen combines with the sulphur to form hydrosulphuric acid, while the oxygen converts the iron into protoxide, with which the sulphuric acid unites. *Hydrosulphuric acid* is a colourless gas, having a smell like that of putrid eggs. Its sp. gr. is 1·1782. It saturates bases, with which it forms salts called *hydrosulphates*, *sulphohydrates*, or *hydrosulphurets*. It consists of one eq. of sulphur 16, and one of hydrogen 1 = 17. B.

FICUS. *U.S., Br.*

Fig.

The dried fruit of Ficus Carica. *U.S., Br.*

Figues, *Fr.;* Feigen, *Germ.;* Fichi, *Ital.;* Higos, *Span.*

Ficus. *Sex. Syst.* Polygamia Dicœcia.—*Nat. Ord.* Urticaceæ.

Gen. Ch. Common receptacle turbinate, fleshy, converging, concealing the florets in the same or distinct individuals. Male. *Calyx* three-parted. *Corolla* none. *Stamens* three. Female. *Calyx* five-parted. *Corolla* none. *Pistil* one. *Seed* one, covered with the closed, persistent, somewhat fleshy calyx. *Willd.*

Ficus Carica. Willd. *Sp. Plant.* iv. 1131; Woodv. *Med. Bot.* p. 714, t. 244. The fig-tree, though often not more than twelve feet high, sometimes rises in warm climates twenty-five or even thirty feet. Its trunk, which seldom exceeds seven inches in diameter, is divided into numerous spreading branches, covered with a brown or ash-coloured bark. Its large, palmate leaves, usually divided into five obtuse lobes, are deep-green and shining above, pale-green and downy beneath, and stand alternately on strong, round footstalks. The flowers are situated within a common receptacle, placed upon a short peduncle in the axils of the upper leaves. This receptacle, the walls of which become thick and fleshy, constitutes what is commonly called the fruit; though this term is, strictly speaking, applicable to the small seed-like bodies found in great numbers on the internal surface of the receptacle, to which they are attached by fleshy pedicels. Cultivation has produced in the fig, as in the apple and peach, a great diversity in shape, size, colour, and taste. It is usually, however, turbinate, or top-shaped, umbilicate at the large extremity, of the size of a small pear, of a whitish, yellowish, or reddish colour, and of a mild, mucilaginous, saccharine taste.

The fig-tree is supposed to have come originally from the Levant. It was introduced at a very early period into various parts of the south of Europe, and is now very common throughout the whole basin of the Mediterranean, particularly in Italy and France. To hasten the maturation of the fruit, it is customary to puncture it with a sharp-pointed instrument covered with olive oil. The ancient process of *caprification* is still practised in the Levant. It consists in attaching branches of the wild fig-tree to the cultivated plant. The fruit of the former contains great numbers

of the eggs of an insect of the genus Cynips, the larvæ of which, as soon as they are hatched, spread themselves over the cultivated fruit, and, by conveying the pollen of the male organs over which they pass to the female florets, hasten the impregnation of the latter, and cause the fig to come quickly to perfection, which might otherwise ripen very slowly, or wither and drop off before maturity. Some authors attribute the effect to the piercing of the fruit by the young insects. According to Landerer, the unripe fig contains an irritant juice, which inflames the skin, and may even disorganize it. (See *Am. Journ. of Pharm.*, xxxiii. 215.)

The figs, when perfectly ripe, are dried by the heat of the sun, or in ovens. Those imported into this country come chiefly from Smyrna, packed in drums or boxes. They are more or less compressed, and are usually covered in cold weather with a whitish saccharine efflorescence, which melts in the middle of summer, and renders them moist. The best are yellowish or brownish, somewhat translucent when held to the light, and filled with a sweet viscid pulp, in which are lodged numerous small yellow seeds. They are much more saccharine than the fresh fruit. Their chief constituents are sugar and mucilage.

Medical Properties and Uses. Figs are nutritious, laxative, and demulcent. In the fresh state they are considered, in the countries where they grow, a wholesome and agreeable aliment, and have been employed from time immemorial. They are apt, however, when eaten freely, to produce flatulence, pain in the bowels, and diarrhœa. Their chief medical use is as a laxative article of diet in constipation. They occasionally enter into demulcent decoctions; and, when roasted or boiled, and split open, are sometimes applied as a suppurative cataplasm to parts upon which an ordinary poultice cannot be conveniently retained, as, for example, to the gums.

Off. Prep. Confectio Sennæ. W.

FILIX MAS. *U.S., Br.*

Male Fern.

The rhizome covered with portions of the stipes of Aspidium Filix mas. When used, only such part of the rhizome as has retained its green colour should be employed; and the stipes, being inert, should be removed. *U.S.* The dried rhizome with the bases of the footstalks, and portions of the root fibres of Aspidium Filix mas. *Br.*

Fougère male, *Fr.;* Johanniswurzel, *Germ.;* Félce maschio, *Ital.;* Helecho, *Span.*

Aspidium. *Sex. Syst.* Cryptogamia Filices. — *Nat. Ord.* Filices, *Jussieu;* Filicales, *Lindley.*

Gen. Ch. Fructification in roundish points, scattered, not marginal. *Involucre* umbilicated, open almost on every side. *Smith.*

The root of a species of Aspidium, growing in South Africa, has been used by the Kaffirs in the vicinity of Natal, by whom it is called *inkomankomo*, or *uncomocomo* as the name is given by Dr. Theodore Martius. The plant is the *A. athamanticum*, and the root has received the name of *panna* in Europe, where it was first brought into notice in 1851. It is probably in no respect superior to the European species. (*Pharm. Journ.*, xvi. 447.)

Aspidium Filix mas. Willd. *Sp. Plant.* v. 259; Smith, *Flor. Britan.* — *Nephrodium Filix mas.* Lindley, *Flor. Med.* 619. — *Polypodium Filix mas.* Linn.; Woodv. *Med. Bot.* p. 795, t. 267. The male fern has a perennial, horizontal root or rhizome, from which numerous annual fronds or leaves arise, forming tufts from a foot to four feet in height. The stipe or footstalk, and midrib are thickly beset with brown, tough, transparent scales; the frond itself is oval-lanceolate, acute, pinnate, and of a bright-green colour. The pinnæ or leaflets are remote below, approach more nearly as they ascend, and run together at the summit of the leaf. They are deeply divided into lobes, which are of an oval shape, crenate at the edges, and gradually diminish from the base of the pinna to the apex. The fructification is in small dots on the back of each lobe, placed in two rows near the base, and distant from the edges. The plant is a native of Europe, Asia, and the north of Africa. It is said also to be

indigenous, growing in shady pine forests from New York to Virginia; but it may be doubted whether the American plant is identical with the European.

The proper period for collecting the root is during the summer, when, according to M. Peschier, of Geneva, it abounds more in the active principle than at any other season. The same writer informs us that it deteriorates rapidly when kept, and in about two years becomes entirely inert. The roots of other species of fern are frequently substituted for the officinal; and in the dried state it is difficult to distinguish them.

Properties, &c. As taken from the ground, the root consists of a long cylindrical caudex, around which are closely arranged, overlapping each other like the shingles of a roof, the remains of the leafstalks or stipes, which are an inch or two in length, from two to four lines thick, somewhat curved and directed upwards, angular, brown, shining, and surrounded near their origin from the root with thin silky scales, of a light-brown colour. From between these remains of the footstalks emerge numerous small radical fibres. The whole root, thus constituted, presents a somewhat flexible, cylindrical mass, one or two inches thick, and a foot or more in length. In this form, however, it is not usually found in our shops. The whole is ordinarily broken up into fragments, consisting of the separated remains of the leafstalks before described, with a small portion of the substance of the root attached to their base, where they are surrounded by the silky scales. These fragments, as seen in the shops, often appear as if long kept, and are probably, in general, much deteriorated by time. The following observations are made by Geiger in relation to the collection and preservation of the root. The inner parts of the fresh root, and of the portions of stalk attached to it, are fleshy and of a light yellowish-green colour. In collecting them, all the black discoloured portions should be cut away, the fibres and scales separated, and only the sound green parts preserved. These should be immediately but carefully dried, and then pulverized; and the powder should be kept in small well-stopped glass bottles. The powder thus prepared has a pale-yellowish colour with a greenish tinge.

Dried fern root is externally of a brown colour, internally yellowish-white or reddish, with a peculiar but feeble odour which is most obvious in the powder and decoction, and a sweetish, bitter, astringent, nauseous taste. It has been analyzed by H. Bock, who gives, as its constituents, volatile oil, fixed oil, resin, starch, vegetable jelly, albumen, gum, sugar, tannic and gallic acids, pectin, lignin, and various salts. (See *Am. Journ. of Pharm.*, xxiv. 64.) Peschier ascertained that its active properties reside in the ethereal extract, which is the fixed oil in an impure state, containing volatile oil, resin, colouring matter, &c. It is a thick dark liquid, with the odour of the fern, and a nauseous, bitterish, somewhat acrid taste. Dr. E. Luck has found in it a peculiar acid, which he denominates *filicic acid*, and has extracted from the root two others named *tannaspidic* and *pteritannic acids*. (*Chem. Gaz.*, ix. 407 and 452.) The *aspidin* of Pavesi is not entitled to the name, as, though it may contain, it does not itself constitute the active principle, and is probably little if at all superior to the ethereal extract.

Medical Properties and Uses. Male fern is slightly tonic and astringent; but produces, when taken internally, no very obvious effects upon the system. It was used by the ancients as a vermifuge, and is mentioned in the works of Dioscorides, Theophrastus, Galen, and Pliny. Its anthelmintic powers were also noticed by some of the earlier modern writers, among whom was Hoffman. But it does not appear to have been generally known to the profession, till brought into notice, about the year 1775, by the publication of the mode of treating tænia, employed by Madame Nouffer. This lady, who was the widow of a surgeon in Switzerland, had acquired great celebrity in the cure of tape-worm by a secret remedy. Her success was such as to attract the attention of the medical profession at Paris; and some of the most eminent physicians of that city, who were deputed to examine into the subject, having reported favourably of the remedy, the secret was purchased by the King of France, and published by his order. The outlines of her plan were to give a dose of the powdered root of the male fern, and two hours afterwards a powerful cathartic, to be followed, if it should not operate in due time, by some purging salt; and this process was to be repeated, with proper intervals, till the worm should be evacuated.

A German physician, named Herrenschwand, had used the male fern in a manner somewhat similar, before Madame Nouffer's secret was known. Different opinions have been held of the value of this anthelmintic; but the accounts of its efficacy in the treatment of tape-worm are too numerous and authentic to admit of reasonable doubt. Dr. Peschier stated that, in the course of nine months, 150 tape-worms had been expelled by the ethereal extract. Dr. Ebers found the same preparation completely successful in eight cases. The testimony of Brera is also strongly in favour of the remedy, which he found effectual even against the armed tænia. M. Ronzel cured with it more than 100 cases of tænia, and never found it to fail. (*Journ. de Pharm.*, 3e sér., iv. 474.) Perhaps the different results obtained by different practitioners may be in part ascribed to the variable strength and character of the root employed. It is said that the remedy proves more effectual against the tape-worm of the Swiss (*Bothriocephalus latus*) than against the *Tænia solium*, which is more frequent in France and England. (*Bremser.*) It appears to act as a poison to the worm.

The medicine may be given in the form of powder or ethereal extract. The dose of the powder is from one to three drachms, to be administered in electuary or emulsion, and repeated morning and evening for one or two days. M. Ronzel gives half an ounce to adults, made into boluses, to be swallowed in fifteen minutes, in the morning, on an empty stomach. The dose of the ethereal extract (*oil of fern*) is from twelve to twenty-four grains. Dr. Mayor, of Geneva, recommends it in the dose of from thirty to fifty drops, one-half to be taken at night, the other half in the morning, and followed, at the interval of an hour, by an ounce and a half of castor oil. The decoction has also been employed, made with an ounce of the root and a pint of water. It is customary to follow the medicine by a brisk cathartic.

Off. Prep. Extractum Filicis Liquidum, *Br.;* Oleoresina Filicis, *U. S.* W.

FŒNICULUM. *U. S.*

Fennel.

The fruit of Fœniculum dulce (*De Candolle*). *U. S.*

Off. Syn. FŒNICULI FRUCTUS. *Fennel Fruit.* The fruit of Fœniculum dulce, D.C. Imported from Malta. *Br.*

Sweet Fennel Fruit, *Br.;* Fenouil, *Fr.;* Fenchel, *Germ.;* Finnocchio, *Ital.;* Hinojo, *Span.*

The plant producing fennel-seed was attached by Linnæus to the genus *Anethum*, but was separated from it by De Candolle, and placed, with three or four others, in a new genus styled *Fœniculum*, which has been generally adopted by botanists. The *Anethum Fœniculum* of Linnæus embraced two varieties, the *common* or *wild fennel*, and the *sweet fennel;* the latter being the plant usually cultivated in the gardens of Europe. These are considered by De Candolle as distinct species, and named respectively *Fœniculum vulgare* and *Fœniculum dulce*. In previous editions of the U. S. Pharmacopœia, the former of these was recognised as the source of the medicine; but in the present edition, and in the British Pharmacopœia, it has given way to the latter. In the late Ed. Pharmacopœia, the *F. officinale* of Allioni was recognised. The last-mentioned plant De Candolle considers as belonging to his *F. vulgare* (*Prodromus*, iv. 142); while Merat treats of it as a distinct species, differing both from the F. vulgare and F. dulce of De Candolle (*Dict. de Mat. Méd.*); and Dr. Christison, in his Dispensatory, is disposed to unite it with the last-mentioned plant. In this confusion it is impossible to arrive at any definite and satisfactory conclusion as to the botanical history of the drug under consideration. One thing, however, is certain, that there are two kinds of fennel-seed found in the shops; and it is highly probable that these are derived, if not from distinct species of fennel, at least from marked varieties of the plant. One of them corresponds closely with the description given of the fruit of F. vulgare, while the other is undoubtedly produced by the plant cultivated under the name of sweet fennel, whether that be the F. dulce of De Candolle, or F. officinale of Allioni and Merat.

FŒNICULUM. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Umbelliferæ or Apiaceæ.

Gen. Ch. Calyx a tumid obsolete rim. *Petals* roundish, entire, involute, with a squarish blunt lobe. *Fruit* nearly taper. *Half-fruits* with five prominent bluntly keeled ridges, of which the lateral are on the edge, and rather broadest. *Vittæ* single in the channels, 2 on the commissure. *Involucre* none. (*Lindley.*)

Fœniculum vulgare. De Cand. *Prodrom.* iv. 142.—*Anethum Fœniculum.* Linn., Woodv. *Med. Bot.* p. 127, t. 49. *Common fennel* has a biennial or perennial tapering root, and an annual, erect, round, striated, smooth, green, and copiously branching stem, which usually rises three or four feet in height. The leaves, which stand alternately at the joints of the stem, upon membranous striated sheaths, are many times pinnate, with long, linear, pointed, smooth, deep-green leaflets. The flowers are in large, flat, terminal umbels, with from thirteen to twenty rays, and destitute both of general and partial involucres. The corolla consists of five petals, which, as well as the stamens, are golden-yellow. The fruit is ovate, rather less than two lines in length by about a line in breadth, and of a dark colour, especially in the channels. The plant is a native of Europe, growing wild upon sandy and chalky ground throughout the continent.

F. officinale. Merat and De Lens, *Dict. de Mat. Méd.* iii. 270; Allioni, *Ed. Pharm.* This, which is sometimes called *sweet fennel*, is also perennial, with shorter leaves and less elongated leaflets than the common fennel, but resembling it very closely except in the character of the fruit. This is twice as long as that of the former plant, a little curved, of a less dark colour, with prominent ridges, and a persistent peduncle. It is sweeter and more aromatic than common fennel-seed. The plant is a native of the south of Europe; but is cultivated elsewhere in gardens, and is probably the source of much of the fennel-seed of the shops. Whether it is a distinct species, or a mere variety of F. vulgare, is not determined. Some confound it with the following.

F. dulce. De Cand. *Prodrom.* iv. 142. This plant is eminently entitled to the name of *sweet fennel.* It bears a general resemblance to *F. vulgare*, but differs in having its stem somewhat compressed at the base, its radical leaves somewhat distichous, and the number of rays in the umbel only from 6 to 8. It is also a much smaller plant, being only about a foot high; its flowers appear earlier; and its young shoots or turiones are sweeter and edible. It is a native of Portugal, Italy, and perhaps other parts of Southern Europe; and is cultivated largely in Italy and Sicily for the sake of the shoots, which are eaten raw, or in salad, or boiled as potherbs. The fruit is described by Merat and De Lens as "being globular-ovate, twice the size of that of common fennel, and with prominent ridges." This description does not answer to the character of any of the fennel-seed we have seen in the shops.

In all these species or varieties, the whole plant has an aromatic odour and taste, dependent on a volatile oil by which it is pervaded. The roots were formerly employed in medicine, but are generally inferior in virtues to the fruit, which is now the only officinal portion. Our shops are partly supplied from our own gardens; but much the larger portion of the medicine is imported from Europe, and chiefly, as we have been informed, from Germany. The fennel-seed cultivated here is sweeter and more aromatic than that from abroad, probably in consequence of its greater freshness.

Fennel-seeds (half-fruits) are oblong oval, from one to three or four lines in length, flat on one side, convex on the other, not unfrequently connected by their flat surfaces, straight or slightly curved, of a dark grayish-green colour, with longitudinal yellowish ridges on the convex surface. There are two varieties; one of them from one to two lines long, dark-coloured, rather flat, almost always separate, and without footstalks; the other from three to five lines in length, lighter-coloured, with much more prominent ridges, often conjoined by their flat surface, and very frequently provided with a footstalk. They do not differ essentially in aromatic properties. The odour of fennel-seed is fragrant, its taste warm, sweet, and agreeably aromatic. It yields its virtues to hot water, but more freely to alcohol. The essential oil may be separated by distillation with water. (See *Oleum Fœniculi.*) The seeds contain also fixed oil. From 960 parts, Neumann obtained 20 parts of the former and 120 of the latter.

Medical Properties and Uses. Fennel-seed was used by the ancients, is one of our

most grateful aromatics, and in this country is much employed as a carminative, and as a corrigent of other less pleasant medicines, particularly senna and rhubarb. It is recommended for these purposes by the absence of any highly excitant property. The infusion, prepared by introducing two or three drachms of the seeds into a pint of boiling water, is the form usually preferred. The dose of the bruised or powdered seeds is from a scruple to half a drachm. In infants the infusion is frequently employed as an enema for the expulsion of flatus.

Off. Prep. Aqua Fœniculi, *Br.;* Oleum Fœniculi, *U. S.;* Tinctura Rhei et Sennæ, *U. S.* W.

FRASERA. *U. S. Secondary.*

American Columbo.

The root of Frasera Walteri. *U. S.*

Frasera. *Sex. Syst.* Tetrandria Monogynia. — *Nat. Ord.* Gentianaceæ.

Gen. Ch. Calyx deeply four-parted. *Corolla* four-parted, spreading; segments oval, with a bearded, orbicular gland in the middle of each. *Capsule* compressed, partly marginated, one-celled. *Seeds* few, imbricated, large, elliptical, with a membranaceous margin. *Nuttall.*

Frasera Walteri. Michaux, *Flor. Bor. Americ.* i. 96; Barton, *Med. Bot.* ii. 103. — *F. Carolinensis.* Walter. This is among our most elegant indigenous plants, and the only one of its genus. From the root, which is triennial, long, spindle-shaped, horizontal, fleshy, and yellow, a strong, succulent, solid, smooth stem rises, from five to ten feet in height. The leaves are sessile, entire, glabrous, of a deep-green colour, and disposed in whorls, which commence at the root, and ascend to the summit with successively diminishing intervals. The radical leaves, from five to twelve in number, are elliptical, obtuse, a foot or more in length by about four inches in breadth, and lie upon the ground in the form of a star. Those constituting the whorls are successively smaller as they ascend; the lowest oblong-lanceolate, the upper lanceolate and pointed. The flowers are numerous, large, yellowish-white, and disposed in a beautiful terminal pyramidal panicle, from one to five feet long, the branches of which spring from the axils of the upper leaves. The segments of the calyx are lanceolate, acute, and somewhat shorter than those of the corolla. The filaments are inserted into the base of the corolla, between its segments, which they do not equal in length. The anthers are oblong and notched at the base. The germ is oblong-ovate, compressed, and gradually tapers into the style, which ends in a bifid stigma. The fruit is an oval, acuminate, compressed, two-valved, one-celled, yellow capsule, containing from eight to twelve flat elliptical seeds.

The Frasera flourishes in the southern and western portions of the United States, and in many situations is very abundant, especially in Arkansas and Missouri. It prefers rich woodlands and moist meadows. The period of flowering is from May to July; but the stems and flowers are produced only in the third year, the radical leaves being the only part of the plant which previously appears above ground. From this manner of growth, it is inferred that the roots should be collected in the autumn of the second, or spring of the third year. Before being dried, it should be cut into transverse slices.

As formerly in the market, frasera was in pieces irregularly circular, an eighth of an inch or more in thickness, about an inch in diameter, somewhat shrunk in the middle, consisting of a central medullary matter and an exterior cortical portion, of a yellowish colour on the cut surfaces, with a light reddish-brown epidermis. In appearance these pieces somewhat resembled columbo, but were easily distinguishable by the greater uniformity of their internal structure, the absence of concentric and radiating lines, and their purer yellow colour without a greenish tinge. We have met with a parcel of the root sliced longitudinally, so as to imitate gentian, though not likely to be confounded with it by an experienced person. It was called *American gentian.* The taste of frasera is bitterish and sweetish. Water and diluted alcohol extract its virtues; and the tincture lets fall a precipitate upon the addition of water, but is not disturbed by tincture of galls. The hot infusion is not precipitated

by solution of gelatin, and gives with iodine no signs of starch. These reactions afford additional means of distinguishing the root from columbo. Mr. Higinbothom, of Bermuda, found in it gum, pectin, glucose, wax, resin, fatty matter, yellow colouring matter, bitter extractive, and an acid which was probably peculiar. (*Am. Journ. of Pharm.*, Jan. 1862, p. 23.) Experiments by Mr. Frank W. Thomas have determined the entire absence from frasera of berberina, one of the active principles of columbo. (*Ibid.*, July, 1868, p. 310.)

Medical Properties and Uses. Frasera is a mild tonic, calculated to meet the same indications with the other simple bitters. It has been thought to resemble columbo in medical properties as well as in appearance, and hence has received the popular name of *American columbo;* but experience has not confirmed the high estimate at one time formed of its virtues; and though, perhaps, still occasionally used in some places, it has failed to supplant the tonic of Mozambique. It may be given in powder or infusion. The dose of the former is from thirty grains to a drachm; that of an infusion, made in the proportion of an ounce of the bruised root to a pint of boiling water, is one or two fluidounces, to be repeated several times a day. The fresh root is said to operate as an emetic and cathartic, and has been given with a view to the latter effect. W.

GALBANUM. *U.S., Br.*

Galbanum.

The gum-resin of an undetermined plant. *U.S.* A gum-resin, derived from an unascertained umbelliferous plant. *Br.*

Galbanum, *Fr.;* Mutterharz, *Germ.;* Galbano, *Ital., Span.*

It is uncertain from what plant galbanum is derived. At one time it was supposed to be the product of *Bubon Galbanum*, an umbelliferous plant of the eastern coast of Africa. It has also been referred to the *Ferula ferulago* of Linnæus, the *Ferula galbanifera* of Lobel, which inhabits the coasts of the Mediterranean, and is found also in Transylvania and the Caucasus. But no part of either of these plants has the odour of galbanum; and it is, therefore, scarcely probable that they yield the drug. Mr. Don, having found the seeds taken from a parcel of galbanum to belong to an undescribed genus of umbelliferous plants, and concluding that they came from the same source as the gum-resin itself, gave the title of Galbanum to the new genus, and named the species *Galbanum officinale.* This was rather hastily adopted by the London College; as it is by no means certain that the same plant produced the seeds and the gum-resin. Specimens of a plant were received in England from Persia having a concrete juice adhering to them, which was taken by Dr. Lindley for galbanum; and that botanist, finding that the plant belonged to an undescribed genus, named it *Opoïdia*, with the specific name *galbanifera.* Dr. Pereira, however, found the substance not to be galbanum; and this supposed origin of the drug, therefore, though admitted as probable by the Edinburgh College, and recognised by the Dublin, must be considered as more than doubtful. A German traveller, F. A. Bukse, who has resided in Persia, states that, in 1848, he met with the galbanum plant on the declivities of the Demawend, near the southern coast of the Caspian. He saw the gum-resin exuding spontaneously from the plant, and was informed by the natives that the drug was collected from it. The plant is a Ferula, and closely resembles the *F. erubescens* of Bossier, if not identical with it. (*Pharm. Cent. Blatt*, March 17, 1852, p. 206.) Galbanum is said to be obtained by making incisions into the stem, or cutting it off a short distance above the root. A cream-coloured juice exudes, which concretes upon exposure to the air. A portion of juice also exudes spontaneously from the joints, and hardens in the shape of tears. The drug is brought from India and the Levant.

Properties. Galbanum usually appears in the form of masses composed of whitish, reddish, or yellowish tears, irregularly agglutinated by a darker coloured yellowish-brown, or greenish substance, more or less translucent, and generally mixed with pieces of stalk, seeds, or other foreign matters. It is also found, though rarely in

our markets, in the state of distinct roundish tears, about as large as a pea, of a yellowish-white or pale brownish-yellow colour, shining externally as if varnished, translucent, and often adhering together. Galbanum has in cool weather the consistence of firm wax; but softens in summer, and by the heat of the hand is rendered ductile and adhesive. At 212° F. it is sufficiently liquid to admit of straining; and it generally requires to be strained before it can be used. A dark-brown or blackish colour, a consistence always soft, the absence of whitish grains, a deficiency in the characteristic odour and taste, and the intermixture of earthy impurities are signs of inferiority.

The odour of galbanum is peculiar and disagreeable; its taste bitterish, warm, and acrid; its sp. gr. 1·212. Triturated with water, it forms an imperfect milky solution, which on standing deposits the greater portion of what was taken up. Wine and vinegar act upon it in a similar manner. Alcohol dissolves a considerable proportion, forming a yellow tincture, which has the smell and taste of galbanum, and becomes milky with water, but affords no precipitate. In dilute alcohol it is wholly soluble, with the exception of impurities. Ether dissolves the greater portion. Pelletier found in 100 parts, 66·86 parts of resin, 19·28 of gum, 6·34 of volatile oil including the loss, 7·52 of wood and impurities, with traces of supermalate of calcium. A small proportion of bassorin was found by Meissner. The medicine is, therefore, a *gum-resin*. By distillation at the temperature of about 250° F., the volatile oil is obtained of a fine indigo-blue colour, which it imparts to alcohol. Procured by distillation with water, it is colourless, and becomes yellowish by age. It is lighter than water.

According to Ludewig, a gum-resin, designated as *Persian galbanum*, is received in Russia by the way of Astracan or Orenburg, and is the kind used in that country. It comes enclosed in skins, and is in masses of a reddish-brown colour with whitish streaks, of a disagreeable odour, somewhat like that of assafetida, and of an unpleasant, bitter, resinous taste. It is so soft as to melt with a slight elevation of temperature. It differs from common galbanum in its odour, in its colour, which is never greenish, and in the absence of tears, and is probably derived from a different plant. It abounds in impurities.

Medical Properties and Uses. Galbanum was known to the ancients. It is stimulant, expectorant, and antispasmodic; and is considered as intermediate in power between ammoniac and assafetida, though much less employed than either of these gum-resins. The complaints to which it has been thought applicable, are chiefly chronic affections of the bronchial mucous membrane, amenorrhœa, and chronic rheumatism. It is occasionally applied externally as a plaster to indolent swellings, with the view of promoting resolution or suppuration. The dose is from ten to twenty grains, and may be given in pill, or triturated with gum arabic, sugar, and water, so as to form an emulsion.

Off. Prep. Emplastrum Assafœtidæ, *U. S.;* Emplastrum Galbani, *Br.;* Emplastrum Galbani Compositum, *U. S.;* Pilula Assafœtidæ Composita, *Br.;* Pilulæ Galbani Compositæ, *U. S.* W.

GALLA. *U. S., Br.*

Nutgall. Galls.

A morbid excrescence upon Quercus infectoria. *U. S.* Excrescences on Quercus infectoria, caused by the punctures and deposited ova of Diplolepsis Gallæ tinctoriæ. *Br.*

Noix de galle, *Fr.;* Galläpfel, *Germ.;* Galla, *Ital.;* Agallas de Levante, *Span.*

Many vegetables, when pierced by certain insects, particularly those of the genus *Cynips*, are affected at the points of puncture with a morbid action, resulting in excrescences, which, as they are derived from the juices of the plant, partake more or less of its chemical character. Most of the oaks are occasionally thus affected; and the resulting excrescences, having in a high degree the astringency of the plant, have been employed for various practical purposes. They are known by the name of *galls*, a term which, as well as their use in medicine, has been handed down from the ancients. *Quercus infectoria*, *Q. Ægilops*, *Q. excelsa*, *Q. Ilex*, *Q. Cerris*, and *Q. robur* have been particularized as affording this product; but it is now generally admitted,

on the authority of Olivier, that the officinal galls are derived chiefly, if not exclusively, from *Q. infectoria;* and this is recognised as their source in the U. S. and Br. Pharmacopœias.*

Quercus. See QUERCUS ALBA.

Quercus infectoria. Willd. *Sp. Plant.* iv. 436; Olivier, *Voy. Orient.* t. 14 *et* 15; Carson, *Illust. of Med. Bot.* ii. 40, pl. 85. The *dyer's oak* is a small tree or shrub, with a crooked stem, seldom exceeding six feet in height. The leaves are obtusely toothed, smooth, of a bright-green colour on both sides, and stand on short footstalks. The acorn is elongated, smooth, two or three times longer than the cup, which is sessile, somewhat downy, and scaly. This species of Quercus grows, according to Olivier, throughout Asia Minor, from the Archipelago to the confines of Persia. Captain M. Kinnier found it also in Armenia and Kurdistan; General Hardwicke observed it growing in the neighbourhood of Adwanie; and it probably pervades the middle latitudes of Asia.

The gall originates from the puncture of the *Cynips quercûsfolii* of Linnæus, the *Diplolepis gallæ tinctoriæ* of Geoffroy, a hymenopterous insect or fly, with a fawn-coloured body, dark antennæ, and the upper part of its abdomen shining brown. The insect pierces the shoots and young boughs, and deposits its egg in the wound. This irritates the part, and a small tumour quickly rises, which is the result of a morbid growth, exhibiting various cells under the microscope, but no proper vegetable fibre. The egg grows with the gall, and is soon converted into a larva, which feeds upon the vegetable matter around it, and thus forms a cavity in the centre of the excrescence. The insect at length becomes a fly, and escapes by eating its way out. The galls are in perfection when fully developed, before the egg has been hatched, or the fly has escaped. Collected at this period, they are called, from their dark colour, *blue*, *green*, or *black galls*, and are most highly esteemed. Those which are gathered later, and which have been injured by the insect, are called *white galls*. They are usually larger, less heavy and compact, and of a lighter colour than the former.

The galls collected in Syria and Asia Minor are brought to this country chiefly from the ports of Smyrna and Trieste, or from London. As they are produced abundantly near Aleppo, it has been customary to designate them by the name of that town; though the designation, however correct it may formerly have been, is now wholly inapplicable, as they are obtained from many other places, and the produce of different parts of Asiatic Turkey is not capable of being discriminated, at least in our markets. Great quantities of galls, very closely resembling those from the Mediterranean, have been brought to the United States from Calcutta. Dr. Royle states that they are taken to Bombay from Bussorah through the Persian Gulf. We are, nevertheless, informed that galls are among the products of Moultan.

* Under the name of *Chinese galls*, a product has been brought from China, supposed to be caused by an insect allied to the Aphis, as such an insect has been found in the interior of them. A specimen, which came under our notice, consisted of irregularly spindle-shaped bodies, often more or less bent, with obtusely pointed protuberances, about two inches long by an inch in diameter at the central thickest part, of an ash colour and a soft velvety feel, very light, hollow, with translucent walls about a line in thickness, of a slight odour recalling that of ipecacuanha, and a bitter astringent taste. From an examination of fragments of leaves and petioles found among these galls, Dr. Schenck concluded that the tree on which they are found is a species of Rhus; but, according to M. Decaisne, professor at the Museum of Natural History in Paris, their true source is probably the *Distylium racemosum* of Zuccarini (*Flor. Japon.*, i. p. 178, t. 94), a large tree of Japan, the leaves of which produce a velvety gall, resembling the one in question. (Guibourt, *Hist. Nat. des Drogues*, A.D. 1850, iii. 703.) More recently, however, it has been asserted by Mr. Daniel Hanbury that this opinion of Decaisne is erroneous; as, in his examination of the packages imported from China and Japan, he has found remains of different parts of a species of Rhus, but never any of a Distylium. Besides, the form of the galls of the Distylium, as figured by Siebold and Zuccarini, is entirely different. The species of Rhus to which they are ascribed is the *R. semi-alata.* (*Pharm. Journ.*, Feb. 1862, p. 421.) The Chinese make great use of this product both in dyeing and as a medicine. L. A. Buchner, jun., has found it to contain 65 per cent. of tannic acid identical with that of the officinal galls. (*Pharm. Cent. Blatt*, July, 1851, p. 526.) It is recommended by Stenhouse for the manufacture of gallic acid, being preferable for this purpose to the officinal galls, in consequence of its less amount of colouring matter. (*Pharm. Journ.*, Dec. 1862, p. 330.)

An inferior kind of galls has been recently produced in great quantities in England, by the attack of another species of Cynips, the *C. Kollari* of Hartig, upon the common English oak. But they have been ascertained to contain little tannic acid, and will not, probably, supersede the galls of the Levant. (*Note to the twelfth edition.*)

Those of France and other southern countries of Europe have a smooth, shining, reddish surface, are little esteemed, and are seldom or never brought to the United States.

Properties. Galls are nearly round, from the size of a pea to that of a very large cherry, with a surface usually studded with small tuberosities, in the intervals of which it is smooth. The best are externally of a dark-bluish or lead colour, sometimes with a greenish tinge, internally whitish or brownish, hard, solid, brittle, with a flinty fracture, a striated texture, and a small spot or cavity in the centre, indicating the presence of the undeveloped or decayed insect. Their powder is of a light yellowish-gray. Those of inferior quality are of a lighter colour, sometimes reddish or nearly white, of a loose texture, with a large cavity in the centre, communicating externally by a small hole through which the fly has escaped. Galls have a bitter, very astringent taste, and when whole are inodorous or nearly so, but bruised or in powder, they have a decided and peculiar though not very strong smell. From 500 parts Davy obtained 185 parts of matter soluble in water, of which, according to his analysis, 130 were tannin, 31 gallic acid with a little extractive, 12 mucilage and matter rendered insoluble by evaporation, and 12 saline matter and calcareous earth. Braconnot discovered the presence of a small quantity of an acid to which he gave the name *ellagic*, derived from *galle*, the French name for galls, by reversing the order of the letters. According to M. Pelouze, however, neither gallic nor ellagic acid pre-exists in galls, being formed by the reaction of atmospheric oxygen upon their tannin. (*Journ. de Pharm.*, xx. 359.) Galls also yielded to Professor Branchi, by distillation with water, a concrete volatile oil. Guibourt found 65 per cent. of tannic acid, 10·5 of lignin, 5·8 of gum, sugar, and starch, 4·0 of gallic, ellagic, and luteo-gallic acids, and 11·5 of water, besides extractive, chlorophyll, volatile oil, albumen, and salts. For some interesting views of the chemical nature of galls, see *Acidum Gallicum* in the *second part* of this work. All the soluble matter of galls is taken up by forty times their weight of boiling water, and the residue is tasteless. Alcohol dissolves seven parts in ten, ether five parts. (*Thompson's Dispensatory.*) A saturated decoction deposits upon cooling a copious pale-yellow precipitate. The infusion or tincture affords precipitates with sulphuric and muriatic acids, lime-water, and the carbonates of ammonium and potassium; with solutions of acetate and subacetate of lead, the sulphates of copper and iron, the nitrates of silver and mercury, and tartrate of antimony and potassium; with solution of gelatin; and with the infusions of Peruvian bark, columbo, opium, and many other vegetables, especially those containing alkaloids, with most of which tannic acid forms insoluble compounds. The infusion of galls reddens litmus-paper, is rendered orange by nitric acid, milky by the corrosive chloride of mercury, and has its colour deepened by ammonia; but yields no precipitate with either of these reagents. Sulphate of zinc was said by Dr. A. T. Thomson to occasion a slow precipitate, but this result was not obtained by Dr. Duncan.

A variety of galls has been imported into, and is at present largely circulating in Germany, which are said to be derived from Central Asia, especially from the provinces of Kokand, Chiva, and Bucharia, where they are used in dyeing. They are of various forms, some being long, others round, cylindrical, or angular; and sometimes they are grouped upon a single stalk, and covered with little elevations. They differ from all other galls by their colour, being on one side yellow, and on the other of a fine red. Most of them present a little opening; and in the interior are eggs and larvæ of a peculiar species of Aphis. They have yielded, on analysis, 43·10 per cent. of tannin, 3·03 of a green wax, 16 of cellulose, and an undetermined quantity of fecula and volatile oil. (R. Palne, *Archives du Pharm.*, Mars, 1872, extracted in the *Journ. de Pharm.*, Avril, 1873, p. 336.)

Medical Properties and Uses. Galls are powerfully astringent. They are little employed as an internal remedy, though occasionally prescribed in chronic diarrhœa and chronic dysentery. They have been recommended as an antidote to tartar emetic, and those vegetable poisons which depend for their activity upon organic alkalies; but, though the insoluble compounds which these principles form with galls may be less active than their soluble native compounds, they cannot be considered

as inert. In the form of infusion or decoction, made in the proportion of half an ounce to a pint of water, galls may be advantageously used as an astringent gargle, lotion, or injection; and, mixed with simple ointment, in the proportion of one part of galls, in very fine powder, to eight parts of the unguent, they are frequently applied to the anus and rectum in hemorrhoidal affections. The dose of powdered galls is from ten to twenty grains, to be repeated several times a day.*

Off. Prep. Acidum Gallicum; Acidum Tannicum; Tinctura Gallæ; Unguentum Gallæ; Unguentum Gallæ cum Opio, *Br.* W.

GAMBOGIA. *U.S.*

Gamboge.

A gum-resin derived from Garcinia Morella (*Desrousseaux*), *var.* pedicellata. *U.S.*

Off. Syn. CAMBOGIA. *Gamboge.* A gum-resin obtained from Garcinia Morella (*Desrous.*), *var.* pedicellata. *Br.*

Gomme gutte, *Fr.;* Gummigutt, *Germ.;* Gomma-gotta, *Ital.:* Gutta gamba, *Span.*

Several plants belonging to the natural family of *Guttiferæ*, growing in the equatorial regions, yield on incision a yellow opaque juice, which hardens on exposure, and bears a close resemblance to gamboge; but it is only from a particular tree, growing in Siam, that the officinal gum-resin is procured.† Formerly the United States and all the British Pharmacopœias ascribed it to *Stalagmitis Cambogioides.* This genus and species were established by Murray of Göttingen, in 1788, from dried specimens belonging to König, procured in Ceylon; and, from information derived from the same source, it was conjectured by Murray that the tree yielded not only the gamboge of Ceylon, but that also collected in Siam. On this authority, the British Colleges made the reference alluded to. But it was ascertained by Dr. Graham, of Edinburgh, that there is no such plant as Stalagmitis Cambogioides; the description of Murray having been drawn up from accidentally conjoined specimens of two trees belonging to different genera; one being the *Xanthochymus ovalifolius* of Roxburgh, and the other, the *Hebradendron Cambogioides* of Graham. By several botanists the gum-resin has been ascribed to *Garcinia Cambogia*, also a tree of Ceylon belonging to the Guttiferæ, and yielding a yellowish concrete juice; but a specimen of this juice, sent to Edinburgh, was found by Dr. Christison to differ from gamboge both in composition and appearance, being of a pale lemon-yellow colour. Thus it appears that neither of these references is correct; and, besides, the fact seems to have been overlooked, that commercial gamboge is never obtained from Ceylon, but exclusively from Siam and Cochin-China. A gum-resin from Ceylon having been found similar in composition to the gamboge of commerce, and the tree which produced it having been referred by Dr. Graham to a new genus, and named by him *Hebradendron Cambogioides*, the Edinburgh College, in the last edition of its Pharmacopœia, was induced to adopt this Ceylon gamboge as officinal, and to recognise the name proposed by Dr. Graham for the tree producing it. But, as this variety is never found in western commerce, and exists only in cabinets, or the bazaars of India, it scarcely merited a place in an officinal catalogue; and the sufficiency of the grounds upon which the proposed genus Hebradendron was separated from Garcinia is not universally admitted. At length, however, through the instrumentality mainly of Prof. Christison and Mr. Daniel Hanbury, the true gamboge plant seems to have

* The following preparation has been made in imitation of one much used by the late Dr. Physick and Dr. Jos. Parrish, of Philadelphia. Macerate for twenty-four hours half an ounce of powdered galls, two drachms of bruised cinnamon, and two drachms of bruised nutmeg, in half a pint of brandy; then percolate, and, when the liquor has ceased to pass, add enough diluted alcohol to yield half a pint of filtered liquor. Put this into a shallow capsule, suspend over it two ounces of sugar on a slip of wire-gauze, and set the tincture on fire. The sugar melts with the flame, and falls into the liquid beneath. When the combustion ceases, agitate and filter. A highly astringent aromatic syrup is obtained, which may be given in obstinate diarrhœas in the dose of a fluidrachm. (*Am. Journ. of Pharm.*, xxvii. 416.)—*Note to the eleventh edition.*

† According to observations of Messrs. Baildon and Jamie, gamboge is obtained exclusively from the province of Cambodia; the plant being found in no other part of Siam or in Cochin-China. (*Journ. de Pharm.*, Juillet, 1874, p. 65.)—*Note to the fourteenth edition.*

been determined with considerable certainty. Several years since, Dr. Christison received from Singapore specimens of the gamboge plant cultivated in that island, and derived from Siam, which proved to be a Garcinia, differing from the *G. elliptica* of Wallich chiefly in having its male flower upon pedicels. More recently Mr. Hanbury obtained from the same source numerous specimens of the same plant, and was enabled to confirm the statement of Dr. Christison; but he also found that the plant approached as near to the *Garcinia Morella* of Desrousseaux, from which it could be distinguished only by its pedicellate flowers. These specimens were afterwards submitted to the inspection of Mr. Thwaites in Ceylon, who is perfectly familiar with the Garcinias of that island, and were pronounced by him to belong to a variety of G. Morella, scarcely differing from the Ceylon plant, except in having pedicelled instead of sessile flowers. Hence, in the existing editions of the U. S. and British Pharmacopœias, the true Siam gamboge plant is recognised as the Garcinia Morella, *var.* pedicellata; while the Ceylon product, which never enters English or American commerce, must be derived from the other variety, having sessile flowers, and hence designated as *Garcinia Morella*, *var.* sessile. Considering, however, the constancy of the peculiar character of the flower in the Siam plant, and the fact that the gamboge of commerce is never brought from Ceylon, it appears to the author highly probable that the plant will be ultimately admitted as a distinct species, with the title of *Garcinia pedicellata.*

Gamboge is collected in Siam and Cochin-China. Similar products are obtained in Ceylon; but they do not appear to be sent out of the island. Milburn does not mention gamboge among the exports. It is said to be procured in Siam by breaking off the leaves and shoots of the tree, from which the juice issues in drops, and, being received in suitable vessels, gradually thickens, and at length becomes solid. Portions of it, when of the requisite consistence, are rolled into cylinders, and wrapped in leaves. The juice is sometimes received into the hollow joints of the bamboo, which give it a cylindrical form; and, as it contracts during concretion, the cylinder is often hollow in the centre. The name *gummi gutta*, by which it is generally known on the continent of Europe, probably originated from the circumstance that the juice escapes from the plant by drops. The officinal title was undoubtedly derived from the province of Cambodia, in which the gum-resin is collected. It was first brought to Europe by the Dutch about the middle of the 17th century. We import gamboge from Canton and Calcutta, whither it is carried by the native or resident merchants. There is no difference in the appearance or character of the drug as brought from these two ports; an evidence that it is originally derived from the same place.

Varieties. The best gamboge is in cylindrical rolls, from one to three inches in diameter, sometimes hollow in the centre, sometimes flattened, often folded double, or agglutinated in masses so that the original form is not always easily distinguishable. The pieces sometimes appear as if rolled, but are in general striated longitudinally from the impression made by the inner surface of the bamboo. They are externally of a dull-orange colour, which is occasionally displaced by greenish stains, or concealed by the bright-yellow powder of the drug, slightly adhering to the surface. In this form the drug is sometimes called *pipe gamboge.* Another variety is imported under the name of *cake* or *lump gamboge.* It is in irregular masses of two or three pounds or more, often mixed with sticks and other impurities, containing many air cells, less dense, less uniform in texture, and less brittle than the former variety, and breaking with a dull and splintery, instead of a shining and conchoidal fracture. The worst specimens of this variety, as well as of the cylindrical, are sometimes called by the druggists *coarse gamboge.* They differ, however, from the preceding, only in containing a greater amount of impurities. Indeed, it would appear, from the experiments of Christison, that all the commercial varieties of this drug have a common origin, and that cake or lump gamboge differs from the cylindrical, only from the circumstance that the latter is the pure concrete juice; while to the former, farinaceous matter and other impurities have been added for the purpose of adulteration. The inferior kinds of gamboge may be known by their greater hardness and coarser fracture; by the brownish or grayish colour of their broken surface, which is often marked with black spots; by their obvious impurities; and by the green colour which

their decoction, after having been cooled, gives with tincture of iodine. When pure, the gum-resin is completely dissolved by the successive action of ether and water.*

Properties. Gamboge, in its pure form, is brittle, with a smooth, conchoidal, shining fracture; and the fragments are slightly translucent at their edges. The colour of the mass when broken is a uniform reddish orange, which becomes a beautiful bright-yellow in the powder, or when the surface is rubbed with water. From the brilliancy of its colour, gamboge is highly esteemed as a pigment. It has no smell and little taste; but, after remaining a short time in the mouth, produces an acrid sensation in the fauces. Its sp. gr. is 1·221. Exposed to heat, it burns with a white flame, emitting much smoke, and leaving a light spongy charcoal. It is a gum-resin, without volatile oil. In 100 parts of it Braconnot found 19·5 parts of gum, 80 of resin, and 0·5 of impurities. John obtained 10·5 per cent. of gum, 89 of resin, and 0·5 of impurities. Christison has shown that the proportion of gum and resin varies in different specimens even of the purest drug. In one experiment, out of 100·8 parts he obtained 74·2 of resin, 21·8 of gum, and 4·8 of water. The gum is quite soluble in water, and of the variety denominated arabin. In a specimen of *cake gamboge* he found 11·2 per cent. of fecula and lignin, and in a very bad one of *coarse gamboge*, no less than 41 per cent. of the same impurities. In addition to gum and resin, Ph. Büchner found a small and variable proportion of a peculiar reddish-yellow colouring matter, soluble both in alcohol and water. (*Journ. de Pharm.*, 3e sér., iii. 303.) Gamboge is readily and entirely diffusible in water, forming a yellow opaque emulsion, from which the resin is very slowly deposited. It yields its resinous ingredient to alcohol, forming a golden-yellow tincture, which is rendered opaque and bright-yellow by the addition of water. Its solution in ammoniated alcohol is not disturbed by water. Sulphuric ether dissolves about four-fifths of it, taking up only the resin. It is wholly taken up by alkaline solutions, from which it is partially precipitated by the acids. The strong acids dissolve it; but the solution when diluted with water deposits a yellow sediment. The colour, acrimony, and medicinal power of gamboge reside in the resin. This has the neutralizing property of the acids, and has been named *gambogic acid.* It is obtained by evaporating an ethereal tincture of the gum-resin. In mass it is of a cherry-red colour, but becomes of a deep-orange in thin layers, and yellow when powdered. So intense is its colour, that one part of it communicates a perceptible yellowness to ten thousand parts of water or spirit. It is insoluble in water, but soluble in alcohol, and very soluble in ether, chloroform, and benzole. It forms with the alkalies dark-red solutions of *gambogiates*, from which the acids throw down gambogic acid of a yellow colour, and with the soluble salts of lead, copper, and iron, gambogiates of those metals respectively; the salt of lead being yellow, that of copper brown, and that of iron dark-brown. Its composition is given by Johnston as $C_{40}H_{23}O_8$. (*Lond. Philos. Trans.*, 1839.) In the dose of five grains it is said to produce copious watery stools, with little or no uneasiness. If this be the case, it is probable that, as it exists in the gum-resin, its purgative property is somewhat modified by the other ingredients.

Medical Properties and Uses. Gamboge is a powerful, drastic, hydragogue cathartic, very apt to produce nausea and vomiting when given in the full dose. In large quantities it is capable of producing fatal effects, and death has resulted from a drachm. It is much employed in the treatment of dropsy attended with torpid bowels, generally in combination with bitartrate of potassium or jalap. It is also prescribed in cases of obstinate constipation, and has frequently been found effectual in the expulsion of the tape-worm. It is often combined with other and milder cathartics, the action of which it promotes and accelerates, while its own is moderated. The full dose is from two to six grains, which in cases of tænia has been raised to

* *Ceylon gamboge*, derived from the *Hebradendron Cambogioides* of Graham (*Cambogia gutta*, Linn., *Garcinia Morella*, De Cand.), is procured by incisions, or by cutting away a portion of the bark, and scraping off the juice which exudes. The specimens sent to Dr. Christison were in flattish or round masses, eight or nine inches in diameter, apparently composed of aggregated irregular tears, with cavities which are lined with a grayish and brownish powdery incrustation. It resembled coarse gamboge, and was identical in composition. In Ceylon it is used as a pigment and purgative. (*Christison.*)

ten or fifteen grains. As it is apt to occasion much sickness and griping, the best plan, under ordinary circumstances, is to give it in small doses, repeated at short intervals till it operates. It may be given in pill or emulsion, or dissolved in an alkaline solution. The last method of administration has been recommended in dropsical complaints.

Off. Prep. Pilulæ Catharticæ Compositæ, *U. S.;* Pilula Cambogiæ Comp., *Br.*

W.

GAULTHERIA. *U.S.*

Gaultheria. Partridge-berry.

The leaves of Gaultheria procumbens. *U. S.*

Gaultheria. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Ericaceæ.

Gen. Ch. Calyx five-cleft, bibracteate at the base. *Corolla* ovate. *Capsule* five-celled, invested with the berried calyx. *Pursh.*

Gaultheria procumbens. Willd. *Sp. Plant.* ii. 616; Bigelow, *Am. Med. Bot.* iii. 27; Barton, *Med. Bot.* i. 171. This is a small, indigenous, shrubby, evergreen plant, with a long, creeping, horizontal root, which sends up at intervals one or two erect, slender, round, reddish stems. These are naked below, leafy at top, and usually less than a span in height. The leaves are ovate or obovate, acute, revolute at the edges with a few mucronate serratures, coriaceous, shining, bright-green above, paler beneath, of unequal size, and supported irregularly on short red petioles. The flowers, of which not more than from three to five are usually on each stem, stand upon curved, drooping, axillary peduncles. The calyx is white, five-toothed, and furnished at its base with two concave cordate bractes, described by some as an outer calyx. The corolla is white, ovate, or urceolate, contracted at the mouth, and divided at the border into five small acute segments. The stamens have curved, plumose filaments, and oblong orange-coloured anthers opening on the outside. The germ, which rests upon a ring having ten teeth alternating with the ten stamens, is roundish, depressed, and surmounted by an erect filiform style, ending in an obtuse stigma. The fruit is a small, five-celled, many-seeded capsule, with a fleshy covering, formed by the enlarged calyx, and presenting the appearance of a bright scarlet berry.

The plant extends from Canada to Georgia, growing in large beds in mountainous tracts, or in dry barrens and sandy plains, beneath the shade of shrubs and trees, particularly of other evergreens, as the Kalmiæ and Rhododendra. It is abundant in the pine-barrens of New Jersey. In different parts of the country, it is variously called *partridge-berry*, *deer-berry*, *tea-berry*, *winter-green*, and *mountain-tea*. The flowers appear from May to September, and the fruit ripens at corresponding periods. Though the leaves only are officinal, all parts of the plant are endowed with the peculiar flavour for which these are employed, and which is found in several other plants, particularly in the bark of *Betula lenta*, or sweet birch. The fruit possesses it in a high degree, and, being at the same time sweetish, is much relished by some persons, and forms a favourite article of food with partridges, deer, and other wild animals. To the very peculiar aromatic odour and taste which belong to the whole plant, the leaves add a marked astringency. The aromatic properties reside in a volatile oil, which may be separated by distillation. (See *Oleum Gaultheriæ.*)

Medical Properties and Uses. Gaultheria has the usual stimulant operation of the aromatics, united with astringency; and may, therefore, be used with advantage in some forms of chronic diarrhœa. Like other substances of the same class, it has been employed as an emmenagogue, and with the view of increasing the secretion of milk; but its chief use is to impart an agreeable flavour to mixtures and other preparations. It may be conveniently administered in the form of infusion, which, in some parts of the country, is not unfrequently used at the table as a substitute for common tea. The oil, however, is more used in regular practice than the leaves. Instances of death are on record, resulting from the taking of the oil, by mistake, in the quantity of about a fluidounce. On examination after death, strong marks of gastric inflammation were discovered.

Off. Prep. Oleum Gaultheriæ, *U. S.* W.

GELSEMIUM. *U.S.*

Yellow Jasmine.

The root of Gelsemium sempervirens (Gray, *Manual of Botany*). *U.S.*

Gelsemium. *Sex. Syst.* Pentandria Digynia. — *Nat. Ord.* Scrophulariaceæ Loganiaceæ. (Gray, *Man. of Bot.* pp. 296, 703.)

Gen. Ch. Calyx five-parted. *Corolla* funnel-form, with a spreading border, five-lobed, nearly equal. *Anthers* oblong, sagittate. *Style* long and slender. *Stigmas* two two-parted. *Capsule* elliptical, flat, two-valved, two-celled. *Seeds* flat, attached to the margin of the valves.

Gelsemium sempervirens. Gray, *Man. of Bot.* — *Gelseminum nitidum.* Michaux. — *Bignonia sempervirens.* Willd. *Sp. Plant.* iii. 291. Figured in *Am. Journ. of Pharm.*, xxvii. 197. The *yellow* or *Carolina jasmine* is one of the most beautiful climbing plants of our Southern States, ascending lofty trees, and forming festoons from one tree to another, and in its flowering season, in the early spring, scenting the atmosphere with its delicious odour. The stem is twining, smooth, and shining; the leaves perennial, opposite, shortly petiolate, lanceolate, entire, dark-green above and paler beneath; the flowers in axillary clusters, large, of a deep-yellow colour, and fragrant, with a very small, five-leaved calyx, and a funnel-shaped corolla, having a spreading, five-lobed, nearly equal border. The fruit is a flat, compressed capsule, divisible into two parts, two-celled, and furnished with flat seeds, which adhere to the margins of the valves. The plant grows in rich, moist soils along the sea-coast from Virginia to the south of Florida. The root is the part employed. The flowers are said to be poisonous.

Properties. As we have seen it in the shops, the root is sliced into pieces, about an inch in length, cylindrical or split, very light and fibrous, of a dirty yellowish-white colour, but darker where the epidermis remains, of a slight feebly narcotic odour, and a bitterish, not unpleasant taste. It yields its virtues to water, and readily to diluted alcohol. Analyzed by Mr. Henry Kollock, it was found to contain gum, starch, pectic acid, albumen, gallic acid, fixed oil, a fatty resin, a dry acrid resin, yellow colouring matter, volatile oil, extractive, lignin, a peculiar alkaloid called *gelsemia*, salts of potassa, lime, and magnesia, iron and silica. The alkaloid, however, was not obtained sufficiently pure to admit of a full investigation of its properties. (*Am. Journ. of Pharm.*, xxvii. 203.)

After Mr. Kollock's experiments, the alkaloid was obtained in a crystalline form, but still impure, by Prof. Maisch, from a tincture of the root, by a process of which a very brief abstract is given in the *Am. Journ. of Pharm.*, Jany. 1869, p. 36, by Mr. C. L. Eberle, who, in the same paper, publishes the results of his own investigation. Mr. Eberle not only extracted gelsemia, but satisfactorily established its alkaline properties, and proved that it was not contained in the wood of the root. Soon afterwards, the chemistry of Yellow Jasmine was more thoroughly investigated by Dr. Theo. G. Wormley, Professor of Chemistry and Toxicology in Starling Med. College, whose paper is contained in the *Am. Journ. Pharm.* (Jany. 1870, p. 1). Dr. Wormley succeeded in obtaining not only pure gelsemia from the root, but also a peculiar acid, which he calls *gelseminic* (gelsemic) acid, and which probably exists in combination with the alkaloid, forming the *gelsemate of gelsemia*.

Gelsemic or *Gelseminic Acid.* The doctor obtains the acid from a fluid extract of the root, which is actually a concentrated tincture, by evaporating it on a water-bath to about one-eighth of its volume, adding to the residue several times its bulk of pure water, allowing the mixture to stand until the supernatant liquid is nearly or quite clear, then transferring to a filter, washing the solids well with water, and reducing the filtrate thus obtained, together with the washings, on a water-bath, to about the volume of the concentrated fluid extract. To this, filtered if necessary, muriatic acid is added in the proportion of a drop of the pure acid to each fluidounce of the original fluid extract; the acidulated liquid is then agitated with twice its volume of ether; and, after the liquids have separated, the ethereal portion is decanted, the aqueous liquid

again agitated with a similar quantity of ether, which is in its turn decanted, and the watery part finally washed with about its volume of ether. On mixing the ethereal liquids thus obtained, and allowing them to evaporate spontaneously, the gelsemic acid is left, chiefly in the form of nearly colourless groups of crystals, together with more or less yellowish or brownish resinous matter. From this the crystals are separated by washing with a little cold absolute alcohol, which dissolves the resin, with but a little of the crystals. To purify the crystals further, they are mixed with a little hot water, and extracted from the mixture when cool by chloroform, which, on spontaneous evaporation, yields them nearly if not quite colourless. More of the gelsemic acid crystals may be obtained from the alcoholic washings, by a method for which the reader is referred to the original paper (*page* 3).

The acid, when pure, is colourless, inodorous, almost tasteless, and readily crystallizable, usually in groups or tufts of fine needles. It has strong neutralizing powers; combining with bases to form completely neutral salts, of which those formed with alkalies are freely soluble, while the others are at best but sparingly soluble in water. The acid itself is freely soluble in chloroform and ether, but slightly so in cold water, which takes up only about one-thousandth of its weight of the acid. Hot water dissolves it more freely, but on cooling deposits it in long, slender needles. For a further account of its properties see the paper of Dr. Wormley (*page* 4). The action of concentrated nitric acid may be considered as a test. If a drop of this acid be added to gelsemic acid or any of its salts, it forms a yellow, reddish, or red solution, which, if treated with ammonia in excess, becomes of a deep blood-red colour, lasting for hours. The $\frac{1}{1000}$ of a grain will exhibit these changes. Caustic potassa, soda, or ammonia, added to the acid, causes it to become intensely yellow, and forms with it highly fluorescent solutions. The acid is fusible, and, at a high heat, volatilizable without change.

Gelsemin, Gelsemia, Gelsemine, Gelseminia. This may be obtained from the concentrated extract from which gelsemic acid has been separated by ether, by rendering it slightly alkaline with potassa, then agitating repeatedly with chloroform, which dissolves the alkaloid with some impurities, and yields it, when evaporated at a very moderate heat, in the form of a hard, gum-like, yellowish, or brownish-yellow solid. If this be treated with a little water, and acidulated with muriatic acid, it yields the alkaloid with some impurities to the liquid, which, if now filtered, evaporated to about one-sixteenth by volume of the original fluid extract employed, and then treated with a slight excess of caustic potassa, will give up the alkaloid in the form of a more or less white precipitate. This, upon being separated, and allowed to dry, shrinks greatly, and becomes dark. To purify it, the dry mass is powdered, and dissolved, with the aid of a few drops of muriatic acid, in a little water, from which the alkaloid is precipitated by a slight excess of caustic potassa, and then taken up by ether, which leaves it, on spontaneous evaporation, in the state of a very hard, brittle, and transparent mass, strongly adhering to the surface of the vessel employed. If now detached and pulverized, it forms a powder nearly or quite colourless. If still coloured, it may be again treated with ether.

Gelsemia, when pure, is a colourless inodorous solid, not yet obtained in well-defined crystals, of an intensely bitter and persistent taste, having strongly basic properties, and completely neutralizing the strongest acids. Of its salts, the sulphate, nitrate, chloride, and acetate are freely soluble in water. It is itself sparingly soluble in water, requiring several hundred times its weight for solution; but it is very freely soluble in chloroform and ether. A drop of strong sulphuric acid added to a little gelsemia, or any one of its colourless salts, produces with it a reddish solution, which, if moderately heated, acquires a beautiful purple colour; and bichromate of potassium mixed with it causes no marked change. For the various chemical relations of the alkaloid solutions, we must again refer to Dr. Wormley's paper (*page* 12).

Medical Properties and Uses of Yellow Jasmine. From the accounts given by various authors of the effects of yellow jasmine, it appears to be a nervous and arterial sedative, without nauseating or purgative properties, but sometimes causing diaphoresis, especially in febrile diseases. In moderate doses it produces agreeable sensations of languor, with muscular relaxation, so that the patient finds some difficulty in moving the eyelids, and keeping the jaws closed. More largely taken it occasions dizziness,

dimness of vision, dilated pupil, general muscular debility, and universal prostration; reducing the frequency and force of the pulse, and the frequency of respiration, and producing insensibility to pain; but without stupor or delirium. After a short time these symptoms pass off, leaving no unpleasant effects. It usually begins to act in half an hour, and ceases to act after one or two hours. It is no doubt capable of causing death in overdoses. Indeed, two cases of poisoning by a fluid extract of gelsemium, one of which proved fatal, and the other ended in recovery, have been reported by Dr. R. P. Davis, of Parkersburg, Va. The quantity taken was about a tablespoonful. In the case which ended favourably, an emetic was followed, after acting efficiently, by the free use of quinia and brandy. In the fatal case there was no opportunity for the effective application of remedies. (*Med. and Surg. Reporter*, May 11, 1867, p. 410.)

Gelsemium is said to have been long popularly employed as a vermifuge in the Southern and Southwestern States; but its more valuable properties have been known but for a few years. Their discovery was accidental. A planter of Mississippi, labouring under an obstinate bilious fever, directed his servant to get a particular root from the garden, and prepare a tea from it. The tea was prepared accordingly, and drank by the invalid, who was soon afterwards affected with great prostration, and especially muscular debility, so that he could not raise a limb, but without stupor. These effects gradually passed off, and with them the fever. The servant had made a mistake in the root, and dug that of the Gelsemium instead of the one intended. The planter, having made this discovery, employed the root afterwards with success upon his own plantation and in the neighbourhood. The remedy passed into the hands of irregular practitioners, and was used by the "eclectic physicians" before its virtues came to the knowledge of the profession.* The diseases in which the medicine has been prescribed are intermittent, remittent, typhoid, and yellow fevers, †the irritative fevers of childhood, inflammation of the lungs and pleura, dysentery, rheumatism and other inflammatory affections, neuralgia, dysmenorrhœa, morbid wakefulness, ‡delirium tremens, §trismus nascentium, chorea, hysteria, and epilepsy. It has been used also successfully in gonorrhœa, by Dr. John Douglass, of Chester Dist., S. C.

Since the publication of the preceding edition of this work, much has appeared in the medical journals about the therapeutic applications of gelsemium, most of which, however, is rather confirmatory of what has been previously known, with more or less modification, than absolutely new. Thus, while there is a general concurrence as to the use of the medicine in periodic fever, Dr. James D. McGaughey of Wallingford, Connecticut, has found it specially useful in cases of intermittent fever which is obstinately disposed to return after suspension under quinia, and which will generally yield to gelsemium; and in a second variety of cases which lose their regular paroxysmal form, and are characterized by irregular chills and sweats. In those cases, if quinia has been used alone without success, the addition of gelsemium to the treatment will, in most instances, soon conquer the disease. (*Philad. Med. Times*, March 7, 1874, p. 355). It is said above to be useful in neuralgia; but more recent experience would seem to show that it is peculiarly applicable to facial and supraorbital neuralgia, and by more than one practitioner it is highly recommended in odontalgia. Dr. U. Scott Hill, of Maine, has found gelsemium successful in irritable bladder, but generally associated with bromide of potassium. (*Am. Journ. of Med. Sci.*, Jan. 1872.)

* Attention was called to it by a paper of Prof. Procter, in the *Am. Journ. of Pharmacy* for October, 1852 (*page* 307), who derived most of his information from the "*Eclectic Dispensatory*," and a paper by F. D. Hill, in the "*Eclectic Medical Journal*" of Cincinnati. Communications have since been published in reference to it in the *Southern Journ. of Med. and Phys. Sciences* for Jan. 1853 (*page* 40) by Dr. W. S. Jenkins, of Castalian Springs, Tenn.; in the *Stethoscope* of Nov. 1853 (*page* 636) by Dr. H. M. Nash, of Norfolk, Va.; and in the *Iowa Med. Journ.* by Dr. Bachelor. (See *Charleston Med. Journ. and Rev.*, March, 1854, *page* 243.) Confirmatory accounts have still more lately appeared by Dr. C. H. Cleveland in the *Am. Med. Gaz.* (vi. 154), by Dr. J. A. Mayes in the *Charleston Med. Journ.* (xii. 180), and by Dr. F. F. Gary, of Cokesbury, S. C., in the *Med. and Surg. Reporter* (June 11, 1859, p. 226). An abstract, by Dr. John Bell, of the various papers which have appeared in relation to it is contained in the *N. Am. Med.-chirurg. Review* (Sept. 1858, p. 931). From these various sources we have chiefly derived the above account of the medical properties and uses of the root.

† Dr. H. Wardner, *Med. and Surg. Reporter*, March 30, 1867, p. 266.

‡ Dr. D. L. Phares, *Ibid.*, May 25, 1867, p. 442.

§ *Ibid.*, Oct. 26, 1867, p. 369.

Dr. E. P. Hurd, of Newburyport, Mass., reports of the medicine very favourably as a cardiac sedative, and considers it more efficient than any other remedy in the palpitation and dyspnœa of heart disease. It is said also to be useful in rigidity of the os uteri, dyspnœa, and puerperal convulsions. (*Boston Med. and Surg. Jour.*, Dec. 8, 1870, p. 376.)

Besides the cases of poisoning above referred to, so many others have been since reported, either fatal or highly dangerous, that no doubt can be entertained of the dangerous character of the medicine, and of the necessity of much care in its administration. The symptoms are those of great prostration of the nerve power, with paralysis of sensation and motion; and, when death takes place, it is probably through asphyxia. The treatment should consist, first in evacuation of the poison by emetics or otherwise, and then in the administration of stimulants internally and externally; and, in instances of great insensibility, recourse may be had to electricity. The following appearances were said to have been presented after death, in a fatal case from this poison;—no emaciation; cadaveric rigidity very slight; countenance natural as in sleep; the membranes and substance of the brain and medulla oblongata normal; lungs slightly collapsed; cavities of the heart greatly distended with dark grumous blood; abdominal organs healthy. It would seem that, in this case, death must have ensued from cessation of the heart's action; the medicine probably operating through the nerve centres. (*Am. Journ. of Pharm.*, Jany. 1870, p. 14.)

The medicine is given in substance, tincture, or fluid extract. The dose of the powdered root is two or three grains. The tincture is more convenient, and may be made in the proportion of two ounces to a pint of alcohol, and given in the dose of 10 or 15 minims. The fluid extract is a perhaps still more advisable form; and, having been adopted in the late edition of the U. S. Pharmacopœia, will of course be found among the Preparations. It is only a very concentrated tincture, and is no doubt fully saturated. The dose should not exceed two or three minims to begin with. In each case, the dose may be repeated if necessary every 2, 4, or 6 hours, and may be gradually increased till the object is obtained, or some obvious effect is produced on the system. How much exactly would produce fatal effects has not been determined. In one fatal case recorded, 40 drops of the fluid extract were said to have been taken; but much less than this would be a dangerous dose.

It is not impossible that the alkaloid gelsemia may some time come into use. There is no doubt that it is the main, if not the only, active principle of the root; but it is so extremely powerful that it should be used with great caution. Dr. Wormley gave one-eighth of a grain by subcutaneous injection to a strong cat, which in forty minutes exhibited evidence of great prostration, and died in an hour and a half from the injection of the poison. By the same author, the fluid extract was carefully examined; and, as the average result of several experiments, eight fluidounces of it were found to yield 3·20 grains of the pure alkaloid. On the basis of this result, the dose of gelsemia may be estimated at the 200th or 300th of a grain, supposing all the virtue of the root to reside in the alkaloid. But this estimate probably exceeds its strength; and the proper dose can be determined only by a series of carefully conducted trials.

Off. Prep. Extractum Gelsemii Fluidum, *U. S.* W.

GENTIANA. *U. S.*

Gentian.

The root of Gentiana lutea. *U. S.*

Off. Syn. GENTIANÆ RADIX. *Gentian Root.* The dried root of Gentiana lutea. *Br.*

Gentiane jaune, *Fr.*; Rother Enzian, *Germ.*; Genziana, *Ital.*; Genciana, *Span.*

GENTIANA. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Gentianaceæ.

Gen. Ch. Corolla one-petaled. *Capsule* two-valved, one-celled, with two longitudinal receptacles. *Willd.*

Gentiana lutea. Willd. *Sp. Plant.* i. 1331; Woodv. *Med. Bot.* p. 273, t. 95; Carson, *Illust. of Med. Bot.* ii. 12, pl. 60. *Yellow Gentian* is among the most re-

markable of the species which compose this genus, both for its beauty and great comparative size. From its thick, long, branching, perennial root, an erect, round stem rises to the height of three or four feet, bearing opposite, sessile, oval, acute, five-nerved leaves of a bright-green colour, and somewhat glaucous. The lower leaves, which spring from the root, are narrowed at their base into the form of a petiole. The flowers are large and beautiful, of a yellow colour, peduncled, and placed in whorls at the axils of the upper leaves. The calyx is monophyllous, membranous, yellowish, and semi-transparent, splitting when the flower opens, and reflected when it is fully expanded; the corolla is rotate, and deeply divided into five or six lanceolate, acute segments; the stamens are five or six, and shorter than the corolla. This plant grows among the Apennines, the Alps, the Pyrenees, and in other mountainous or elevated regions of Europe. The root is the only part used in medicine.

Several other species possess analogous virtues, and are used for similar purposes. The roots of *G. purpurea* and *G. punctata*, inhabiting the same regions as G. lutea, and of *G. Pannonica*, growing in Austria, are said to be often mingled with the officinal, from which they are scarcely distinguishable. The *G. macrophylla* of Pallas is used in Siberia; one indigenous species, *G. Catesbæi*, growing in the Southern States, has a place in the secondary catalogue of the U. S. Pharmacopœia; and *G. quinqueflora*, growing throughout the Northern and Northwestern States, is said to be much used in domestic practice.

Properties. As found in the shops, gentian is in pieces of various dimensions and shape, usually of considerable length, consisting sometimes of longitudinal slices, sometimes of the root cut transversely, twisted, wrinkled externally, sometimes marked with close transverse rings of a grayish-brown colour on the outside, yellowish or reddish within, and of a soft, spongy texture. An account of the microscopic character of the root will be found in the *Pharm. Journ. and Trans.* (July, 1872, p. 42). The odour is feeble, but decided and peculiar. The taste is slightly sweetish and intensely bitter, without being nauseous. The powder is yellowish. Water and alcohol extract the taste and virtues of the root. Examined by MM. Henry and Caventou, it was found to contain 1. a crystallizable principle which they supposed to be the chief active ingredient of the root, and therefore named *gentianin*, 2. a volatile odorous principle, 3. a substance identical with birdlime (*glu*), 4. a greenish fixed oil, 5. a free organic acid, 6. uncrystallizable sugar, 7. gum, 8. yellow colouring matter, and 9. lignin. Mr. Denis afterwards detected pectic acid; and the gentianin of Henry and Caventou was proved by Trommsdorff and Leconte to be, when quite pure, wholly destitute both of bitterness and medicinal power; so that it would not appear to merit the name given to it. M. Leconte proposed, accordingly, to call it *gentisin;* and, as it possesses the property of neutralizing the alkalies, it has received also the name of *gentisic acid.* It is obtained by treating the alcoholic extract of gentian, previously exhausted by water, with sulphuric ether, filtering the ethereal solution, and allowing it to evaporate spontaneously. It is in needle-shaped crystals, pale-yellow, insoluble in water, and soluble in alcohol. The same chemist believes that he has ascertained the *birdlime* or *glu* of Henry and Caventou to be a mixture of wax, oil, and caoutchouc. When distilled with water, gentian yields a minute proportion of a concrete oil, having a strong odour of the root. Professor Dulk, of Königsberg, gave a process for isolating the *bitter principle;* but the substance obtained was in all probability complex, and, therefore, not deserving of the name of gentianin bestowed upon it. In a note, we give the process and its results.* At length, Lud-

* The alcoholic extract is macerated in water, and the solution, having been subjected to the vinous fermentation in order to separate the sugar, is treated first with acetate of lead, and then, after filtration, with subacetate of lead and a very little ammonia, in order to precipitate the combination of the bitter principle with oxide of lead; care being taken not to use too much ammonia, lest by its stronger basic powers it should separate the vegetable principle from the oxide. The precipitate is washed with a little water, then mixed with a large proportion of the same fluid, and decomposed by hydrosulphuric acid. The liquid, having been filtered, is evaporated with a gentle heat to dryness, and the residue treated with alcohol of 0·820. The alcoholic solution, being evaporated, yields the gentianin. It is a brownish-yellow, uncrystallizable substance, having strongly the bitter taste of the root. It is almost insoluble in absolute alcohol, but soluble in ordinary alcohol, and very soluble in water. It reddens litmus, and appears to possess acid properties. (*Journ. de Pharm.*, xxiv. 638.)

wig and Kromayer appear to have been successful in discovering the long sought for principle. They prepared an alcoholic extract of the fresh root, treated this with water, and the aqueous solution twice with animal charcoal which absorbed all the bitterness, extracted the bitterness from the charcoal with alcohol, evaporated the tincture, treated the residue in solution with oxide of lead to separate the precipitable matter, removed the lead by sulphuretted hydrogen, evaporated to the consistence of syrup, and agitated the residue with ether, which precipitated the bitter principle. This they named *gentiopicrin*, though its proper name would be *gentianin*. It is crystallizable, very bitter, soluble in water and alcohol, but not in ether, neutral, and not precipitable by tannin or subacetate of lead. It ranks with the glucosides; as it is resolved by the action of acids into glucose and an amorphous substance called *gentiogenin*. Its formula is $C_{40}H_{30}O_{24}$. (See *Am. J. of Pharm.*, xxxv. 330.) M. Louis Magnes found in the root, when perfectly dried at 212° F., 15 per cent. of glucose, and 12 per cent. in the root in its ordinary state. (*Am. Journ. of Pharm.*, July, 1868, pp. 333–4.) When gentian is macerated in cold water, it undergoes the vinous fermentation, in consequence of the presence of this saccharine principle. From the fermented infusion a spirituous liquor is obtained by distillation, which, though bitter and unpleasant to the smell, is said to be relished by the Swiss and Tyrolese. Infusion of gentian is precipitated by tannic acid and the soluble salts of lead, but is compatible with the salts of iron.

Medical Properties and Uses. Gentian possesses, in a high degree, the tonic powers which characterize the simple bitters. It excites the appetite, invigorates digestion, moderately increases the temperature of the body and the force of the circulation, and operates in fact as a general corroborant. In very large doses, however, it is apt to load and oppress the stomach, to irritate the bowels, and even to occasion nausea and vomiting. It has been known as a medicine from the highest antiquity, and is said to have derived its name from Gentius, a king of Illyria. Many of the complex preparations handed down from the Greeks and Arabians contain it among their ingredients; and it enters into most of the stomachic combinations employed in modern practice. It may be used in all cases of pure debility of the digestive organs, or requiring a general tonic impression. Dyspepsia, atonic gout, amenorrhœa, hysteria, scrofula, intermittent fever, diarrhœa, and worms are among the many affections in which it has proved useful; but it is the condition of the stomach and of the system generally, not the name of the disease, which must be taken into consideration in prescribing it; and there is scarcely a complaint in which it can be advantageously given under all circumstances. Its powder has been applied externally to malignant and sloughing ulcers. It is usually administered in the form of infusion or tincture. A syrup may be prepared by forming a saturated infusion by means of percolation, and incorporating this at a boiling heat with simple syrup; or, perhaps more eligibly, by dissolving two drachms of the extract of gentian, and afterwards fifteen ounces of sugar, in half a pint of water. The dose of the powder is from ten to forty grains. In consequence of the porous property of the root, which causes it to expand with moisture, it has been employed, as a substitute for sponge tent, in the enlargement of strictured passages.

Off. Prep. Extractum Gentianæ; Extractum Gentianæ Fluidum, *U. S.;* Infusum Gentianæ Compositum; Mistura Gentianæ, *Br.;* Tinctura Gentianæ Composita.

W.

GENTIANA CATESBÆI. *U. S. Secondary.*

Blue Gentian.

The root of Gentiana Catesbæi (*Elliot*). *U. S.*

GENTIANA. See GENTIANA.

Several indigenous species of gentian approach more or less nearly to *Gentiana lutea* in the bitterness of their roots; but *G. Catesbæi*, which resembles it most closely, is the only one officinally directed.

Gentiana Catesbæi. Walter. *Flor. Car.* 109; Bigelow, *Am. Med. Bot.* iii. 137. The blue gentian has a perennial, branching, somewhat fleshy root, and a simple,

erect, rough stem, rising eight or ten inches in height, and bearing opposite leaves, which are ovate-lanceolate, acute, and rough on their margin. The flowers are of a palish-blue colour, crowded, nearly sessile, and axillary or terminal. The divisions of the calyx are linear-lanceolate, and longer than the tube. The corolla is large, ventricose, plaited, and divided at its border into ten segments, of which the five outer are more or less acute, the five inner bifid and fringed. The number of stamens is five, and the two stigmas are seated on the germ. The capsule is oblong, acuminate, with two valves, and a single cell.

G. Catesbæi grows in the grassy swamps of North and South Carolina, where it flowers from September to December. It was named by Walter and Elliot in honour of Catesby, by whom it was delineated nearly a century ago. Pursh confounds it with *G. Saponaria*, to which it is closely allied.

Properties. By Dr. Bigelow we are told that the dried root of this plant has at first a mucilaginous and sweetish taste, which is soon succeeded by an intense bitterness, approaching nearly to that of the officinal gentian. Alcohol and boiling water extract its virtues, and the tincture and decoction are even more bitter than the root in substance.

Medical Properties. As a medicine it is little inferior to the European gentian, and may be employed for similar purposes. In the Northern and Middle States it is not used; but it is said to be occasionally prescribed by the practitioners of the South in dyspepsia, and other cases of stomachic and general debility. It may be given in powder in the dose of from fifteen to thirty grains, or in the form of extract, infusion, wine or tincture, which may be prepared in the manner directed for the similar preparations of foreign gentian. W.

GERANIUM. *U.S.*

Geranium. Cranesbill.

The rhizome of Geranium maculatum. *U.S.*

GERANIUM. *Sex. Syst.* Monadelphia Decandria.—*Nat. Ord.* Geraniaceæ.

Gen. Ch. Calyx five-leaved. *Corolla* five-petaled, regular. *Nectary* five melliferous glands, united to the base of the longer filaments. *Arilli* five, one-seeded, awned, at the base of a beaked receptacle; awns simple, naked, neither spiral nor bearded. *Willd.*

Geranium maculatum. Willd. *Sp. Plant.* iii. 705; Bigelow, *Am. Med. Bot.* i. 84; Barton, *Med. Bot.* i. 149. This plant has a perennial, horizontal, fleshy root, which is furnished with short fibres, and sends up annually an herbaceous stem, with several radical leaves. The stem is erect, round, dichotomously branched, from one to two feet high, of a grayish-green colour, and thickly covered, in common with the petioles and peduncles, with reflexed hairs. The leaves are deeply divided into three, five, or seven lobes, which are variously incised at their extremities, hairy, and of a pale-green colour, mottled with still paler spots. Those which rise from the root are supported on footstalks eight or ten inches long; those of the stem are opposite, the lower petiolate, the upper nearly sessile, with lanceolate or linear stipules. The flowers are large, and usually of a purple colour. The peduncles spring from the forks of the stem, and severally support two flowers upon short pedicels. The calyx is composed of five oblong, ribbed, cuspidate leaves; the petals are five, obovate, and entire; the stamens ten, with oblong, deciduous anthers, the five alternate filaments being longer than the others, and having glands at their base; the germ is ovate, supporting a straight style as long as the stamens, and surmounted by five stigmas. The fruit consists of five aggregate, one-seeded capsules, attached by a beak to the persistent style, curling up and scattering the seeds when ripe.

The cranesbill is indigenous, growing throughout the United States, in moist woods, thickets, and hedges, and generally in low grounds. It flowers from May to July. The root should be collected in autumn.

This, when dried, is in pieces from one to three inches long, from a quarter to half an inch in thickness, somewhat flattened, contorted, wrinkled, tuberculated, and beset

with slender fibres. It is externally of an umber-brown colour, internally reddish-gray, compact, inodorous, and of an astringent taste, without bitterness or other unpleasant flavour. Water and alcohol extract its virtues. According to Dr. Edward Staples, it contains tannic and gallic acids, mucilage, red colouring matter, resin, and a crystallizable vegetable principle. (*Journ. of Phil. Col. of Pharm.*, Oct. 1829, p. 171.) The Messrs. Tilden found, besides tannic and gallic acids, gum, pectin, sugar, starch, albumen, resin soluble in ether, resin soluble in alcohol, oleo-resin soluble in ether only, colouring matter, chlorophyll, lignin, and various salts. (*Pharm. Journ.*, July, 1863, p. 22.) Tannic and gallic acids are probably the sole active ingredients.

Medical Properties and Uses. Geranium is one of our best indigenous astringents, and may be employed for all the purposes to which these medicines are applicable. The absence of unpleasant taste, and other offensive qualities, renders it peculiarly serviceable in the cases of infants, and persons of very delicate stomach. Diarrhœa, chronic dysentery, cholera infantum in the latter stages, and the various hemorrhages are the forms of disease in which it is most commonly used, and with greatest advantage; but care should be taken, before it is administered, that the condition of the system and of the part affected is such as not to contraindicate the use of astringents. As an application to indolent ulcers, an injection in gleet and leucorrhœa, a gargle in relaxation of the uvula and aphthous ulcerations of the throat, it answers the same purpose as kino, catechu, and other medicines of the same class. It is a popular domestic remedy in various parts of the United States, and is said to be employed by the Indians. It may be given in substance, decoction, tincture, or extract. The dose of the powder is twenty or thirty grains, that of a decoction, made by boiling an ounce of the root in a pint and a half of water to a pint, from one to two fluidounces. The medicine is sometimes given to children, boiled in milk.

Off. Prep. Extractum Geranii Fluidum, *U. S.* W.

GEUM. *U. S. Secondary.*

Water Avens.

The rhizome of Geum rivale. *U. S.*

Benoite aquatique, *Fr.*; Wiesen Benediktenwurzel, *Germ.*

Geum. *Sex. Syst.* Icosandria Polygynia.—*Nat. Ord.* Rosaceæ.

Gen. Ch. Calyx ten-cleft. *Petals* five. *Seeds* with a bent awn. *Willd.*

Several species belonging to this genus have been medicinally employed; but two or three only are deserving of particular notice—*Geum rivale*, which has a place in the secondary list of the United States Pharmacopœia, *G. urbanum*, formerly recognised by the Dublin College, and perhaps *G. Virginianum*, an indigenous species, the root of which has been recommended in dysentery by Dr. W. A. Gibson, of St. Louis. (*Med. Record*, Oct. 5, 1868, p. 384; from the *St. Louis Med. Reporter.*)

Geum urbanum, or *avens*, is a native of Europe, where it grows wild in shady places. The root, which is the part used, consists of a short oblong body, from a quarter to half an inch in thickness, externally brown, internally white towards the circumference and reddish at the centre, and furnished with numerous long descending fibres. When quite dry it is nearly inodorous; but in the recent state has a smell like that of cloves, whence it is sometimes called *radix caryophillatæ*. The taste is bitterish and astringent. It imparts its virtues to water and alcohol, which it tinges red. Distilled with water it yields a thick, greenish-yellow volatile oil, and gives a pleasant flavour to the liquid. It contains, besides, according to Trommsdorff, tannic acid, which is abundant, a tasteless resin, gum, bassorin, and lignin. It has been much used in Europe as a tonic and astringent, in chronic and passive hemorrhages, chronic dysentery and diarrhœa, leucorrhœa, intermittent fever, &c. The dose is from thirty grains to a drachm of the powder three or four times a day, or an equivalent quantity in decoction.

Geum rivale. Willd. *Sp. Plant.* ii. 1115; *Engl. Bot.* 106. *Water avens* has a perennial, horizontal, jointed, scaly, tapering root, about six inches long, of a reddish-brown colour externally, white internally, and furnished with numerous descending

yellowish fibres. One or more stems rise from the same root, which also sends up numerous leaves. The stems are about a foot and a half high, simple, erect, pubescent, and of a purplish colour. The radical leaves are interruptedly pinnate, with large terminal leaflets, and long, hairy footstalks; those of the stem are petiolate, and divided into three serrate, pointed segments. The flowers are few, solitary, nodding, yellowish-purple, and supported on axillary and terminal peduncles. The colour of the stems and flowers gave rise to the name of *purple avens*, sometimes applied to the plant. The calyx is inferior, with ten lanceolate, pointed segments, of which the five alternate are smaller than the others. The petals are five, and as long as the calyx. The seeds are oval, with plumose awns, minutely uncinate, and nearly naked at the summit.

This species of Geum is common to Europe and the United States; though the plant of this country has smaller flowers, with petals more rounded on the top, and leaves more deeply incised than the European. It delights in wet, boggy meadows, and extends from Canada into New England, New York, and Pennsylvania. Its flowers appear in June and July. The dried root is hard, brittle, easily pulverized, of a reddish or purplish colour, without smell, and of an astringent, bitterish taste. Boiling water extracts its virtues.

Medical Properties and Uses. Water avens is tonic and powerfully astringent. It may be used with advantage in chronic or passive hemorrhages, leucorrhœa, and diarrhœa; and is said to be beneficially employed in the Eastern States, as a popular remedy in the debility of phthisis pulmonalis, in simple dyspepsia, and in visceral diseases consequent on disorder of the stomach. In Europe it is sometimes substituted for the root of *common avens*, or Geum urbanum, but is less esteemed. The dose of the powdered root is from a scruple to a drachm, to be repeated three times a day. The decoction, which is usually preferred, may be made by boiling an ounce of the root in a pint of water, and given in the quantity of one or two fluid-ounces. A weak decoction is sometimes used by invalids in New England as a substitute for tea and coffee. W.

GILLENIA. *U.S. Secondary.*

Gillenia.

The root of Gillenia trifoliata, and of Gillenia stipulacea. *U.S.*

Indian physic, American ipecacuanha.

GILLENIA. *Sex. Syst.* Icosandria Pentagynia.—*Nat. Ord.* Rosaceæ.

Gen. Ch. Calyx tubular campanulate, border five-toothed. *Corolla* partly unequal. *Petals* five, lanceolate, attenuated at the base. *Stamens* few, included. *Styles* five. *Capsules* five, connate at the base, opening on the inner side, each two-seeded. *Torrey.*

This genus was separated by Moench from *Spiræa.* It is exclusively North American, and includes only two discovered species—*G. trifoliata* and *G. stipulacea*—both of which are recognised in our Pharmacopœia.

1. *Gillenia trifoliata.* Bigelow, *Am. Med. Bot.* iii. 10; Barton, *Med. Bot.* i. 65; Carson, *Illust. of Med. Bot.* i. 40, pl. 34. This is an herbaceous plant, with a perennial root, consisting of many long, slender, brown branches, proceeding from a thick, tuber-like head. The stems, several of which usually rise from the same root, are two or three feet high, erect, slender, smooth, flexuose, branched, and commonly of a reddish colour. The leaves are ternate, with very short petioles, and small linear-lanceolate stipules. The leaflets are ovate-lanceolate, sharply serrate, and acuminate. The flowers grow in a loose terminal nodding panicle, with long peduncles. The calyx is tubular campanulate, ventricose, and terminates in five-pointed segments. The corolla is composed of five linear-lanceolate, recurved petals, the two upper separated from the three lower, white, with a reddish tinge on their border, and of three times the length of the calyx. The stamens are twenty, the filaments short, the anthers small and yellow. Each flower is succeeded by five capsules, connate at the base, oblong, acuminate, gibbous without, acute within, two-valved, one-celled, opening inward, and containing each one or two oblong seeds.

This species of Gillenia grows throughout the United States, east of the Alleghany ridge, and, in Pennsylvania, may also be found abundantly west of these mountains. Pursh found it in Florida, and it extends as far north as Canada. It frequents light soils, in shady and moist situations, and flowers in June and July. The root should be gathered in September.

2. *G. stipulacea.* Barton, *Med. Bot.* i. 71. This species is also herbaceous and perennial, though much taller and more bushy than the preceding. The stems are brownish and branched. The upper leaves are ternate, lanceolate, serrate; the lower more deeply incised, becoming towards the root pinnatifid, and of a reddish-brown colour at the margin The stipules are ovate, acuminate, deeply serrate, resembling leaves, and marking the species at the first glance. The flowers are smaller than those of *G. trifoliata*, and grow on long slender peduncles in a lax corymb.

In the valley of the Mississippi, this plant occupies the place of G. trifoliata, which is not found beyond the Muskingum. It grows as far north as the State of New York, extends through Ohio, Indiana, Illinois, and Missouri, and probably into the States south of the Ohio, as it has been found in Western Virginia. Its root is precisely similar to that of the eastern species, and is reputed to possess the same properties.

The dried root of Gillenia is not thicker than a quill, wrinkled longitudinally with occasional transverse fissures, and, in the thicker pieces, presenting in some places an irregular, undulated, somewhat knotty appearance, arising from indentations on one side corresponding with prominences on the other. It is externally of a light-brown colour, and consists of a thick, somewhat reddish, brittle, cortical portion, with an interior slender, tougher, whitish, ligneous cord. The bark, which is easily separable, has a bitter, not disagreeable taste; the wood is nearly insipid and comparatively inert, and should be rejected. The powder is of a light-brownish colour, and possesses a feeble odour, which is scarcely perceptible in the root. The bitterness is extracted by boiling water, which acquires the red colour of wine. The root yields its bitterness also to alcohol. By various experimenters it has been shown to contain gum, starch, gallo-tannic acid, fatty matter, wax, resin, colouring matter, albumen, and lignin, besides salts. (*Am. Journ. of Pharm.*, xxvi. 490.) The name of *gillenin* has been given, by Mr. W. B. Stanhope, to a substance obtained by first preparing an alcoholic extract, treating this with water, which took up various substances with a little of the active matter, then macerating the residue for ten days in water acidulated with sulphuric acid, saturating with magnesia, evaporating to dryness, and finally treating with alcohol, filtering, and allowing the alcoholic solution to evaporate spontaneously. The substance thus obtained was whitish, very bitter, slightly odorous, permanent in the air, soluble in water, alcohol, ether, and the dilute acids, and neutral to test-paper. Nitric acid rendered it blood-red, chromic acid green. Tannic acid produced no effect. It gave white precipitates with potassa, subacetate of lead, and tartar emetic. Half a grain of it produced nausea and retching. (*Ibid.*, xxviii. 202.)

Medical Properties and Uses. Gillenia is a mild and efficient emetic, and, like most substances belonging to the same class, occasionally acts upon the bowels. In very small doses it has been thought to be tonic. It is much used by some practitioners in the country as a substitute for ipecacuanha, which it is said to resemble in its mode of operation. It was employed by the Indians, and became known as an emetic to the colonists at an early period. Linnæus was aware of its reputed virtues. The dose of the powdered root is from twenty to thirty grains, repeated at intervals of twenty minutes till it vomits. W.

GLYCERINA. *U.S.*

Glycerin.

"A colourless, inodorous, syrupy liquid, of a sweet taste, and having the sp. gr. 1·25." *U. S.*

Off. Syn. GLYCERINUM. *Glycerine.* A sweet principle, $C_6H_8O_6$, obtained from fats and fixed oils, and containing a small percentage of water. *Br.*

In the U. S. Pharmacopœia of 1850 a process was given for the preparation of glycerin; but it is now so exclusively a product of wholesale manufacturing, that it was deemed proper, in a subsequent revision of the work, to transfer it to the Materia Medica Catalogue, where it also stands in the British Pharmacopœia. The following is the process referred to.

"Take of Lead Plaster, recently prepared and yet fluid, Boiling Water, each, *a gallon.* Mix them, stir briskly for fifteen minutes, then allow them to cool, and pour off the supernatant liquid. Evaporate this until it has the specific gravity 1·15, and pass a current of sulphohydric acid slowly through it until a black precipitate is no longer produced. Filter, and apply heat until the sulphohydric acid is driven off. Lastly, evaporate the liquid until it ceases to lose weight."

In the process for making lead plaster, litharge, olive oil, and water are boiled together, with the result of decomposing the oil, the oily acids of which unite with the oxide of lead to form the plaster. At the same time the sweet principle of the oil, called glycerin, which was previously united to the oily acids to constitute the oil, is set free, becomes hydrated, and dissolves in the water. (See *Emplastrum Plumbi.*) It follows, therefore, that the plaster, while still hot and in the liquid state, contains an aqueous solution of glycerin, diffused through it. It was the plaster in this state that was made use of for preparing glycerin in the former U. S. formula. Accordingly, when the liquid plaster is mixed with an equal measure of boiling water, and the mixture stirred briskly, a solution of glycerin is obtained; which, after having been decanted, and evaporated to a limited extent, is freed from lead by sulphuretted hydrogen. The liquid is then filtered to separate sulphuret of lead, heated to free it from sulphuretted hydrogen, and finally evaporated to expel the free water, which is known to be all removed when it ceases to lose weight.

Glycerin was discovered in 1789 by Scheele, by whom it was called the *sweet principle of oils.* It is produced not only during the saponification of the fats and oils by oxide of lead in forming lead plaster, but also during the same process, when effected by potassa and soda in the manufacture of soap; the alkalies uniting with the oily acids, and setting the glycerin free. Hence soap-makers' waste is an abundant source of glycerin; but, thus originating, it is apt to have more or less odour, which even percolation through animal charcoal does not always remove. A method of purifying glycerin from soap-makers' waste is given by M. Bruère-Perrin. (*Am. Journ. of Pharm.*, xx. 549.)* The process of Mr. Richard A. Tilghman, of this city, patented, Jan. 9, 1854, consists in subjecting fatty bodies to the action of water at a high temperature under pressure, whereby their constituents combine with water, so as to form free fatty acids, and solution of glycerin. (*Am. Journ. of Pharm.*, March, 1855, p. 121.) Thus obtained it is called *distilled glycerin*, and is produced at once in the purest form. This process is used at the great candle manufactory of Price & Co., London, whence our markets have been largely supplied with glycerin. Through a distillatory apparatus containing palm oil, heated steam between 550° and 600° is passed. The oil is decomposed into its oily acids and glycerin, which, together with water, distil over, and, condensing in the receiver, separate into two layers, the lower of which is glycerin. If this, as first procured, contain too much

* Dr. Campbell Morfit has given the following process for making pure glycerin on the large scale. Melt *one hundred pounds* of tallow, lard, or pressed lard, in a clean iron-bound barrel, by the direct application of a current of steam, and add to the melted liquid *fifteen pounds* of lime, previously slaked and made into milk with *two and a half gallons* of water. Then cover the vessel, and continue the steaming for several hours, or until the completion of the saponification. This is known to be completed, when a portion of the cooled soap gives a smooth shining surface on being scraped with the nail, and breaks with a cracking noise. By this treatment the fat is decomposed, the oily acids unite with the lime to form an insoluble lime soap, and the liberated glycerin remains in solution in the water, along with the excess of lime. After the liquid has been sufficiently boiled, it is allowed to cool and settle, and then strained through a crash cloth. The strained liquid containing only the glycerin and excess of lime, is carefully concentrated by steam heat, treated with a current of carbonic acid to remove the lime as carbonate of calcium, boiled again to decompose any bicarbonate of calcium that may have been formed, and allowed to repose. The supernatant clear liquid is finally decanted or strained off from the precipitated carbonate of calcium, and concentrated, if necessary, to expel any excess of water. The residue of the process, the lime soap, is sold to the stearine candle makers, or reconverted into saleable fat. Dr. Morfit has found his process for glycerin to combine the advantages of saving time, labour, and money. (*Silliman's Journal*, 2d ser., xv. 429.)—*Note to the tenth edition.*

water, it must be concentrated; if discoloured, it must be redistilled with vapour. (*Pharm. Journ.*, Jan. 1861, p. 350.) Ordinary impure glycerin may be purified by distillation with steam under pressure. Though, when distilled alone, it is partially decomposed, giving out pungent vapours of *acrolein*, yet, in a current of superheated steam, it passes over unchanged at temperatures between 400° and 500°. (*Brande & Taylor.*) Very pure glycerin is now prepared in the U. States.

Properties, &c. Glycerin is a thick syrupy liquid, either colourless or of a slight amber colour, without smell when pure, unctuous to the touch, and of a very sweet taste. In properties it is intermediate between water and the oils. When exposed to the air it gradually absorbs moisture. As already stated, though decomposed by a high heat in its unmixed state, yet with water under pressure it is volatilizable unchanged at a temperature between 400° and 500° F. Cooled down in its ordinary state to zero, it only becomes more viscid, without congealing; but, under certain not well-understood circumstances, it appears to be capable of crystallization, forming hard, brilliant crystals of a probably octohedral form, which on melting maintain a temperature of 45° F.* (*Amer. Journ. of Pharm.*, March, 1867, p. 163.) Its sp. gr. is 1·25, *U. S.*, *Br.* According to Mr. G. F. Wilson, glycerin, when of the density 1·24, contains 94 per cent. of anhydrous glycerin; when of the density 1·26, 98 per cent. It is soluble in all proportions in water and alcohol, but insoluble in ether. Glycerin possesses extensive powers as a solvent, and is an excellent excipient for many medicinal substances. It dissolves bromine and iodine, the iodide of sulphur, the chlorides of potassium and sodium, the fixed alkalies, some of the alkaline earths, lime, for example, for which it increases the solvent powers of water (*J. de Pharm.*, Juin, 1874), and a large number of neutral salts. It also dissolves the vegetable acids, particularly tannic acid, and either suspends or dissolves the vegetable alkalies. Many of the salts of the vegetable alkalies are soluble in it, forming convenient solutions for external application. Such solutions are now made for medicinal purposes with some of the salts of morphia, quinia, strychnia, veratria, and atropia. It is a good solvent of pepsin, and is used for the extraction of this principle from the mucus of the stomach. Two parts and a half of glycerin dissolve one of sugar, and three and a half parts one of gum. When starch-paste and glycerin are heated together, a turbid liquid is formed, which lets fall a deposit on cooling; the supernatant liquid holding starch in solution. (*Journ. de Pharm.*, Nov. 1868, pp. 361–2.) Prof. J. S. Blockey, of London, has ascertained that certain neuter vegetable substances are far more soluble in glycerin than in water. Thus, salicin dissolves in eight parts of cold glycerin, and santonin in eighteen parts when boiling. The latter solution, when of half this strength, forms on cooling an almost solid mass. Glycerin, next to alcohol, is the best solvent of iodine. Iodine and iodide of potassium, when dissolved in it, form *iodized glycerin*, the medical applications of which are given under iodine. (See *Iodinium.*)† It combines with potassa and baryta, and also with sulphuric acid. *U. S.*

* Mr. Wm. Crookes gives an account, in the *Chem. News* of Jan. 18, 1867, of 5 tons of glycerin imported into London from Germany in casks of 8 cwt. each, which, though when it left the continent it was in its ordinary state of a viscid liquid, was found, on reaching London, to have become solidified into a mass of very hard, brilliant crystals. The same result has been noticed in Vienna, in a mass of glycerin which had been in an iron tank more than a year. (*Chem. News*, April 5, 1867, p. 174.) The crystalline mass noticed by Mr. Crookes yielded pure glycerin when melted. (*Note to the thirteenth edition.*)

† The following table by Klever, gives a general view of the solvent powers of glycerin.

"The author found that 100 parts of glycerin dissolve the annexed quantities of chemicals:

	PARTS.		PARTS.		PARTS.		PARTS.
Acidum arseniosum..	20	Brucia.....	2·25	Morphia.....	0·45	Sodii bicarbonas.....	8
" arsenicum...	20	Calcii sulphid.....	5	Morphiæ acetas.....	20	" boras.....	60
" benzoicum..	10	Cinchonia.....	0·30	" murias.....	20	" carbonas.....	98
" boracicum...	10	Cinch. sulpha.....	6·70	Phosphorus.....	0·20	" chloras.....	20
" oxalicum....	15	Cupri acetas.....	10	Plumbi acetas.....	20	Sulphur.....	0.10
" tannicum ...	50	" sulphas.....	30	Potassii arsenias.....	50	Strychnia.....	0·25
Alumen.....	40	Ferr. et potas. tart....	8	" chloras.....	3·50	Strychniæ nitras.....	4
Ammoniæ carbonas...	20	" lactas.....	16	" bromidum..	25	" sulphas..	22·50
" murias.....	20	" sulphas.....	25	" cyanidum ..	32	Urea.....	50
Antimon. et pot. tart.	5·50	Hydrarg. chlorid. corrosiv. }	7·50	" iodidum.....	40	Veratria.....	1
Atropia.....	3	" cyanidum.	27	Quinia.....	0·50	Zinci chloridum.....	50
Atropiæ sulphas.....	33	Iodinium.....	1·90	Quiniæ tannas.....	0·25	" iodidum.....	40
Barii chloridum.....	10			Sodii arsenias.....	50	" sulphas.....	35

(*Neues Jahrb. für Pharm.*, 1869, Mai and Juni, 315.)—*Note to the fourteenth edition.*

Glycerin is not susceptible of becoming rancid, or of fermenting spontaneously; but will generate a portion of alcohol under the combined influence of chalk, and of a ferment formed of cheese or animal tissue. During this change there is no intermediate formation of glucose, provided carbonate of calcium is present. (*Berthelot.*) Glycerin does not evaporate when exposed to the air; nor can it be distilled without decomposition, unless in the presence of water or steam. When decomposed by heat, it emits extremely irritating vapours. At a full red heat it takes fire, and burns with a blue flame. In consequence of the high temperature required for its volatilization, it has been proposed to use it for an evaporating bath, in which a heat beyond that of boiling water is required. Glycerin is antiseptic, and has been recommended by Mr. Warington and M. Demarquay to preserve alimentary substances and objects of natural history, and to inject bodies for dissection. According to Dr. W. Frazer, it does not answer to keep pathological preparations; as they are completely softened by its action. M. Berthelot, of Paris, has succeeded in combining glycerin with a number of acids, both mineral and organic, forming three distinct series of neutral compounds. Among others he has united it with the fatty acids, producing, by synthesis, the organic fatty substances, stearine, margarin, olein, &c. Glycerin has been recently formed artificially, by a complicated process, by M. A. Wurtz. (See *Chem. Gaz.*, June 1, 1857, p. 205.) By Pasteur it has been ascertained to be one of the products of the vinous fermentation. Glycerin consists of one eq. of the hypothetical radical *glyceril* (C_6H_7), 5 eqs. of oxygen, and one of water. Its formula is therefore, $C_6H_7O_5+HO$.

The solvent and preservative properties, as well as agreeable taste and permanent consistence of glycerin, render it very useful as a menstruum in pharmacy; and a class of preparations consisting of medicinal substances dissolved in it has come into extensive use. The British Pharmacopœia has adopted such a class, under the name of *glycerina* or *glycerines*. The title of *glyceroles*, adopted from the French, is objectionable, as the termination has been used as designative of certain proximate principles. We prefer the name of *glycerates*, suggested in a previous edition of this work; and, though this name belongs to the salts of glyceric acid, yet this acid is comparatively seldom referred to, and might readily be styled glycerinic acid, so as to leave the convenient name of glycerates for this large and much used class of substances. But the title, *glycerita* or *glycerites*, adopted for the class, which has been introduced into the U. S. Pharmacopœia, is still better, as it avoids the difficulty referred to, and has the advantage of being regularly officinal.

Impurities and Tests. Glycerin is occasionally deficient in density and consistency. According to M. Dalpiaz, it is sometimes perfectly colourless from being bleached by chlorine, when it is apt to contain chloride of calcium, as well as free chlorine. The latter may be detected by rendering the suspected sample slightly blue by a few drops of sulphate of indigo, and then adding a little sulphuric acid, when, if free chlorine be present, the blue colour will disappear. Lime may be detected by oxalate of ammonium; lead by hydrosulphate of ammonium; and sulphuric acid by a soluble salt of baryta. Diluted, and boiled with a solution of potassa, it is not altered in colour, showing the absence of glucose. Trommer's test is probably still more effectual. Chloroform was proposed as a test of sugar, in consequence of the complete insolubility of sugar in it, while glycerin was said to be very soluble; but subsequently chloroform has been shown to be incapable of dissolving glycerin, though readily forming an even mixture with it, separating into its two constituents, on standing. (*Chem. News*, Feb. 25, 1870, p. 87.) The absence of sugar is shown, if, upon the addition of two drops of concentrated sulphuric acid, and the application of heat, no brown discoloration is observed. (*Journ. de Pharm.*, Nov. 1863, p. 405.) The chloroform test was found unsatisfactory by the late Prof. Procter, who stated that commercial glycerin is not soluble in chloroform. He believes that the most satisfactory method of detecting cane sugar is to dilute a little glycerin with three parts of water, then add a few grains of tartaric acid, and boil for a short time. Cane sugar, if present, is thus converted into glucose, which may be detected by adding first a solution of sulphate of copper, and then the solution of potassa to the heated liquid, when the formation of the reddish suboxide of copper will afford the requisite proof. (Procter,

Am. Journ. of Pharm., March, 1867, p. 110.) According to M. Hager, sugar or dextrine may be detected in the following manner. Dilute the glycerin with water, add molybdate of ammonium and some drops of nitric acid, and boil. If these impurities are present, a blue colour is produced; if not, it remains colourless. (*Ibid.*, May, 1869, p. 206.) Diluted with water, glycerin should give no precipitate with hydrosulphate of ammonium, or ferrocyanide of potassium, showing the absence generally of metallic salts, nitrate of barium, oxalate of ammonium, or nitrate of silver. *U. S.* If a drop be rubbed on the hand, no odour should be perceived. One volume of glycerin should dissolve completely in one volume of alcohol, acidulated with 1 per cent. of sulphuric acid, without affording any precipitate of sulphate of calcium, even after standing for twelve hours. When mixed with twice its bulk of cold sulphuric acid, it does not produce a brown colour. *U. S.* For the tests of pure glycerin, given more in detail, see the paper of M. Cap in the *Journ. de Pharm.* (Mars, 1856, p. 212.)

Among the most injurious impurities of glycerin are thought to be oxalic and formic acids, the latter of which is especially irritating to the skin, so as to unfit glycerin for some of the purposes for which it is most employed. The oxalic acid is said to result from the action of sulphuric acid employed in purifying glycerin; the formic, from the reaction between glycerin and oxalic acid. The oxalic acid may be detected by boiling a very little glycerin with a solution of chloride of calcium to which water of ammonia has been added, which causes a deposition of oxalate of calcium; the formic acid, by a black deposit produced by allowing a mixture of glycerin and solution of nitrate of silver to stand for a long time. (Hager, *Journ. de Pharm. et de Chim.*)* Mr. Henry Bower, of Philadelphia, who manufactures very pure glycerin, says that nitrate of silver is the most reliable test. Glycerin which shows no reaction with this salt, he considers suitable for all uses. (*Am. Journ. of Pharm.* May, 1868, p. 265.)

Medical Properties, &c. The uses of glycerin as a vehicle of other medicines have been already given. Employed *internally* as a therapeutic agent, it is deemed alterative, nutrient, and demulcent. Dr. J. L. Crawcour, of New Orleans, has used it with supposed advantage in phthisis, and prefers it to cod-liver oil. Dr. R. P. Cotton, however, has tried it in the Consumption Hospital at Brompton, and concluded that it has generally but little influence, and that, as a remedial agent, it will bear no comparison with cod-liver oil. Dr. W. Lauder Lindsay made experiments with it, to determine its alterative and nutrient properties, and found it to increase the weight of the body; but his experiments were not made on a sufficient scale to be conclusive. It sometimes appeared to act beneficially in tuberculous and strumous affections, forming a useful succedaneum for cod-liver oil, when the latter could not be borne by the stomach. By Drs. Parry and Abbot Smith it has been found useful in diabetes. (*Annuaire de Thérap.*, A.D. 1869, p. 142.)

Glycerin has come into extensive use as an *external* remedy. Its emollient virtues and undrying property adapt it to the treatment of skin diseases, in which a softening and soothing application is required. It appears to have been first employed externally, in 1846, by Mr. Thomas De la Rue, of London, whose observation of its utility led Mr. Startin to try it in the Hospital for Skin Diseases, where it came into extensive use. The principal cutaneous diseases in which it has been found beneficial are pityriasis, lepra, herpes, eczema, psoriasis, prurigo, and lichen. It is a useful addition to lotions in the incrusted form of lupus, and in various syphilitic and strumous eruptions. It is also useful in chapped skin and excoriated surfaces. Added to poultices, in a proportion varying from one-fourth to one-sixteenth, it has the effect of keeping them soft for a long time. To collodium it gives a plasticity which renders

* As impure glycerin is often irritant to the skin, and thus unfitted for some of the most important uses of this principle, it is very important to have a test by which this kind of impurity may be detected. According to M. Hager, if equal volumes of the irritating glycerin and pure sulphuric acid be mixed in a glass tube, there will be an immediate disengagement of gas; and, after the escape of gas has ceased, and the mixture allowed to rest, a renewed agitation will cause a new development of gas; and this phenomenon may be repeated several times; whereas, if the glycerin be pure and unirritant, there is a rise of temperature, and there may be a slight discoloration, but no effervescence, and only the production of a few bubbles of air on agitation. (*Journ. de Pharm. et de Chim.*, Nov. 1867, p. 360.) — *Note to the thirteenth edition.*

it often better suited to skin affections. Incorporated in very small proportion with extracts and pills, it keeps them soft and free from mouldiness. M. Devergie, in giving the results of his trials of glycerin in skin diseases, thinks its virtues have been exaggerated, and that it is not superior to pure lard and similar fatty substances; though it has the advantages of liquidity and freedom from odour. In cases of deafness, from deficiency, accumulation, or hardness of the cerumen, and attended with dryness of the meatus, glycerin is an excellent remedy, introduced into the canal by means of raw cotton, saturated with it. In relation to the uses of glycerin in diseases of the ear, the reader is referred to a paper by Mr. Thomas Wakley, in the London *Lancet* for June, 1849. Glycerin may be prepared as an ointment, for which formulas are given by Mr. J. Laidley, and by Mr. J. H. Ecky.* (*Am. Journ. of Pharm.*, xxii. 118, and xxv. 27.) It is recommended, in its perfectly pure state, by Dr. Foucher, as a vehicle in collyria, agreeing with all the substances used locally in diseases of the eye. (*Chem. News*, Dec. 8, 1860, p. 306.) Another important application of glycerin has been suggested by Dr. M. Rosenthal, in the *Medical Press of Vienna;* as a solvent, namely, for substances used in hypodermic injection. To this purpose it is adapted by its demulcent properties, and by its extraordinary solvent power, which, as regards various medicines administered in this way, much exceeds that of water. (See *Am. Journ. of Pharm.*, July, 1872, p. 325.) Under the name of *plasma*, a preparation was brought into notice, in the year 1858, by Mr. G. F. Schacht, as a substitute for ointments, the emollient and demulcent properties of which it possesses, without their inconvenience, whether used simply, or as a vehicle for other substances to be employed locally. It is a compound of glycerin and starch, and is prepared, according to Mr. Schacht, by mixing 70 grains of starch in powder, and a fluidounce of glycerin, heating to 240° until the union is effected, and stirring constantly. After the vessel is removed from the fire, the stirring should be continued moderately, during the cooling process, to secure a proper consistence. As the plasma is liable to absorb moisture, it should be kept in well-closed vessels. (*Pharm. Journ. and Trans.*, Oct. 1866, p. 210.) It is stated by Dr. J. Dabney Palmer, of Monticello, Florida (*Am. Journ. of Pharm.*, Dec. 1871, p. 535), that he has found glycerin an excellent remedy in putrid sore-throat and contagious affections, administered in the case of children every six hours.

Glycerin has been used by M. Demarquay, of Paris, as a dressing in hospital gangrene, and in wounds in general. The wound is covered with folds of linen, dipped in the glycerin, over which lint is applied, and secured by a bandage. The advantages claimed for this dressing are that it lessens suppuration, promotes cicatrization, and, when removed, leaves the wound clean. Glycerin, used in this way, has been tried by two London surgeons, Mr. Skey and Mr. Hutchinson, and both conclude that it possesses no particular virtues. It is conceded, however, that it is an agreeable application, causes no smarting, excludes the air, keeps the sore moist, and does not adhere to its edges; and these are no small recommendations. It has the advantage over bland oils that it may be readily washed from the wound, on account of its solubility in water. (See *Am. Journ. of Med. Sci.*, July, 1856, p. 253.)† The vaccine lymph and scab have been dissolved in glycerin with a view to the preservation of the virus, and Dr. Andrews, of Chicago, has successfully vaccinated with the solution; but the expedient, to say the least, is of doubtful advantage.

As a bath for the evaporation of substances requiring a higher temperature than

* Mr. Ecky's *glycerin ointment* is made as follows. Take of spermaceti *half an ounce;* white wax *a drachm;* oil of almonds *two fluidounces;* glycerin *a fluidounce.* Melt the spermaceti and wax with the oil of almonds by a moderate heat. Then, having poured the melted liquid into a Wedgwood mortar, add the glycerin, and rub until the ingredients are thoroughly mixed and cool. This ointment may be used with advantage in chaps and excoriations.

† *Glyconine.* Under this name has been several years employed, in France, both for medical purposes and for those of the toilet, an emulsion made of glycerin and the yelk of eggs. When these two substances are rubbed together, they unite to form a very intimate mixture, which remains transparent. It has the consistence of honey, and forms an opaque emulsion with water. It may be preserved almost indefinitely. The usual proportions of the ingredients are four parts of the yelk of eggs, and five parts of very pure glycerin. It is largely used in the hospitals as a dressing for burns, and a local application in erysipelas, fissures of the nipples, and various cutaneous affections. (*Arch. Général. de Méd.*, Mai, 1868, p. 640.)—*Note to the thirteenth edition.*

that of water, glycerin has been recommended by M. Vogel as a substitute for the common water-bath. A temperature of 212° F. can be applied by means of it, without the diffusion of unpleasant odours, as from fixed oils or paraffine used in the same way. (*Journ. de Pharm.*, Oct. 1868, p. 315.)

Off. Prep. Extracta Fluida, *U. S.;* Glycerinum Acidi Carbolici, *Br.;* Glycerinum Acidi Gallici, *Br.;* Glycerinum Acidi Tannici, *Br.;* Glycerinum Amyli, *Br.;* Glycerinum Boracis, *Br.;* Glyceritum Acidi Carbolici, *U. S.;* Glyceritum Acidi Gallici, *U. S.;* Glyceritum Acidi Tannici, *U. S.;* Glyceritum Picis Liquidæ, *U. S.;* Glyceritum Sodii Boratis, *U. S.;* Linimentum Potassii Iodidi cum Sapone, *Br.* B.

GLYCYRRHIZA. *U. S.*

Liquorice Root.

The root of Glycyrrhiza glabra. *U. S.*

Off. Syn. Glycyrrhizæ Radix. *Liquorice Root.* The root or underground stem, fresh and dried, of Glycyrrhiza glabra, *Br.;*

Bois de réglisse, *Fr.;* Süssholzwurzel, *Germ.;* Liquirizia, *Ital.;* Regaliza, *Span.*

GLYCYRRHIZA. *Sex. Syst.* Diadelphia Decandria.—*Nat. Ord.* Leguminosæ or Fabaceæ.

Gen. Ch. Calyx bilabiate; upper lip three-cleft, lower undivided. *Legume* ovate compressed. *Willd.*

Glycyrrhiza glabra. Willd. *Sp. Plant.* iii. 1144; Woodv. *Med. Bot.* p. 420, t. 152; Carson, *Illust. of Med. Bot.* i. 38, pl. 32. The liquorice plant has a perennial root, which is round, succulent, tough, and pliable, furnished with sparse fibres, rapid in its growth, and in a sandy soil penetrates deeply into the ground. The stems are herbaceous, erect, and usually four or five feet in height, have few branches, and are garnished with alternate, pinnate leaves, consisting of several pairs of ovate, blunt, petiolate leaflets, with a single leaflet at the end, of a pale-green colour, and clammy on their under surface. The flowers are violet or purple, formed like those of the pea, and arranged in axillary spikes supported on long peduncles. The calyx is tubular and persistent. The fruit is a compressed, smooth, acute, one-celled legume, containing from one to four small kidney-shaped seeds.

The plant is a native of the south of Europe, Barbary, Syria, and Persia; and is cultivated in England,* the north of France, and Germany. Much of the root imported into this country comes from Messina and Palermo in Sicily. It is also largely produced in the north of Spain, where it is an important article of commerce. It is not improbable that a portion of the root from Italy and Sicily is the product of *G. echinata*, which grows wild in Apulia. This species is also abundant in the south of Russia, where, according to Hayne, sufficient extract is prepared from it to supply the whole Russian empire.

A species of Glycyrrhiza, *G. lepidota*, grows abundantly about St. Louis, in the State of Missouri, and flourishes along the banks of the Missouri river to its source. It is probably the same as the liquorice plant mentioned by Mackenzie as growing on the northern coast of this continent. Mr. Nuttall states that its root possesses in no inconsiderable degree the taste of liquorice.

Properties. The liquorice root of the shops is in long pieces, varying in thickness from a few lines to more than an inch, fibrous, externally grayish-brown and wrinkled by desiccation, internally yellowish, without smell, and of a sweet mucilaginous taste, mingled with a slight degree of acrimony. It is often worm-eaten and more or less decayed. The best pieces are those which have the brightest yellow colour internally, and of which the layers are distinct. The powder is of a grayish-yellow colour, when the root is pulverized without being deprived of its epidermis; of a pale sulphur-yellow, when the epidermis has been removed. Robiquet found the following ingredi-

*It is cultivated in England at Pontefract in Yorkshire, and somewhat largely at Mitcham, in Surrey, whence considerable quantities are sent into market. For an account of its growth at Mitcham the reader is referred to an article in the *American Journ. of Pharm.*, Oct. 1874, p. 473–4. Attempts have been made to introduce its cultivation into this country, but, we believe, hitherto with no great success commercially.—*Note to the fourteenth edition.*

ents in liquorice root; 1. a peculiar transparent yellow substance, called *glycyrrhizin* or *glycion*, of a sweet taste, scarcely soluble in cold water, very soluble in boiling water, with which it gelatinizes on cooling, thrown down from its aqueous solution by acids, readily soluble in cold alcohol, insusceptible of the vinous fermentation, yielding no oxalic acid by the action of the nitric, and therefore wholly distinct from sugar; 2. a crystallizable principle named *agedoïte* by Robiquet, but subsequently proved to be identical with *asparagin;* 3. starch; 4. albumen; 5. a brown acrid resin; 6. a brown azotized extractive matter; 7. lignin; 8. salts of lime and magnesia, with phosphoric, sulphuric, and malic acids. Robiquet prepared *glycyrrhizin* by subjecting a strong cold infusion of the root to ebullition, in order to separate the albumen; then filtering, precipitating with acetic acid, and washing the precipitate with water to remove any adhering acid. It may be still further purified by solution in absolute alcohol, and evaporation at a very gentle heat. According to Dr. T. Lade, glycyrrhizin, as it exists in the root, is rendered soluble in water by combination with inorganic bases, such as lime and ammonia, from which it is separated by the addition of an acid. From the observations of Dr. Lade, it is to be inferred that this principle has no affinity for the acids, but combines with salifiable bases, forming salts of various degrees of solubility. Its sweetness is retained in the compounds which it forms with the alkalies. It consists of carbon, hydrogen, and oxygen, and ranks among the glucosides. Its formula, according to M. Gorup-Besanez, is $C_{48}H_{36}O_{18}$, according to Vogel, $C_{16}H_{12}O_6$. (*Journ. de Pharm.*, Juillet, 1861, p. 72.) Mr. Joseph M. Hirsh, of Chicago, has not found the method of extracting glycyrrhizin by cold infusion very practicable, in consequence of its slight solubility. He considers the best method to be to form acetate of glycyrrhizin with a hot infusion, to evaporate to dryness, dissolve in alcohol, and then neutralize with soda; after which the new salt crystallizes out, and the glycyrrhizin remains in solution. This principle was found to have an extraordinary power of neutralizing bitters, one part covering the bitter taste of four parts of Epsom salt. (*Am. Journ. of Pharm.*, Feb. 1871, p. 77.)

An extract of liquorice root is brought from Spain and Italy, and much used under the name of liquorice. (See *Extractum Glycyrrhizæ.*)

Medical Properties and Uses. Liquorice root is an excellent demulcent, well adapted to catarrhal affections, and to irritations of the mucous membrane of the bowels and urinary passages. It is best given in the form of decoction, either alone, or combined with other demulcents. It is frequently employed as an addition to the decoctions of acrid or irritating vegetable substances, such, for example, as senega and mezereon, the acrimony of which it covers, while it renders them more acceptable to the stomach. Before being used, it should be deprived of its cortical part, which is somewhat acrid, without possessing the peculiar virtues of the root. The decoction may be prepared by boiling an ounce of the bruised root, for a few minutes, in a pint of water. By long boiling, the acrid resinous principle is extracted. Perhaps, however, to this principle may in part be ascribed the therapeutical virtues of liquorice root in chronic bronchial diseases. The powder is used in the preparation of pills, either to give due consistence, or to cover their surface and prevent them from adhering together.

Off. Prep. Confectio Terebinthinæ, *Br.;* Decoctum Sarsæ Compositum, *Br.;* Decoctum Sarsaparillæ Compositum, *U. S.;* Extractum Glycyrrhizæ, *Br.;* Extractum Glycyrrhizæ Fluidum, *U. S.;* Extractum Sarsaparillæ Fluidum Compositum, *U. S.;* Infusum Lini, *Br.;* Infusum Lini Compositum, *U. S.;* Pilula Ferri Iodidi, *Br.;* Pil. Hydrargyri; Syrupus Sarsaparillæ Compositus, *U. S.* W.

GOSSYPII RADICIS CORTEX. *U. S.*

Bark of Cotton Root.

The bark of the root of Gossypium herbaceum, and of other species of Gossypium. *U. S.*

GOSSYPIUM. *U.S., Br.*

Cotton.

A filamentous substance separated from the seed of Gossypium herbaceum, and of other species of Gossypium. *U.S.* The hairs of the seed of various species of Gossypium, carded. *Br.*

Coton, *Fr.;* Baumwolle, *Germ.;* Cotone, *Ital.;* Algodon, *Span.*

GOSSYPIUM. *Sex. Syst.* Monadelphia Polyandria. — *Nat. Ord.* Malvaceæ.

Gen. Ch. Calyx cup-shaped, obtusely five-toothed, surrounded by a three-parted involucel, with dentate-incised, cordate leaflets, cohering at the base. *Stigmas* three to five. *Capsule* three to five-celled, many-seeded. *Seeds* surrounded by a tomentose wool. *De Cand.*

In consequence of changes produced in the plants of this genus by cultivation, botanists have found great difficulty in determining which are distinct species, and which merely varieties. De Candolle describes thirteen species in his Prodromus, and mentions six others; but considers them all uncertain. Royle describes eight and admits others. Schwartz thinks they may all be referred to one original species. The plants inhabit different parts of tropical Asia and Africa, and many of them are cultivated for their cotton in climates adapted to their growth. The species from which most of the cotton of commerce has been thought to be obtained, is the one specially indicated by the U.S. Pharmacopœia. According to Dr. Royle, it is the India cotton which is produced by *G. herbaceum*, while *G. Barbadense* furnishes all the cotton of N. America, and *G. Peruvianum* that produced in Brazil, Peru, and other parts of S. America. (See *Am. Journ. of Pharm.*, July, 1858, p. 339.) Dr. A. W. Chapman, however, in his *Flora of the Southern United States* (N. Y., A. D. 1860, p. 58), states that the numerous varieties of the cotton-plant are now referred to two species, the *long-staple* or *sea-island*, to *G. album* (Haw.), and the *short-staple* or *upland*, to *G. nigrum* (Haw.).

Gossypium herbaceum. Linn. *Sp.* 975; De Cand. *Prodrom.* i. 456. This is a biennial or triennial plant, with a branching stem from two to six feet high, and palmate hoary leaves, the lobes of which are somewhat lanceolate and acute. The flowers are pretty, with yellow petals, having a purple spot near the claw. The leaves of the involucel or outer calyx are serrate. The capsule opens when ripe, and displays a loose white tuft of long slender filaments, which surround the seeds, and adhere firmly to the outer coating. The plant is a native of Asia, but is cultivated in most tropical countries. It requires a certain duration of warm weather to perfect its seeds, and, in the United States, cannot be cultivated advantageously north of Virginia.

The herbaceous part of the plant contains much mucilage, and has been used as a demulcent. The seeds yield by expression a fixed oil of the drying kind, which is employed for making soap and other purposes.* The root has been supposed to pos-

* *Cotton-seed Oil.* This is obtained by expression from the seeds previously deprived of their shells. In this state, they yield two gallons of oil to the bushel. As first obtained, it is thick and turbid, but deposits a portion of its impurities on standing. Besides this crude oil, there are three varieties in the shops of the South, more or less purified, recognized as the *clarified*, the *refined*, and the *winter-bleached*. The last-mentioned is of a pale-straw colour, a mild peculiar odour, and a bland sweetish taste, not unlike that of almond oil. The oil is used in the preparation of woollen cloth and morocco leather, and for oiling machinery. There seems to be some doubt of its drying qualities. It has been found to be an excellent substitute for almond and olive oil in most pharmaceutical preparations in which they are employed; but does not answer well in the formation of the lead plaster. Citrine ointment carefully prepared with it, too great heat being avoided, retains long a rich-orange colour and proper unctuous consistence. Its sp. gr. is stated at 0·921. It is insoluble in alcohol, soluble in not less than its own bulk of ether, and dissolved in all proportions by chloroform. By sulphuric acid it is made deep-red, almost brown; but it is not obviously affected by nitric or muriatic acid. These interesting facts have been extracted from a dissertation by Mr. Wm. Henry Weatherby, whose residence in a cotton-growing district of the South gave him peculiar opportunities. (See *Am. Journ. of Pharm.*, May, 1861, p. 208.) — *Note to the twelfth edition.*

Since the above remarks were made, the subject of cotton-seed oil has been examined by Dr. A. Adriani, the results obtained by whom have been published in the London *Chemical News* (Jan. 7, 1865, p. 5), to which the reader is referred. The following are among the more important statements contained in Dr. Adriani's paper. The product of the expressed seeds is from 15 to 18 per cent. In its impure state it is dark reddish-brown, not quite clear, and contaminated with mucilage and albumen. In this state, its sp. gr. varies from 0·930 to 0·932, which is increased, by washing

sess medical virtues, and is now recognised by the U.S. Pharmacopœia. Another officinal portion, and that for which the plant is cultivated, is the filamentous substance surrounding the seeds. This when separated constitutes the cotton of commerce.

Cotton consists of filaments, which, under the microscope, appear to be flattened tubes, with occasional joints indicated by transverse lines. It is without smell or taste, insoluble in water, alcohol, ether, the oils, and vegetable acids, soluble in strong alkaline solutions, and decomposed by the concentrated mineral acids. In chemical character, it bears a close analogy to lignin. By nitric acid it is converted into that remarkable explosive substance denominated gun cotton, for an account of which, as well as of a valuable adhesive preparation made by dissolving it in ether, the reader is referred to the articles *Gun Cotton* and *Collodium*. Repeated experiments have proven that cotton will take fire and burn spontaneously, if impregnated with olive oil, linseed oil, or almost any other fixed oil, and allowed to stand. (*Pharm. Journ.*, Sept. 1872, p. 225.) Cotton, analyzed by M. Schunck, was found, independently of cellulose ($C_{12}H_{10}O_{10}$), of which it chiefly consists, to contain vegetable wax, a fatty acid, colouring matter, pectic acid, and a little of an albuminoid substance. (*Journ. de Pharm.*, Sept. 1868, p. 233.) For medical use it should be carded into thin sheets; or the wadding of the milliners may be employed, consisting of sheets somewhat stiffened, and glazed on the surface by starch. In the latter case, the sheets should be split open when applied. It is said that air, passed through cotton, loses the property of inducing the putrefactive fermentation in animal substances.

Medical Properties, &c. Cotton has been used from time immemorial for the fabrication of cloth; but it is only of late that it has entered the catalogue of medicines. It is chiefly employed in recent burns and scalds; an application of it adopted from popular practice. It is said to relieve the pain, diminish the inflammation, prevent vesication, and very much to hasten the cure. Whatever advantages result from it are probably ascribable to the absorption of effused liquids, and the protection of the part affected from the air. It is applied in thin and successive layers; and benefit is said to result from the application of a bandage when the skin is not too much inflamed. We have, however, seen cotton do much harm in burns, by becoming consolidated over a vesicated surface, and acting as a mechanical irritant. Such a result may be prevented by first dressing the burn with a piece of fine linen spread with simple ointment. Cotton is also recommended in erysipelas, and as a dressing for blisters; and we have found it useful, applied in a large batch over parts affected with rheumatism, especially in lumbago. It has recently been introduced into use in the hospitals of Paris, as a dressing for wounds, including amputation and other operations by the surgeons; being largely applied to injured surfaces, and confined in its place by bandages, which are allowed to remain undisturbed. It was hoped that the protection thus afforded might prevent the injurious influence of the impure hospital air, and the access to the wounds of organic germs, which dispose to putrefactive, and other varieties of fermentation, productive of hospital gangrene and septicæmia, so fatal in those receptacles for the sick and wounded. The practice is said to have been very successful. A full account of the process, by Dr. T. B. Curtis, of Boston, is contained in the *Boston Med. and Surg. Journal*, Aug. 27, 1874, p. 197. See

with boiling water, to 0·934. The latter sp. gr. is very nearly that of linseed oil, which this oil also closely resembles in taste and odour, and in its drying property. The colour is not essential to the oil, being dependent on the oxidation of a peculiar substance contained in the seeds.

The oil is clarified by first boiling it with water to separate the mucilage, and then heating it with a weak solution of caustic potassa, by which the colouring matter is removed. As this oil is said to be much used in England for adulterating olive oil, a test to distinguish it is very desirable; and, according to Mr. R. Reynolds, nitrate of mercury will answer the purpose. Of this a test-solution may be made by dissolving, without heat, 6 parts of mercury in 7·5 parts of nitric acid of 1·36. This salt has the effect, when mixed with olive oil, of entirely solidifying and hardening it upon standing; while, under the same circumstances, the cotton-seed oil remains fluid. If the two oils are mixed, an intermediate effect is produced; the oil, though possibly solidified, remaining soft and pasty, and not becoming hard like pure olive oil. (*Pharm. Journ. and Trans.*, 2d ser., vii. 226.)—*Note to the thirteenth edition.*

It is stated, that there are at present more than twenty mills in this country, employed exclusively in the manufacture of this oil from cotton-seed, consuming 150,000 tons of the seed. The oil-cake is largely exported to England, where it is used as food for cattle, and the oil to France, and other olive-growing countries of Europe, whence much of it returns to us mixed with olive oil. (*Am. Journ. of Pharm.*, Oct. 1872, p. 467.)—*Note to the fourteenth edition.*

also *Journal de Pharmacie*, Janv. 1872, p. 88, and *Archives Générales* from Dec. 1871, p. 641, to Juin, 1872, p. 325. A similar use of cotton was made some years previously by Dr. Wm. Warren Greene, Prof. of Surgery in the Med. School of Maine. (*Boston M. and S. Journ.*, May 23, 1872, p. 325.) Prof. Gubler, of Paris, proposes to employ cotton impregnated with glycerin for a dressing for wounds. (*Pharm. Journ.*, Sept. 1871, p. 264.)

The root of the cotton plant has been employed by Dr. Bouchelle, of Mississippi, who believes it to be an excellent emmenagogue, and not inferior to ergot in promoting uterine contraction. He states that it is habitually and effectually resorted to by the slaves of the South for producing abortion; and thinks that it acts in this way without injury to the general health. To assist labour, he employs a decoction made by boiling four ounces of the inner bark of the root in a quart of water to a pint, and gives a wineglassful every twenty or thirty minutes. (*West. Journ. of Med. and Surg.*, Aug. 1840.) Dr. T. J. Shaw, of Tennessee, thinks it superior, in the treatment of amenorrhœa, to any other emmenagogue, and equal to ergot as a parturient, while attended with less danger. He uses a tincture made by macerating eight ounces of the dried bark of the root in two pounds of diluted alcohol for two weeks, and gives a drachm three or four times a day. (*Nashv. Journ. of Med. and Surg.*, July, 1855.) Mr. Weatherby denies the statement that the root is used for producing abortion among the slaves, at least within his observation. Dr. Bellamy, of Columbus, Geo., who has had much experience with the root, fully confirms the favourable statement of Dr. Bouchelle. He thinks it most effectual when collected as late in the autumn as possible, before frost. (*Atlanta Med. and Surg. Journ.*, Oct. 1866.)

The bark of the root, which is the officinal portion, and is no doubt much more active than the wood, has been submitted to analysis by Prof. E. S. Wayne, of Cincinnati, in the hope of finding some alkaloid analogous to those which give its parturient virtues to ergot. He did not, however, succeed; but found a peculiar acid resin, colourless and soluble in water, when pure, but absorbing oxygen on exposure, and then becoming red and insoluble in water. It is deposited by the fluid extract on standing. He suggests that this may be the active principle of the root; but the fact has not been determined. (*Am. Journ. of Pharm.*, July, 1872, p. 289.)

Cotton seeds have been employed in our Southern States with great asserted success in the treatment of intermittents. In a communication from Prof. H. R. Frost to the *Charleston Medical Journal* for May, 1850, it is stated, on the authority of Dr. W. K. Davis, of Monticello, that this application of the cotton seed originated with a planter in Newberry District, S. Carolina, who had often used the remedy in intermittents, and never failed to effect a cure. A pint of the seeds is boiled in a quart of water to a pint, and a teacupful of the decoction is given to the patient in bed, an hour or two before the expected return of the chill.

Off. Prep. Collodium, *U. S.;* Extractum Gossypii Radicis Fluidum, *U. S.;* Pyroxylin, *Br.* W.

GRANATI FRUCTÛS CORTEX. *U. S.*

Pomegranate Rind.

The rind of the fruit of Punica Granatum. *U. S.*

GRANATI RADICIS CORTEX. *U. S., Br.*

Bark of Pomegranate Root.

The bark of the root of Punica Granatum. *U. S.* The dried bark of the root. *Br.*

Ecorce de granade, *Fr.;* Granatäpfel-Echalin, *Germ.;* Malicorio, Scorza del melograna ti, *Ital.;* Corteza de granada, *Span.*

PUNICA. *Sex. Syst.* Icosandria Monogynia.—*Nat. Ord.* Myrtaceæ.

Gen. Ch. Calyx five-cleft, superior. *Petals* five. *Pome* many-celled, many-seeded. *Willd.*

Punica Granatum. Willd. *Sp. Plant.* ii. 981; Woodv. *Med. Bot.* p. 531, t. 190; Carson, *Illust. of Med. Bot.* i. 45, pl. 38. The pomegranate is a small shrubby tree,

attaining in favourable situations the height of twenty feet, with a very unequal trunk, and numerous branches which sometimes bear thorns. The leaves are opposite, entire, oblong or lance-shaped, pointed at each end, smooth, shining, of a bright-green colour, and placed on short footstalks. The flowers are large, of a rich scarlet colour, and stand at the end of the young branches. The petals are roundish and wrinkled, and are inserted into the upper part of the tube of the calyx, which is red, thick, and fleshy. The fruit is a globular berry, about the size of an orange, crowned with the calyx, covered with a reddish-yellow, thick, coriaceous rind, and divided internally into many cells, which contain an acidulous pulp, and numerous oblong, angular seeds.

This tree grows wild upon both shores of the Mediterranean, in Arabia, Persia, Bengal, China, and Japan, has been introduced into the East and West Indies, and is cultivated in all civilized countries, where the climate is sufficiently warm to allow the fruit to ripen. In higher latitudes, where it does not bear fruit, it is raised in gardens and hot-houses for the beauty of its flowers, which become double, and acquire increased splendour of colouring by cultivation. Doubts have been entertained as to its original country. The name of *Punicum malum*, applied by the ancients to its fruit, implies that it was abundant at an early age in the vicinity of Carthage. The fruit, for which the plant is cultivated, varies much in size and flavour. It is said to attain greater perfection, in both these respects, in the West Indies than in its native country. The pulp is red, succulent, pleasantly acid, and sweetish, and is used for the same purposes as the orange. The rind of the fruit and bark of the root are the parts indicated in the U. S. Pharmacopœia, the latter only in the British. The flowers were formerly recognised by the Dublin College, and the seeds are offi cinal in France.

Rind of the Fruit. This is presented in commerce under the form of irregular fragments, hard, dry, brittle, of a yellowish or reddish-brown colour externally, paler within, without smell, and of an astringent, slightly bitter taste. It contains a large proportion of tannin, and, in countries where the tree abounds, has been employed for tanning leather.

Flowers. The flowers, sometimes called *balaustines*, are inodorous, have a bitterish, astringent taste, and impart a violet-red colour to the saliva. They contain tannic and gallic acids, and were used by the ancients in dyeing.

Bark of the Root. The roots of the pomegranate are hard, heavy, knotty, ligneous, and covered with a bark which is yellowish-gray or ash-gray on the outer surface, and yellow on the inner. As found in the shops, the bark is in quills or fragments, breaks with a short fracture, has little or no smell, colours the saliva yellow when chewed, and leaves in the mouth an astringent taste without disagreeable bitterness. It contains, according to M. Latour de Trie, fatty matter, tannin, gallic acid, a saccharine substance having the properties of *mannite*, resin, wax, and chlorophyll, besides insoluble matters. The name of *punicin* has been given by Giovanni Righini to a peculiar principle which he extracted from the bark. It has the aspect of an oleoresin, affects the nostrils somewhat like medicinal veratria, and is of an acrid taste. It may be obtained by rubbing a hydro-alcoholic extract of the bark with one-eighth of hydrate of potassa, heating the mixture with eight parts of pure water gradually added, and then dropping in dilute sulphuric acid to saturate the potassa. The punicin subsides, and may be separated by filtration. (*Journ. de Pharm.*, 3e sér., v. 298.) The infusion of the bark yields a deep-blue precipitate with salts of iron, and a yellowish-white precipitate with solution of gelatin. The inner surface of the bark, steeped in water and then rubbed on paper, produces a yellow stain, which, by the contact of sulphate of iron, is rendered blue, and by that of nitric acid acquires a slight rose tint, which soon vanishes. (*Ibid.*, xvii. 438.) These properties serve to distinguish this bark from those of the box root and barberry, with which it is said to be sometimes adulterated. When used it should be separated from the ligneous portion of the root, as the latter is inert.*

* It was stated some years since, in the German Medical Journals, by Dr. C. Harz, that the commercial bark, sold as the bark of the root of the pomegranate, consisted really, in great measure, of that of the stem; a little of the proper root-bark being occasionally intermingled with it. This

Medical Properties and Uses. The rind of the fruit is astringent, and in the form of decoction is sometimes employed in diarrhœa and colliquative sweats, and, more frequently, as an injection in leucorrhœa, and as a gargle in sore-throat in the earlier stages, or after the inflammatory action has in some measure subsided. The powdered rind has also been recommended in intermittent fever. The flowers have the same medical properties, and are used for the same purposes. The bark of the root was used by the ancients as a vermifuge, and is recommended in the writings of Avicenna; but was unknown in modern practice till brought into notice by Dr. F. Buchanan, who learned its powers in India. The Mahometan physicians of Hindostan consider it a specific against tænia. One of these practitioners, having relieved an English gentleman in 1804, was induced to disclose his secret, which was then made public. Numerous cures were subsequently effected in Europe; and there can be no doubt of the occasional efficacy of the remedy. The French writers prefer the product of the wild pomegranate, growing on the borders of the Mediterranean, to that of the plant cultivated in gardens for ornamental purposes. The bark may be administered in powder or decoction; but the latter form is usually preferred. The decoction is prepared by macerating two ounces of the bruised bark in two pints of water for twenty-four hours, and then boiling to a pint. Of this a wineglassful may be given every half hour, hour, or two hours, until the whole is taken. It often nauseates and vomits, and usually purges. Portions of the worm often come away soon after the last dose. It is recommended to give a dose of castor oil, and to diet the patient strictly on the day preceding the administration of the remedy; and, if it should not operate on the bowels, to follow it by castor oil, or an enema. If not successful on the first trial, it should be repeated daily for three or four days, until the worm is discharged. It appears to have been used by the negroes of St. Domingo before its introduction into Europe.

The dose of the rind and flowers in powder is from twenty to thirty grains. A decoction may be prepared in the proportion of an ounce of the medicine to a pint of water, and given in the dose of a fluidounce. The seeds are demulcent.

Off. Prep. of the Bark of the Root. Decoctum Granati Radicis, *Br.* W.

GUAIACI LIGNUM. *U.S., Br.*

Guaiacum Wood.

The heart-wood of Guaiacum officinale. *U.S.* The wood reduced by the turning lathe to the form of a coarse powder or small chips. *Br.*

Bois de gayac, *Fr.;* Pockenholz, *Germ.;* Legno guaiaco, *Ital.;* Guayaco, *Span.*

GUAIACUM. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Zygophyllaceæ.

Gen. Ch. Calyx five-cleft, unequal. *Petals* five, inserted into the calyx. *Capsule* angular, three or five-celled. *Willd.*

Guaiacum officinale. Willd. *Sp. Plant.* ii. 538; Woodv. *Med. Bot.* p. 557, t. 200; Carson, *Illust. of Med. Bot.* i. 25, pl. 17. This is a large tree, of very slow growth. When of full size it is from forty to sixty feet high, with a trunk four or five feet in circumference. The branches are knotted, and covered with an ash-coloured striated

statement he now reiterates as correct, in reference to the present time. The root-bark, the author observes, "has large cells; and at a distance from the cambium, the cells of the medullary rays are not elongated but quadratic. The trunk-bark, as well as that of the root, has anthelmintic properties." (*Am. J. of Pharm.*, May, 1870, p. 220.) A minute description of the microscopic character of the root-bark, by which it may be distinguished, is contained in the *Pharm. Journ. and Trans.* (March, 1873, p. 703).

The following remarks by Prof. Maisch, editor of the *American Journ. of Pharmacy*, in relation to *Pomegranate Bark*, contained in the number of that Journal for Feb. 1874 (*page* 49), are of considerable interest and value. This bark "usually occurs in our commerce in small fragments of quills, which rarely attain the diameter of a finger. It is in single and double quills, varying in length from 2·5 to 7 inches, and from one-half of an inch to an inch in diameter. It has apparently been collected from the lower part of the trunk and the thicker roots. Those quills, which are covered with a rather thick, pale, brownish-gray cork, more or less covered with irregular longitudinally cleft ridges, appear to me to belong to the root; while the trunk-bark appears to have a thinner cork, with the fissured ridges more regularly longitudinal, and a colour more decidedly gray, varied by patches of blackish-brown. Both barks are said to be alike active as anthelmintics; but the medicinal reputation appears to be based mainly upon the effects of the bark of the trunk and branches." (*Note to the fourteenth edition.*)

bark. That of the stem is of a dark-gray colour, variegated with greenish or purplish spots. The leaves are opposite, and abruptly pinnate, consisting of two, three, and sometimes four pairs of leaflets, which are obovate, veined, smooth, shining, dark-green, from an inch to an inch and a half long, and almost sessile. The flowers are of a rich blue colour, stand on long peduncles, and grow to the number of eight or ten at the axils of the upper leaves. The seeds are solitary, hard, and of an oblong shape.

G. officinale grows in the West Indies, particularly in Hayti and Jamaica, and is found also in the warmer parts of the neighbouring continent. All parts of the tree are possessed of medicinal properties; but the wood and the concrete juice only are officinal. The bark, though much more efficacious than the wood, is not kept in the shops. It is said that other species of Guaiacum contribute to the supplies brought into the market. *G. sanctum* of Linnæus, and *G. arboreum* of De Candolle, are particularly specified. The former, however, is said by Woodville not to be sufficiently characterized as a distinct species. Fée states that the wood of *G. sanctum* is paler, and less heavy and hard than the officinal.

Guaiacum wood is imported from Hayti and other West India islands, in the shape of logs or billets, covered with a thick gray bark, which presents on its inner surface, and upon its edges when broken, numerous shining crystalline points. These were supposed by Guibourt to be benzoic acid, by others a resinous exudation from the vessels of the plant; but Dr. Otto Berg has determined that they are crystals of sulphate of calcium. The billets are used by the turners for the fabrication of various instruments and utensils, for which the wood is well adapted by its extreme hardness and density. It is kept by the druggists and apothecaries in the state of shavings or raspings, which they obtain from the turners. It is commonly called *lignum vitæ*, a name which obviously originated from the supposition that the wood was possessed of extraordinary remedial powers.

Properties. The colour of the sap-wood is yellow, that of the older and central layers greenish-brown, that of the shavings a mixture of the two. It is said that, when the wood is brought into a state of minute division, its colour is rendered green by exposure to the air, and bluish-green by the action of nitric acid fumes; and the latter change may be considered as a test of its genuineness. (*Duncan.*) An easier test is a solution of corrosive sublimate, which, added to the shavings and slightly heated, causes a bluish-green colour in the genuine wood. (*Chem. Gaz.*, No. 80, Feb. 1846.) Guaiacum wood is almost without smell unless rubbed or heated, when it becomes odorous. When burnt it emits an agreeable odour. It is bitterish and slightly pungent, but requires to be chewed for some time before the taste is developed. It contains, according to Trommsdorf, 26 per cent. of resin, and 0·8 of a bitter pungent extractive, upon both of which, probably, though chiefly on the former, its medicinal virtues depend. (See *Guaiaci Resina.*) It yields its virtues but partially to water. One pound of the wood afforded to Geiger two ounces of extract. In this extract M. Thierry discovered a volatilizable acid, which he considered peculiar, and named *guaiacic acid* (*acide gayacique*). He obtained it by treating the extract with ether, evaporating the liquid, and carefully subliming the residue. The acid condenses in small, brilliant needles. If the heat be pushed too far, an oil is also produced which colours the crystals. He procured the same acid from the *guaiac* of the shops. (*Journ. de Pharm.*, xxvii. 381.) According to Jahn, however, this substance is nothing more than benzoic acid, rendered impure by adhering volatile oil and resin. (*Pharm. Central Blatt*, 1843, p. 309.)

Medical Properties and Uses. Guaiacum wood ranks among the stimulant diaphoretics. It is said to have been introduced to the notice of European practitioners by the natives of Hispaniola, soon after the discovery of America. It was used in Europe so early as 1508, and attained great celebrity as a remedy for lues venerea: but more extended experience has proved it to be wholly inadequate to the cure of that disease; and it is now employed simply to palliate the secondary symptoms, or to assist the operation of other and more efficient remedies. It is thought to be useful also in chronic rheumatism and gout, scrofula, certain cutaneous eruptions, ozæna, and other protracted diseases dependent on a depraved or vitiated condition of the system. It is usually exhibited in decoction, and in combination with other medi-

cines, as in the compound decoction of sarsaparilla. As but a small portion of the guaiac contained in it is soluble in water, the probability is that its virtues have been greatly overrated, and that the good which has followed its employment resulted rather from the more active medicines with which it is associated, or from the attendant regimen, than from the wood itself. The simple decoction may be prepared by boiling an ounce in a pint and a half of water down to a pint, the whole of which may be administered in divided doses during the twenty-four hours. An aqueous extract is directed by the French Codex.

Off. Prep. Decoctum Sarsæ Compositum, *Br.;* Decoctum Sarsaparillæ Comp., *U. S.;* Syrupus Sarsaparillæ Comp., *U. S.* W.

GUAIACI RESINA. *U.S., Br.*

Guaiac.

A peculiar resin obtained from Guaiacum officinale by spontaneous exudation, by incision, by dry heat, or by decoction of the comminuted wood. *U. S.* The resin obtained from the stem by natural exudation, by incisions, or by heat. *Br.*

Résine de gayac, *Fr.;* Guajakharz, *Germ.;* Resina de guajaco, *Ital.;* Resina de guayaco, *Span.*

For a description of *Guaiacum officinale*, see GUAIACI LIGNUM.

Guaiac is the concrete juice of this tree. It is obtained in several different modes. The most simple is by spontaneous exudation, or by incisions made into the trunk. Another method is by sawing the wood into billets about three feet long, boring them longitudinally with an auger, then placing one end of the billet on the fire, and receiving in a calabash the melted guaiac, which flows out through the hole at the opposite extremity. But the plan most frequently pursued is probably to boil the wood, in the state of chips or sawdust, in a solution of common salt, and skim off the matter which rises to the surface. Guaiac is brought to this market from the West Indies. It is usually in large irregular pieces of various size, in which small fragments of bark, sand, and other impurities are mixed with the genuine guaiac, so as to give to the mass a diversified appearance. Sometimes we find it in small roundish homogeneous portions, separate or agglutinated; sometimes in homogeneous masses, prepared by melting and straining the drug in its impure state. It is probable that the guaiac, obtained from the billets in the manner above described, is of uniform consistence.

Properties. The masses are of a deep greenish-brown or dark-olive colour on their external surface, and internally wherever the air could penetrate. The predominant hue of those parts not exposed to the air is reddish-brown or hyacinthine, diversified, however, with shades of various colours. The odour is feeble but fragrant, and is rendered stronger by heat. The taste, which is at first scarcely perceptible, becomes acrid after a short period; and a permanent sense of heat and pungency is left in the mouth and fauces. Guaiac is brittle, and when broken presents a shining glass-like surface, conchoidal or splintery, with the smaller fragments more or less translucent. It is readily pulverized; and the powder, at first of a light-gray colour, becomes green on exposure to the light. Its sp. gr. varies from 1·2 to 1·23. It softens in the mouth, and melts with a moderate heat. According to Mr. Brande, it consists of 91 per cent. of a peculiar substance analogous to the resins, and 9 per cent. of extractive. Buchner found 79·8 parts pure resin, and 20·1 of bark consisting of 16·5 of lignin, 1·5 of gum, and 2·1 of extractive; but he must have operated on the unstrained guaiac. An acid discovered by M. Thierry is asserted by Jahn to be benzoic acid. Water dissolves a small proportion of guaiac, not exceeding nine parts in 100, forming an infusion of a greenish-brown colour and sweetish taste, which, upon evaporation, yields a brown substance soluble in hot water and alcohol, but scarcely so in ether. Alcohol takes up the whole with the exception of impurities. The tincture is of a deep-brown colour, is decomposed by water, and affords blue, green, and brown precipitates, with the mineral acids. It is coloured blue by nitric acid and by chlorine, and usually by spirit of nitrous ether; and is similarly changed when treated successively by dilute hydro-

cyanic acid, and solution of sulphate of copper. Either in substance or tincture, guaiac gives a blue colour to gluten and substances containing it, to mucilage of gum arabic, to milk, and to various freshly cut roots, as the potato, carrot, and horseradish. It is soluble also in ether, alkaline solutions, and sulphuric acid. The solution in sulphuric acid is of a rich claret colour, deposits, when diluted with water, a lilac precipitate, and, when heated, evolves charcoal. Exposed to air and light, guaiac absorbs oxygen and becomes green, and the change takes place rapidly in the sunshine. Tincture of guaiac has been used for the detection of blood stains, which it does by the blue colour produced by it, when in contact with the red colouring matter of blood, in connection with some ozonized substance, especially peroxide of hydrogen. (*Guy's Hosp. Reports*, 3d ser., xiii. 432.)

It may be used also to distinguish the blood of man and other mammals, in which the corpuscles are non-nucleated, from that of other classes, as birds, fishes, and reptiles, which have nucleated corpuscles. The following method of applying the test, made known by Dr. R. M. Bertolet, microscopist of the Philadelphia Hospital, has the advantage that it will present the evidence to the spectator, and thus be made to give conviction in jury trials. A microscopic preparation, duly mounted, is carefully irrigated with a simple tincture of guaiac resin, and then, under glass, exposed to the action of a very small quantity of an ethereal solution of peroxide of hydrogen. The mammalian corpuscles will exhibit a uniform blue colouration throughout, of different shades in the different corpuscles, while, if the blood corpuscle is nucleated, the nucleus is seen as a well-defined and deep-blue body, with a delicate violet-coloured medium around it. (*Am. Journ. of Med. Sci.*, Jan. 1874, p. 129.)

Guaiacin is a name given to the pure resinoid principle of guaiac. It is insoluble in water, but is dissolved readily by alcohol, and less readily by ether. It combines with the alkalies, forming soluble compounds, which are decomposed by the mineral acids and by several salts. Hence it has been called *guaiacic acid*. It has been obtained in crystals by Prof. Hlasiwetz by first forming a soap with potassa, dissolving this in hot solution of potassa, precipitating with muriatic acid, washing the precipitated resin, and then dissolving it in alcohol, which yields it crystallized by spontaneous evaporation. (*Annal. der Chem. und Pharm.*, cxii. 183.) It differs from most of the resins in being converted by nitric acid into oxalic acid instead of artificial tannin. It is also peculiar in the changes of colour, already alluded to, which it undergoes under the influence of various reagents. By nitric acid and chlorine it is made to assume successively a green, blue, and brown colour. These changes are ascribed by Mr. Brande to the absorption of oxygen, which forms variously coloured compounds according to the quantity absorbed. M. Kossman considers guaiacin to be a glucoside, having, by heating it with dilute sulphuric acid, succeeded in converting it into glucose, and a peculiar principle which he names *gaïaretine*. (*Journ. de Pharm.*, Août, 1860, p. 83.) According to Jahn, guaiac resin consists of three distinct bodies, viz.: 1. a soft resin soluble in ether and ammonia, and constituting 18·7 per cent.; 2. another soft resin, soluble in ether, but with difficulty dissolved by ammonia, amounting to 58·3 per cent.; and 3. a hard resin, insoluble in ether, but soluble in ammonia, in the quantity of 11·3 per cent. The same chemist found in guaiac traces of benzoic acid, and 11·7 per cent. of impurities. (*Pharm. Cent. Blatt*, 1843, p. 317.)*

It will be inferred, from what has been said, that the mineral acids are incompatible with the solutions of guaiac.

This drug is sometimes adulterated with the resin of the pine. The fraud may be detected by the terebinthinate odour exhaled when the sophisticated guaiac is thrown upon burning coals, as well as by its partial solubility in hot oil of turpentine. This liquid dissolves resin, but leaves pure guaiac untouched. Amber is said

* By the destructive distillation of guaiac, Unverdorben obtained two volatile oils; one heavier than water, and variously called *pyroguyic acid*, *guyacol*, and *hydruret of guyacyl*, the last of which names was given by MM. Pelletier and Deville, who determined its resemblance to creasote; the other called by Voelkel, who has particularly investigated it, *guyol*, and having an odour which recalls that of bitter almonds. (*Journ. de Pharm.*, Mai, 1854, p. 396.) Ebermayer has obtained, by the dry distillation of the same resin, a crystallized product which he calls *pyroguaiacine*. (*Chem. Gaz.*, Oct. 16, 1854, p. 386.)—*Note to the eleventh edition.*

to be another adulteration. Nitric acid affords an excellent test of guaiac. If paper moistened with the tincture be exposed to the fumes of this acid, it speedily becomes blue.

Medical Properties and Uses. Guaiac is stimulant and alterative, producing, when swallowed, a sense of warmth in the stomach, with dryness of the mouth and thirst, and promoting various secretions. If given to a patient when covered warm in bed, especially if accompanied with opium and ipecacuanha, or the antimonials, and assisted by warm drinks, it often excites profuse perspiration; and hence has been usually ranked among the diaphoretics. If the patient be kept cool during its administration, it is sometimes directed to the kidneys, the action of which it promotes. In large doses it purges; and it is thought by some practitioners to be possessed of emmenagogue powers. The complaint in which it has been found most beneficial is rheumatism. In the declining stages of the acute form of this disease, after due depletion, it is given in combination with opium, ipecacuanha, nitre, and the antimonials; and in the chronic form is frequently useful without accompaniment. It is also advantageously prescribed in gouty affections, and is occasionally used in secondary syphilis, scrofulous diseases, and cutaneous eruptions; though the guaiacum wood is more frequently resorted to in these latter complaints. It was much relied upon by the late Dr. Dewees in the cure of amenorrhœa and dysmenorrhœa. Dr. D. Lewis has found it useful in hay-fever, given at bedtime, for six successive nights, in the dose of twenty grains, in a cup of warm tea. Dr. James Jackson, of Boston, recommends it occasionally as a laxative, in the dose of a drachm.

The medicine is given in substance or tincture. The dose of the powder is from ten to thirty grains, which may be exhibited in pill or bolus, or in the shape of an emulsion formed with gum arabic, sugar, and water. An objection to the form of powder is that it quickly aggregates. Guaiac is sometimes administered in combination with alkalies, with which it readily unites. Several European Pharmacopœias direct a *soap of guaiac*, under the name of *sapo guaiacinus*, to be prepared by diluting the liquor potassæ with twice its weight of water, boiling lightly, then adding guaiac gradually, with continued agitation, so long as it continues to be dissolved, and finally filtering, and evaporating to the pilular consistence. One scruple may be taken daily in divided doses.

Off. Prep. Mistura Guaiaci, *Br.;* Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.;* Tinctura Guaiaci, *U. S.;* Tinctura Guaiaci Ammoniata. W.

GUTTA-PERCHA. *U. S.*

Gutta-percha.

The concrete juice of Isonandra gutta. (Hooker, *London's Journal of Botany*, 1848.) *U. S.*

This valuable product of the East Indies was first brought into notice by Dr. Wm. Montgomerie, a British army surgeon, who became acquainted with its singular properties in the year 1842, at Singapore, and in the following year sent specimens of it to Europe. It is the product of a large tree growing in the southern extremity of the Malayan Peninsula, the islands of Singapore and Borneo, and probably many other islands in the neighbourhood. This tree belongs to the Linnæan class and order Decandria Monogynia, natural family Sapotaceæ, and genus Isonandra of Dr. Wight, and has received the name of *Isonandra gutta*. It is of considerable magnitude, with a trunk commonly three feet, and sometimes as much as six feet in diameter, having numerous ascending branches, which are crowded with leaves at their extremities. The flowers are small and white; the leaves petiolate, oblong, four or five inches long by two in breadth, bright-green above and brownish beneath.*

* *Bulata.* In the twelfth edition of this work, allusion was made to a product analogous to gutta-percha, said to be produced by a tree, *Sapota Mulleri*, growing in great abundance in Dutch Guiana in S. America. Under the name of *bulata*, this product has recently attracted considerable attention, having been imported into England from Demarara. It is said to have properties which will render it, in some instances, a useful substitute for gutta-percha, which it resembles in elasticity

Dr. Montgomerie states that the natives procure the gutta-percha by the very wasteful mode of cutting down the tree, stripping off the bark, and then collecting the milky juice, which is put into convenient recipients, and coagulates on exposure to the air. Twenty or thirty pounds are thus collected from each tree; but the probability is that the product would be much greater if obtained by tapping the tree, and thus preserving it for future use. In consequence of the abundance in which it is collected, and the wasteful methods pursued, fears are entertained that the tree will before long be extirpated. Large quantities of gutta-percha are now imported into Europe and this country. As found in commerce it is generally impure, containing fragments of vegetable matter and earth. From these it may be freed by kneading it in hot water, or by melting it with oil of turpentine, straining, and evaporating. It may also be purified by means of chloroform. One part of gutta-percha cut into small pieces, put into a flask with 20 parts of chloroform, and frequently shaken, will be fully dissolved in two or three days. To this solution, which cannot be readily filtered, add one-fourth of a part of water, shaking the mixture, and then allowing it to rest for two weeks. The impurities rise or sink, and the clear intervening liquid yields pure gutta-percha by the distillation of the chloroform. (*Chem. Cent. Blatt*, Feb. 1857, p. 108.)*

Properties. Gutta-percha is of a dull-white or whitish colour, of a feeble odour, tasteless, at ordinary temperatures hard and almost horny, somewhat flexible in thin pieces, having an unctuous feel under the fingers, and very tenacious. Its sp. gr. is 0·9791. (*Soubeiran.*) At about 120° F., it becomes softer and more flexible, but is still elastic, resisting, and tenacious. At 150° or 160°, it is soft, very plastic, and capable of being welded and moulded into any form. It is thus softened, whether by means of hot water or by dry heat. On cooling it reassumes its former state, and retains any form which may have been given to it. In the softened state it is readily cut with a knife, though with some difficulty when cold. Exposed to a heat of 330° it loses a portion of water, and on hardening becomes translucent and gray; but it recovers its original characters if immersed in water. Subjected to igneous distillation, it yields volatile products, resembling closely the volatile oil obtained from caoutchouc by the same process. Heated in an open vessel, it melts, foams up, and takes fire, burning with a brilliant flame and smoke. A portion thus melted retains the state of a viscid fluid on cooling. Gutta-percha is a non-conductor of electricity. It is insoluble in water, alcohol, alkaline solutions, and the weak acids,

and exceeds in ductility, while requiring a much higher heat to soften. Its solubilities in various menstrua do not seem to have been determined; but they are probably analogous to those of gutta-percha and caoutchouc. As above stated, it is the concrete juice of *Sapota Mulleri*, or the bullet tree. The idea is entertained that it may serve as a good insulating material for submarine telegraphic wires. Another possible substitute for gutta-percha has been found in the concrete juice of an *Apocynea* growing in Ceylon, named *Alstonia scholaris*. (*Pharm. Journ. and Trans.*, 2d ser., vi. 490, A. D. 1865.)—*Note to the thirteenth edition.*

* A more satisfactory method is probably by dissolving one part of gutta-percha in twenty of boiling benzole, shaking the solution frequently with sulphate of calcium, which upon standing two or three days carries down with it the colouring matter, then decanting the clear liquid, and adding it, in small portions at a time, to alcohol, agitating continually. During this process the gutta-percha is deposited perfectly white. To dry it thoroughly requires an exposure of several weeks; but the result may be hastened by rubbing in a mortar. (*Journ. de Pharm.*, Août, 1863, p. 138.)—*Note to the twelfth edition.*

Pure white gutta-percha. For dental purposes, as for filling carious hollows, it is desirable that gutta-percha should be purified, and rendered perfectly white. But what is sold as such in the market is said to consist largely of the white oxide of zinc, and is on this account badly adapted to the purpose intended. Mr. F. Baden Benger recommends the following method of purification for dentists' use. He states that good crude gutta-percha will yield at least 75 per cent. of the purified. Four ounces of the gutta-percha, in small pieces, are to be digested for a few days with five pounds of methyllated chloroform; and the solution thus formed should be filtered in such a way as to permit little or no loss of chloroform. To the liquid thus filtered, which should be nearly colourless, an equal bulk of alcohol should be added, or a sufficiency to precipitate the gutta-percha, which will separate as a white mass. This is to be washed with alcohol, pressed in a cloth, and dried by exposure to the air. In this state, the gutta-percha is perfectly white, but too porous for use. To give it the proper consistence, it should be boiled for half an hour in a porcelain capsule, and rolled into cylinders while hot. The dentist can readily prepare this himself, and with sufficient economy if he guard against the loss of chloroform. This may be separated from alcohol by washing with water, and the alcohol from the water by distillation. (*Pharm. Journ. and Trans.*, Sept. 1868, p. 160.)—*Note to the thirteenth edition.*

Ether and the volatile oils soften it in the cold, and imperfectly dissolve it with the aid of heat. Oil of turpentine dissolves it perfectly, forming a clear colourless solution, which yields it unchanged by evaporation. It is also dissolved by bisulphuret of carbon, chloroform, and benzole. According to Soubeiran, it contains, besides pure gutta-percha, small portions of a vegetable acid, casein, and two resins, one soluble in ether and oil of turpentine, the other in alcohol. (*Journ. de Pharm.*, 3e sér., xi. 22.) Freed from these impurities, it has an ultimate composition closely analogous if not identical with that of caoutchouc. For a particular account of the distinctive properties of pure gutta-percha, and the two resins mixed with it, the reader is referred to an article by M. Payen, in the *Journ. de Pharm.* (3e sér., xxii. 183), also in the *Chem. Gaz.* (x. 353). According to Baumhauer, pure gutta-percha, as it issues from the tree, is a carbohydrogen, with the formula $C_{20}H_{16}$, which he calls *gutta*, and by the oxidation of which, in various degrees, the different bodies constituting gutta-percha are produced. This carbohydrogen can be separated by treating gutta-percha with dilute muriatic acid, and boiling the residue with ether, which deposits the gutta on cooling; but the ethereal treatment must be frequently repeated to obtain it quite pure. (*Journ. für prakt. Chem.*, lxxviii. 279.) M. Arppe considers gutta-percha as a mixture of six different resins, which may have been formed from a carbohydrogen $C_{10}H_8$. (See *Chem. Gaz.*, ix. 471.) This vegetable product resists putrefaction strongly; but in certain situations, as when employed to protect underground telegraph wires passing near the roots of the oak, it has been observed to undergo speedy decomposition, in consequence, as is supposed, of the action of fungi arising from sporules generated in such exposures. (*Pharm. Journ.*, xvii. 193.)

Gutta-percha has been applied to many useful and ornamental purposes. Its plasticity when moderately heated, great firmness and tenacity at ordinary temperatures, and insolubility in water and alcohol are the properties to which it chiefly owes its value. By immersing it in hot water, it is made susceptible of being formed into any desirable shape; so that utensils of various kinds, ornamental impressions, casts, sheets, bands, cords, sticks, tubes, &c., applicable to numerous purposes in the arts, may be made from it with great facility. To give it greater pliability, it is sometimes mixed with the tar resulting from the igneous decomposition of caoutchouc, or with its own tar and lampblack. It may be vulcanized in the same manner as caoutchouc, and undergoes a similar change of properties. (See *Caoutchouc.*) In the dissolved state it may be employed as a varnish, impervious to moisture.

Medical Uses. Gutta-percha has been introduced into surgery, in order to preserve limbs and joints in fixed positions; and has been used beneficially in club-foot, fractures, and diseases of the joints. It is employed for these purposes in the shape of bands, two or three inches broad and about a line thick, which, being softened in water, are applied in this state, and, when they harden, form a firm case for the limb. Holes should be made through the bands, for the escape of the vapour from the surface. It may in some cases be applied by moulding it, in its soft state, upon the part to be kept at rest, as to the hip and adjacent parts of the body and thigh, in cases of hip-joint disease, for which, when dried, it will form a support equal to the most accurately carved wooden splint. It is also used for the formation of catheters and other tubes, splints, stethoscopes, bougies, specula, pessaries, and various other instruments useful in surgery. The author has seen it employed in the form of a bandage, in fracture of the thigh, in the hospital at Edinburgh. Being softened by immersion in warm water at the time, it was applied without difficulty; and hardening, afterwards, it acted as a splint to the injured limb. Vogel recommends the solution in bisulphuret of carbon as an application to the skin in incised wounds. The liquid speedily evaporates, producing a refrigerant effect; while the gutta-percha hardens, and holds the edges of the wound firmly together. According to Mr. Acton, the best substance for protecting the surface from the contact of poisons, contagions, &c., is prepared by dissolving with a gentle heat a drachm of gutta-percha in an ounce of benzole, and ten grains of caoutchouc in the same quantity of the same menstruum, and mixing the solutions. It may be applied by a brush, and a delicate film is left by the evaporation of the liquid. A saturated solution in chloroform is very useful

in slight superficial injuries and in various chronic affections of the skin. It is applied by means of a camel's-hair pencil, and forms, on the evaporation of the solvent, a thin, elastic covering, which completely excludes the air, and acts like an artificial cuticle to the part. The crusts or scales should be previously removed by poultices or alkaline solutions. The affections in which it has been found most efficacious are the dry scaly and tubercular diseases of the skin, especially psoriasis. It has been used also to render the variolous eruption abortive. The preparation is now officinal under the name of *Liquor Gutta-perchæ.* (See *Part II.*) Another application of gutta-percha is to serve as a vehicle of certain caustic substances, particularly chloride of zinc, and caustic potassa. The preparation is made by reducing the caustic substance to fine powder, and then thoroughly mixing it with its weight of gutta-percha, melted at the lowest possible temperature. (See *Potassa*, and *Zinci Chloridum.*) A great advantage of the preparation is that it may be made into any desirable form, and will retain that form without spreading when applied.

Off. Prep. Liquor Gutta-perchæ, *U. S.* W.

HÆMATOXYLON. *U. S.*

Logwood.

The heart-wood of Hæmatoxylon Campechianum. *U. S.*

Off. Syn. HÆMATOXYLI LIGNUM. *Logwood.* The sliced heart-wood of Hæmatoxylum Campechianum. *Br.*

Bois de Campêche, *Fr.;* Blutholz, Kampeschenholz, *Germ.;* Legno di Campeggio, *Ital.;* Palo de Campeche, *Span.*

HÆMATOXYLON. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Fabaceæ or Leguminosæ.

Gen. Ch. Calyx five-parted. *Petals* five. *Capsule* lanceolate, one-celled, two-valved, with the valves boat-form. *Willd.*

Hæmatoxylon Campechianum. Willd. *Sp. Plant.* ii. 547; Woodv. *Med. Bot.* p. 455, t. 163; Carson, *Illust. of Med. Bot.* i. 33, pl. 25. This is a tree of middle size, usually not more than twenty-four feet high, though, under favourable circumstances, it sometimes rises forty or fifty feet. The trunk, seldom exceeding twenty inches in diameter, is often very crooked, and is covered with a dark rough bark. The branches are also crooked, with numerous smaller ramifications, which are beset with sharp spines. The sap-wood is yellowish, but the interior layers are of a deep-red colour. The leaves are alternate, abruptly pinnate, and composed of three or four pairs of sessile, nearly obcordate, obliquely nerved leaflets. The flowers, which are in axillary spikes or racemes near the ends of the branches, have a brownish-purple calyx and lemon-yellow petals. They exhale an agreeable odour, said to resemble that of the jonquil.

The tree is a native of Campeachy, the shores of Honduras Bay, and other parts of tropical America; and has become naturalized in Jamaica. The wood, which is the part used in medicine, is a valuable article of commerce, and largely employed in dyeing. It comes to us in logs deprived of the sap-wood, and having a blackish-brown colour externally. For medical use it is cut into chips, or rasped into coarse powder, and in these states it is kept in the shops.

Properties. Logwood is hard, compact, heavy, of a deep-red colour becoming dark by exposure, of a slight peculiar odour, and a sweet, somewhat astringent taste. It imparts its colour to water and to alcohol. The infusion made with cold water, though red, is less so than that with boiling water. It affords precipitates with sulphuric, nitric, muriatic, and acetic acids, alum, sulphate of copper, acetate of lead, and sulphate of iron, striking a bluish-black colour with the last-mentioned salt. (*Thomson's Dispensatory.*) Precipitates are also produced with it by lime-water and gelatin. Chevreul found in logwood a volatile oil, an oleaginous or resinous matter, a brown substance the solution of which is precipitated by gelatin (*tannin*), another brown substance soluble in alcohol but insoluble in water or ether, an azotized substance resembling gluten, free acetic acid, various salts, and a peculiar principle, called

hæmatoxylin or *hematin*, on which the colouring properties of the wood depend. This is obtained by digesting the aqueous extract in alcohol, evaporating the tincture till it thickens, then adding a little water, and submitting the liquid to a new but gentle evaporation. Upon allowing it to rest, hematoxylin is deposited in crystals, which may be purified by washing with alcohol and drying. Thus procured, the crystals are shining, of a yellowish rose colour, bitterish, acrid, and slightly astringent to the taste, readily soluble in boiling water, forming an orange-red solution which becomes yellow on cooling, and soluble also in alcohol and ether. According to Erdmann, who obtained hematoxylin by the process of Chevreul, substituting ether for alcohol, its crystals, when quite pure, are yellow, without a tinge of redness; its taste is sweet, like that of liquorice, without bitterness or astringency; and it is not of itself a colouring substance, but affords beautiful red, blue, and purple colours, by the joint action of an alkaline base and the oxygen of the air. It consists of carbon, hydrogen, and oxygen. (*Journ. de Pharm.*, 3e sér., ii. 293.) Its formula in crystals is given as $C_{32}H_{14}O_{12}+2HO$, or $C_{32}H_{14}O_{12}+6HO$, according to the amount of its water of crystallization. (*Chem. Gaz.*, June 15, 1859, p. 227.) It is sometimes found in distinct crystals in the crevices of the wood.

Medical Properties and Uses. Logwood is a mild astringent, devoid of irritating properties, and well adapted to the treatment of that relaxed condition of bowels which is apt to succeed cholera infantum. It is also occasionally used with advantage in ordinary chronic diarrhœa and chronic dysentery. It may be given in decoction or extract.

Off. Prep. Decoctum Hæmatoxyli; Extractum Hæmatoxyli. W.

HEDEOMA. *U. S.*

Hedeoma. American Pennyroyal.

The leaves and tops of Hedeoma Pulegioides. *U. S.*

This herb, first attached to the genus *Melissa*, and afterwards to *Cunila*, is at present universally considered by botanists as belonging to the *Hedeoma* of Persoon. It has been very erroneously confounded by some with *Mentha Pulegium*, or European pennyroyal.

Hedeoma. *Sex. Syst.* Diandria Monogynia.—*Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Calyx bilabiate, gibbous at the base, upper lip three-toothed, lower two; dentures all subulate. *Corolla* ringent. *Stamens* two, sterile; the two fertile stamens about the length of the corolla. *Nuttall.*

Hedeoma pulegioides. Barton, *Med. Bot.* ii. 165.— *Cunila pulegioides.* Willd. *Sp. Plant.* i. 122. This is an indigenous annual plant, from nine to fifteen inches high, with a small, branching, fibrous, yellowish root, and a pubescent stem, which sends off numerous slender erect branches. The leaves are opposite, oblong-lanceolate or oval, nearly acute, attenuated at the base, remotely serrate, rough or pubescent, and prominently veined on the under surface. The flowers are very small, pale-blue, supported on short peduncles, and arranged in axillary whorls along the whole length of the branches. The plant is common in all parts of the United States, preferring dry grounds, and, where abundant, scenting the air for a considerable distance with its grateful odour.

Both in the recent and dried state it has a pleasant aromatic smell, and a warm, pungent, mint-like taste. It readily imparts its virtues to boiling water. The volatile oil upon which they depend may be separated by distillation, and employed instead of the herb itself.

Medical Properties and Uses. Pennyroyal is a gently stimulant aromatic, and may be given in flatulent colic and sick stomach, or to qualify the action of other medicines. Like most of the aromatic herbs, it possesses the property, when administered in warm infusion, of promoting perspiration, and of exciting the menstrual flux when the system is predisposed to the effort. Hence it is much used as an emmenagogue in popular practice, and frequently with success. A large draught of the warm tea is given at bedtime, in recent cases of suppression of the menses, the feet having been previously bathed in warm water.

Off. Prep. Oleum Hedeomæ, *U. S.* W.

HELIANTHEMUM. *U. S. Secondary.*

Frostwort.

The herb of Helianthemum Canadense (*Michaux*). *U. S.*

Helianthemum. *Sex. Syst.* Polyandria Monogynia. — *Nat. Ord.* Cistaceæ.

Gen. Ch. Calyx five-leaved, the two exterior sepals bract-like, smaller, or wanting. *Petals* five, rarely three, sometimes abortive. *Stigma* capitate, sometimes subsessile. *Capsule* triangular, three-valved, with the dissepiments in the middle of the valves. *Seeds* angular.

Helianthemum Canadense. Michaux, *Flor.* i. 308; Torrey & Gray, *Flor. of N. Am.* i. 151. — *Cistus Canadensis.* Willd. *Sp. Plant.* ii. 1199. The *frostwort*, *frost-weed*, or *rock rose*, as this plant is variously called, is an herbaceous perennial, from six to eighteen inches high, with a slender, rigid, pubescent stem, oblong, somewhat lanceolate leaves about an inch in length, and large yellow flowers, the calyx and peduncles of which, as well as the branches, are covered with a white down. The flowers which first appear are terminal, few or solitary, large, on short peduncles, with crosely emarginate petals about twice as long as the calyx. Later in the season, or on different plants, other flowers appear, very small, axillary, solitary or somewhat clustered, nearly sessile, sometimes destitute of petals, and usually wanting the two outer sepals of the calyx. The fruit is a capsule, smooth and shining, with brown, scabrous, punctate seeds. Eaton states that, in the months of November and December, he has seen hundreds of these plants sending out, near the roots, broad, thin, curved ice crystals, about an inch in breadth, which melted in the day, and were renewed in the morning. (*Manual of Botany*, 7th ed., p. 246.)

Frostwort grows in all parts of the United States, preferring dry sandy soils, and flowering in June in the Middle States.

Medical Properties and Uses. The herb has an astringent, slightly aromatic, and bitterish taste; and appears to possess tonic and astringent properties. It is now some years since attention was attracted to it as a medicine. We have been told that it was first introduced into regular practice by Dr. Ives, of New Haven, Connecticut, who considered it a valuable remedy in scrofula. The late Dr. Isaac Parrish, of Philadelphia, informed us that he had employed it, with much apparent benefit, as an internal remedy, in scrofulous affections of the eyes. In a pamphlet upon the frost-weed by Dr. D. A. Tyler, published at New Haven, A.D. 1846, it is stated that *H. corymbosum* possesses similar properties, and is indiscriminately employed with *H. Canadense*. He found both useful in scrofula, diarrhœa, and secondary syphilis, and locally as a gargle in scarlatina, and a wash in prurigo.* The plant has been used in the forms of powder, decoction, fluid extract, tincture, and syrup; and may be given freely with impunity. Dr. Tyler, however, has known the strong decoction and the extract to produce vomiting. He considers two grains of the latter as a full dose for an adult.

W.

* The herb of *H. corymbosum* has been examined by Mr. Fred. J. Kruell, who found in it *tannin* in large proportion, resin, glucose, gum, extractive, chlorophyll, and inorganic salts. He presumes that its virtues reside in the tannin and extractive. (*Am. Journ. of Pharm.*, Aug. 1874, p. 358.)

Prof. Howard Primm, of the St. Louis College of Pharmacy, offers the following formula for a fluid extract. Taking 16 troyounces of the leaves, and 16 fluidounces of alcohol, he macerates the former for eight hours with 12 fluidounces of the latter, then percolates till the liquid ceases to pass, and pours gradually into the percolator a mixture of the residuary alcohol with 4 fluidounces of water, until the percolate equals 12 fluidounces, which he reduces by means of a water-bath to 4 fluidounces. The residuary marc is then mixed with a pint of cold water, and, after being allowed to macerate for twelve hours, is subjected to strong pressure, so as to yield a liquid, which is evaporated to eight fluidounces, mixed with the four fluidounces previously obtained, together with eight troyounces of sugar, and agitated till this is dissolved. (*Am. Journ. of Pharm.*, Jan. 1869, p. 30; from *Humb. Med. Archives*, Sept. 1868.)—*Note to the fourteenth edition.*

HELLEBORUS. *U.S.*

Black Hellebore.

Root of Helleborus niger. *U.S.*

Ellébore noire, *Fr.*; Schwarze Niesswurzel, *Germ.*; Elleboro nero, *Ital.*; Helebor negro, *Span.*

HELLEBORUS. *Sex. Syst.* Polyandria Polygynia.—*Nat. Ord.* Ranunculaceæ.

Gen. Ch. Calyx none. *Petals* five or more. *Nectaries* bilabiate, tubular. *Capsules* many-seeded, nearly erect. *Willd.*

Helleborus niger. Willd. *Sp. Plant.* ii. 1336; Woodv. *Med. Bot.* p. 473, t. 169; Carson, *Illust. of Med. Bot.* i. 8, pl. 1. The root or rhizome of the black hellebore is perennial, knotted, blackish on the outside, white within, and sends off numerous long, simple, depending fibres, which are brownish-yellow when fresh, but become dark-brown upon drying. The leaves are pedate, of a deep-green colour, and stand on long footstalks which spring immediately from the root. Each leaf is composed of five or more leaflets, one terminal, and two, three, or four on each side, supported on a single partial petiole. The leaflets are ovate-lanceolate, smooth, shining, coriaceous, and serrated above. The flower-stem, which also rises from the root, is six or eight inches high, round, tapering, and reddish towards the base, and bears one or two large, pendent, rose-like flowers, accompanied with floral leaves, which supply the place of the calyx. The petals, five in number, are large, roundish, concave, spreading, and of a white or pale rose-colour, with occasionally a greenish tinge. There are two varieties of the plant—*humilifolius* and *altifolius*—in the former of which the leaves are shorter than the flower-stem, in the latter longer. It is a native of the mountainous regions of southern and temperate Europe, and is found in Greece, Austria, Italy, Switzerland, France, and Spain. It is cultivated in gardens for the beauty of its flowers, which expand in the middle of winter, and have thus given it the name of *Christmas rose.*

Till the publication of Tournefort's travels in the Levant, this plant was regarded as identical with the hellebore of the ancient Greeks and Romans. But in the island of Anticyra, and various parts of continental Greece, in which it appears from the testimony of ancient writers that the hellebore abounded, this traveller discovered a species entirely distinct from those before described, and particularly from *H. niger.* He called it *H. orientalis*, and reasonably inferred that it was the true hellebore of the ancients; and botanists at present generally coincide in this opinion. But, as *H. niger* is also found in some parts of Greece, it is not impossible that the two plants were indiscriminately used. It is, indeed, highly probable that they possess similar properties; and a third, *H. viridis*, which grows in the west of Europe, is said to be frequently substituted for *H. niger*, which it closely resembles, if it does not equal in medicinal power. The roots of various other plants, not belonging to the same genus, are said to be frequently substituted for the black hellebore. They may usually be readily distinguished by attending to the characters of the genuine root.*

*The following minute description of the root, which we translate from Geiger's *Handbuch der Pharmacie*, may, perhaps, be useful in enabling the druggist to distinguish this from other analogous roots, mingled with or substituted for it in commerce. "It is usually a many-headed root, with a caudex or body half an inch thick or less, seldom thicker, and several inches long, horizontal, sometimes variously contorted, uneven, knotty, with transverse ridges, slightly striated longitudinally, presenting on its upper surface the short remains of the leaf and flower stalks, and thickly beset upon the sides and under surface with fibres of the thickness of a straw, and from six to twelve inches long. These are undivided above, but, at the distance of from two to six inches from their origin, are furnished with small, slender branches. The colour of the root is dark-brown, sometimes rather light-brown, dull, and for the most part exhibiting a gray, earthy tinge. Internally it is whitish, with a somewhat darker pith, which, when cut transversely, shows lighter converging rays. Sometimes it is porous. It has a medullary or fleshy, not a ligneous consistence. The fibres, when dried, are wrinkled, very brittle, sometimes grayish internally, horny, with a white point in the centre. The odour of the dried root is feeble, somewhat like that of seneka, but more nauseous, especially when it is rubbed with water. The taste is at first sweetish, then nauseously acrid and biting, but not very durable, and slightly bitterish." (*Handbuch*, ii. *s.* 1181.)

A root said to be not unfrequently substituted for or mixed with the genuine, and often to be met with in the shops of this country, is thought to be that of the *Actæa spicata* of Europe. This has been particularly described by Dr. Carson in the *American Journal of Pharmacy* (xx. 163). The points of difference upon which that writer especially insists are the diffuse, jointed, stem-like character of the caudex of the false root, the straggling, separated, and horizontal arrangement of

The medicine of which we are treating is sometimes called *melampodium*, in honour of Melampus, an ancient shepherd or physician, who is said to have cured the daughters of King Prætus by giving them the milk of goats which had been fed on hellebore.

Properties. Though the whole root is kept in the shops, the fibres are the portion usually recommended. They are about as thick as a straw, when not broken from four inches to a foot in length, smooth, brittle, externally black or deep-brown, internally white or yellowish-white, with little smell, and a bitterish, nauseous, acrid taste. In their recent state they are extremely acrimonious, producing on the tongue a burning and benumbing impression, like that which results from taking hot liquids into the mouth. This acrimony is diminished by drying, and still further impaired by age. MM. Feneulle and Capron obtained from black hellebore a volatile oil, an acrid fixed oil, a resinous substance, wax, a volatile acid, bitter extractive, gum, albumen, gallate of potassium, supergallate of calcium, a salt of ammonia, and woody fibre. Mr. William Bastick discovered a peculiar crystalline principle, which he proposed to call *helleborin*. It was obtained by diluting with water a strong tincture of the root, expelling the alcohol by heat, filtering to separate the resin, adding carbonate of potassium in excess, and agitating the mixture with three or four times its volume of ether. The ethereal solution was separated, and on evaporation yielded the helleborin, which was purified by solution in alcohol, and crystallization. It is in white, translucent crystals, of a bitter taste with a tingling effect on the tongue, not volatilizable, slightly soluble in water, more so in ether and alcohol, and more readily in these liquids hot than cold. Though nitrogenous, it is neither acid nor alkaline. It probably exists uncombined in the root. (*Pharm. Journ.*, xii. 274.) Water and alcohol extract the virtues of the root, which are impaired by long boiling.

Some interesting results, chemical and physiological, in relation to both the black and green hellebore, which in these respects may be considered as one, have been obtained by Marme and Husemann. A solution of an extract of the root, having been purified by precipitation with solution of subacetate of lead, and then freed from lead by sulphuretted hydrogen, yielded with phospho-molybdic acid a precipitate, which was found to have poisonous properties. Unfortunately, they gave to this principle the name of *helleborin*, which had been already appropriated by Mr. Bastick. They ascertained that it was a glucoside, separable by boiling with acid into glucose and a peculiar principle which they propose to call *helleboretin*. The helleborin of these chemists exists both in the root and leaves. It has a taste at once sweet and bitter, is soluble in water and weak alcohol, and much less so in ether and absolute alcohol, and is crystallizable in rhomboidal prisms. It is precipitable by tannic acid and the protacetate of mercury. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 258.) In the *American Journ. of Pharm.* (May, 1866, p. 247), quoting from the *Druggists' Circular*, an account is given of a second glucoside obtained by the same chemists from the same source, which they distinguish by the name of *helleborein;* but the mode of its preparation, and its precise chemical properties, are not given. May it not be the helleborin of Bastick? Though both the principles referred to by the German chemists mentioned are poisonous, the products of their decomposition are said to be harmless. Neither of them is volatile. Helleborein is strongly irritant to the mucous membranes, causing, when applied to the conjunctiva, redness, swelling, and increased secretion with indirect enlargement of the pupil, and to the nasal membrane, sneezing, though in less degree than veratria. The salivary secretion appears to be stimulated not only by its application to the mouth, but also through the system. Small doses produce little effect on the stomach; but, repeated and accumulated, they cause anorexia, nausea even to vomiting, pain, increased secretion, and inflammation both of the stomach and bowels. The kidneys and generative organs in women

the fibres, and their dense, woody structure, and reddish-brown colour, contrasted with the thickness, double-headed form, and sponginess of the genuine caudex, the close-set, perpendicular position of its fibres, and their wrinkled appearance, soft texture, and grayish-brown colour. The transverse section of the fibre of the Actæa presents the appearance of a cross, which is not obvious in that of the black hellebore, though the central point of this, if closely examined, will be found to present a somewhat stellate appearance. In the *Pharm. Journ. and Trans.* for Aug. 1861 (p. 112), Prof. Bentley states that solution of perchloride of iron produces little change of colour and little or no precipitation with an infusion of black hellebore, while, with a similar infusion of the Actæa root, it causes a deep-blue or black colour and a copious precipitate.

are also stimulated. In very small doses, it lessens the frequency of the pulse; but in large doses, it accelerates the circulation, often even fatally. Gradual paralysis and convulsions are among its poisonous effects. The *helleborin* of Marme and Husemann is a more active poison, though less irritant to the mucous membrane. It acts on the tongue like aconite. Its influence appears to be directed especially to the nervous system. In the lower animals it causes quickened breathing, restlessness, tension and trembling of the muscles, uncertainty of movement; then retardation of the breathing and pulse, irritability of the peripheral nerves, dilatation of the pupil, loss of hearing, and finally almost complete anæsthesia, with cerebral and spinal congestion, even to apoplexy.

Medical Properties and Uses. Black hellebore is a drastic hydragogue cathartic, possessed of emmenagogue powers, which by some are ascribed to a specific tendency to the uterus, by others are supposed to depend solely on the purgative property. In overdoses it produces inflammation of the gastric and intestinal mucous membrane, with violent vomiting, hypercatharsis, vertigo, cramp, and convulsions, which sometimes end in death. The fresh root applied to the skin produces inflammation and even vesication. The medicine was very highly esteemed by the ancients, who employed it in mania, melancholy, amenorrhœa, dropsy, epilepsy, various cutaneous affections, and verminose diseases. By the earlier modern physicians it was also much used. *Bacher's pills*, celebrated for the cure of dropsy, consisted chiefly of black hellebore. It is at present little employed except as an emmenagogue, in which capacity it is highly esteemed by some practitioners. Dr. Meade considered it superior to all other medicines belonging to this class. It may be given in substance, extract, decoction, or tincture. The dose of the powdered root is from ten to twenty grains as a drastic purge, two or three grains as an alterative. The decoction is prepared by boiling two drachms in a pint of water, of which a fluidounce may be given every four hours till it operates. The extract and tincture are officinal.

Off. Prep. Extractum Hellebori, *U.S.;* Tinctura Hellebori, *U.S.* W.

HEMIDESMI RADIX. *Br.*

Hemidesmus Root. Indian Sarsaparilla.

The dried root of Hemidesmus indicus, *D.C.* Imported from India. *Br.*

HEMIDESMUS. *Sex. Syst.* Petandria Digynia.—*Nat. Ord.* Asclepiadaceæ.

Gen. Ch. Corolla rotate. *Filaments* connate at the base, not united above, inserted into the tube of the corolla. *Anthers* cohering separate from the stigma, with twenty pollen-masses. *Stigma* flattish, pointless.

Hemidesmus Indicus. R. Brown, *Hort. Kew.* ii. 75; Lindley, *Flor. Med.* p. 543.—*Periploca Indica.* Willd. *Sp. Plant.* i. 1251. This is a climbing plant, with twining, woody, slender stems, and opposite petiolate leaves, which are entire, smooth, shining, and of a firm consistence. The leaves vary much in size and shape, some being linear and acute, others broad-lanceolate, and others again oval or ovate. The flowers are small, green on the outside, purple within, and disposed in axillary racemes. The calyx is five-parted, with acute divisions; the corolla flat, with oblong, pointed divisions. The fruit consists of two long, slender, spreading follicles.

This plant is common over the whole peninsula of Hindostan. The officinal portion is the root, which has long been used in India as a substitute for sarsaparilla. It is long, slender, tortuous, cylindrical, and little branched, consisting of a ligneous centre, and a brownish, corky bark, marked with longitudinal furrows and transverse fissures.* It has an aromatic odour and bitter taste. Mr. Garden obtained from it a peculiar volatilizable acid principle, which he named *smilasperic acid*, under the erroneous impression that the root was derived from *Smilax aspera*. Pereira proposed to call it *hemidesmic acid*.

Medical Properties and Uses. Indian sarsaparilla is said to be tonic, diuretic, and

* For the microscopic characters of this root, which are curious and of much interest to the structural botanist, see a communication by Mr. Henry Pocklington in the *Pharm. Journ. and Trans.*, July 27, 1872, p. 62. (*Note to the fourteenth edition.*)

alterative. It was introduced into Great Britain from India, and was employed for some time under the name of *smilax aspera*. It is used for the same purposes as sarsaparilla. In some instances it is said to have proved successful in syphilis when that medicine had failed; but it cannot be relied on. The native practitioners in India are said to employ it in nephritic complaints, and in the sore-mouth of children. It is used in the form of infusion or decoction, made in the proportion of two ounces of the root to a pint of water. A pint may be given in wineglassful doses, in the course of the day. A syrup is directed in the British Pharmacopœia. (See *Syrupus Hemidesmi.*)

Off. Prep. Syrupus Hemidesmi, *Br.* W.

HEPATICA. *U. S. Secondary.*

Liverwort.

The leaves of Hepatica Americana (*De Candolle*). *U. S.*

Hepatica. *Sex. Syst.* Polyandria Polygynia.—*Nat. Ord.* Ranunculaceæ.

Gen. Ch. Calyx three-leaved. *Petals* six to nine. *Seeds* naked. *Nuttall.*

Hepatica Americana. De Cand.; Eaton, *Manual of Botany*, p. 241.—*H. triloba.* Willd. *Enum.;* figured in Rafinesque's *Med. Flor.* i. 238. Botanists generally admit but one species of Hepatica, *H. triloba*, and consider as accidental the difference of structure and colour observable in the plant. Pursh speaks of two varieties, one having the lobes of the leaf oval and acute, the other rounded and obtuse. These are considered as distinct species by De Candolle; and the latter is the one adopted by the Pharmacopœia, and popularly employed as a medicine in this country, under the name of *liverwort.* Both have a perennial fibrous root, with three-lobed leaves, cordate at their base, coriaceous, nearly smooth, glaucous, and purplish beneath, and supported upon hairy footstalks from four to eight inches long, which spring directly from the root. The scapes or flower-stems are several in number, of the same length with the petioles, round, hairy, and terminating in a single white, bluish, or purplish flower. The calyx is at a little distance below the corolla, and is considered by some an involucre, while the corolla takes the name of the calyx. In *H. acutiloba* the leaves are cordate, with from three to five entire, acute lobes; and the leaflets of the calyx are acute. In *H. Americana* the leaves are cordate-reniform, with three entire, roundish, obtuse lobes; and the leaflets of the calyx are obtuse. Both are indigenous, growing in woods upon the sides of hills and mountains; the former, according to Eaton, preferring the northern, the latter the southern exposure. The leaves resist the cold of the winter, and the flowers make their appearance early in spring. The whole plant is used.

It is without smell, and has a mucilaginous, somewhat astringent, slightly bitterish taste. Water extracts all its active properties.

Medical Properties and Uses. Liverwort is a very mild, demulcent tonic and astringent, supposed by some to possess diuretic and deobstruent virtues. It was formerly used in Europe in various complaints, especially chronic hepatic affections, but has fallen into entire neglect. In this country some years since, it acquired considerable popular reputation, which, however, it has not maintained, as a remedy in hæmoptysis and chronic coughs. It may be used in infusion, and taken ad libitum. The term *liverwort* properly belongs to the cryptogamous genus *Marchantia.* W.

HEUCHERA. *U. S. Secondary.*

Alum-root.

The rhizome of Heuchera Americana. *U. S.*

Heuchera. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Saxifragaceæ.

Gen. Ch. Calyx five cleft. *Petals* five, small. *Capsule* bi-rostrate, bi-locular, many-seeded. *Nuttall.*

Heuchera Americana. Willd. *Sp. Plant.* i. 1328; Barton, *Med. Bot.* ii. 159.—*H. cortusa.* Michaux, *Flor. Boreal. Am.* i. 171.—*H. viscida.* Pursh, *Flor. Am. Sept.* p. 187. The *alum-root* or *American sanicle* is a perennial, herbaceous plant, the leaves of which are all radical, petiolate, cordate, with rounded lobes, furnished with obtuse

mucronate teeth. There is no proper stem; but numerous scapes or flower-stems are sent up by the same root, from one to three feet in height, very hairy in their upper part, and terminating in long, loose, pyramidal, dichotomous panicles. The calyx is small, with obtuse segments; the petals lanceolate, rose-coloured, and of the same length as the calyx; the filaments much longer, yellowish, and surmounted by small, red, globose anthers. The whole plant is covered with a viscid pubescence.

It is found in shady, rocky situations, from New England to Carolina, and flowers in June and July. The root, which is officinal, is horizontal, somewhat compressed, knotty, irregular, yellowish, and of a strongly styptic taste.

Medical Properties. Alum-root is powerfully astringent, and may be employed in similar cases with other medicines belonging to the same class. It has hitherto, however, been little used. We are informed, in Dr. Barton's "Collections," that it is applied by the Indians to wounds and obstinate ulcers, and that it is the basis of a powder which, when the author wrote, enjoyed some reputation as a cure for cancer. Mr. Frederick Stearns, in a report to the Am. Pharmaceutical Association in reference to the medicinal plants of Michigan (*Proceedings*, A.D. 1858, p. 263), speaks of two other species, *H. caulescens* and *H. pubescens*, as having similar properties. W.

HIRUDO. *Br.*

The Leech.

Sanguisuga medicinalis, the *Speckled Leech;* and S. officinalis, the *Green Leech, Br* Sangsue, *Fr.;* Blutegel, *Germ.;* Mignátta, *Ital.;* Sanguijuela, *Span.*

Hirudo. *Class* 1, Annelides. *Order* 3, Abranchiatæ. *Family* 2, Asetigeræ. *Cuvier.*

The leech belongs to that class of invertebrated articulated animals called *Annelides.* This class contains the worms with red blood, having soft retractile bodies composed of numerous segments or rings, breathing generally by means of branchiæ, with a nervous system consisting in a double knotted cord, destitute of feet, and supplying their place by the contractile power of their segments or rings. The third order of this class—*Abranchiatæ*—comprehends those worms which have no apparent external organ of respiration. This order is again divided into two families, to the second of which—the *Asetigeræ*, or those not having setæ to enable them to crawl—the leech belongs.

It is an aquatic worm with a flattened body, tapering towards each end, and terminating in circular flattened disks, the hinder one being the larger of the two. It swims with a vertical undulating motion, and moves when out of the water by means of these disks or suckers, fastening itself first by one and then by the other, and alternately stretching out and contracting its body. The mouth is placed in the centre of the anterior disk, and is furnished with three cartilaginous lens-shaped jaws at the entrance of the alimentary canal. These jaws are lined at their edges with fine sharp teeth, and meet so as to make a triangular incision in the flesh. The head is furnished with small raised points, supposed by some to be eyes. Respiration is carried on through small apertures ranged along the inferior surface. The nervous system consists of a cord extending the whole length, furnished with numerous ganglions. The intestinal canal is straight, and terminates in the anus, near the posterior disk. Although hermaphrodite, leeches mutually impregnate each other. They are oviparous; and the eggs, varying from six to fifteen, are contained in a sort of spongy, slimy cocoon, from half an inch to an inch in diameter. These are deposited near the edge of the water, and hatched by the heat of the sun. The leech is torpid during the winter, and casts off from time to time a thick slimy coating from its skin. It can live a considerable time in sphagnous moss, or in moistened earth, and is frequently transported in this manner to great distances by the dealers.

Savigny has divided the genus Hirudo of Linnæus into several genera. The true leech is the Sanguisuga of this author, and is characterized by its three lenticular jaws, each armed with two rows of teeth, and by having ten ocular points. Several species are used for medical purposes, of which the most common are the gray and the green

leech of Europe, both of which are varieties of the *Hirudo medicinalis* of Linnæus; and the *Hirudo decora* of this country.

1. *Hirudo medicinalis.* Linn. *Ed. Gmel.* i. 3095. — *Sanguisuga officinalis.* Savigny, *Mon. Hir.* p. 112, t. 5, f. 1. *The green leech.* — *Sanguisuga medicinalis.* Savigny, *Mon. Hir.* p. 114, t. 5, f. 2. *The gray leech.* Many of the bests zoologists regard the *Sanguisuga officinalis* and *S. medicinalis* of Savigny as mere varieties. They are both marked with six longitudinal dorsal ferruginous stripes, the four lateral ones being interrupted or tesselated with black spots. The colour of the black varies from a blackish to a grayish-green. The belly in the first variety is of a yellowish-green colour, free from spots, and bordered with longitudinal black stripes. In the second it is of a green colour, bordered and maculated with black. This leech varies from two to four inches in length. It inhabits marshes and running streams, and is abundant throughout Europe.*

The great use made of leeches in the modern practice of medicine has occasioned them to become a considerable article of commerce. They are collected in Spain, France, Italy, Germany, and Sweden, and carried in large numbers to London and Paris. They are also frequently brought to this country; as the practitioners in some of our large cities use only the foreign leech, although our own waters furnish an inexhaustible supply of this useful worm.†

2. *Hirudo decora.* Say, *Colonel Long's Second Expedition*, ii. 268. The medicinal leech of America has been described by Say under the name of *Hirudo decora*, in the Appendix to the Second Expedition of Colonel Long. Its back is of a deep pistachio-green colour, with three longitudinal rows of square spots. These spots are placed on every fifth ring, and are twenty-two in number. The lateral rows of spots are black, and the middle range, of a light brownish-orange colour. The belly is of the latter colour, variously and irregularly spotted with black. The American leech sometimes attains the length of four or five inches, although its usual length is from two to three. It does not make so large and deep an incision as the European leech, and draws less blood.

The indigenous leech is much used in the city of Philadelphia. The practitioners of New York and Boston are supplied chiefly from abroad. The leeches employed

* A variety of the leech has recently come into use in Europe, called in commerce *African leeches.* They are of a beautiful light-green colour, varying to a deep-green, and often inclining to red, with black points on the back, and broad streaks of a bright orange-yellow, which are black towards the abdomen. They correspond perfectly with the *Sanguisuga interrupta* of Moquin-Tandon. These leeches draw very well. (*Pharm. Journ.*, x. 38; from *Buchner's Repertorium*, A.D. 1850, p. 376.) The leeches from Algiers, called in French commerce *dragons* (*Sanguisuga troctena* of Moquin-Tandon), of which considerable numbers have been taken to France, are said by M. A. de Quatrefages, contrary to former opinion, to be quite equal to the European. (*Journ. de Pharm.*, 3e sér., xxxiii. 105.) It is stated in the *Pharmaceutical Journal and Transactions* (June, 1867, p. 735) that great numbers of leeches are collected in Australia, and sent to Melbourne, whence a large proportion are exported to Europe and America, chiefly to London and Paris in the former continent, and San Francisco, Panama, and New York in the latter. It is estimated that two or three millions annually pass through the hands of the Murray River Fishing Company. In the same journal (March, 1865, p. 481), the leech is said to abound in almost every river and lagoon in Australia, and to differ from the ordinary English leech only, that the olive streaks are much lighter in the former. They are collected by throwing into the water a fresh sheep-skin, to which they attach themselves. They bear transportation wonderfully well. In Hindostan and the Island of Ceylon, where the varieties of leeches are said to be more numerous than in any other part of the world, it is stated by Mr. P. L. Simmonds, that the propagation of the kind used in medicine is carefully kept secret. (*Pharm. Journ. and Trans.*, Dec. 1870, p. 522.)—*Note to the ninth, twelfth, thirteenth, and fourteenth editions.* W.

† Attempts have been made, in France, on a large scale, to propagate leeches for sale. This is done by means of natural meadows, in which numerous small ponds are made, where the leeches, with certain cautions as to nourishment and preservation, multiply and grow so rapidly as to become a source of profit. In order that they may propagate, it is necessary that they should be fed on blood, which is given them either by causing animals, as horses, cows, &c., to be driven into the meadows, or by obtaining blood from slaughter-houses, and, after depriving it of fibrin by agitation, immersing the animals for a time in it while yet warm. For very interesting particulars in relation to this kind of culture, the reader is referred to papers in the *Journ. de Pharm.* (Jan. 1854, p. 5, and Mai, 1854, p. 336). Much money is made in France by means of these artificial leech meadows, and in the *Pharm. Journ. and Trans.* (Dec. 1870, p. 522), we are told by Mr. P. L. Simmonds, in a paper on "the trade in leeches," that a poor farmer, named Bichade, in the neighborhood of Bordeaux, rose to be a millionaire by converting poor marshes, for which he could scarcely pay a rent of 300 francs, into magnificent meadows for leeches, which are let for 25,000 francs a year. (*Note to the eleventh and fourteenth editions.*) W.

in Philadelphia are generally brought from Bucks and Berks counties, in Pennsylvania, and occasionally from other parts of the State.

The proper preservation of leeches is an object of importance to the practitioner, as they are liable to a great and sudden mortality. They are usually kept in jars, in clear, soft water, which should be changed twice a week in winter, and every other day in summer. The jar must be covered with a linen cloth, and placed in a situation not liable to sudden changes of temperature. They will live a long time and continue active and healthy, without any other attention than that of frequently changing the water in which they are kept. M. Derheims has proposed the following excellent method of preserving them. In the bottom of a large basin or trough of marble he places a bed, six or seven inches deep, of a mixture of moss, turf, and fragments of wood. He strews pebbles above, so as to retain them in their place without compressing them too much, or preventing the water from freely penetrating them. At one end of the trough, and about midway of its height, is placed a thin slab of marble or earthenware, pierced with numerous holes, and covered with a bed of moss, which is compressed by a thick layer of pebbles. The reservoir being thus disposed is half filled with water, so that the moss and pebbles on the shelf shall be kept constantly moist. The basin is protected from the light by a linen cover stretched over it. By this arrangement the natural habits of the leech are not counteracted. One of these habits, essential to its health, is that of drawing itself through the moss and roots to clear its body from the slimy coat which forms on its skin and is a principal cause of its disease and death. Mr. James Banes recommends that, when kept in jars, they should be cleansed by means of a whisk of very fine broom or willow, when the water is changed. M. Lahache, an apothecary at Bruyères, strongly recommends the carrageen or Irish moss (*Chondrus crispus*), as admirably adapted to the habits and wants of the leech, furnishing the animal, as he supposes, with nutriment, as it does not die of inanition when thus kept. The water should be renewed in the jars daily. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 128.)*

Medical Uses. Leeches afford the least painful, and in many instances the most effectual means for the local abstraction of blood. They are often applicable to parts which, either from their situation or their great tenderness when inflamed, do not admit of the use of cups; and, in the cases of infants, are under all circumstances preferable to that instrument. They are indeed a powerful therapeutic agent, and

* M. Soubeiran considers it important that the leeches should be kept in running water, and has figured an apparatus for this purpose in the second edition of his Treatise on Pharmacy. The addition of a solution of chlorine to the water, in the proportion of one or two drops to the pint, or of a little muriatic or sulphuric acid to neutralize the ammonia which forms, has sometimes been found a preservative against disease. (*Journ. de Pharm.*, 3e sér., x. 186.) M. Domine has found the following plan for preserving leeches most successful. He selects the greenest moss he can find, washes it perfectly clean, and puts alternately it and the leeches, also well washed, into a glass vessel of convenient size, taking care to fill the vessel completely with the loosened moss, and then to cover it with a piece of linen. In winter, it is sufficient merely to introduce the leeches and moss moistened; but, as soon as warm weather approaches, a little water should be put at the bottom of the vessel. It is not necessary to change often in winter; but in summer the moss should be renewed nearly every other day, and the vessel should be kept in the cellar. (*Ibid.*, xvi. 110.) —*Note to the ninth edition.* W.

Mr. Alfred Allchin has had great success in the preservation of leeches by the use of *aquaria*, in which the natural conditions necessary for the health of the animal are supplied, by introducing a living and growing water plant, to afford oxygen and consume carbonic acid, and water snails to consume the decaying vegetable matter, the confervæ which grow on the sides of the vessel, and the slimy matter given off by the leeches themselves. For full particulars in relation to the structure and management of these aquaria, the reader is referred to the *Am. Journ. of Pharm.* (xxviii. 222), and the *Pharm. Journ.* (xv. 453), in the latter of which journals the account was originally published. (*Note to the eleventh edition.*) W.

An interesting account of the culture of both the Spanish and American leech (the latter H. decora) has been published in the "*Proceedings of the American Pharmaceutical Association*" *for the year* 1857, by Mr. Frederick Stearns, of which the following is an epitome. A wooden tank, eight feet in length by six in breadth and four in depth, is placed in the ground, near a running stream, so that a portion of the water passes through it, the orifices through which it enters and escapes being covered with wire-gauze to prevent the exit of the animal. A layer of cobble stones eighteen inches thick is placed in the bottom of the tank. The outlet is about ten inches below the top of the tank, and from the edge at top, all round, a ledge of boards is made to project inward. A few frogs are thrown in once a week for food. In winter the animal is torpid, and the tank is allowed to remain frozen over till spring. The eggs are produced in June and July; the leech is mature in about two years, and will live fifteen. (*Note to the twelfth edition.*) W.

give to the physician, in many instances, a control over disease which he could obtain in no other way. Their use is in great measure restricted to the treatment of local inflammation; and, as a general rule, they should not be resorted to until the force of the circulation has been diminished by bleeding from the arm, or in the natural progress of the complaint.

In applying leeches to the skin, care should be taken to shave off the hair, if there be any, and to have the part well cleansed with soap and water, and afterwards with pure water. If the leech do not bite readily, the skin should be moistened with a little blood, or milk and water. It is said to bite more freely if the skin is previously reddened by a sinapism, and then washed perfectly clean. Sometimes the leech is put into a large quill open at both ends, and applied with the head to the skin until it fastens itself, when the quill is withdrawn. If it be desirable that the leech shall bite in a particular spot, this end may be attained by cutting a small hole in a piece of blotting-paper, and then applying this moistened to the skin, so that the hole shall be immediately over the spot from which the blood is to be taken. Leeches continue to draw blood until they are gorged, when they drop off.* The quantity of blood which they draw varies with the part to which they are applied, and the degree of inflammation existing in it. From the loose and vascular textures they will abstract more than from those which are firm and compact, and more from an inflamed than a healthy part. As a general rule, our leechers apply six for every fluidounce of blood. A single European leech will draw from half an ounce to an ounce. The quantity may often be much increased by bathing the wound with warm water. Leeches will continue to suck after their tails are cut off, which is sometimes done, although it is a barbarous practice.† It is said that they will draw better if put into cold beer, or diluted wine, and allowed to remain until they become very lively. They may be separated from the skin at any time by sprinkling a little salt upon them. After they drop off, the same application will make them disgorge the blood they have swallowed. Some leechers draw the leeches from the tail to the head through their fingers, and thus squeeze out the blood, after which all that is necessary is to put them in clean water, and change it frequently.‡ Leeches which are

* As a very efficient mode of applying leeches, it is recommended, after having moistened the skin with pure warm water, to put the leeches into a tumbler half full of cold water, and by an adroit movement invert it upon the part. The leeches are said to attach themselves so rapidly that it seems to the patient as though they made but a single bite. When they are all attached, the glass is to be carefully removed, the water being absorbed, as it runs off on one side, by a sponge or linen cloths.

Another method of increasing the efficiency of leeches, recommended by Dr. C. R. Sloan, of Ayr, Scotland, is to cover them with a cupping-glass, and, by means of an air-pump, moderately exhaust the air over them. An extraordinary increase in their activity is immediately observable. (*Ed. Monthly Journ. of Med. Sci.*, Aug. 1852, p. 126.) W.

† Under the name of *bdellatomy*, a practice has been introduced into Germany, of making a small incision in the side of the leech while drawing. The blood escapes through the wound, and the animal will continue to suck for a long time, so that one will perform the office of many in the quantity of blood taken. It is asserted that the operation causes little or no pain, but is in fact a source of gratification by prolonging the pleasure of taking food. Some years since, the author received a communication on the subject from the originator of the process; but he regrets that it has been mislaid, and he cannot give the name, as he would desire. (*Note to the thirteenth edition.*) W.

‡ MM. Soubeiran and Bouchardat, after numerous experiments upon the different modes of fitting the gorged leeches for use again, came to the conclusion that a carefully managed pressure is the best. Two conditions, however, are necessary to success; one that they should be disposed to disgorge the blood, and the other that they should be immersed in warm water previously to the stripping. The first object is effected by common salt. The following plan is recommended. The leeches are to be thrown into a solution of 16 parts of common salt in 100 of water, from which they are to be taken out one by one, and, being held by the tail, are to be dipped into water which feels hot to the hand, but yet can be borne by it, and then passed lightly between the fingers. Thus treated, they easily give up the blood. After being stripped, they should be placed in vessels containing fresh water, which should be renewed once a day. At the end of eight or ten days, they are fit for reapplication. (*Journ. de Pharm.*, 3 sér., xi. 343 and 350.) It is said that, in the French military hospitals, a mixture of vinegar and water, consisting of one part of the former to eight of the latter, is preferred to salt water for promoting disgorgement. (*Lond. Med. Times and Gaz.*, Oct. 1856, p. 375.)

It has been stated that, if the leeches, after being stripped, be put into water sweetened with a little white sugar, and the solution be renewed several times, at intervals of six or twelve hours, they will speedily recover their activity, and may be reapplied two or three times in the course of a few days. Immersion in camphor-water, for a few moments, is said by Mr. Boyce to cause them

gorged with blood should be kept in a vessel by themselves; as they are more subject to disease, and often occasion a great mortality among the others. They should not be again used until they have recovered their activity. In cases where the bleeding from leech-bites continues longer than is desirable, it may be stopped by continued pressure, with the application of lint, by the use of collodium, or by touching the wounds with lunar caustic.* It may sometimes be necessary, in the case of a deep bite, to sew the wound, which is readily done with a single stitch of the needle, that need not penetrate deeper than the cutis.† D. B. S.

HORDEUM. *U. S.*

Barley. Pearl Barley.

The decorticated seed of Hordeum distichon. *U. S.*

Off. Syn. HORDEUM DECORTICATUM. *Pearl Barley.* The husked seeds of Hordeum distichon. *Br.*

Orge, *Fr.*; Gerstengraupen, *Germ.*; Orzo, *Ital.*; Cebada, *Span.*

HORDEUM. *Sex. Syst.* Triandria Digynia.—*Nat. Ord.* Graminaceæ.

Gen. Ch. Calyx lateral, two-valved, one-flowered, three-fold. *Willd.*

Several species of Hordeum are cultivated in different parts of the world. The most common are *H. vulgare* and *H. distichon*, both of which have been introduced into the United States.

1. *Hordeum vulgare.* Willd. *Sp. Plant.* i. 472; Loudon's *Encyc. of Plants*, p. 73. The culm or stalk of common barley is from two to four feet in height, fistular, and

to vomit the blood. They should afterwards be put into clean water, to be changed in half an hour. Dr. Frodsham, of England, has found camphor-water preferable either to salt water or diluted vinegar, for disposing the gorged leech to part with blood.

M. Grannat, a French military pharmaceutist, has found the natural process of disgorging preferable to all others. He placed some gorged leeches in wooden tubs, containing at bottom a little clay and water, and renewed the water every forty-eight hours. After eight days, the leeches, now in good health, were transferred to a pond prepared for the purpose, where they propagated. He put 1000 leeches in the pond, and at the end of a year had taken out 850 fit for service, without interfering with the reproduction. (*Journ. de Pharm.*, 3e sér., xx. 186.)

M. Vayson's plan of preserving leeches has been highly recommended. It consists simply in putting them, after stripping, if they have been used, in an earthenware vessel of the shape of an inverted truncated cone, with holes in the bottom so small as to prevent the escape of the leech, and filled with turfy earth. After the introduction of the leech the opening is to be closed with a coarse cloth. The vessel is then placed in a tub containing water four inches deep. If to be sent to a distance, the earth in the vessel should be moistened throughout. W.

* A little cotton, impregnated with a saturated solution of alum in boiling-hot water, and after it has become sufficiently cool, but before the alum has begun to crystallize, pressed upon the wound, will often prove effectual. Another mode of repressing the hemorrhage is to press upon the bite a piece of thin caoutchouc, previously softened upon one side by heat, so as to become adhesive. If lunar caustic be applied, the stick must first be brought to a fine point, which is to be inserted in the wound. Some have even recommended the use of a fine wire made red hot. When the part wounded is without a bony basis, pressure may be made by pinching the wound between the fingers. W.

† An instrument has been invented called the *mechanical leech*, by which the attempt has been made to imitate the action of the leech in drawing blood. It consists essentially of two parts, one for making the puncture, and the other for abstracting blood through the agency of atmospheric pressure. In other words, it is a minute cupping instrument. Practically, however, it has not been found so convenient as to supersede the use of the living leech. For an account of the instrument, see the *Am. Journ. of the Med. Sciences* (xvi. 207). W.

Danger from Leeches. Young leeches are sometimes swallowed by men and animals while drinking from streams or ponds inhabited by them. If swallowed they probably perish in the stomach; but occasionally they attach themselves in the passages, in man most frequently to the fauces or pharynx, but in the lower animals also to the gums, cheeks, soft palate, and even the nasal passages. The animal has been known to attach itself within the larynx, with the most alarming effects. It grows in its new quarters, living on the blood which it draws, much of which also escapes from the punctures, causing spitting of blood, which probably first calls attention to the case. There are also various morbid sensations, such as arise from the presence of a foreign body in the throat, and symptoms of impending suffocation when the animal is near the glottis. Death has occurred from this cause. Generally there is little danger, and anemic symptoms are the most serious of those existing. The animal can generally be seen when in the fauces, and may be removed by seizing it with an instrument. If it cannot be seized, or if invisible, as in the nares, it should be attacked by solution of salt or vinegar, which will cause it to give up its hold. Emetics have been recommended, and in one instance laryngotomy was performed. (See *Archives Gén.*, Août, 1863, p. 161.)—*Note to the twelfth edition.* W.

furnished with alternate, sheathing, lanceolate, roughish, and pointed leaves. The flowers are all perfect, and arranged in a close terminal spike, the axis of which is dentate, and on each tooth supports three sessile flowers. The calyx or outer chaff has two valves. The corolla or inner chaff is also composed of two valves, of which the interior is larger than the other, and terminates in a long, rough, serrated awn or beard. The seeds are arranged in four rows.

2. *H. distichon.* Willd. *Sp. Plant.* i. 473; Loudon's *Encyc. of Plants*, p. 73. This species is distinguished by its flat spike or ear, which on each flat side has a double row of imperfect or male florets without beards, and on each edge, a single row of bearded perfect or hermaphrodite florets. The seeds, therefore, are in two rows, as indicated by the specific name of the plant.

The original country of the cultivated barley is unknown. The plant has been found growing wild in Sicily, and various parts of the interior of Asia. *H. vulgare* is said by Pursh to grow in some parts of the United States, apparently in a wild state. The seeds are used in various forms.

1. In their natural state they are oval, oblong, pointed at one end, obtuse at the other, marked with a longitudinal furrow, of a yellowish colour externally, white within, having a faint odour when in mass, and a mild sweetish taste. They contain, according to Proust, in 100 parts, 32 of starch, 3 of gluten, 5 of sugar, 4 of gum, 1 of yellow resin, and 55 of *hordein*, a principle closely analogous to lignin. Berzelius suggests that hordein may be an intimate mixture of vegetable fibre with gluten and starch, which are very difficultly separable as they exist in this grain. Einhoff found in 100 parts 67·18 of starch, 5·21 of uncrystallizable sugar, 4·62 of gum, 3·52 of gluten, 1·15 of albumen, 0·24 of phosphate of calcium, and 7·29 of vegetable fibre; the remainder being water and loss.

2. *Malt* consists of the seeds made to germinate by warmth and moisture, and then baked so as to deprive them of vitality. By this process the sugar, starch, and gum are increased at the expense of the *hordein*, as shown by the analysis of Proust, who found in 100 parts of malt, 56 of starch, 1 of gluten, 15 of sugar, 15 of gum, 1 of yellow resin, and only 12 of *hordein*. Berzelius attributes the diminution of the hordein to the separation, during germination, of the gluten or starch from the fibrous matter with which he supposes them to be associated in that substance. It is in the form of malt that barley is so largely consumed in the manufacture of malt liquors.

An interesting substance, called *diastase*, was discovered by MM. Payen and Persoz in the seeds of barley, oats, and wheat, and in the potato. It is found, however, only after germination, in which process the production of it appears to be the first step. Germinated barley seldom contains it in larger proportion than two parts in a thousand. It is obtained by bruising freshly germinated barley, adding about half its weight of water, expressing strongly, treating the viscid liquid thus obtained with sufficient alcohol to destroy its viscidity, then separating the coagulated albumen, and adding a fresh portion of alcohol, which precipitates the diastase in an impure state. To render it pure, it must be redissolved as often as three times in water, and precipitated by alcohol.* It is solid, white, tasteless, soluble in water and weak alcohol, but insoluble in the latter fluid when concentrated. Though without action upon gum and sugar, it has the extraordinary property, when mixed, in the proportion of only one part to 2000, with starch suspended in water, and maintained at a temperature of about 160°, of converting that principle into dextrin and sugar of grapes.† The whole of the starch undergoes this change, except the teguments of the granules, amounting to about 4 parts in 1000. The change which barley undergoes during germination, and in malting, is of a similar character. The name of *maltine* has been given to the diastase of malt; and this principle has been found identical in its action with the diastase of the saliva on the same alimentary substances. Indeed, according to M. Contara,

* For an account of the mode of preparing diastase from malt, recommended by M. Perrot, see the *Journal de Pharmacie*, Juillet, 1874, p. 43. (*Note to the fourteenth edition.*)

† It is asserted by Mr. O. Sullivan, as the result of his investigation, that the saccharine principle obtained by the action of malt is not glucose $C_6H_{12}O_6$, but a substance essentially different in composition, having the formula $C_{12}H_{22}O_{11}$, which he calls saccharose; and Mr. Ernst Schulze has obtained the same results in his experiments, but given the more appropriate name of *maltose* to the saccharine principle developed. (*Journ. de Pharm.*, Nov. 1874, p. 411.)

the two forms of diastase, vegetable and animal, appear to be identical, not only in the action referred to, but in their chemical and physical properties; and consequently there is but one diastase, whether vegetable or animal. (*Arch. Gén.*, Avril, 1870, p. 501.)

3. *Hulled barley* is merely the grain deprived of its husk, which, according to Einhoff, amounts to 18·75 parts in the hundred.*

4. *Barley meal* is formed by grinding the seeds, previously deprived of their husk. It has a grayish-white colour, and contains, according to Fourcroy and Vauquelin, an oleaginous substance, sugar, starch, azotized matter, acetic acid, phosphates of calcium and magnesium, silica, and iron. It may be made into a coarse, heavy, hard bread, which in some countries is much used for food.

5. *Pearl barley* (*hordeum perlatum*) is the seed deprived of all its investments, and afterwards rounded and polished in a mill. It is in small round or oval grains, having the remains of the longitudinal furrow of the seeds, and of a pearly whiteness. It is wholly destitute of hordein, and abounds in starch, with some gluten, sugar, and gum. This is the proper officinal form of barley, and is kept in the shops almost to the exclusion of the others.

Medical Properties. Barley is one of the mildest and least irritating of farinaceous substances; and, though not medically used in its solid state, forms, by decoction with water, a drink admirably adapted to febrile and inflammatory complaints, and much employed from the time of Hippocrates to the present. Pearl barley is the form usually preferred for the preparation of the decoction, though the hulled grain is sometimes used, and malt affords a liquor more demulcent and nutritious. (See *Decoctum Hordei.*) The decoction of malt may be prepared by boiling from two to four ounces in a quart of water and straining. When hops are added, the decoction takes the name of wort, and acquires tonic properties, which render it useful in debility, especially when attended with suppuration.

Diastase or maltine has been given with extraordinary success in certain cases of dyspepsia, in which it acts by favouring the digestion of farinaceous substances. The dose may be two or three grains before each meal, and may sometimes be usefully combined with pepsin. (*New York Med. Journ.*, Oct. 1871, p. 422.)

Off. Prep. Decoctum Hordei. W.

HUMULUS. *U.S.*

Hops.

The strobiles of Humulus Lupulus. *U.S.*

Off. Syn. LUPULUS. *Hop.* The dried strobiles of the female plant of Humulus Lupulus. *Br.*

Houblon, *Fr.;* Hopfen, *Germ.;* Luppolo, *Ital.;* Lupolo Hombrecillo, *Span.*

HUMULUS. *Sex. Syst.* Dioecia Pentandria.—*Nat. Ord.* Urticaceæ.

Gen. Ch. MALE. *Calyx* five-leaved. *Corolla* none. FEMALE. *Calyx* one-leafed, obliquely spreading, entire. *Corolla* none. *Styles* two. *Seed* one, within a leafy calyx. *Willd.*

Humulus Lupulus. Willd. *Sp. Plant.* iv. 769; Bigelow, *Am. Med. Bot.* iii. 163. The root of the hop is perennial, and sends up numerous annual, angular, rough, flexible stems, which twine around neighbouring objects in a spiral direction, from left to right, and climb to a great height. The leaves are opposite, and stand upon long footstalks. The smaller are sometimes cordate; the larger have three or five lobes; all are serrate, of a deep-green colour on the upper surface, and, together with the petioles, extremely rough, with minute prickles. At the base of the footstalks

* M. Lemoine, a French pharmaceutist, proposes a chemical method of decorticating barley and other seeds. Putting 100 parts of the seeds into a wooden vessel, he pours upon them 15 parts of sulphuric acid, stirs the mixture for 15 or 20 minutes, applying in the case of barley a gentle heat, then adds 50 parts of water, which he decants after a very few moments of constant agitation. After sufficient washing, and the neutralization of the last remains of acid by solution of carbonate of sodium or potassium, he puts the grain upon a piece of cloth with large meshes stretched upon a frame, where he allows it to drain for about an hour, then transfers it to a similar cloth, and exposes it to a current of air for several days to dry. (*Journ. de Pharm.*, Mars, 1863, p. 223.)—*Note to the twelfth edition.*

are two or four smooth, ovate, reflexed stipules. The flowers are numerous, axillary, and furnished with bractes. The male flowers are yellowish-white, and arranged in panicles; the female, which grow on a separate plant, are pale-green, and disposed in solitary, peduncled aments, composed of membranous scales, ovate, acute, and tubular at the base. Each scale bears near its base, on its inner surface, two flowers, consisting of a roundish compressed germ, and two styles, with long filiform stigmas. The aments are converted into ovate membranous cones or strobiles, the scales of which contain, each, at its base, two small seeds, surrounded by a yellow, granular powder.

The hop is a native of North America and Europe. It is occasionally found growing wild in the Eastern States, and, according to Mr. Nuttall, is abundant on the banks of the Mississippi and Missouri. In parts of New England, New York, and Michigan, it is extensively cultivated, and most of the hops consumed in the United States are supplied by those districts. The part of the plant used is the fruit or strobiles. These when fully ripe are picked, dried by artificial heat, packed in bales, and sent into the market under the name of hops. The total produce in the United States in 1850 is said to have been somewhat over three millions of pounds, which had increased in 1860 to nearly eleven millions; and in 1861 about eight millions. (Emmet Kannal, *on the culture of hops in the United States.* (*Am. Journ. of Pharm.*, June, 1871, p. 253.)

Hops consist of numerous thin, translucent, veined, leaf-like scales, which are of a pale greenish-yellow colour, and contain near the base two small, round, black seeds. Though brittle when quite dry, they are pulverized with great difficulty. Their odour is strong, peculiar, somewhat narcotic, and fragrant; their taste very bitter, aromatic, and slightly astringent. Their aroma, bitterness, and astringency are imparted to water by decoction; but the first-mentioned property is dissipated by long boiling. The most active part of hops is a substance formed on the surface of the scales, and, in the dried fruit, existing in the state of very small granules. This substance was called *lupulin* by the late Dr. A. W. Ives, of New York, by whom its properties were first investigated and made generally known; though it was previously noticed by Sir J. E. Smith, of England, and M. Planche, of France. The scales themselves, however, are not destitute of virtues, and contain, as shown by MM. Payen and Chevallier, the same active principles as the lupulin, though in less proportion.*

Lupulina. *U. S. Lupulin.* This is obtained separate by rubbing or threshing and sifting the strobiles, of which it constitutes from one-sixth to one-tenth by weight. It is in the state of a yellowish powder, mixed with minute particles of the scales, from which it cannot be entirely freed when procured by a mechanical

* Hops are often subjected in Germany to the fumes of burning sulphur, from the supposition that they keep better when thus treated. Besides, by being partially bleached by the process, old hops, which have suffered from time, having become darker, generally spotted, and weaker, assume a brighter appearance, as if fresher, and generally command a better price in the market. To detect the consequent presence of sulphurous acid, the brewers put a silver spoon in a mixture of hops and water, under the impression that it will produce a black stain upon the silver. But this test will answer only when applied within a fortnight after the use of the sulphur. A more delicate method is that of Dr. Heidenreich, who puts 20 or 30 cones of the hops in a flask with zinc and muriatic acid, and passes the hydrogen evolved through solution of acetate of lead. If sulphurous acid be present, sulphuretted hydrogen will be produced, which will occasion a dark precipitate with the solution. But even this plan often fails when the hops have been kept more than three or four weeks. A modification of this test has been proposed by Dr. R. Wagner. For the solution of acetate of lead used in Heidenreich's method, there is to be substituted a solution of nitroprusside of sodium, so weak as to have a very light-brown colour, to which have been added a few drops of solution of potassa. If the gas evolved contain the minutest proportion of sulphur, a violet colour will be produced when the first bubble passes into the solution; and this will by a continuance of the process become a magnificent purple. The least trace of sulphurous acid may thus be found; but, a few months after the sulphuring of hops, none at all can be detected. (*Chem. Gaz.*, April 1, 1856; from *Comptes Rendus.*)

Hops are said to be sometimes threshed in order to separate the lupulin, which is sold separately. Their efficiency is thus, no doubt, greatly impaired. Hops thus treated have the scales more or less broken; and any parcel presenting this appearance may be suspected. Hops often contain a variable quantity of lupulin, in consequence of the granules of this substance separating, especially on agitation, and seeking the lower portion of the mass, which thus becomes richer, while the upper is poorer. They should always be examined in reference to the lupulin they contain, and, if nearly or quite destitute of it, should be deemed of inferior value, though not worthless. (*Note to the eleventh and twelfth editions.*)

process. It has the peculiar flavour of hops, and appeared to MM. Lebaillif and Raspail, when examined by the microscope, to consist of globules filled with a yellow matter, resembling in this respect the pollen of vegetables; but, from the investigations of M. Personne, it would seem to be of the nature of a gland, commencing in a cell formed among those of the epidermis, and, when fully developed, secreting a resinous matter. (*Journ. de Pharm.*, 3e sér., xxvi. 242.) It is inflammable, and when moderately heated becomes somewhat adhesive. MM. Chevallier and Payen obtained from 200 parts, 105 of resin and 25 of a peculiar bitter principle, beside volatile oil, gum, traces of fixed oil, a small quantity of an azotized substance, and various salts. Dr. Ives found in 120 grains, 5 of tannin, 10 of extractive, 11 of bitter principle, 12 of wax, 36 of resin, and 46 of lignin. M. Personne found in the liquid distilled from it not only volatile oil, but also *valerianic acid.* (*Ibid.*, p. 333.) The virtues of the powder probably reside in the volatile oil and bitter principle, and are readily imparted to alcohol. By boiling in water the bitterness is extracted, but the aroma is partially driven off. The *volatile oil*, which may be obtained by distillation with water, is yellowish, of the odour of hops, of an acrid taste, and lighter than water. It was formerly supposed to be narcotic, but this is denied by Dr. Wagner, who gave twenty drops of it to a rabbit, with no observable effect. (*Chem. Gaz.*, July 15, 1853.) It is said to consist of a carbohydrogen isomeric with pure oil of turpentine, and of an oxygenated oil.

The bitter principle which has been named *lupulite* or *lupuline*, but ought to be called *humulin*, may be procured by treating with alcohol the aqueous extract of lupulin, previously mixed with a little lime, evaporating the tincture thus formed, treating the resulting extract with water, evaporating the solution, and washing the residue with ether. When pure it is yellowish or orange-yellow, inodorous at common temperatures, but of the smell of hops when heated, of the peculiar bitter taste of hops, partially soluble in water which takes up 5 per cent. of its weight, readily soluble in alcohol, almost insoluble in ether, neither acid nor alkaline in its reaction, and destitute of nitrogen. It is scarcely affected by the weak acids or alkaline solutions, or by the metallic salts. It is probably the tonic principle of the medicine.*

Hops, according to Wagner, contain from 3 to 7 per cent. of tannic acid, of the variety which precipitates the salts of iron greenish, and differing, moreover, from the tannic acid of galls in not being convertible into gallic acid, and in not having the characteristic property of the glucosides. Besides the tannin, Wagner has discovered in hops a yellow substance which appeared to him to be quercitrin. (*Pharm. Journ.*, Dec. 1859, p. 459.) In 1863 Lermer suggested the existence of a peculiar alkaloid in hops; but it is only of late that this seems to be determined by experiments of Griessmayer. A concentrated decoction of hops was distilled with potassa or magnesia, the distillate neutralized with muriatic acid, evaporated to dryness, and treated with cold absolute alcohol to remove sal ammoniac; the alcoholic liquid was heated to boiling and cooled, when much muriate of trimethylamina crystallized. The residuary liquid was filtered, the filtrate evaporated, first by a water-bath and then spontaneously, the residue was redissolved in water in a narrow cylinder, agitated with potassa and ether, and the ethereal liquid allowed to evaporate spontaneously. The remaining alkaline liquid had a peculiar odour recalling that of conia, and a cooling but not bitter taste. It soon exhibited small crystals, and finally solidified completely. The author supposed that these crystals were impurities, and that the pure alkaloid is liquid or gaseous. He proposes for it the name of lupulina. (*Am. Journ. of Pharm.*, Aug. 1874, p. 360.)

Medical Properties and Uses. Hops are tonic and moderately narcotic, and have been highly recommended in diseases of general or local debility, associated with mor-

* It is extremely doubtful whether the lupulite thus obtained is the active principle in a pure state. Dr. J. C. Lermer has recently obtained from hops a crystalline bitter principle, which he believes to have acid properties, and the composition of which is represented by the formula $C_{32}H_{25}O_7$. He obtained it by a very complex process; and it is, perhaps, somewhat doubtful whether it may not be a product of the operation rather than an educt: especially as he has found two other crystalline bitter principles, which he was still investigating. (See *Am. Journ. of Pharm.*, Nov. 1863, p. 540.)—*Note to the twelfth edition.*

bid vigilance, or other nervous derangement. They have some tendency to produce sleep and relieve pain, and may be used for these purposes in cases where opiates, from their disposition to constipate, or other causes, are inadmissible. Diuretic properties have also been ascribed to them, but are by no means very obvious. The complaints in which they have been found most useful are dyspepsia, and the nervous tremors, wakefulness, and delirium of drunkards. Dr. Maton found the extract advantageous in allaying the pain of articular rheumatism. Dr. W. Y. Godberry, of Benton, Miss., has found hops efficacious in intermittents, and considers them inferior in antiperiodic powers only to quinia. (*West. Journ. of Med. and Surg.*, March, 1853.)

The medicine may be given in substance, infusion, tincture, or extract. From three to twenty grains are mentioned as the dose of the powder; but the quantity is too small to produce any decided effect; and this mode of administration is scarcely ever resorted to. An infusion, prepared with half an ounce of hops and a pint of boiling water, may be given in the dose of two fluidounces three or four times a day. In intermittents Dr. Godberry gives, in the apyrexia, a pint of the infusion made with an ounce of hops. The extract and tincture are officinal. (See *Extractum Lupuli* and *Tinctura Humuli.*) A pillow of hops has proved useful in allaying restlessness and producing sleep in nervous disorders. They should be moistened with spirit previously to being placed under the head of the patient, in order to prevent rustling. Fomentations with hops, and cataplasms made by mixing them with some emollient substance, are often beneficial in local pains and tumefactions. An ointment of the powder with lard is recommended by Mr. Freake as an anodyne application to cancerous sores.

The effects of hops may be obtained most conveniently by the use of *lupulin*, though Dr. Fronmüller, having after two trials with it obtained no soporific effect, denies it a place among the narcotics with hypnotic properties. (*B. and F. Medico-chirurg. Rev.*, April, 1867, pp. 526–7.) Dr. Wm. Byrd Page, of Philadelphia, has found this substance very effectual as an antaphrodisiac, in the treatment of gonorrhœa, spermatorrhœa, and other irritated conditions of the genito-urinary apparatus; and the same result has been obtained by other practitioners. We have found it apparently effectual in irritable bladder, when other narcotics had failed. The dose of lupulin in substance is from six to twelve grains, given in the form of pills, which may be made by simply rubbing the powder in a warm mortar till it acquires the consistence of a ductile mass, and then moulding it into the proper shape. There is an officinal tincture. (See *Tinctura Lupulinæ.*) Mr. Livermore proposes an alcoholic extract of lupulin, prepared by exhausting commercial lupulin with alcohol by the process of percolation, and exposing the tincture thus formed to spontaneous evaporation. The dose will be about one-third less than that of lupulin itself. (*Am. Journ. of Pharm.*, xxv. 294.)* A fluid extract and oleoresin have been introduced into the U. S. Pharmacopœia. (See *Part II.*) Lupulin may be incorporated with poultices, or formed into an ointment with lard, and used externally for the same purposes as hops.

Off. Prep. of Hops. Extractum Lupuli, *Br.;* Infusum Humuli, *U. S.;* Infusum Lupuli, *Br.;* Tinctura Humuli, *U. S.;* Tinctura Lupuli, *Br.*

Off. Prep. of Lupulin. Extractum Lupulinæ Fluidum, *U. S.;* Oleoresina Lupulinæ, *U. S.;* Tinctura Lupulinæ. W.

* Dr. Dyce Duckworth, of St. Bartholomew's Hospital, London, recommends, as the result of his own observation, the aromatic spirit of ammonia as a better solvent of lupulin than any other yet proposed. He offers the following formula; "Take of lupulin ℥ij, the aromatic spirit Oj. Macerate for seven days, with occasional agitation, then filter, and add sufficient of the menstruum to make up a pint. The dose is from ♏xx to f℥j. I propose to call it *Tinctura Lupulinæ Ammoniata.* (*Am. Journ. of Pharm.*, Sept. 1869, pp. 415–416; from *Pharm. Journ. and Trans.*, Oct. 1868.)—*Note to the fourteenth edition.*

HYDRARGYRUM. *U.S., Br.*

Mercury.

"A silver white metal, liquid at common temperatures, and having the sp. gr. 13·5." *U.S.*

Quicksilver; Mercurius, *Lat.;* Mercure, Vif argent, *Fr.;* Quecksilber, *Germ.;* Mercurio, *Ital.;* Azógue, *Span.* and *Port.*

Mercury is found pure, forming an amalgam with silver, in the form of protochloride (native calomel), but most abundantly as the bisulphuret, or native cinnabar. Mines of this metal are found at Almaden in Spain, at Idria, in Carniola, in the Duchy of Deux-ponts, in Belluno a province of Venetia,* in Corsica, in the Philippine Islands and China, near Huancavelica in Peru, near Azogue in New Granada, at Durasco in Mexico, and at New Almaden, New Idria, and other localities in Santa Clara county, California, about sixty-six miles from San Francisco. The most ancient mine is that of Almaden in Spain, which was worked before the Christian era. This mine, and the mines in California, are the most productive at the present day; the Spanish mine yielding about three millions of pounds, and the California more than this amount annually. The ore in all the mines mentioned is cinnabar. The cinnabar from old Almaden is of a dull-red colour in mass, of a dull brick-red colour when in fine powder, and of the sp. gr. 3·6. That from New Almaden is of a bright-red colour, slightly inclining to purple, not so hard as the Spanish ore, of a brilliant vermilion colour in powder, and having the sp. gr. 4·4. The California cinnabar is richer in mercury, because purer, than the Spanish; the former yielding about 70, the latter about 38 per cent. of mercury, according to the analysis of Mr. Adam Bealey. The California mine had been long known to the Indians, but its commercial value was first made known about 1843, by a Mexican, named Castillero, who became its first owner. At present it is in the hands of Americans. (See *Pharm. Journ.*, Feb. 1855; also a paper by Dr. Ruschenberger, U. S. N., in the *Am. Journ. of Pharm.*, March, 1856.) Dr. Ruschenberger has detected selenium in California cinnabar. A quicksilver ore has recently been found in Macon county, Tennessee, where it is said to exist in vast quantities. According to Mr. E. S. Wayne, it is a talcose rock, and contains mercury in the metallic state, yielding 7·5 per cent. of the metal. (*Am. Journ. of Pharm.*, Jan. 1868, p. 76.) A new locality has also been found in the Island of Borneo, district of Sarawak, which promises to be one of the richest sources of the metal. (*Chem. News*, Nov. 5, 1869, p. 224.)

Extraction, &c. Mercury is obtained almost exclusively from the bisulphuret, or native cinnabar. It is extracted by two principal processes. According to one process, the mineral is picked, pounded, and mixed with lime. The mixture is then introduced into cast-iron retorts, which are placed in rows, one above the other, in an oblong furnace, and connected with earthenware receivers, one-third full of water. Heat being applied, the lime combines with the sulphur, so as to form sulphuret and sulphate of calcium; while the mercury distils over, and is condensed in the receivers. The other process is practised at Almaden in Spain. Here a square furnace is employed, the floor of which is pierced with many holes, for the passage of the flame from the fireplace beneath. In the upper and lateral part of the furnace, holes are made, communicating with several rows of *aludels*, formed of adapters passing into one another, which terminate in a small chamber that serves both as condenser and receiver. The mineral, having been picked by hand and pulverized, is kneaded with clay, and formed into small masses, which are placed on the floor of the furnace. Heat being applied, the sulphur undergoes combustion; while the mercury, being volatilized, passes through the aludels to be condensed in the chamber. The process pursued at New Almaden is described by Dr. Ruschenberger. (See *Am. Journ. of Pharm.*, March, 1856.)

Mercury, as found in commerce, is contained in cylindrical wrought-iron bottles, called flasks, each containing 75 pounds. Since the regular working of the California mine of New Almaden, the importation of the metal from Spain and Austria

* For an account of these Italian mines and the mode of working them, see a paper in the *Pharm. Journ. and Trans.*, March, 1873, p. 746.

has gradually diminished, and at present the domestic production is sufficient not only to supply the home consumption, but to give an excess for exportation. The value of American mercury exported was 94,335 dollars for the year ending June 30th, 1854, and 806,119 dollars, or more than eight-fold, for the next fiscal year. (*Treasury Report on the Finances*, Washington, 1856.) The different mines of California were, in the year 1862, said to be yielding mercury at the rate of four millions of pounds per annum. (*Am. Journ. of Pharm.*, Sept. 1862, p. 410.) The exports are made principally to China, Mexico, Chili, and Peru. The chief uses of the metal are in mining silver and gold, in preparing vermilion, in making thermometers and barometers, in silvering looking-glasses, and in forming various pharmaceutical compounds.

Properties. Mercury is a very brilliant liquid, of a silver-white colour, and without taste or smell. When perfectly pure it undergoes no alteration by the action of air or water, but in its ordinary state suffers a slight tarnish. When heated to near the boiling point, it gradually combines with oxygen, and is converted into deutoxide; but at the temperature of ebullition it parts with the oxygen which it had absorbed, and is reduced again to the metallic state. Its sp. gr. is 13·5, and its equivalent 200.* It boils at 662°, without residue, and congeals at 39° below zero, forming a malleable solid resembling lead. It is a good conductor of caloric, and its specific heat is small. It is not attacked by muriatic acid, nor by cold sulphuric acid; but boiling sulphuric acid or cold nitric acid dissolves it, generating a bisulphate or binitrate of the deutoxide; with the extrication, in the former case, of sulphurous acid; in the latter, of nitric oxide becoming hyponitric acid fumes. Its combinations are numerous, and several of them constitute important medicines. It forms two oxides, two regular sulphurets, two chlorides, three iodides, and one cyanide, all of which, excepting the protoxide, protosulphuret, and sesquiodide, are officinal. Both the oxides are capable of uniting with acids so as to form salts, of which the binitrate, sulphate, and bisulphate of the deutoxide are officinal, or enter into officinal compounds.

Mercury, as it occurs in commerce, is in general sufficiently pure for pharmaceutical purposes. Occasionally it contains foreign metals, as lead, tin, zinc, and bismuth. Mr. Brande informs us that, in examining large quantities of this metal in the London market, he found it only in one instance intentionally adulterated. When impure, the metal has a dull appearance, leaves a trace on white paper, is deficient in due fluidity and mobility, as shown by its not forming perfect globules, is not totally dissipated by heat, and, when shaken in a glass bottle, coats its sides with a pellicle, or, if very impure, deposits a black powder. If agitated with strong sulphuric acid, the adulterating metals become oxidized and dissolved, and thus the mercury may to a limited extent be purified. Lead is detected by shaking the suspected metal with equal parts of acetic acid and water, and then testing the acid by sulphate of sodium, or iodide of potassium. The former will produce a white, the latter a yellow precipitate, if lead be present. Bismuth is discovered by dropping a nitric solution of the mercury, prepared without heat, into distilled water, when subnitrate of bismuth will be precipitated. The complete solubility of the metal in nitric acid shows that tin is not present; and, if sulphuretted hydrogen does not act upon muriatic acid previously boiled upon the metal, the absence of contaminating metals is shown. When "a globule is made to roll over white paper, it occasions no trace." *U. S.*

Mercury may be purified by digesting it with a small portion of weak nitric acid, or with a solution of bichloride of mercury (corrosive sublimate); whereby all the ordinary contaminating metals will be removed. M. Ulex recommends its purification by triturating, for ten minutes, a pound of the metal with an ounce of the solution of sesquichloride of iron (sp. gr. 1·48), diluted with an equal measure of water.

* Some chemists adopt 100 as the equivalent of mercury, or half the number given in the text. There are many arguments in favour of the smaller number; but, as the pharmaceutical processes involving this metal are generally explained by the use of the larger number, we shall adhere to it for the present. The use of the smaller number makes a perplexing change in the nomenclature of the mercurial compounds. Thus, the black oxide becomes the dioxide, and the red oxide the protoxide, instead of deutoxide. Again, calomel becomes the dichloride, and corrosive sublimate the protochloride, instead of the bichloride. (*Note to the eleventh edition.*)

The mercury is thus divided to a very great extent, and the contaminating metals are separated as chlorides; the sesquichloride of iron being, in the mean time, reduced to protochloride. After decanting the iron solution, and washing with water, the mercury is dried by a gentle heat, and subjected to trituration, when the greater portion of it runs together. Mercury, however, is usually purified by distillation.

The British Pharmacopœia of 1864 gave the following process for the purification of mercury, using for this purpose an impure form of the metal, under the name of *Commercial Mercury* or *Quicksilver.*

"Take of Mercury of Commerce *three pounds* [*avoirdupois*]; Hydrochloric Acid *three fluid drachms;* Distilled Water a sufficiency. Place the Commercial Mercury in a glass retort or iron bottle, and applying heat cause two pounds and a half of the metal to distil over into a flask employed as a receiver. Boil on this for five minutes the Hydrochloric Acid diluted with nine fluid drachms of Distilled Water, and having, by repeated affusions of Distilled Water and decantations, removed every trace of acid, let the mercury be transferred to a porcelain capsule, and dried first by filtering paper, and finally on a water-bath." *Br.*

Mercury, being much more volatile than the contaminating metals, rises first in distillation, while they are left behind. But it is necessary to avoid pushing the distillation too far; for in that event, some of the foreign metals are apt to be carried over. The British Council, on account of this danger, directed only five-sixths of the mercury to be distilled. The distilled product is boiled for a few minutes with dilute muriatic acid, which, while it does not attack the mercury, dissolves any contaminating metals which may have passed over. The distillation is directed to be performed from a glass retort or iron bottle; but it is more conveniently conducted from the latter, over a common fire, into water contained in a receiver. In small operations a wash-hand basin will answer for a receiver. Millon has ascertained the curious fact, that the presence of so small a quantity as one ten-thousandth of lead or zinc in mercury raises its boiling point. M. Violette has made known a new method of distilling mercury, or amalgamated silver, which presents many advantages. It consists in subjecting the metal, in iron vessels, to a current of high pressure steam, which serves the double purpose of imparting the necessary heat, and carrying over the mercurial vapour by a mechanical agency. (*Philos. Mag.*, Dec. 1850; from *Comptes Rendus.*) As it is difficult and troublesome to purify mercury by distillation, it is better to purchase pure samples of the metal, which may always be found in the market.

Medical Properties. Mercury in its uncombined state is inert; but, in combination, acts as a peculiar and universal stimulant. When exhibited in minute division, as it exists in several preparations, it produces its peculiar effects; but this does not prove that the uncombined metal is active, but only that the condition of minute division is favourable to chemical combination, and consequently to its solution in the stomach. Its compounds exhibit certain general medical properties and effects which belong to the whole as a class; while each individual preparation is characterized by some peculiarity in its operation. In this place we shall consider the physiological action of mercury, and the principles by which its administration should be regulated; while its effects, as modified in its different combinations, will be noticed under the head of the several preparations.

Of the modus operandi of mercury we know nothing, except that it probably acts through the medium of the circulation, and that it possesses a peculiar alterative power over the vital functions, which enables it in many cases to subvert diseased actions. This alterative power is sometimes exerted, without being attended with any other vital phenomenon than the removal of disease; while at other times it is accompanied with certain obvious effects, indicative of the agency of a potent stimulus. In the latter case, its operation is marked by a quickened circulation, a frequent jerking pulse, and increased activity of all the secretory functions, particularly those of the salivary glands and the liver, by an exaltation of nervous sensibility, and, in short, by a general excitation of the organic actions of the system.

When mercury acts slowly as an alterative, there is not the least apparent disturbance of the circulation. When it operates decidedly and obviously, it is very prone to let the brunt of its action fall upon the salivary glands, causing, in many

instances, an immoderate flow of saliva, and constituting the condition denominated ptyalism or salivation. Under these circumstances, the effects of depletion and revulsion are added to the alterative action of the metal. In the saliva discharged, as a consequence of its action, mercury has been detected by chemical tests. Occasionally its depletory action is exhibited in an increased secretion of urine, or an immoderate flow of the bile; and one or both of these effects are apt to be experienced where ptyalism cannot be induced. Mercury has been found in the urine of those under the influence of corrosive sublimate, by M. Audouard.* It has, indeed, been detected in most of the solids and fluids of the body, including the blood. When in the blood it cannot be detected by the ordinary tests, on account of its intimate union with the organic matter of that liquid. To discover it, the blood must be subjected to destructive distillation. The liver is the organ which retains mercury the longest. It has been detected in that viscus, though absent in the lungs, heart, bile, and spinal marrow, in the body of a person who had long worked in mercury, but had desisted from the occupation for a year before death, on account of the occurrence of mercurial cachexy.

Mercury has been used in almost every disease, but too often empirically, and without the guidance of any recognised therapeutic principle. Nevertheless its efficacy in certain classes of diseases is universally acknowledged. In functional derangement of the digestive organs, mercurials in minute doses often exert a salutary operation, subverting the morbid action, and that too by their slow, alterative effect, without affecting the mouth. In these cases no decided disturbance of the vital functions takes place; but the alvine discharges, if clay-coloured, are generally restored to their natural hue, a certain proof that the remedy is stimulating the liver and promoting the secretion of bile. Indeed, there is no fact better established in medicine than that of the influence of the mercurial preparations over the hepatic system; and, whether the liver be torpid and obstructed as in jaundice, or pouring out a redundancy of morbid bile as in melæna, its judicious use seems equally efficacious in unloading the viscus, or restoring its secretion to a healthy state. In the acute and chronic hepatitis of India it is considered as almost a specific; but here its use must be carried to the extent of exciting ptyalism. In chronic inflammation of the mucous and serous membranes, the alterative effects of mercury are sometimes attended with much benefit. In many of these cases effusion has taken place; and, under these circumstances, the mercury often proves useful, as well by promoting absorption as by removing the chronic inflammation on which the effusion depends. Hence, it is often given with advantage in chronic forms of meningitis, bronchitis, pleuritis, pneumonia, dysentery, rheumatism, &c., and in hydrocephalus, hydrothorax, ascites, and general dropsy.

Mercury may also be advantageously resorted to in certain states of febrile disease. In some forms of remittent and typhoid fever, a particular stage is marked by a parched tongue, torpor of the bowels, scanty urine, and dryness of the surface. Here depletion by the lancet or leeches is generally inadmissible, and one of the measures most to be relied on is the very cautious employment of mercury. It acts in such cases by increasing the secretions and stimulating the exhalant capillaries, and, perhaps, by producing a new impression incompatible with the disease.

In syphilitic affections, mercury, until of late years, was held to be indispensable. Of its mode of action in these affections we know nothing, except that it operates by substituting its own peculiar impression for that of the disease. Without entering into the question of the necessity of mercury in venereal complaints, we are free to admit that the discussion which has grown out of it has shown that this remedy has frequently been unnecessarily resorted to in affections resembling syphilis, though of a different character; and that the disease in question ought to be treated less empirically, and more in accordance with the general principles of combatting morbid action. Mercury exerts a peculiar control over the deleterious effects of lead; and, hence, in colica pictonum, it is accounted by some writers to act almost as a specific.

For inducing the specific effects of mercury on the constitution, blue pill or calomel is generally resorted to. In order to procure what we have called the slow altera-

* For a method of detecting mercury in the urine, see *Pharm. Journ. and Trans.*, Aug. 1873, p. 145. (*Note to the fourteenth edition.*)

tive effects of the metal, from half a grain to a grain of blue pill may be given in the twenty-four hours, or from a sixth to a fourth of a grain of calomel; or, if a gentle ptyalism be our object, two or three grains of the former, or a grain of the latter, two or three times a day. Where the bowels are peculiarly irritable, it is often necessary to introduce the metal by means of friction with mercurial ointment; and where a speedy effect is desired, the internal and external use of the remedy may be simultaneously resorted to.

The first observable effects of mercury in inducing ptyalism are a coppery taste in the mouth, a slight soreness of the gums, and an unpleasant sensation in the sockets of the teeth, when the jaws are firmly closed. Shortly afterwards the gums begin to swell, a line of whitish matter is seen along their edges, and the breath is infected with a peculiar and very disagreeable smell, called the mercurial fetor. The saliva at the same time begins to flow; and, if the affection proceed, the gums, tongue, throat, and face become much swollen; ulcerations attack the lining membrane of the mouth and fauces; the jaws become excessively painful; the tongue is coated with a thick whitish fur; and the saliva flows in streams from the mouth. It occasionally happens that the affection of the mouth proceeds to a dangerous extent, inducing extensive ulceration, gangrene, and even hemorrhage. The best remedies are astringent and detergent gargles, used weak at first, as the parts are extremely tender. In cases attended with swelling and protrusion of the tongue, the wash is best applied by injection, by means of a large syringe. We have found lead-water among the best applications in these cases; and dilute solutions of chlorinated soda or of chlorinated lime, while they correct the fetor, will be found to exert a curative influence on the ulcerated surfaces. A wash of nitrate of silver, made by dissolving eight grains in a fluidounce of water, has also been used with benefit. As excessive ptyalism and its frequent attendants of severe inflammation and ulceration of the mouth and fauces, are not at all essential to the remedial constitutional effects of mercury, it becomes desirable if possible to moderate or prevent them; and for this purpose it is believed that the simultaneous use of chlorate of potassium is very effective. (See *New Remedies*, January, 1873, p. 217.)

While the system is under the action of mercury, the blood is more watery than in health, less charged with albumen, fibrin, and red globules, and loaded with a fetid fatty matter. (*Dr. S. Wright*, quoted by *Christison*.) When drawn from a vein, it exhibits the same appearance as in inflammation.

In the foregoing observations, we have described the ordinary effects of mercury; but occasionally, in peculiar constitutions, its operation is quite different, being productive of a dangerous disturbance of the vital functions. The late Mr. Pearson gave a detailed account of this occasional peculiarity in the operation of mercury, in his work on the venereal disease. The symptoms which characterize it are a small and frequent pulse, anxiety about the præcordia, pale and contracted countenance, great nervous agitation, and alarming debility. Their appearance is the signal for discontinuing the mercury; as a further perseverance with it might be attended with fatal consequences. Mercury also produces a peculiar eruption of the skin, which is described by writers under the various names of *hydrargyria*, *eczema mercuriale*, and *lepra mercurialis*.

Those who work in mercury, and are, therefore, exposed to its vapour, such as water-gilders, looking-glass silverers, and quicksilver miners, are injured seriously in their health, and not unfrequently affected with shaking palsy, attended with vertigo and other cerebral disorders. The miners are often salivated.

Many plants, exposed to the influence of the vapour spontaneously rising from mercury in confined air, perish in a few days; while, if sulphur be placed by the side of the metal, no effect of the kind is experienced. (Boussingault, *Journ. de Pharm. et de Chim.*, Sept. 1867, p. 176.) A probable inference from this fact is, that workmen, necessarily exposed to the vapour of mercury, might be protected by the presence of sulphur in sufficient quantity.

Mercury is sometimes given in the metallic state, in the quantity of a pound or two, in obstruction of the bowels, to act by its weight: but the practice is of doubtful advantage.

Mercury is detected with great delicacy by Smithson's process, which consists in the use of a plate of tin, lined with one of gold, in the form of a spiral. When immersed in a mercurial solution, this galvanic combination causes the precipitation of the mercury on the gold, which consequently contracts a white stain. In order to be sure that the stain is caused by mercury, the metal must be volatilized in a small tube, so as to obtain a characteristic globule. MM. Danger and Flandin have improved on Smithson's process. (See *Chem. Gaz.*, No. 61, p. 191.) A minute portion of any of the preparations of mercury, either in the solid state or in concentrated solution, being placed on a bright plate of copper, and a drop of a strong solution of iodide of potassium added, a silvery characteristic stain will immediately appear on the copper.

Mercury is officinal:—

I. In the Metallic state.

Hydrargyrum, *U. S.*, *Br.* — *Mercury.*

Emplastrum Ammoniaci cum Hydrargyro, *U. S.*, *Br.* — *Plaster of Ammoniac with Mercury.*

Emplastrum Hydrargyri, *U. S.*, *Br.* — *Plaster of Mercury.*

Hydrargyrum cum Cretâ, *U. S.*, *Br.* — *Mercury with Chalk.*

Pilulæ Hydrargyri, *U. S.;* Pilula Hydrargyri, *Br.* — *Mercurial Pills. Blue Pills.*

Unguentum Hydrargyri, *U. S.*, *Br.* — *Mercurial Ointment.*

Linimentum Hydrargyri, *Br.* — *Liniment of Mercury.*

Suppositoria Hydrargyri, *Br.* — *Mercurial Suppositories.*

Unguentum Hydrargyri Compositum, *Br.* — *Compound Ointment of Mercury.*

II. Oxidized.

Hydrargyri Oxidum Rubrum, *U. S.*, *Br.* — *Red Oxide of Mercury. Red precipitate.*

Unguentum Hydrargyri Oxidi Rubri, *U. S.*, *Br.* — *Ointment of Red Oxide of Mercury. Red precipitate ointment.*

Hydrargyri Oxidum Flavum, *U. S.*, *Br.* — *Yellow Oxide of Mercury.*

Unguentum Hydrargyri Oxidi Flavi, *U. S.* — *Ointment of Yellow Oxide of Mercury.*

III. Sulphuretted.

Hydrargyri Sulphuretum Rubrum, *U. S.* — *Red Sulphuret of Mercury. Cinnabar.*

IV. As Protochloride.

Hydrargyri Chloridum Mite, *U. S.;* Hydrargyri Subchloridum, *Br.* — *Mild Chloride of Mercury. Subchloride of Mercury. Calomel.*

Lotio Hydrargyri Nigra, *Br.* — *Black Mercurial Lotion.*

Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.* — *Compound Pills of Antimony. Compound Pills of Calomel. Plummer's Pills.*

Pilulæ Catharticæ Compositæ, *U. S.* — *Compound Cathartic Pills.*

V. As Bichloride.

Hydrargyri Chloridum Corrosivum, *U. S.;* Hydrargyri Perchloridum, *Br.* — *Corrosive Chloride of Mercury. Corrosive Sublimate.*

Hydrargyrum Ammoniatum, *U. S.*, *Br.* — *Ammoniated Mercury. White precipitate.*

Unguentum Hydrargyri Ammoniati, *U. S.*, *Br.* — *Ointment of Ammoniated Mercury. White precipitate ointment.*

Liquor Hydrargyri Perchloridi, *Br.* — *Solution of Perchloride of Mercury.*

Lotio Hydrargyri Flava, *Br.* — *Yellow Mercurial Lotion.*

VI. Combined with Iodine.

Hydrargyri Iodidum Rubrum, *U. S.*, *Br.* — *Red Iodide of Mercury.*

Liquor Arsenici et Hydrargyri Iodidi, *U. S.* — *Solution of Iodide of Arsenic and Mercury. Donovan's Solution.*

Unguentum Hydrargyri Iodidi Rubri, *Br.* — *Ointment of Red Iodide of Mercury.*

Hydrargyri Iodidum Viride, *U. S.*, *Br.* — *Green Iodide of Mercury.*

VII. Combined with Cyanogen.

Hydrargyri Cyanidum, *U. S.* — *Cyanide of Mercury.*

VIII. Oxidized and combined with Acids.

Liquor Hydrargyri Nitratis, *U. S.;* Liquor Hydrargyri Nitratis Acidus, *Br.* — *Solution of Nitrate of Mercury.*

Unguentum Hydrargyri Nitratis, *U. S.*, *Br.* — *Ointment of Nitrate of Mercury. Citrine ointment.*

Hydrargyri Sulphas, *Br.* — *Sulphate of Mercury.*

Hydrargyri Sulphas Flava, *U. S.* — *Yellow Sulphate of Mercury. Turpeth Mineral.* B.

HYDRASTIS. *U. S.*

Hydrastis.

The root of Hydrastis Canadensis. *U. S.*

Hydrastis. *Sex. Syst.* Polyandria Polygynia. — *Nat. Ord.* Ranunculaceæ.

Gen. Ch. Calyx of three petalloid sepals, falling when the flower opens. *Ovaries* in a roundish ovoid head; *stigmas* subsessile, dilated, flat, rounded at the apex. *Carpels* fleshy, one or two-seeded, cohering in a compound berry.

This genus was at first included by Linnæus in Hydrophyllum, but was afterwards separated, and received the name by which it is now generally recognised. The officinal species is the only known one of the genus.

Hydrastis Canadensis. Gray, *Manual of Bot.* p. 14; figured in Griffith's *Med. Bot.* p. 82. — *Yellow-root, Orange-root, Yellow Puccoon.* This is a small, herbaceous, perennial plant, with a thick, fleshy, yellow rhizome, from which numerous long radical fibres proceed, and an erect, simple, pubescent stem, from six inches to a foot in height. There are usually but two leaves, which are unequal, one sessile at the top of the stem, the other attached to it a short distance below by a thick, roundish footstalk, causing the stem to appear as if bifurcate near the summit. The leaves are pubescent, roundish-cordate, with from three to seven, but generally five lobes, which are pointed and unequally serrate. A solitary flower stands upon a peduncle rising from the basis of the upper leaf. It is whitish, rose-coloured, or purplish, without corolla, but with a coloured calyx, the sepals of which closely resemble petals, and are very caducous, falling very soon after the flower has expanded. The fruit is a globose, compound, red or purple berry, half an inch or more in diameter, composed of many minute granules, each containing one, or more rarely two seeds. The plant grows in moist, rich woodlands, in most parts of the United States, but abundantly in the North and West. The fruit bears a close resemblance to the raspberry, but is not edible. The root is the part employed. Though long used in domestic and empirical practice, and more or less by regular practitioners, it was not recognised as officinal before the publication of the U. S. Pharmacopœia of 1860, in which it was placed in the Secondary Catalogue, though in the present edition transferred to the Primary. The Indians employed it for staining and dyeing yellow, and it is said to impart a rich and permanent yellow, and with indigo a fine green to wool, silk, and cotton.

Properties. The fresh root is juicy and loses much of its weight in drying. The dried caudex or rhizome is contorted, irregular, very rough and wrinkled, hard and brittle, from an inch to two inches or more in length, usually two or three lines in thickness, and either beset with numerous slender rootlets, or showing marks upon the surface where they have been broken off. Many of the detached rootlets are mixed with the rhizomes in mass. The colour of the rhizome, though yellow in the recent root, becomes of a dark yellowish-brown by age; that of the rootlets and the interior of the root is yellow, and of the powder still more so. The odour is strong, sweetish, and somewhat narcotic, the taste bitter and peculiar. The medicine imparts its virtues and colouring matters to water and alcohol. Examined by Mr. Alfred A.

B. Durand, of Philadelphia, it was found to contain albumen, starch, fatty matter, resin, yellow colouring matter, sugar, lignin, and various salts. He also discovered a peculiar nitrogenous, crystallizable substance, for which he proposed the provisional name of *hydrastin*, until it should be determined whether it was, as he suspected, an organic alkali. (*Am. Journ. of Pharm.*, April, 1851, p. 112.) Since that time it has been ascertained that the claims of this principle to be considered as an alkaloid were just, and it has definitely taken the name of *hydrastia*, of which *hydrastin* and *hydrastina* are merely synonymes. It has also been determined that the root contains another alkaloid, to which it owes its yellow colour, and which is probably identical with the yellow colouring matter of Mr. Durand. A muriate of this latter alkaloid, obtained by the precipitation essentially of an infusion of the root by muriatic acid, has been for some time known and used by the "Eclectics," under the name of hydrastin, and the reader must be cautious not to confound this substance with the alkaloid to which the name properly belongs. Mr. F. Mahla first ascertained that this new alkaloid of hydrastis is in fact *berberina* (*Am. Journ. of Sci. and Arts*, Jan. 1862, p. 43), which was long since found in the root of Berberis vulgaris, and has since been detected in columbo, and other medicinal roots. An account of its mode of preparation and properties is contained in the article on *Berberis*. (See *page* 176.) It exists in large proportion in hydrastis, constituting, according to Perrins, nearly 4 per cent. There can be no doubt that this medicine owes much of its virtues to berberina.

Hydrastia, which is its characteristic alkaloid, may be obtained by exhausting the powdered root as far as possible with water by percolation, adding muriatic acid to the infusion so as to precipitate the berberina in the form of muriate, and treating the mother-liquor with solution of ammonia in slight excess. The hydrastia is precipitated, in an impure state, and may be purified by repeated solution in boiling alcohol, which deposits it in crystals on cooling. A little animal charcoal may be used towards the close of the process, in order completely to deprive the crystals of colour. To Mr. Mahla, of Chicago, and Mr. Perrins, of London, is due the credit of having fully investigated the properties of this alkaloid.* Hydrastia crystallizes in brilliant, four-sided prisms, which are white or colourless when pure, inodorous, and almost tasteless in consequence of their insolubility in the saliva, but become bitter and somewhat acrid in saline combination. It melts at 275° F., is decomposed at a higher temperature, and is inflammable. It is nearly insoluble in water, but is readily dissolved by alcohol, ether, chloroform, and benzole. It has an alkaline reaction, and with the acids forms salts, most of which are readily soluble in water, and, according to Mr. Merrill, of Cincinnati, either uncrystallizable, or crystallizable with difficulty. The alkalies and tannic acid precipitate it from its saline solutions. With sulphuric acid and bichromate of potassium or red oxide of lead, it assumes a red colour; but differs from strychnia in exhibiting no tint of blue or violet. Its constituents are carbon, hydrogen, nitrogen, and oxygen, and its formula, as given by Mr. Mahla, is $C_{44}H_{24}NO_{12}$. Mr. Perrins obtained 1·5 per cent. of it from the root; and, having given five grains of it to a rabbit, without any other effect than a slight uneasiness which soon ceased, concluded justly that it was not poisonous.

It is highly probable, from the odour of hydrastis, that, besides the two alkaloids here mentioned, it contains also an active volatile principle; but this has not yet been isolated. Mr. A. K. Hale, of Ann Arbor, Michigan, has ascertained that there is another alkaloid in hydrastis, somewhat resembling berberina, but quite distinct. To the neutral mother-liquor of hydrastia, he added water of ammonia in great excess, say 10 per cent., which caused a yellow precipitate, darker than berberina, and having different reactions. Mr. Hale has not given it a name, and has not determined its ultimate composition. (*Am. Journ. of Pharm.*, June, 1873, p. 248.)

Medical Properties and Uses. Very diversified powers have been claimed for hydrastis. Thus, while all admit its tonic properties, it is considered by different practitioners as aperient, alterative in its influence on the mucous membranes, cholagogue, deobstruent in reference to the glands generally, diuretic, antiseptic, &c. It has been employed in dyspepsia and other affections requiring tonic treatment, in jaundice and

* For a paper by Mr. Mahla, see *American Journal of Sci. and Arts*, July, 1863, p. 57, and for another by Mr. J. Dyson Perrins, of London, the *Pharm. Journ.*, May, 1862, p. 546.

other functional disorders of the liver, as a laxative in constipation and piles, and as an alterative in various diseases of the mucous membranes, as catarrh, chronic enteritis, cystirrhœa, leucorrhœa, gonorrhœa, &c., being used in the latter complaints both internally and locally. By some it is used as one of the best substitutes for quinia in intermittents. In the form of infusion, it has been used in the Western States as a topical application in ophthalmia; and the Indians are said to employ it in the same manner in old ulcers of the legs. The notion of its efficacy in cancer, originating in a report which reached the late Professor Barton, that it was used in the cure of this complaint by the Cherokees, is probably altogether groundless. Dr. U. E. Ewing, of Lexington, Ky., and Dr. D. M. McCann, of Martinsburg, Ohio, have recommended an infusion or decoction of the root as an injection in gonorrhœa. Dr. McCann made the decoction in the proportion of a drachm of the dried root to a pint of water, and injected a syringeful three times a day. Dr. Ewing used the infusion with the addition of *sulphate of copper*. (*Med. Examiner*, N. S., vii. 733.) Dr. P. C. Gooch has subsequently used it in five cases, and obtained no good effect whatever. (*Am. Journ. of Med. Sci.*, N. S., xxiii. 286.) But a more precise investigation into its physiological and therapeutic properties is necessary before we can venture to decide upon its place among medicines.

It has been given in the form of infusion, decoction, tincture, and extract; and the fluid extract is now officinal. In regard to other forms of preparation, the root may be treated like columbo or gentian. The impure muriate of berberina, obtained as above mentioned from hydrastis, is used by the "Eclectics," under the name of hydrastin, in the dose of from three to five grains.

Off. Prep. Extractum Hydrastis Fluidum, *U. S.* W.

HYOSCYAMI FOLIA. *U. S., Br.*

Hyoscyamus Leaves. Henbane Leaves.

Hyoscyami Folium. *U. S. Pharm.*, 1860.

The leaves of Hyoscyamus niger. *U. S.*

"The fresh leaves, with the branches to which they are attached, of Hyoscyamus niger, *Linn.;* also the leaves separated from the branches and carefully dried; gathered from wild, or cultivated British, biennial plants, when about two-thirds of the flowers are expanded." *Br.*

HYOSCYAMI SEMEN. *U. S.*

Hyoscyamus Seed. Henbane Seed.

The seed of Hyoscyamus niger. *U. S.*

Henbane; Jusquiame noire, *Fr.;* Schwarzes Bilsenkraut, *Germ.;* Giusquiamo nero, *Ital.;* Beleno, *Span.*

HYOSCYAMUS. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Solanaceæ.

Gen. Ch. Corolla funnel-form, obtuse. *Stamens* inclined. *Capsules* covered with a lid, two-celled. *Willd.*

Hyoscyamus niger. Willd. *Sp. Plant.* i. 1010; Woodv. *Med. Bot.* p. 204, t. 76; Carson, *Illust. of Med. Bot.* ii. 19, pl. 66. Henbane is usually a biennial plant, with a long, tapering, whitish, fleshy, somewhat branching root, not unlike that of parsley, for which it has been eaten by mistake, with poisonous effects. The stem, which rises in the second year, is erect, round, branching, from one to four feet high, and thickly furnished with leaves. These are large, oblong-ovate, deeply sinuated with pointed segments, undulated, soft to the touch, and at their base embrace the stem. The upper leaves are generally entire. Both the stem and leaves are hairy, viscid, and of a sea-green colour. The flowers form long, one-sided, leafy spikes, which terminate the branches, and hang downwards. They are composed of a calyx with five pointed divisions, a funnel-shaped corolla, with five unequal, obtuse segments at the border, five stamens inserted into the tube of the corolla, and a pistil with a blunt, round stigma. Their colour is an obscure yellow, beautifully variegated with purple

veins. The fruit is a globular two-celled capsule, covered with a lid, invested with the persistent calyx, and containing numerous small seeds, which are discharged by the horizontal separation of the lid. The whole plant has a rank offensive smell.

H. niger is susceptible of considerable diversity of character, causing varieties which have by some been considered as distinct species. Thus, the plant is sometimes annual, the stem simple, smaller, and less downy than in the biennial plant, the leaves more deeply incised and less hairy and viscid, and the flowers often yellow without the purple streaks. It has been ascertained that much difference of medical properties is connected with these diversities of character; and the British Pharmacopœia directs the biennial variety as the most efficient.

The plant is found in the northern and eastern sections of the United States, occupying waste grounds in the older settlements, particularly graveyards, old gardens, and the foundations of ruined houses. It grows in great abundance about Detroit, in Michigan. It is not, however, a native of this country, having been introduced from Europe. In Great Britain, and on the continent of Europe, it grows abundantly along the roads, around villages, amidst rubbish, and in uncultivated places. Both varieties are cultivated in England. The annual plant flowers in July or August, the biennial in May or June.*

H. albus, so named from the whiteness of its flowers, is used in France indiscriminately with the former species, with which it appears to be identical in medicinal properties.

All parts of *Hyoscyamus niger* are active. The leaves are usually employed, but both these and the seeds are recognised in the U. S. Pharmacopœia. Much of the efficacy of henbane depends upon the time at which it is gathered. The leaves should be collected soon after the plant has flowered. In the biennial plant, those of the second year are preferred to those of the first. The latter, according to Dr. Houlton, are less clammy and fetid, yield less extractive, and are medicinally much less efficient. It is said that the plant is sometimes destroyed by severe winters in England, and that no leaves of the second year's growth are obtainable. This is, perhaps, one of the causes of the great uncertainty of the medicine as found in the shops. The root also is said to be much more poisonous in the second year than in the first.†

Properties. The recent leaves have, when bruised, a strong, disagreeable, narcotic odour, somewhat like that of tobacco. Their taste is mucilaginous and very slightly acrid. When dried, they have little smell or taste. Thrown upon the fire, they burn with a crackling noise, as if they contained a nitrate, and at the same time emit a strong odour. Their virtues are completely extracted by diluted alcohol. The watery infusion is of a pale-yellow colour, insipid, with the narcotic odour of the plant. The leaves were analyzed by Lindbergsen, who obtained from them a narcotic principle. They contain a large proportion of nitrate of potassium; Mr. F. Mahla having obtained, as nearly as he could estimate from his experiments, 2 per cent. of that salt. (*Am. Journ. of Pharm.*, Sept. 1859, p. 402.) The seeds are very small, roundish, compressed, somewhat kidney-shaped, a little wrinkled, of a gray or yellowish-gray colour, of the odour of the plant, and an oleaginous, bitterish taste. Analyzed by Brandes, they yielded 24·2 per cent. of fixed oil, 1·4 of a solid fatty substance, traces

* For an account of the cultivation of the biennial variety of H. niger at Hitchin, Herts, England, see *Pharm. Journ.*, Feb. 1860, p. 414.

† The following important facts in relation to the cultivation of henbane, and the relative strength of the different varieties, and of the same under different circumstances, are taken from a communication by M. Rufus Usher, a cultivator of medicinal plants, to the *Journal of the Society of Arts*, and republished in the *Lond. Pharm. Journ.* (Aug. 1867). The several products of the henbane plants are placed by Mr. Usher in the following order, as to efficiency: 1. the leaves of the biennial plant of the second year's growth; 2. the biennial plant of the first year; 3. the British annual henbane; 4. the German annual henbane. The last two, though most extensively used, are really nearly valueless, and should always be rejected. The British annual so nearly resembles the biennial of the second year, having flowers, that the two may be easily mistaken for one another; but a sufficient distinction is that the annual plant "possesses no flavour or aroma." Besides, the leaves are much shorter; and occasionally there is a pure primrose blossom, which never happens with the biennial, which is beautifully streaked. The biennial plant is so liable to the attacks of worms, that at one time little of the second year's growth was collected, and the market was consequently supplied with a very inferior article. But, from the great attention recently paid to its cultivation, it may now be furnished at reasonable prices; and we may hope to be supplied with efficient preparations of this valuable narcotic. (*Note to the thirteenth edition.*)

of sugar, 1·2 of gum, 2·4 of bassorin, 1·5 of starch, 3·4 of a substance soluble in water, insoluble in alcohol, and precipitated by infusion of galls (phyteumacolla, *Brandes*), 4·5 of albumen, 26·0 of vegetable fibre, 24·1 of water, and 9·7 of salts, including the malate of an alkaloid called *hyoscyamin* or *hyoscyamia*. But the process employed by Brandes for separating this principle has not succeeded in other hands; and it is doubtful whether the substance obtained by him was really what he supposed it to be. Geiger and Hesse were the first to demonstrate the existence of an organic alkali in hyoscyamus. Its extraction from the plant is somewhat difficult, in consequence of its tendency to undergo change by the contact of alkaline solutions, which render it very soluble in water. The following is the process of these chemists. The seeds are macerated in alcohol; the tincture obtained is evaporated by a very gentle heat, decolorized by repeated additions of lime and sulphuric acid, with filtration after each addition, and then still further concentrated by evaporation; an excess of powdered carbonate of sodium is added, and the precipitate produced is separated, as speedily as possible, from the alkaline carbonate by expressing and treating it with absolute alcohol, while the mother-waters are at the same time treated with ether; the alcoholic and ethereal liquors are united, again treated with lime, filtered, decolorized with animal charcoal, and evaporated by a very gentle heat. If the hyoscyamia now deposited should still be coloured, it will be necessary to combine it anew with an acid, and proceed as before, in order to obtain it quite pure. The product is very small.*

From experiments made by Mr. Hirtz upon the relative medicinal power of extracts from the seeds and leaves, he inferred that the former had ten times the strength of the latter.

Hyoscyamia crystallizes in colourless, transparent, silky needles, is inodorous, of an acrid disagreeable taste, slightly soluble in water, very soluble in alcohol and ether, and volatilizable with little change if carefully distilled. It is quickly altered by contact with water and an alkali, and when heated with potassa or soda is completely decomposed, with the disengagement of ammonia. It neutralizes the acids, forming crystallizable salts, and is precipitated by infusion of galls. The alkaloid and its salts are very poisonous; and the smallest quantity, introduced into the eye, produces dilatation of the pupil, which continues long. From the experiments, however, of Professors Erdmann and Kolbe, it appears to be inferior in this respect to atropia. In relation to its chemical properties, it is stated by these experimenters, contrary to what has been previously asserted, that hyoscyamia in concentrated solution gives with a drop of muriatic acid and bichloride of platinum a yellow crys-

* Mr. Wm. A. Tilden, after unsatisfactory trials with Geiger's and Sonnenschein's processes for obtaining hyoscyamia, for the latter of which the reader is referred to Mr. Tilden's paper, succeeded in procuring it by the following method. Half a pound of freshly prepared extract of the leaves was dissolved in three pints of water mixed with a very little milk of lime, and filtered. To the clear liquid carbonate of potassium was added till it became strongly alkaline, and the whole shaken with a pint of chloroform. After standing all night, the chloroform had subsided with the appearance of a greenish oil. This having been separated by a funnel, filtered into a bottle, and shaken with water acidulated with sulphuric acid, the chloroform was recovered. The aqueous liquid was made alkaline with carbonate of potassium, and shaken with ether. The ether, which contained all the hyoscyamia, was shaken with acidulated water, and distilled over a water-bath. The acid solution remaining, neutralized with bicarbonate of sodium, gave a dirty-white precipitate soluble in acetic acid with tannin, a yellowish flocculent precipitate with chloride of gold, a brown one with iodine dissolved in hydriodic acid, and none with bichloride of platinum or corrosive sublimate. The alkaloid is very soluble in alcohol, ether, chloroform, and even water; and in aqueous solution has a strongly acrid and bitter taste. It is generally obtained as a colourless gummy mass; but, when its solution has been suffered to evaporate over sulphuric acid, it has crystallized in groups of radiating needles. It has a slight odour quite different from that of the plant, and is decidedly alkaline to test paper. It is rapidly destroyed by the caustic alkalies, especially with heat; an alkaline vapour, probably ammonia, being evolved. (*Pharm. Journ. and Trans.*, 2d ser., viii. 127, A.D. 1867.)—*Note to the thirteenth edition.*

MM. Hœhn and Reichardt advise to treat hyoscyamus seed, at first with ether to separate fatty matter, then with alcohol acidulated with a few drops of sulphuric acid, and afterwards distil the alcoholic solution. The watery residue is to be neutralized by soda, and the liquid precipitated by a solution of tannin. The precipitate having been placed on a porcelain plate to dry, is mixed while yet moist with an excess of lime, and then exhausted by strong alcohol. The alcoholic solution is treated with sulphuric acid, then with soda, and finally with ether, which dissolves the liberated hyoscyamia. By distilling off the ether a colourless oleaginous liquid is left, which at length concretes. (*Journ. de Pharm.*, Mai, 1872, p. 385.)—*Note to the fourteenth edition.*

talline precipitate, whilst a weak solution gives no precipitate whatever with the bichloride. (*Neues Repertorium*, A.D. 1867, p. 502.) M. Reynard adds to what is known of the chemical properties of hyoscyamia the following facts. The alkaloid is precipitated by the concentrated alkalies, but not when these are diluted. Phosphomolybdate of sodium precipitates it yellowish-white, passing to green when it is heated with ammonia. With iodobismuthate of potassium it affords an orange, with iodohydrargyrate of potassium a white, and with tannin a yellowish precipitate; while chloride of gold produces a magma consisting of yellowish flakes and a brown resinous mass. (*Journ. de Pharm. et de Chim.*, Mars, 1868, p. 238.)

Henbane leaves yield, by destructive distillation, a very poisonous empyreumatic oil.

Medical Properties and Uses. Hyoscyamus ranks among the narcotics. In moderate quantities it usually accelerates the circulation, increases the general warmth, occasions a sense of heat in the throat, and after a short period induces sleep. This action is sometimes attended with vertigo, pain in the head, and dilated pupils; and the medicine occasionally acts as a diaphoretic or diuretic, and even produces a pustular eruption. It does not constipate like opium, but, on the contrary, often proves laxative. In overdoses it powerfully irritates the brain and alimentary canal, causing dilatation of the pupil, disordered vision, loss of speech, difficult deglutition, delirious intoxication or stupor, great restlessness or jactitation, sometimes tonic spasms, convulsions, paralysis, pain in the bowels, diarrhœa, excitement of the circulation, followed by great feebleness of the pulse, coldness of the surface, petechiæ, and other alarming symptoms, which sometimes end in death. Dissection exhibits marks of inflammation of the stomach and bowels. The poisonous effects are to be counteracted in the same manner as those of opium. Dr. Garrod has suggested animal charcoal as an antidote, as it has the property of absorbing the active principle, and thus rendering it inert. All parts of *H. niger* are deleterious when largely taken; but the seeds are said to be most powerful. Upon inferior animals its effects are not always the same. Though fatal to birds and dogs, the leaves are eaten with entire impunity by horses, cows, sheep, goats, and swine. It is not impossible that injury has in some cases resulted from the use of milk, derived from cows or goats which had been feeding on henbane. According to Dr. Garrod, the remedial properties of hyoscyamus are completely neutralized by solution of potassa or soda; so that they cannot properly be combined in prescriptions; but as the carbonates of the alkalies have no such effect, these should be substituted. From these facts it might be inferred that the caustic alkalies would be the best antidote to the poisonous effects of hyoscyamus; but the quantity required would be so great as to endanger the integrity of the gastric mucous membrane, and thus probably to cause more danger than the poison itself. (*Med. Times and Gaz.*, Dec. 1857, p. 589.)

The remedial operation of hyoscyamus is anodyne and soporific. The medicine was known to the ancients, and was employed by some of the earlier modern practitioners; but had fallen into disuse, and was almost forgotten, when Baron Störck again introduced it into notice. By this physician and some of his successors it was prescribed in numerous diseases, and, if we may credit their testimony, with the happiest effects; but subsequent experience of its operation has been such as very much to narrow the extent of its application. It is at present used almost exclusively to relieve pain, procure sleep, or quiet irregular nervous action; and is not supposed to exercise any specific curative influence over particular diseases. Even for the purposes which it is calculated to answer it is infinitely inferior to opium or its preparations; and is generally resorted to only in cases in which the latter remedy is from peculiar circumstances deemed inadmissible. Hyoscyamus, however, has this great advantage over opium in certain cases, that it has no tendency to constipate. The diseases to which it is applicable it would be useless to enumerate, as there are few in which circumstances might not be such as to call for its employment. Neuralgic and spasmodic affections, rheumatism, gout, hysteria, and various pectoral diseases, as catarrh, pertussis, asthma, phthisis, &c., are among those in which it is most frequently prescribed. It is also much used in connection wiith griping cathartics, the disagreeable effects of which it is thought to counteract. The officinal *pills of colocynth and henbane* are formed upon this principle. In Europe, where the fresh

leaves are readily obtained, it is often applied externally in the shape of lotion, cataplasm, or fomentation, to allay pain and irritation, in scrofulous or cancerous ulcers, scirrhous, hemorrhoidal, or other painful tumours, gouty and rheumatic swellings, and nervous headache. The smoke of the leaves or seeds has also been used in toothache; but the practice is deemed hazardous. Henbane is used by European oculists for dilating the pupil, previously to the operation for cataract. For this purpose an infusion of the leaves, or a solution of the extract, is dropped into the eye. The Br. Pharmacopœia gives as one of the characters of the leaves, that "the fresh juice dropped into the eye, dilates the pupil." The effect is usually greatest at the end of four hours from the application, and in twelve hours ceases entirely. Vision is not impaired during its continuance. Reisinger recommends a solution of hyoscyamia in the proportion of one grain to twenty-four of water, of which one drop is to be applied to the eye. Its solubility in water gives it an advantage for this purpose over atropia, the alcoholic solution of which irritates the conjunctiva. According to Schroff, there is nothing which acts so quickly and so powerfully in dilating the pupil. He uses one part of hyoscyamia, one hundred parts of water, and ten of alcohol; the latter fluid being added to prevent decomposition. (*Annuaire de Thérap.*, A.D. 1858, p. 25.)

Henbane may be given in substance, extract, or tincture. The dose of the powdered leaves is from five to ten grains, of the seeds somewhat smaller. The common extract, or inspissated juice of the fresh leaves (*Extractum Hyoscyami, U. S.*), is exceedingly variable in its operation, being sometimes active, sometimes almost inert. The usual dose is two or three grains, repeated and gradually increased till its effects are obtained. Cullen rarely procured its anodyne operation till he had carried the dose to eight, ten, or even fifteen or twenty grains. Collins pushed it to thirty-six grains; and Professor Fouquier, who experimented largely with hyoscyamus in the Hôpital de la Charité, gave two hundred and fifty grains of the extract during twenty-four hours, without any specific or curative impression. (Richard, *Elém. Hist. Nat. Méd.*) The alcoholic extract, prepared from the recently dried leaves (*Extractum Hyoscyami Alcoholicum, U. S.*), is said to be more certain. The dose of this to begin with is one or two grains, which may be increased gradually to twenty or thirty grains. An extract from the seeds would, no doubt, be much more efficacious. The dose of the tincture is one or two fluidrachms. A fluid extract is directed by the U. S. Pharmacopœia. (See *Extractum Hyoscyami Fluidum.*) A good plan, in administering any of the preparations, is to repeat the dose every hour or two till its influence is felt. Schroff has given hyoscyamia with good effects in allaying cough and procuring sleep, prescribing it in the form of powder mixed with sugar, in doses varying from the sixtieth to the twentieth of a grain. He has found the tenth of a grain too much.

Hyoscyamia has not yet been obtained in quantities sufficient for general use; but, considering the great uncertainty of henbane itself as derived from different sources, it would be a very desirable substitute. Dr. John Harley has given an account of its effects, which appears to be the result of his own observations. Given to an adult subcutaneously in doses insufficient to cause dryness of the mouth, it produces giddiness, somnolency, dilatation of the pupils, and a gradually diminishing frequency of pulse, without lessening of its force or volume. In quantities sufficient to cause dryness of the mouth, it generally occasions increased frequency of pulse with slight increase of its volume and strength. This acceleration generally begins from 10 to 20 minutes after injection, and continues for 20 or 30 minutes, very rarely for an hour. Dryness of the mouth begins about 20 minutes after injection, and lasts for an hour. In most instances there is great sleepiness, with much giddiness, so that the patient cannot walk steadily. The face is flushed and the conjunctiva injected, and the pupils dilate. At the subsidence of the symptoms, which usually begins in an hour, the pulse falls below its natural standard of frequency, sometimes even to 42 in the minute, retaining, however, its volume and power. The maximum dilatation of the pupil is at this period. The effects are precisely the same when the medicine is given by the mouth. The most prominent effects of hyoscyamus or its active principle are excessive giddiness and somnolency; while atropia,

which resembles it in its effects on the mouth and pupils, produces much less of these effects. According to Dr. Harley, atropia is characterized more especially by its influence on the sympathetic nervous system, hyoscyamia on the brain. Hyoscyamia increases the soporific powers of opium; and quantities of hyoscyamia and morphia, which in themselves are insufficient to induce sleep, will cause it when combined. Like atropia, it is eliminated by the kidneys, and was detected by Dr. Harley in the urine 22 minutes after subcutaneous injection. Therapeutically, Dr. Harley has found hyoscyamia extremely useful in irritable states of the brain and the heart, and in determining and invariably increasing the soporific effect of opium. (*Med. Times and Gaz.*, April, 1868, p. 876.)

M. Oulmont, after various experiments and observations with hyoscyamia on the lower animals and man, physiological and therapeutical, has published the following very interesting conclusions to which he had arrived. 1. Hyoscyamia has all the active properties of henbane; and the fixedness of its composition gives a precision to its results, which cannot be obtained from that medicine in substance. 2. The alkaloid should be given at first in feeble doses, 2 milligrammes (about $\frac{1}{30}$ of a grain) daily, either in pills or by hypodermic injection. The dose may be increased to 10 or even 12 milligrammes (·15 to ·18 grains). 3. The medicine should not be discontinued in consequence of slight symptoms of narcotism, as dryness of the throat and dilatation of the pupils; but, if the symptoms become serious, it should be suspended. At all events the symptoms are fugitive, and quickly disappear. 4. Hyoscyamia exercises on man a narcotic action. It is efficacious against pain, especially neuralgic, but is less so than opium and belladonna. 5. It has a favourable action in the spasmodic and convulsive neuroses; cures nervous trembling where all other treatment has failed; and produces a notable amelioration of senile trembling, and paralysis agitans. 6. It has no influence on locomotor ataxy; and, in traumatic tetanus, though the patient has succumbed, it has caused a sufficiently marked amelioration of the symptoms to justify hope in future, and to call for further researches. (*Annuaire de Thérap.*, A.D. 1873, p. 26.)

Off. Prep. Extractum Hyoscyami; Extractum Hyoscyami Alcoholicum, *U.S.;* Extractum Hyoscyami Fluidum, *U.S.;* Tinctura Hyoscyami. W.

ICHTHYOCOLLA. *U.S.*

Isinglass.

The swimming bladder of Acipenser Huso, and of other fishes. *U.S.*

Fish-glue; Ichthyocolle, colle de poisson, *Fr.;* Hausenblase, Fischleim, *Germ.;* Colla di pesce, *Ital.;* Cola de pescado, *Span.*

Isinglass is a gelatinous substance, prepared chiefly from the sounds or swimming bladders of fishes, especially those of different species of sturgeon. Though not retained in the British Pharmacopœia, it still has a place in that of the U. States, and is universally kept in the shops.

In most fishes there is a membranous bag, placed in the anterior part of the abdomen, communicating frequently, though not always, by means of a duct, with the œsophagus or stomach, and containing usually a mixture of oxygen and nitrogen gases in various proportions. From the supposition that it was intended by its expansion or contraction to enable the fish to rise or sink in the water, it has been denominated *swimming bladder*. It is of different shape in different fishes, and consists of three coats, of which the two interior are thin and delicate, the outer tough and of a silvery whiteness.

The *Acipenser Huso*, or *beluga* of the Russians, is particularly designated by the Pharmacopœia as the species of sturgeon from which isinglass is procured; but three others, the *A. Ruthenus*, or sterlet, *A. sturio*, or common sturgeon, and *A. stellatus*, or starred sturgeon, also furnish large quantities to commerce. All these fish inhabit the interior waters of Russia, especially the Wolga and other streams which empty into the Caspian Sea. Immense numbers are annually taken, and consumed as food by the Russians. The air-bags are removed from the fish, and, having been split open and washed in water in order to separate the blood, fat, and adhering extrane-

ous membranes, are spread out, and when sufficiently stiffened are formed into cylindrical rolls, the ends of which are brought together and secured by pegs. The shape given to the roll is that of a staple, or more accurately that of a lyre, which it firmly retains when dried. Thus prepared it is known in commerce by the name of *staple isinglass*, and is distinguished into the *long* and *short staple*. Sometimes the membranes are dried in a flat state, or simply folded, and then receive the name of *leaf* or *book isinglass*. The scraps or fragments of these varieties, with various other parts of the fish, are boiled in water, which dissolves the gelatin, and upon evaporation leaves it in a solid state. This is called *cake isinglass*, from the shape which it is made to assume. It is sometimes, however, in globular masses. Of these varieties, the *long staple* is said to be the best; but the finest *book isinglass* is not surpassed by any brought to this country. It is remarkable for its beautiful iridescence by transmitted light. One hundred grains of this isinglass dissolve in ten ounces of water, forming a tremulous jelly when cold, and yield but two grains of insoluble residuum. That in *cakes* is brownish, of an unpleasant odour, and employed only in the arts. Inferior kinds, with the same commercial titles, are said to be prepared from the peritoneum and intestines of the fish. An inferior Russian product, known in English commerce by the name of *Samovey isinglass*, is procured, according to Pereira, from the *Silurus Glanis*. It comes, like the better kind, in the shape of *leaf*, *book*, and *short staple*.

Isinglass, little inferior to the Russian, is made in Iceland from the sounds of the cod and ling. It is said also to be prepared by the fishermen of Newfoundland. We receive from Brazil the air-bladders of a large fish, prepared by drying them in their distended state. They are oblong, tapering, and pointed at one end, bifid with the remains of their pneumatic duct at the other, and of a firm consistence. The Brazilian isinglass is inferior to the Russian. Considerable quantities have been manufactured in New England, as formerly supposed, from the intestines of the cod, and of other allied fishes. This sort is in the form of thin ribbons several feet in length, and from an inch and a half to two inches in width. One hundred grains dissolve almost entirely in water, leaving but two grains of insoluble membrane, and form a tremulous jelly when cold with eight ounces of water. It is, therefore, as pure and nearly as strong a gelatin as the Russian isinglass; but it retains a fishy taste and odour, which render it unfit for culinary or medicinal purposes. Isinglass of good quality has also been made in New York from the sounds of the weak fish — *Otolithus regalis* of Cuvier (Storer, *Rep. on Fishes of Mass.*, p. 33) — and perhaps of other fishes caught in the neighbourhood. The sounds are dried whole, or merely split open, and vary much in size and texture, weighing from a drachm to an ounce. An article called "*refined or transparent isinglass*" is made by dissolving the New England isinglass in hot water, and spreading the solution to dry on oiled muslin. It is in very thin transparent plates, and is an excellent glue, but retains a strong fishy odour. A variety of Ichthyocolla, called India or China Isinglass, has been consumed largely in China from time immemorial, and became known to the Europeans of India about 1839. It is now found in the markets of London, where it is chiefly employed in clarifying beer. (*Journ. de Pharm.*, Fév. 1870, p. 153.) It is the swimming bladder derived from two species of *Polynemus*, and from several other species of fish in the Indian waters. (*Ibid.*, Janv. 1873, p. 77.) A preparation called *Cooper's gelatin* has been introduced as a substitute for isinglass in making jellies. It appears to be the dried froth of a solution of pure bone glue. Many of the above facts, in relation to American isinglass, were derived from papers by D. B. Smith, in the *Journ. of the Phil. Col. of Pharm.* (iii. 17 and 92).

Mr. C. T. Carney states that the New England isinglass is prepared, not as supposed from the intestines of fish, but from the sounds of the hake (*Gadus merluccius*), by the following process. Having been taken from the fish, split open, cleansed, and dried, they are soaked in water till sufficiently soft, then passed through rollers so as to form a large, homogeneous, dough-like sheet, which is cut into strips, and then again passed through rollers till reduced to a ribbon-like form. The pieces thus prepared are thoroughly dried, and folded into bundles. (*Proceed. of Am. Pharm. Assoc.*, A.D. 1857.)

Isinglass is sometimes kept in the shops cut into fine shreds, and is thus more easily acted on by boiling water.

Properties. In its purest form it is whitish, semi-transparent, of a shining, pearly appearance, and destitute of smell and taste. The inferior kinds are yellowish and more opaque. In cold water it softens, swells up, and becomes opalescent. Boiling water entirely dissolves it, with the exception of a minute proportion of impurities, amounting, according to Mr. Hatchet, to less than 2 per cent. The solution on cooling assumes the form of a jelly, which consists of pure gelatin and water. Isinglass is in fact the purest form of *gelatin* with which we are acquainted, and may be used whenever this principle is required as a test. It is insoluble in alcohol, but is dissolved readily by most of the diluted acids, and by alkaline solutions. It has a strong affinity for tannin, with which it forms an insoluble compound. Boiled with sulphuric acid, it is converted into a peculiar saccharine matter, called *glycocoll* or *sugar of gelatin.* Its aqueous solution speedily putrefies.

An ingenious adulteration of isinglass has been practised in London, apparently by rolling a layer of gelatin between two layers of the genuine substance. This may be detected by the disagreeable odour and taste of the adulterated drug, and the effects of water upon it. Genuine isinglass, cut into shreds and treated with water, becomes opalescent and more opaque than before; while the shreds, though they soften and swell, remain unbroken, and, when examined by the microscope, are seen to be decidedly fibrous. Gelatin, on the contrary, when similarly treated, becomes more transparent than before; the shreds are disintegrated, and the structure appears amorphous under the microscope. In the adulterated article, both these characters are presented in layers more or less distinct. (*Pharm. Journ.*, ix. 505.)

A *false isinglass* has been imported into England from Para, in Brazil, consisting of the dried ovary of a large fish. It has somewhat the form of a bunch of grapes, consisting of ovoid or roundish masses, attached by a footstalk to a central axis. It is not gelatinous, and is unfit for the purposes to which isinglass is applied. (See *Am. Journ. of Pharm.*, xxv. 144.)*

Medical Properties and Uses. Isinglass has no peculiar medical properties. It may be given internally, in the form of jelly, as a highly nutritious article of diet; but it has no advantage over the jelly made from calves-feet. Three drachms impart sufficient consistency to a pint of water. It is employed for clarifying liquors, and imparting lustre to various woven fabrics. Added in small quantities to vegetable jellies, it gives them a tremulous appearance, which they want when unmixed. As a test of tannin it is used in solution, in the proportion of a drachm to ten fluid-ounces of distilled water. It forms the basis of the *English court-plaster.* W.

IGNATIA. *U.S.*

Ignatia. Bean of Saint Ignatius.

The seed of Strychnos Ignatia (Lindley, *Flor. Med.*). *U.S.*

Faba Sancti Ignatii, *Lat.;* Fève de Saint Ignace, *Fr.;* Ignatiusbohne, bittere Fiebernuss, *Germ.;* Fava di Santo Ignazio, *Ital.;* Haba de Santo Ignacio, *Span.*

STRYCHNOS. See NUX VOMICA.

* *Japanese Isinglass.* Under this name, which, however, is altogether inappropriate, a substance has been recently brought into the English market, prepared from sea-weeds in China and Japan. Two forms of it are described by Mr. Hanbury, one in irregularly four-sided sticks, about eleven inches long, very light and porous, the other in long shrivelled strips about one-eighth of an inch thick. It is translucent, yellowish-white, without smell or taste, insoluble in cold water, but swelling up and softening under its influence, and dissolved in great measure by boiling water, with which it gelatinizes on cooling. The peculiarities of this substance are owing to a principle denominated *gelose* by Payen, which resembles gelatin in its gelatinizing property, but differs in its chemical relations, and is probably peculiar. It resembles the carrageenin of Irish moss, but has a greater gelatinizing power. The jelly formed by dissolving it in boiling water, and allowing the solution to cool, requires a higher temperature to liquefy it than gelatin jelly, and does not melt in the mouth. Gelose differs from gelatin in not being precipitated by tannic acid, and from rice jelly in not being rendered blue by iodine. Japan isinglass is used for the same purposes as that of animal origin. It is derived, according to Mr. Hanbury, from different species of various genera of sea-weed, and especially *Gelidium corneum.* (See *Am. Journ. of Pharm.*, July, 1860, p. 354.)—*Note to the twelfth edition.*

Strychnos Ignatia. Lindley, *Flor. Med.* 530.—*Ignatia amara.* Linn. *Suppl.* This species of Strychnos is a tree of middling size, with numerous long, cylindrical, glabrous, vine-like branches, which bear opposite, nearly sessile, oval, pointed, entire, and very smooth leaves. The flowers are long, nodding, white, tubular, fragrant, and arranged in short, axillary racemes. The fruit is of the size and shape of a pear, with a smooth, whitish, ligneous rind, enclosing about twenty seeds, embedded in a dry medullary matter, and lying one upon the other. The seeds are the part used. The tree is a native of the Philippine Islands, where the seeds were highly esteemed as a medicine, and, having attracted the attention of the Jesuits, were honoured with the name of their founder.

Properties. The seeds are about an inch long, rather less in breadth, still less in thickness, convex on one side, obscurely angular, with two, three, or four faces on the other, and marked at one end with a small depression indicating their point of attachment. They are externally of a pale-brown colour, apparently smooth, but covered in fact with a short down or efflorescence, which may be removed by scraping them with a knife. They are somewhat translucent, and their substance is very hard and horny. They have no smell, but an excessively bitter taste. To Pelletier and Caventou they yielded the same constituents as nux vomica, and, among them, 1·2 per cent. of strychnia. Analyzed by Mr. J. M. Caldwell, they were found to contain the two alkaloids, strychnia and brucia, combined with igasuric acid, and, besides these, a volatile principle, extractive, gum, resin, colouring matter, fixed oil, and bassorin, but no starch or albumen. (*Am. Journ. of Pharm.*, July, 1857, p. 298.) In consequence of the relatively larger proportion of strychnia which they yield, they have been considerably used instead of nux vomica, in the preparation of that alkaloid.

Medical Properties and Uses. MM. Magendie and Delile have proved that ignatia acts on the human system in the same manner as nux vomica. In the Philippines, the seeds have been employed for the cure of obstinate intermittents, and in numerous other diseases. It is probable that, in small doses, they act as a tonic. Recently, an extract prepared from them has been much used, having been first introduced into notice empirically, under the name of *ignatia amara.* It has been employed chiefly in cases of debility of the digestive organs, or general defect of nervous power; but, being in all probability identical in its effects with a similar preparation of nux vomica, though somewhat stronger, it may be used for all the therapeutic purposes to which the latter medicine is applied. It is scarcely necessary to observe that so energetic a substance should never be taken without regular medical supervision, as it may prove, if abused, a terrific poison. An extract is directed, in the present edition of the U. S. Pharmacopœia. (See *Extractum Ignatiæ.*) The dose may be from half a grain to a grain and a half, in pill, three times a day. A *tincture* may also be used. Prof. Procter has given the following formula for its preparation. Powder four troyounces of the beans coarsely by grinding, or in a mortar, add two fluidounces of water to the powder in a bottle, and heat by a water-bath until it swells up; then pour on it half a pint of alcohol, and, having continued the heat for three hours, put the whole into a percolator, and displace with alcohol until a pint of tincture is obtained. Or half an ounce of the extract may be dissolved in a pint of alcohol. The commencing dose, corresponding with that above stated of the extract, would be about sixteen minims.

Off. Prep. Extractum Ignatiæ, *U. S.* W.

INULA. *U. S. Secondary.*

Elecampane.

The root of Inula Helenium. *U. S.*

Aunée, *Fr.*; Alantwurzel, *Germ.*; Enula Campana. *Ital., Span.*

Inula. *Sex. Syst.* Syngenesia Superflua. — *Nat. Ord.* Compositæ-Asteroideæ, *De Cand.* Asteraceæ, *Lindley.*

Gen. Ch. Receptacle naked. *Seed-down* simple. *Anthers* ending in two bristles at the base. *Willd.*

Inula Helenium. Willd. *Sp. Plant.* iii. 2089; Woodv. *Med. Bot.* p. 64, t. 26. Elecampane has a perennial root, and an annual stem, which is round, furrowed, villous, leafy, from three to six feet high, and branched near the top. The leaves are large, ovate, serrate, crowded with reticular veins, smooth and deep-green upon the upper surface, downy on the under, and furnished with a fleshy midrib. Those which spring directly from the root are petiolate, those of the stem sessile and embracing. The flowers are large, of a golden-yellow colour, and stand singly at the ends of the stem and branches. The calyx exhibits several rows of imbricated ovate scales. The florets of the ray are numerous, spreading, linear, and tridentate at the apex. The seeds are striated, quadrangular, and furnished with a simple somewhat chaffy pappus.

This large and handsome plant is a native of Europe, where it is also cultivated for medical use. It has been introduced into our gardens, and has become naturalized in some parts of the country, growing in low meadows, and on the roadsides, from New England to Pennsylvania. It flowers in July and August. The roots, which are the officinal part, should be dug up in autumn, and in their second year. When older they are apt to be stringy and woody.

The fresh root of elecampane is very thick and branched, having whitish cylindrical ramifications, furnished with thread-like fibres. It is externally brown, internally whitish and fleshy; and the transverse sections present radiating lines. The dried root, as found in the shops, is usually in longitudinal or transverse slices, and of a grayish colour internally. The smell is slightly camphorous, and, especially in the dried root, agreeably aromatic. The taste, at first glutinous, and compared to that of rancid soap, becomes, upon chewing, warm, aromatic, and bitter. Its medical virtues are extracted by alcohol and water, the former becoming most strongly impregnated with its bitterness and pungency. A peculiar principle, resembling starch, was discovered in elecampane by Valentine Rose, of Berlin, who named it *alantin;* but the title *inulin*, proposed by Dr. Thomson, has been generally adopted. It differs from starch in being deposited unchanged from its solution in boiling water when the liquor cools, and in giving a yellowish instead of a blue colour with iodine. It has been found in the roots of several other plants. It may be obtained white and pure by precipitating a concentrated decoction with twice its volume of alcohol, dissolving the precipitate in a little distilled water, treating the solution with purified animal charcoal, and again precipitating with alcohol. (See *Am. Journ. of Pharm.*, xxxi. i. 69.) Dr. K. Trantl, in response to the offer of a prize by the Philosophical Faculty of the University of Munich, on the subject of inulin, has published a work, containing the results of a thorough experimental investigation into the subject, to which the prize was awarded, and which contains numerous interesting facts. Having no space here for these facts, we refer the reader to an abstract of them in the *Pharm. Journ. and Trans.* (Sept. 1871, p. 262.)* Besides this principle, elecampane contains, according to John, a white, concrete substance, called *helenin*, intermediate in its properties between the essential oils and camphor, and separable by distillation with water; a bitter extractive soluble in water and alcohol; a soft, acrid, bitter resin, having an aromatic odour when heated; gum; albumen; lignin; traces of volatile oil; a little wax; and various saline substances. If water is added to a tincture made by boiling the fresh root in alcohol, the liquid becomes turbid, and, in twenty-four hours, long white crystals of pure helenin are formed, leaving very little in solution. (*Archiv. der Pharm.*, lx. 30.)

Medical Properties and Uses. Elecampane is tonic and gently stimulant, and has been supposed to possess diaphoretic, diuretic, expectorant, and emmenagogue properties. By the ancients it was much employed, especially in the complaints peculiar to females; and it is still occasionally resorted to in amenorrhœa. In this country it is chiefly used in chronic diseases of the lungs, and is sometimes beneficial when the affection of the chest is attended with weakness of the digestive organs, or with general debility. From a belief in its deobstruent and diuretic virtues, it was formerly

* Another interesting paper, giving an account of the modifications which inulin undergoes in the plant producing it, and by the agency of heat and water, by M. Lefranc, is contained in the *Journal de Pharmacie* (Sept. 1870, p. 166), to which the reader is referred. (*Note to the fourteenth edition.*)

prescribed in chronic engorgements of the abdominal viscera, and the dropsy to which they so often give rise. It has also been highly recommended both as an internal and external remedy in tetter, psora, and other diseases of the skin. The usual modes of administration are in powder and decoction. The dose of the powder is from a scruple to a drachm. The decoction may be prepared by boiling half an ounce of the root in a pint of water, and given in the dose of one or two fluidounces. W.

IODINIUM. *U.S.*

Iodine.

Off. Syn. IODUM. "A non-metallic element, obtained principally from the ashes of sea-weeds." *Br.*

Iode, *Fr.;* Jod, *Germ.;* Iodina, *Ital., Span.*

The Iodine of the U. S. and Br. Pharmacopœias is considered as pure; and in both the tests are given by which its purity may be determined. As one of these tests, the latter Pharmacopœia states that "12·7 grains, dissolved in an ounce [fluidounce] of water containing 15 grains of iodide of potassium, require for complete discoloration 1000 grain-measures of the *volumetric solution of hyposulphite of soda.*"

Iodine is a non-metallic element, discovered in 1812 by Courtois, a soda manufacturer of Paris. It exists in certain marine vegetables, particularly the fuci or common sea-weeds, which are its most abundant natural source. It has been detected in some fresh-water plants, among which are the water-cress, brooklime, and fine-leaved water-hemlock; also in the ashes of tobacco, and of Honduras sarsaparilla. (*Chatin.*) It has been found in the beet-root of the Grand Duchy of Baden. (*Lamy.*) M. Chatin announced the presence of iodine in the atmosphere and in rain-water; but the negative experimental results of Dr. S. Macadam of Edinburgh, of Dr. Lohmeyer of Göttingen, and of M. S. De Luca of Paris, threw doubts on the experiments of M. Chatin, who was supposed to have been misled by the use of reagents containing iodine. Nevertheless, M. Chatin, in answer to the two chemists first named, reasserts the correctness of his results; and declares that he has found iodine in the rain-water of Paris, Versailles, and many other towns in France, while he has failed to discover it in the waters of the Alps and Norwegian mountains. (*Journ. de Pharm.*, Avril, 1860, p. 259.) Dr. Macadam detected a trace of iodine in 100 gallons of water used for domestic purposes in Edinburgh, in several of the domestic animals, and in man. He detected it also in potatoes, beans, peas, wheat, barley, and oats. (*Pharm. Journ.*, Nov. 1854, p. 235.) Iodine is moreover found in the animal kingdom, as in the sponge, the oyster, various polypi, cod-liver oil, and eggs; and, in the mineral kingdom, in sea-water in minute quantity, in certain salt springs, as iodide of silver in a rare Mexican mineral, in a zinc ore of Silesia, in native nitrate of sodium, and in some kinds of rock salt. It has been detected by M. Genteles in the aluminous schists of Sweden, by Prof. Sigwart in bituminous slate, by M. Lembert in limestone rocks, and by M. Bussy and M. Duflos in coal. A mineral is said to have been discovered in Chili, consisting of iodide, oxide, and chloride of lead, of which iodine constitutes ten per cent. If, as is reported, this mineral is in large quantities, it may become an important source of iodine. (*Med. and Surg. Reporter.* July 1, 1865, p. 10; from the *Druggists' Circular.*)* M. Bussy has obtained iodine, in the proportion of one part in five thousand, from the coal-gas liquor of the gas-works of Paris. It was first discovered in the United States in the water of the Congress Spring, at Saratoga, by Dr. William Usher. It was detected in the Kenhawa saline waters by the late Professor Emmet; and it exists in the bittern of the salt-works of western Pennsylvania, in the amount of about eight grains to the gallon. In sea-weeds the iodine exists in the state probably of iodide of sodium. In different countries, sea-weeds are burned for the sake of their ashes; the product being a dark-coloured fused mass called *kelp.* This substance, besides carbonate

* By Dr. A. Lachman it is stated that about 40 kilogrammes of iodine are prepared daily, at Tarapaca, Peru, from the crude soda of that country, by a process which will be found detailed in the *American Journ. of Pharmacy* (Jany. 1871, p. 31).—*Note to the fourteenth edition.*

and iodide of sodium, contains more or less common salt, chloride of potassium, sulphate of sodium, &c. The deep-sea fuci contain the most iodine; and, when these are burned at a low temperature for fuel, as is the case in the island of Guernsey, their ashes furnish more iodine than ordinary kelp. (*Graham.*) According to Dr. Geo. Kemp, the laminarian species, especially *Laminaria digitata*, *L. saccharina*, and *L. bulbosa*, which are deep-water sea-weeds, and contain more potassium than sodium, are particularly rich in iodine. In a paper on the extraction of iodine from sea-weeds, Dr. Kemp makes many useful suggestions, having chiefly in view the prevention of the waste of the element, which takes place in the ordinary kelp process. (*Chem. Gaz.*, July 1, 1850.)*

Preparation. Iodine is obtained from kelp, and in Great Britain is manufactured chiefly at Glasgow. The kelp, which on an average contains a 224th part of iodine, is lixiviated with water, in which about half dissolves. The solution is concentrated to a pellicle and allowed to cool; whereby nearly all the salts, except iodide of sodium, are separated, they being less soluble than the iodide. The remaining liquor, which is dense and dark-coloured, is made very sour by sulphuric acid, which causes the evolution of carbonic acid, sulphuretted hydrogen, and sulphurous acid, and the deposition of sulphur. The liquor is then introduced into a leaden still, and distilled with deutoxide of manganese into a series of glass receivers, inserted into one another, in which the iodine is condensed. In this process the iodide of sodium is

* Dr. Wallace and Mr. Lamont, of Glasgow, in a paper describing a new method of estimating the proportion of iodine in kelp, state that, in parcels from the West Highlands, they had obtained from 0·162 to 0·175 per cent., which is a much larger product than that mentioned in the text; but they operated on small quantities, which yield a larger percentage than is procured by operations on a large scale, in consequence of the loss necessarily incurred in them. (*Chem. Gaz.*, April 1, 1859, p. 137.) A complete analysis of kelp by Mr. Lamont is contained in the same journal. (June 1, 1859, p. 210.) To prevent the loss of iodine by volatilization in the burning of sea-weeds, Dr. Wallace proposes to extract all the iodine compounds they contain by boiling them with water, and evaporating the decoction. The extract thus obtained is to be treated as kelp.

New method of preparing kelp. As the preparation of kelp for the extraction of iodine may possibly become a source of profitable occupation upon the sea-coast of some parts of the United States, the following observations, contained in a paper on its manufacture, read by Mr. Ed. C. C. Stanford before a meeting of the British Pharmaceutical Society, may be of advantage. The present process, employed in the Highlands of Scotland, is on various accounts objectionable, but especially from the waste of iodine attending it. From the high heat to which the sea-weed is exposed in its conversion into ashes, much of the iodine is driven off. From the same cause, the sulphates are deoxidized, and converted into sulphurets, the separation of which in the process for extracting the iodine necessitates a large expenditure of sulphuric acid. Besides, there is an entire loss of the volatile matters escaping during combustion which might be utilized by an improved process. The plan suggested by Mr. Stanford is to carbonize the weed in close vessels. The following is a summary of his method, as specified in a patent taken out in Great Britain and France.

The sea-weeds, which may be gathered at all seasons, should be well dried, and then compressed into cakes of convenient size. These are put into large cylindrical vessels of wrought iron heated from without, placed vertically, with the base and upper end conical, and with arrangements for introducing and withdrawing the charge. The retorts, thus formed, are furnished at the upper end with pipes which carry the volatilized products to an iron main, whence they pass through a series of ordinary iron pipe condensers, from which the uncondensed matter passes through a pair of scrubbers to a gasometer. When sufficiently charred, the contents of the retorts are withdrawn into closely-covered iron boxes, which are to be removed to a convenient place. When cool, the charcoal is lixiviated like kelp, and the solution treated in the ordinary manner for separating the iodine. The lixiviated charcoal may be used for heating the retort, and the gas collected in the gasometer for lighting the factory, or for producing heat. The ashes resulting from the burning of the charcoal is a valuable manure. The condensed products of the distillation may be used for obtaining muriate of ammonium, and utilized in various other ways. (*Pharm. Journ.*, April, 1862, p. 502.)—*Note to the twelfth edition.*

M. Ed. Moride proposes the following plan, which he thinks has advantages over those previously in use. He contents himself with carbonizing the plants, fresh or dry, in the locality where collected, by means of a little portable furnace adapted to the purpose. He then lixiviates the charcoal in a percolation apparatus, concentrates the liquid obtained by means of vapour, withdraws the sulphate of potassium and the chlorides thrown down, and then, after having added a hypochlorite or hyponitric acid, treats the liquor with benzine in a special apparatus, arranged so that the benzine takes the iodine from the liquor, yields it afterwards to potassa or soda, and, being itself recovered, may be used again indefinitely. The mixed alkaline iodides and iodates are precipitated by muriatic acid, or, still better, by the chlorine liquors remaining in the manufacture of bromine. The iodine obtained is then dried and brought to the state of mass, as in commerce. The bromine present in the liquors, deprived of iodine by benzine, may be withdrawn either by adding sulphuric acid and black oxide of manganese and distilling, or by eliminating it directly, in the liquid state, in the liquors concentrated and made very acid. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 165, A.D. 1866.)—*Note to the thirteenth edition.*

decomposed, and the iodine evolved; and the sulphuric acid, deutoxide of manganese, and sodium unite, so as to form sulphate of protoxide of manganese and sulphate of sodium.

The British Pharmacopœia of 1864 purified iodine as follows. "Take of Iodine of Commerce *one ounce.* Introduce the Commercial Iodine into a porcelain capsule of a circular shape, cover this as accurately as possible with a glass matrass filled with cold water, and apply to the capsule the heat of boiling water for twenty minutes. Let the matrass be now removed, and should colourless acicular prisms of a pungent odour be found attached to its bottom, let them be separated from it. This being done, the matrass is to be restored to its previous position, and a gentle and steady heat (that of a gas lamp answers well) applied, so as to sublime the whole of the iodine. Upon now allowing the capsule to cool, and lifting off the matrass, the purified product will be found attached to the bottom of the latter. When separated it should be immediately enclosed in a bottle furnished with an accurately ground stopper." *Br.*

In this process, which is that of the former Dublin Pharmacopœia, a short preliminary sublimation by the heat of a water-bath is ordered, in which the bottom of a glass matrass filled with cold water is the refrigerator. The object of this is to separate any iodide of cyanogen that may happen to be present. This impurity is sometimes present in considerable amount. Klobach obtained from eighty avoirdupois pounds of commercial iodine twelve ounces of this iodide, which is in the proportion of nearly one per cent. (*Chem. Gaz.*, April 15, 1850.) Should the matrass, upon its removal, have attached to its bottom white acicular crystals, these will be the iodide in question, and must be rejected. The matrass having been replaced, heat is again applied until the whole of the iodine has sublimed, and attaches itself to the cool bottom of the matrass.

Water has sometimes been found in iodine to the extent of 15 or 20 per cent. If considerable, it is easily discovered by the iodine adhering to the inside of the bottle. M. Bolley estimates its amount by rubbing together, until the smell of iodine disappears, 30 grains of iodine with about 240 of mercury, in a small weighed porcelain dish, using a small weighed agate pestle. When complete combination has been effected, the whole is placed in a water-bath to dissipate the water. The loss of weight gives the amount of water in the iodine. (*Chem. Gaz.*, Mar. 15, 1853, p. 118.) The presence of water is injurious only as it renders all the preparations of iodine weaker than they should be. In the former Ed. Pharmacopœia, directions were given to dry it, by placing it "in a shallow basin of earthenware, in a small confined space of air, with ten or twelve times its weight of fresh-burnt lime, till it scarcely adheres to the inside of a dry bottle."

Properties. Iodine is a soft, friable, opaque substance, in the form of crystalline scales, having a bluish-black colour and metallic lustre. It possesses a peculiar odour, somewhat resembling that of chlorine, and a hot, acrid taste. Applied to the skin, it produces a yellow stain, which soon disappears. Its sp. gr. is 4·9. It is a volatile substance, and evaporates even at common temperatures. When heated, it volatilizes more rapidly, and, when the temperature reaches 225°, it melts and rises in a rich purple vapour, a property which suggested its name. Its vapor has the sp. gr. 8·7, being the heaviest aëriform substance known. If inhaled mixed with air, it excites cough and irritates the nostrils. When it comes in contact with cool surfaces, it condenses in brilliant steel-gray crystals. Iodine is freely soluble in alcohol and ether, but requires 7000 times its weight of water to dissolve it. If water stands on iodine for some time, especially in a strong light, it apparently dissolves more iodine; but the result depends upon the formation of hydriodic acid, in a solution of which iodine is more soluble than in water. The solution of iodine in water has no taste, a feeble odour, and a light-brown colour; in alcohol or ether, is nearly black. Its solubility in water is very much increased by the addition of certain salts, as the chloride of sodium, nitrate of ammonium, or iodide of potassium; and the same effect is produced, to some extent, by tannic acid. Its solution in tannic acid is called *iodo-tannin*, of which MM. Socquet and Guillermond make a syrup for internal, and an aqueous solution for external use. For the formulas, see the *B. and F. Medico-*

chir. Rev., July, 1854, p. 181. It is also soluble in glycerin, as ascertained by M. Cap in 1854. According to Dr. I. Walz, glacial acetic acid is an excellent solvent of iodine, at least equal to alcohol. When the acid is heated by boiling with excess of iodine, and then allowed to cool slowly, it deposits iodine in beautiful large slender crystals, sometimes half an inch long, much larger and more abundant than those formed from the alkaline solution. (*Chem. News*, May 9, 1873, p. 233; from the *Journal of the Franklin Institute.*) In chemical habitudes iodine resembles chlorine, but its affinities are weaker. Its eq. is 126·3, and symbol I. It combines with most of the non-metallic, and nearly all the metallic elements, forming a class of compounds called *iodides*. Some of these are officinal, as the iodides of iron, mercury, lead, potassium, and sulphur. It forms with oxygen one oxide, *oxide of iodine*, and three acids, *iodous*, *iodic*,* and *hyperiodic*, and with hydrogen, a gaseous acid, called *hydriodic acid.*

Tests, &c. Iodine, in most cases, may be recognised by its characteristic purple vapour; but where this cannot be made evident, it is detected unerringly by starch, which produces with it a deep-blue colour. This test was discovered by Colin and Gaultier de Claubry, and is so delicate that it will indicate the presence of iodine in 450,000 times its weight of water. In order that the test may succeed, the iodine must be free, and the solutions cold. To render it free when in combination, as it always is in the animal fluids, a little nitric acid, free from iodine, must be added to the solution suspected to contain it. Thus, in testing urine for iodine, the secretion is mixed with starch, and acidulated with a drop or two of nitric acid; when, if iodine be present, the colour produced will vary from a light purple to a deep indigo blue, according to the amount of the element present. Sometimes, in mineral waters, the proportion of iodine is so minute that the starch test, in connection with nitric acid, gives a doubtful coloration. In such cases, Liebig recommends the addition to the water of a very small quantity of iodate of potassium, followed by a little starch and muriatic acid. Assuming the iodine to be present as hydriodic acid, the liberated iodic acid sets free the iodine of the mineral water, and becomes itself deoxidized, thus increasing the amount of the free iodine ($5HI$ and $IO_5 = 5HO$ and I_6). This test would be fallacious, if iodic acid, mixed with muriatic acid, coloured starch; but this is not the case. Still, Liebig's test is inapplicable in the presence of reducing agents, such as sulphurous acid, which would give rise to free iodine from the test itself, independently of the presence of the element in the water tested. (*Dr. W. Knop.*) Mr. M. Carey Lea proposes chromic acid as a substitute for the nitric, for the liberation of iodine, as a more delicate test. It may be most conveniently applied by first adding starch to the liquid to be tested, and then a little dilute solution of bichromate of potassium, enough to cause a pale-yellow colour, followed by a few drops of muriatic acid. (*Am. Journ. of Sci. and Arts*, A.D. 1866, xlii. 109.) Another test for iodine, proposed by M. Rabourdin, is chloroform, by the use of which he supposes that the element may be not only detected in organic substances, but approximately estimated. Thus, if 150 grains of a solution, containing one part in one hundred thousand of iodide of potassium, be treated with 2 drops of nitric and 15 or 20 of sulphuric acid, and afterwards shaken with 15 grains of chloroform, the latter acquires a distinct violet tint. M. Rabourdin applies his test to the detection of iodine in the several varieties of cod-liver oil. For this purpose he incinerates, in an iron spoon, 50 parts of the specimen of oil with 5 of *pure* caustic potassa, dissolved in 15 of water, and exhausts the cinder with the smallest possible quantity of water. The solution is filtered, acidulated with nitric and sulphuric acids, and agitated with 4 parts of chloroform. After a time the chloroform subsides, of a violet colour more

* Dr. R. H. Brett, of Liverpool, has found that when a small portion of several of the alkaloids, or their salts, is mixed with about an equal portion of iodic acid and a few drops of water, and the mixture gently heated, a succession of distinct explosions, attended by the evolution of gas, takes place. Dr. Brett finds that this phenomenon occurs with all the alkaloids yet tried by him, but not with other classes of organic substances, whether nitrogenous or non-nitrogenous, and thinks it will prove a valuable test for the former. (*Pharm. Journ.*, Nov. 1854.) According to Mr. R. F. Fairthorne, of this city, several of the more poisonous alkaloids, dissolved by the aid of an acid, yield, with the officinal compound solution of iodine, precipitates, insoluble in weak sulphuric, muriatic, or acetic acid. He therefore infers that the above-mentioned solution might prove useful as an antidote to the alkaloids. (*Am. Journ. of Pharm.*, May, 1856.)—*Note to the eleventh edition.*

or less deep according to the proportion of iodine present. M. Lassaigne considers the starch test more delicate than that of chloroform. For detecting iodine in the iodides of the metals of the alkalies, he considers bichloride of palladium as extremely delicate, producing brownish flocks of biniodide of palladium. According to M. Moride, benzine is a good test for free iodine, which it readily dissolves, forming a solution of a bright-red colour, deeper in proportion to the amount of iodine taken up. As benzine does not dissolve chlorine or bromine, it furnishes the means of separating iodine from these elements. Mr. D. S. Price has pointed out the nitrites as exceedingly sensitive tests of iodine, combined as an iodide. The suspected liquid is mixed with starch paste, acidulated with muriatic acid, and treated with solution of nitrite of potassium. The iodine is set free, and a blue colour appears, more or less deep, according to the proportion of iodine present. By this test, iodine may be detected in an aqueous solution containing only one in 400,000 parts. A similar test had been previously proposed by M. Grange.

It has been long known that, when a mixture of iodine and starch in water is subjected to heat, the blue colour disappears, and, if the heat be not too long continued, so as to volatilize the iodine, or convert it into hydriodic acid, the colour will return on the cooling of the liquid. Various explanations have been given of this curious fact by Personne and others, but none quite satisfactory, until that by M. Magnes Lahens, which he supports by experiment, that during the continuance of the heat, the particles of starch and iodine separate to unite again on refrigeration. (*Journ. de Pharm.*, 4e sér., iii. 405.)*

Adulterations. Iodine is said to be occasionally adulterated with mineral coal, charcoal, plumbago, and black oxide of manganese. These are easily detected by their fixed nature, while pure iodine is wholly volatilized by heat. Herberger found native sulphuret of antimony in one sample, and plumbago in another; and Righini has detected as much as 25 per cent. of chloride of calcium. The presence of iodide of cyanogen and of water have already been referred to, and the modes of detecting and separating them pointed out. (See *page* 500.) Besides the test given at page 498, the British Pharmacopœia directs that officinal iodine should be soluble in alcohol, ether, and a solution of iodide of potassium, and should sublime without residue, and that the part which first comes over should contain no colourless prisms of a pungent odour.

Medical Properties. Iodine was first employed as a medicine in 1819, by Dr. Coindet, Sen., of Geneva. It operates as a general excitant of the vital actions, especially of

* *The estimation of iodine.* The following method of estimating the quantity of iodine in any mixture is given by M. Adolphe Bobierre, Doctor of Science and Chief Director of the School of Science, at Nantes, in the *Journal de Pharmacie* (Jan. 1869, p. 8), as the most direct and convenient yet employed, while its accuracy may be relied on.

Preparation of the reagents. A concentrated solution of iodide of potassium is made, which should remain invariable under a fixed series of trials. This solution is intended to receive the iodine to be tried. The normal solution of arsenite of sodium is obtained, by combining 4·95 grammes of arsenious acid with 14·5 grammes of bicarbonate of sodium crystallized, and bringing the aqueous liquid to the volume of one litre. This solution destroyed an iodized liquid containing 12·688 grammes of iodine to the litre; and even granting that the arsenical solution has not exactly this reducing power, the trial would not be less exact, since at the moment of making it, the relation of a given weight of the iodine to the arsenite would be determined.

Performance of the analysis. This is executed advantageously in a little stoppered glass bottle such as is usually employed for hydrometrical experiments. The operator introduces into it 10 cubic centimetres of the solution of arsenite of sodium, to which he adds 5 cubic centimetres of the solution of the bicarbonated alkali; adding to the whole about 4 cubic centimetres of perfectly colourless benzine.

Next, a certain quantity of very pure iodine is weighed between two watch-glasses, and dissolved in the concentrated solution of iodide of potassium already prepared. A phial of 100 cubic centimetres is filled with this coloured liquid, and, after shaking, is emptied into a graduated measure.

On causing the iodized solution to fall, drop by drop, into the arsenical, and shaking vigorously, the brown colour is seen instantly to disappear; but hardly has the arsenite been transformed, when the traces of liberated iodine give rise to a double phenomenon. In the first place, the benzine becomes rose-coloured; and, secondly, the watery liquid, perfectly colourless at the beginning of the process, assumes a very sensible yellowish shade, the significant character of which may justly cause surprise, when the minute quantity of the iodine is considered which determines it.

It is readily comprehended, for the rest, that a second trial made with the iodine to be examined, employed in the same weight, immediately gives the result sought for, since the volume of solution necessary to destroy the alkaline arsenite, is invariably proportionate to the real quantity of iodine which it is purposed to determine. (*Note to the fourteenth edition.*)

the absorbent and glandular systems. Its effects are varied by its degree of concentration, state of combination, dose, &c.; and hence, under different circumstances, it may prove corrosive, irritant, desiccant, tonic, diuretic, diaphoretic, and emmenagogue. It probably acts by entering the circulation; at least it has been proved by numerous observations that, whether taken internally, or applied externally, it always passes with the secretions, particularly the urine and saliva, not, however, uncombined, but in the state of hydriodic acid or an iodide. Cantu detected it not only in the urine and saliva, but also in the sweat, milk, and blood. According to Dr. John C. Dalton, Jun., of New York, iodine, taken in a single moderate dose, appears in the urine in thirty minutes, and may be detected for nearly twenty-four hours. In two cases in which large doses of iodide of potassium had been taken for six or eight weeks, and the medicine intermitted, all trace of iodine disappeared from the urine in eighty-four hours. From this observation Dr. Dalton infers, as Becquerel had previously done, that iodine does not accumulate in the system, and that, therefore, the effect of moderate doses is probably equal to that of large ones, the excess constantly passing off, principally by the kidneys. But iodine is not, like iron, a reconstructive element, and does not act by supplying anything to the system. Hence its rapid elimination by the urine may have a therapeutic effect; and this effect may be in proportion to the amount eliminated. It is certainly not an unreasonable supposition that the medicine, while passing off in larger or smaller quantity by the kidneys, may carry with it more or less abnormal material, and thus act as a sorbefacient.

The tonic operation of iodine is evinced by its increasing the appetite, which is a frequent effect of its use. Salivation is occasionally caused by it, and sometimes soreness of the mouth only. In some cases, pustular eruptions and coryza have been produced; especially when the remedy has been given in the form of iodide of potassium. In an overdose it acts as an irritant poison. Doses of two drachms, administered to dogs, have produced irritation of the stomach, and death in seven days; and the stomach was found studded with numerous little ulcers of a yellow colour. From four to six grains in man, cause a sense of constriction in the throat, sickness and pain at the stomach, and at length vomiting and colic. Even in medicinal doses, it sometimes causes alarming symptoms; such as fever, restlessness, disturbed sleep, palpitations, excessive thirst, acute pain in the stomach, vomiting and purging, violent cramps, frequent pulse, and, finally, progressive emaciation, if the medicine be not laid aside. The condition of the system, marked by these effects of iodine, is called *iodism*. Upon their first appearance, the remedy should be discontinued, and a milk diet prescribed. Though iodism, when it occurs, is generally the result of incautious doses of the medicine too long continued, yet it sometimes arises, under other circumstances, from causes not well understood. On the other hand, large doses have been given for a long time with perfect impunity. Dr. Lugol, of Paris, never observed alarming effects to arise from iodine, given in the doses and in the state of dilution in which he prescribed it. On the contrary, many of his patients gained flesh, and improved in general health.

Testimony is not wanting to the effect, that a long course of the remedy has in some instances occasioned absorption of the mammæ and wasting of the testicles. Yet Dr. T. H. Silvester, who had the opportunity of making extensive observations in St. Thomas's Hospital, London, on the effects of iodine in the form of iodide of potassium, did not meet with a single instance of atrophy or absorption of these glands. Numerous cases of syphilitic periostitis were successfully treated, enlarged testicles from a syphilitic cause reduced, and chronic induration of the inguinal glands removed; but in no case was atrophy or absorption of the breast or testicle observed. It would thus appear that iodine, as a general rule, does not affect the healthy glands, but acts upon abnormal material, such as tumours, enlargements, and thickenings.

The variable operation of iodine may to some extent be accounted for by the more or less amylaceous character of the food; starch having the property of uniting with iodine and rendering it mild. Dr. Lebert, who has practised both in Switzerland and France, explains the fact in another way. Under his observation, the accidents produced by iodine, with scarcely an exception, were in those cases of goitre in which

the remedy acted rapidly in removing the tumour; while in scrofulous, tuberculous, and syphilitic patients, free from goitre, though the medicine was given in considerable doses, no injury to the system ensued. He supposes that the bad effects, in the goitre cases, arose from the too prompt absorption of the abnormal material of the tumour, which, entering the circulation in the course of its elimination, produced the poisonous effect, and not from the iodine itself. (*Ann. de Thérap.*, 1855, p. 228.)

Iodine has been principally employed in diseases of the absorbent and glandular systems. It has been used with success in ascites, especially when connected with diseased liver. It acts most efficiently immediately after tapping. It has proved successful with several British practitioners in ovarian tumours, but has failed in the hands of others. Dr. B. Roemer, of Otter Bridge, Va., reports three cases of ovarian tumour, removed by the combined internal and external use of the remedy. (*Am. Journ. of Med. Sci.*, April, 1857.) In glandular enlargements and morbid growths, it has proved more efficacious than in any other class of diseases. Dr. Coindet discovered its extraordinary power in curing goitre;* and it has been used with more or less advantage in enlargements and indurations of the liver, spleen, mammæ, testes, and uterus. In hepatic affections of this kind, where mercury has failed or is inadmissible, iodine is our best resource. Dr. Morell Mackenzie reports very favourably of the effects of iodine injected hypodermically into the thyroid. (*Am. J. of Med. Sci.*, Oct. 1873, p. 553.) In chronic diseases of the uterus, with induration and enlargement, and in hard tumours of the cervix and indurated puckerings of the edges of the os tincæ, iodine has occasionally effected cures, administered internally, and rubbed into the cervix, in the form of ointment, for ten or twelve minutes every night. The emmenagogue power of iodine has been noticed by several practitioners. It has been recommended in gleet; also in gonorrhœa and leucorrhœa, after the inflammatory symptoms have subsided. In the latter complaint, iodine rendered soluble by iodide of potassium, has been used successfully, in the form of injection, by Dr. T. T. Russell, of Pattersonville, La. He joined to the local treatment, the internal use of the tincture of chloride of iron. (*Am. Journ. of Med. Sci.*, April, 1854.) In pseudo-syphilis, mercurial cachexy, and the poisonous effects of lead, it is one of our best remedies, in the form of iodide of potassium. In the same form, it is a favourite remedy in chronic rheumatism, and, by Gendrin, was employed in acute gout, with the supposed effect of cutting short the fits. Dr. Manson, as early as 1825, recorded cases of the efficacy of iodine in several nervous diseases, such as chorea and paralysis. In various scaly eruptions, the internal and external use of the remedy is very much relied on. The tincture has been strongly recommended in diabetes by M. Bérenger-Féraud. (*Ann. de Thérapeutique*, 1866, p. 243.) Professor Felix de Willdetrand, of the University of Helsingfors, Finland, has used iodine largely in typhus and typhoid fevers; and found it to act favourably in moderating the disease and diminishing its mortality. He also found it beneficial in the malarious fevers of his neighbourhood, disposing them when given early to assume the intermittent form, and often arresting them promptly in this state. (*Archives Gén. de Méd.*, Juillet, 1869, p. 46.) Dr. Schmidt has witnessed good effects from tincture of iodine in incontinence of urine from palsy, and in that of the old. (*New Remedies*, July, 1874, p. 211.) Dr. Menzel obtained great success in a severe epidemic of diphtheria prevalent in Triest, from the local application of iodine to the mouth and fauces. Wonderfully curative effects resulted in some of these cases from the injection of solution of iodine into the substance of the inflamed tonsil. (*Med. Record*, Feb. 2, 1874, p. 67, from *Wiener Med. Wochensc.*, Nov. 8, 1873.)

But it is in scrofulous diseases that the most striking results have been obtained

* M. Chatin, finding, according to his observations, a great variation in the amount of iodine in the air, water, and soil of different localities, has founded on this supposed fact an explanation of the prevalence of goitre and cretinism in some places, and their absence in others. Thus, in certain parts of France, near Paris, which he calls the Paris zone, the amount of iodine thus distributed is comparatively large, and goitre and cretinism are unknown; while, in the Alpine valleys, where only one-tenth the amount of iodine is found, these affections are endemic. The conclusions of M. Chatin are controverted by the experiments, so far as they go, of M. Lohmeyer, of Göttingen, and of M. Kletzinsky, of Vienna, who failed to detect iodine in the air of those cities the inhabitants of which are free from goitre. (*Note to the eleventh edition.*)

by the use of iodine. Dr. Coindet first directed attention to its effects in scrofula, and Dr. Manson reported a number of cases of this affection, in a large proportion of which the disease was either cured or meliorated. The latter physician derived benefit from its use also in white swelling, hip-joint disease, and distortions of the spine, diseases admitted to be connected with the scrofulous taint. We are indebted, however, to Dr. Lugol for the most extended researches in relation to the use of iodine in scrofula. This physician began his trials in the hospital Saint Louis, in 1827, and published his results in three memoirs, in 1829, 1830, and 1831. The scrofulous affections, cured by Dr. Lugol by the iodine treatment, were glandular tubercles, ophthalmia, ozæna, lupus, and fistulous and carious ulcers.

After the publication of Dr. Lugol's memoir, his practice was imitated and extended. Dr. Bermond, of Bordeaux, succeeded with the iodine treatment in enlarged testicle from a venereal cause, scrofulous ophthalmia of six years' duration, and scrofulous ulcers and abscesses of the cervical and submaxillary glands. In numerous other cases of scrofula under his care, iodine proved beneficial; though, before its commencement, the cases underwent no improvement. The only peculiarity in Dr. Bermond's treatment was that, in some cases, he associated opiates with the iodine. In ophthalmia, the collyrium employed by him consisted of *thirty drops* of tincture of iodine, *thirty-six* of laudanum, and *four fluidounces* of distilled water. When the local application of the iodine created much pain or rubefaction, he found advantage from combining extract of opium with it. A plaster, which proved efficacious as an application to an enlarged parotid, consisted of lead plaster (diachylon) and iodide of potassium, each, *four parts*, and iodine and extract of opium, each, *three parts*. In confirmation of Dr. Bermond's statements, M. Lemasson published a number of cases, proving the efficacy of a combination of iodine and opium in the local treatment of scrofulous ulcerations. One of the combinations which he employed consisted of *fifteen grains* of iodine, *a drachm* of iodide of potassium, and *two drachms* of Rousseau's laudanum, made into an ointment with *two ounces* of fresh lard.

The most eligible form of iodine for internal administration is its solution in water, aided by iodide of potassium. This is the form preferred by Dr. Lugol; and such a solution is among the preparations of the U. S. Pharmacopœia. The solutions employed by Dr. Lugol contained one part of iodine, and two of iodide of potassium; and the doses given by him were equivalent to half a grain of iodine daily for the first fortnight, three-quarters of a grain daily for the second and third fortnights, one grain daily during the fourth and fifth, and, in some cases, a grain and a quarter daily for the remainder of the treatment; always largely diluted. (See *Liquor Iodinii Compositus.*) The tincture of iodine is not eligible for internal use; for, when freshly prepared, the iodine is precipitated from it by dilution with water; and, as a consequence, the irritating solid iodine will come in contact with the stomach when the dose is swallowed. The same objection is not applicable to the compound tincture, or to the simple tincture after having been long kept.

The favourable results obtained by Dr. Lugol, in the treatment of scrofulous diseases by the iodine preparations, are so numerous as to leave no doubt of their efficacy in these affections. To judge fairly, however, of his results, it is not sufficient to give iodine; but it should be given in the manner in which it was employed by him. We can readily conceive that a dilute aqueous solution of iodine may act differently from the tincture; for a therapeutical agent may in a dilute form be introduced gradually into the current of the circulation, and thus produce important alterative effects; while in a concentrated form it may create irritation of the stomach without being absorbed, and thus prove mischievous. A case in point is furnished by natural mineral waters, which, though generally containing a minute proportion of saline matter, often produce remedial effects which cannot be obtained by their constituents in larger doses. These views are confirmed and extended by M. Benj. Belli, in an able paper on the efficacy of a certain dilution of medicines, illustrated by examples drawn from iodine, bromine, iron, antimony, belladonna, oil of turpentine, and common salt, published in the *Annuaire de Thérapeutique*, for 1857, p. 270. They correspond also with the views of Dr. A. Buchanan, of Glasgow, who

gives iodine in the form of iodide of starch, and of hydriodic acid largely diluted with water. (See *Iodide of Starch* and *Hydriodic Acid* in *Part III.*)

A mode of safely bringing and maintaining the system under the influence of iodine, proposed by M. Boinet, and called by him *iodic alimentation*, is to mix the medicine with the food, as with bread and other farinaceous substances, so that the patient may take daily a due quantity, which, with this mode of administration, may be large, if desirable, without inconvenience. The compound formed with starch by the iodine, while destitute of irritating properties, is taken readily into the system, and produces the remedial effects of the medicine.

M. Marchal (de Calvi), under the impression that cod-liver oil owed its chief virtue to the presence of iodine, proposed, in 1848, to prepare an *iodized oil*. Following out this proposal, M. Personne devised the following formula. Five parts of iodine are mixed with a thousand of almond oil, and the mixture is subjected to a jet of steam, until decolorized. The same operation is repeated with five additional parts of iodine. The oil is then washed with a weak alkaline solution, to remove the hydriodic acid, developed in the process. By this mode of proceeding, it may be presumed that the iodine is intimately united with the oil, along with which it would find an easy entrance into the system; and that, while about half of the iodine is lost as hydriodic acid, the remainder takes the place of the hydrogen eliminated from the oil. In 1851, the French Academy appointed MM. Guibourt, Soubeiran, Gibert, and Ricord, to report upon the therapeutic value of a definite combination of iodine and oil. The reporter (Guibourt) approved of M. Personne's process; and MM. Gibert and Ricord reported favourably of the therapeutic effects of the preparation. M. Personne's iodized oil differs little in appearance and taste from almond oil, and is easily taken alone or in emulsion. The usual dose is two fluidounces daily, which may be increased to three fluidounces or more. (*Am. Journ. of Med. Sci.*, xxiii. 502.)

M. Berthé and M. Lepage have objected to M. Personne's iodized oil, that it is of variable iodine strength, and that it is liable to become rancid, in consequence of the use of steam in its preparation. M. Berthé makes an iodized oil, which he alleges to be free from these objections, by heating, to about 176°, five parts of iodine with a thousand parts of almond oil, in a water-bath, until decoloration shall have taken place. The resulting oil is colourless, perfectly transparent, without odour or rancidity, not acted on by starch, and of a constant composition. To shorten the time in preparing the oil, M. Lepage dissolves the iodine in three times its weight of ether, before adding it to the oil, and briskly shakes the mixture for eight or ten minutes. The preparation is then heated in a water-bath, to decolorize it and drive off the ether. M. Hugounenq objects to this process that, if the oil be completely deprived of the odour of ether, the heating must be continued for several hours. He also objects to any process which requires the continued application of heat, as rendering the oil liable to become quickly rancid. His plan is to rub up the iodine, for five or six minutes, in a porcelain mortar, with a small portion of the oil, and then gradually to add the remainder. A red limpid liquid is obtained, which may be completely decolorized by exposure for fifteen minutes to the sun's rays. Iodized oil, thus prepared, has the odour and taste of almond oil, is not more liable to become rancid than the pure oil, and is free from hydriodic acid. (*Journ. de Pharm.*, Mars, 1856.) From the above statements it is not easy to determine which is the best method of preparing iodized oil; but it may be useful to state that the preparation may be made with good olive oil, instead of the more expensive almond oil. From the statements of Hutet it may be inferred, that strong infusion of coffee is one of the best vehicles for the administration of iodine; one grain of iodine being deprived entirely of taste and smell by one teaspoonful of that liquid. (*Pharm. Journ.*, Dec. 1870, p. 529.)

The external treatment by iodine may be divided into general and topical. By its use in this way it does not create a mere local effect; but, by its absorption, produces its peculiar constitutional impression. The external treatment, when general, consists in the use of the *iodine bath*. This for adults should contain from two to four drachms of iodine, with double that quantity of iodide of potassium, dissolved in water, in a *wooden* bath tub; the proportion of the water being about a gallon for

every three grains of iodine employed. The quantity of ingredients for the baths of children is one-third as much as for adults, but dissolved in about the same proportional quantity of water. The quantity of iodine and iodide for a bath having been determined upon, it is best to dissolve them in a small quantity of water (half a pint for example), before they are added to the water of the bath; as this mode of proceeding facilitates their thorough diffusion. The iodine baths, which may be directed three or four times a week, usually produce a slight rubefacient effect; but, occasionally, a stronger impression, causing the epidermis to peel off, particularly of the arms and legs. The skin at the same time acquires a deep-yellow tinge, which usually disappears in the interval between the baths.

The topical application of iodine is made by means of several officinal preparations. (See *Unguentum Iodinii* and *Unguentum Iodinii Compositum.*) Besides these, several others have been employed topically. Lugol's *iodine lotion* consists of from two to four grains of iodine, and double that quantity of iodide of potassium, dissolved in a pint of water. It is used as a wash or injection in scrofulous ophthalmia, ozæna, and fistulous ulcers. His *rubefacient iodine solution* is formed by dissolving half an ounce of iodine and an ounce of iodide of potassium in six fluidounces of water. This is useful for exciting scrofulous ulcers, for touching the eyelids, and as an application to recent scrofulous cicatrices, to render them smooth. The rubefacient solution, added to warm water in the proportion of about a fluidrachm to the gallon, makes a convenient local bath for the arms, legs, feet, or hands; and, mixed with linseed meal or some similar substance, it forms a cataplasm useful in certain eruptions, especially where the object is to promote the falling off of scabs. External applications of iodine have been recommended for the removal even of internal plastic exudations, as to the side for example in protracted pleurisy. The rubefacient preparation of iodine at present most commonly employed is the tincture. (See *Tinctura Iodinii.*) The preparation, called *iodine paint*, is a tincture twice as strong as the officinal tincture, and is made by dissolving a drachm of iodine in a fluidounce of alcohol, and allowing the solution to stand in a glass-stoppered bottle for several months before it is used, when it will become thick and syrupy. It is applied with a glass or a camel's-hair brush, in one or more coatings, according to the degree of effect desired. Iodine paint is used as a counter-irritant, with advantage, in pains of the chest; in aphonia, applied to the front of the throat; in chronic pleuritic effusion, or consolidated lung, applied extensively opposite to the diseased part; in periostitis, whether syphilitic, strumous, or the result of injury; in inflammation of the joints; in serous effusion into bursæ; and in the cicatrices of burns. When thus used, it must be borne in mind that the iodine acts also by being absorbed. Another valuable application of it is for the removal of cutaneous nævi. Lugol's *caustic iodine solution* is made of iodine and iodide of potassium, each, an ounce, dissolved in two fluidounces of water. This is used to destroy soft and fungous granulations, and has been employed with decided benefit in lupus. The *Liniment of Iodine* of the British Pharmacopœia is intermediate in strength between the two solutions last mentioned. (See *Linimentum Iodi.*) Another caustic solution of iodine, under the name of *iodized glycerin*, is made by dissolving one part of iodide of potassium in two parts of glycerin, and adding the solution to one part of iodine, which it completely dissolves. Dr. Max Richter, of Vienna, to whom the credit belongs of having introduced into practice the solution of iodine in glycerin, found this caustic particularly useful in lupus, non-vascular goitre, and scrofulous and constitutional syphilitic ulcers. The solution is applied by means of a hair-pencil to the diseased surface, which must then be covered with gutta-percha paper, fixed at the edges by strips of adhesive plaster, in order to prevent the evaporation of the iodine. The application produces burning pain, which rarely lasts for more than two hours. The dressing is removed in twenty-four hours, and pledgets, dipped in cold water, applied. This iodine caustic is too strong for ordinary local use. A weaker solution is recommended by Dr. Szukits, formed of one part of iodine to five of glycerin, for application to the neck, female breast, abdomen, &c. After four or five paintings it causes excoriation, which requires its discontinuance, and the use of cold applications. A mode of applying iodine locally has been suggested by Dr. R. Greenhalgh, of Lon-

don, which consists in thoroughly impregnating raw cotton with a solution in glycerin of iodide of potassium and of iodine, in the proportion of two ounces of the former and one ounce of the latter to eight ounces of the menstruum, and then drying the "iodized cotton." It is intended for application to the cervix or os uteri, which is effected through a speculum. (*Lancet*, May 26, 1866, p. 582.)

Iodine is used by injection into various cavities. It has been employed in this way for the cure or relief of hydrocephalus, pleuritic effusion, hydropericardium, ascites, ovarian dropsy, hernia, hydrocele, spina bifida, dropsy of the joints, large cystic bronchocele, and chronic abscesses. Dr. J. M. Winn, of London, reports a case of chronic hydrocephalus in an infant, in which the injection of iodine was used, after tapping, with the apparent effect of retarding the reaccumulation of the fluid. M. Aran, of Paris, tried the same treatment, after tapping, in two cases of pleuritic effusion, and with success in one of the cases. The same physician reports a case of hydropericardium, relieved by twice tapping the sac, and twice injecting it with iodine within the space of twelve days. (*Am. Journ. of Med. Sci.*, April, 1856, p. 499.) Dr. Costes has tried these injections in ascites, but not with encouraging results. In practising them in this disease, Dr. Tessier lays down these rules; *first*, not to empty the peritoneal cavity before performing the injection, as the injected fluid requires dilution by the effused fluid; *second*, to regulate the amount of the injected fluid by the nature of the effused fluid, using twice as much, if the latter is decidedly alkaline and albuminous; and *third*, to practise a tapping some days before the time of injecting, if the abdomen be very voluminous, in order to diminish the peritoneal surface. Iodine injections in ovarian cysts were first practised, in 1846, by Dr. Allison, of Indiana, in a case that terminated favourably. They have been advocated by Prof. Simpson, of Edinburgh, who has employed them in twenty or thirty cases, with variable but encouraging results. A fatal case, however, is recorded by M. Demarquay. (*B. and F. Med.-chirurg. Rev.*, April, 1862, p. 553.) The injection causes little or no pain, if the case is one of genuine *cystic* dropsy. Three cases of the radical cure of hernia by similar injections are reported by M. Jobert, of Paris. (*Am. Journ. of Med. Sci.*, Jan. 1855, p. 241.) In hydrocele iodine has superseded the wine injection formerly employed. It would seem hazardous to inject dropsical joints with a substance so irritating as iodine; and yet Velpeau is stated to have repeatedly used it in these cases with success; and, when the operation has failed, no bad consequences, it is alleged, have followed to the joint. Iodine injections have been employed by Dr. Brainard, of Chicago, in seven cases of spina bifida, in all without dangerous symptoms, and in three uncomplicated with hydrocephalus, with the effect of a permanent cure. (*Am. Journ. of Med. Sci.*, July, 1861, p. 67.) In all these cases, the object is to excite a new action in the walls of the cavity, with the effect either of obliterating it by the adhesive inflammation, or of restoring its secreting surface to a healthy condition. Iodine injections have been used with advantage in fistula in ano, effecting the cure, when successful, by exciting adhesive inflammation. This treatment originated with Mr. Charles Clay, of London, and is praised by Dr. Boinet, who recommends that it should always be tried before having recourse to the knife. For the mode of preparing iodine injections, see *Tinctura Iodinii*. In order to avoid the staining of the skin by these injections, Dr. Percy Boulton, of London, recommends the addition of carbolic acid, which renders the solution colourless, while in many instances it is useful as an antiseptic. He adds six drops of the acid to a fluidrachm of the compound tincture, and six fluidounces of water. (*N. Y. Med. Record*, Nov. 1, 1867, p. 391.) Whether the iodine would produce the same effect in this altered state can be determined only by experience. Dr. Luton, of Rheims, has found the injection of tincture of iodine into the substance of goitres rapidly successful in effecting cures, with no other disadvantage than some temporary inflammation and swelling of the tumour, which rapidly diminishes. He injects thirty drops of the tincture undiluted. (*Arch. Gén.*, Oct. 1867, p. 438.)

As connected with the subject of iodine injections, it is proper to notice in this place the method of treating serpent bites and other poisoned wounds, proposed by Prof. Brainard, of Chicago. This consists in infiltrating the tissues, where the bite has been inflicted, with from half a drachm to a drachm and a half of a solution,

made of five grains of iodine and fifteen of iodide of potassium in a fluidounce of distilled water. A cupping-glass is applied over the wound as soon as possible; and the infiltration is effected by passing beneath the skin, under the edge of the cup, a small trocar, through the cannula of which the solution is injected. Forty experiments were tried with this treatment on pigeons, kittens, and dogs, with generally successful results. Prof. Brainard proposes to extend it to dissection wounds, and all poisoned wounds of a dangerous character. (See Prof. Brainard's *Essay*, &c., Chicago, 1854; also *N. Y. Med. Times*, iii. 210.) Dr. E. Harwood treated successfully two cases of snake bite, by simply brushing the tincture of iodine over the wound. (*Boston Med. and Surg. Journ.*, May 17, 1854; from the *N. W. Med. and Surg. Journ.*)

Enemata containing iodine have been used, by several practitioners, in the chronic dysentery and diarrhœa of both adults and children, with decided benefit, a prominent effect being the relief of tenesmus. They are supposed to act locally on ulcers in the colon and rectum, and generally by absorption. The preparation of iodine used was the tincture, rendered miscible with water, without precipitation by iodide of potassium. The formula recommended by M. Delioux is from three to six fluidrachms of the tincture, with from fifteen to thirty grains of iodide of potassium, dissolved in half a pint of water. The injection should be preceded by an emollient enema to empty the intestine, and should be repeated once or twice daily, gradually increasing its strength. If the pain be severe, a laudanum injection will bring immediate relief.

Dr. Norman Cheevers, of India, strongly recommends iodine gargles in mercurial salivation. The gargle employed by him was composed of from four to ten fluidrachms of the compound tincture of iodine in a pint of water.

Iodine, in the state of vapour, has been employed by inhalation; and the experiments, as yet tried, have been in the treatment chiefly of phthisis and chronic bronchitis. Sir Charles Scudamore, Sir James Murray, and Dr. Corrigan have recommended iodine vapour in phthisis. The plan of Sir Charles is to inhale from a glass inhaler, for ten minutes, two or three times a day, a small portion of a solution of iodurretted iodide of potassium, mixed with a saturated tincture of conium. The iodurretted solution is made by dissolving six grains, each, of iodine and iodide of potassium, in five ounces and three-quarters of distilled water, and a quarter of an ounce of alcohol. The dose, for each inhalation, is from half a drachm to a drachm of the iodurretted solution, gradually increased, with half a drachm of the tincture, added to a portion of water at 120° F., nearly sufficient to half fill the inhaler. M. Piorry employs iodine vapour in phthisis in a different way. He places one or two scruples of iodine, or from one to three fluidounces of the tincture, in a quart jar, and causes the patient to take a deep inspiration from the air in the vessel, one or two hundred times a day. The patient is made to inhale iodine vapour also during sleep, by placing iodine in several saucers near his pillow, and in numerous vials attached to his bedstead. Modes of internal treatment, appropriate to each case, were concurrently adopted. M. Piorry avers that, in almost every case subjected to iodine treatment in this way, there was a diminution of the space in which the physical signs of diseased lung were manifested. Many patients with cavities in the lungs were apparently cured. (*Comptes Rendus*, Jan. 24, 1854.) Fetid breath will often yield to the same remedy; and the vapours may be employed locally to correct the odour of foul or gangrenous ulcers, by placing vessels containing iodine in the vicinity. Another application of iodine inhalation is to the cure of aphonia, a plan of treatment suggested by Prof. Pancoast, of this city. A successful case of this affection, of twenty months' standing, treated in this way, is related by Dr. Edward B. Stevens. (*Charleston Med. Journ.*, March, 1854; from the *Iowa Med. Journ.*) Mr. J. Waring-Curran speaks in strong terms of the curative effects of iodine inhalation in diphtheria, having tried it successfully in several seemingly desperate cases. He gives it mixed with an infusion of sage in hot vinegar. (*Lancet*, Sept. 21, 1867, p. 357.)

Another method of administering iodine vapour by inhalation in phthisis and chronic bronchitis has been proposed by M. Barrère, of Toulouse. It consists in forming what he calls *iodized camphor*, which is to be taken like snuff. This is pre-

pared by putting powdered camphor in a snuff-box, with a hundredth part in bulk of iodine, contained in a muslin bag. In the course of a few hours, the substances, by occasional shaking, unite, forming a powder resembling iodine in colour. The difficulty in practising ordinary iodine inhalation depends chiefly on the irritation caused by the vapour, which excites cough and fatigues the patient. According to M. Barrère, this inconvenience is avoided by the use of the iodized camphor. A pinch of it produces sneezing and some smarting in the nostrils; but when the vapour reaches the lungs, it causes a refreshing sensation, which induces the patient to draw a long and deep breath. (*Ann. de Thérap.*, 1855, p. 232.) The only remaining proposition for iodine inhalation that we have seen, is the one made by M. Huett, who recommends the use of hydriodic ether. This has been employed by him, with success, in a case of phthisis with cavities at the top of the left lung.

Dr. Brainard employs the vapour of iodine, with great advantage, in the treatment of indolent ulcers, first dressing the ulcer with simple cerate spread on lint, then applying over this several layers of lint in which from one to four grains of iodine have been folded, and covering the whole with oiled silk and tin foil, secured by a bandage, so as to prevent the escape of the iodine, which is vaporized by the heat of the body. (*Chicago Med. Journ.*, Jan. 1860.)

Iodine should not be given in solution with quinia or strychnia, as it forms insoluble compounds with these alkaloids. It has even been suggested by Dr. H. W. Fuller, of London, upon this ground, as an antidote to strychnia; but the probability is that the insoluble compound of these substances would by no means be inert in the stomach. (*Lancet*, March 21, 1868, p. 373.)

In cases of poisoning by iodine, the stomach must be first evacuated, and afterwards drinks administered containing an amylaceous substance, such as flour, starch, or arrow-root.

Iodine is officinal:—

I. As simple tincture and ointment.

Tinctura Iodinii, *U. S.* — *Tincture of Iodine.*

Unguentum Iodinii, *U. S.* — *Ointment of Iodine.*

II. Combined with sulphur.

Sulphuris Iodidum, *U. S.*, *Br.* — *Iodide of Sulphur.*

Unguentum Sulphuris Iodidi, *U. S.* — *Ointment of Iodide of Sulphur.*

III. Combined with metals.

Arsenici Iodidum, *U. S.* — *Iodide of Arsenic.*

Liquor Arsenici et Hydrargyri Iodidi, *U. S.* — *Solution of Iodide of Arsenic and Mercury. Donovan's solution.*

Cadmii Iodidum, *Br.* — *Iodide of Cadmium.*

Unguentum Cadmii Iodidi, *Br.* — *Ointment of Iodide of Cadmium.*

Ferri Iodidum, *Br.* — *Iodide of Iron.*

Syrupus Ferri Iodidi, *U. S.*, *Br.* — *Syrup of Iodide of Iron.*

Pilulæ Ferri Iodidi, *U. S.*; Pilula Ferri Iodidi, *Br.* — *Pills of Iodide of Iron.*

Hydrargyri Iodidum Rubrum, *U. S.*, *Br.* — *Red Iodide of Mercury.*

Unguentum Hydrargyri Iodidi Rubri, *Br.* — *Ointment of Red Iodide of Mercury.*

Hydrargyri Iodidum Viride, *U. S.*, *Br.* — *Green Iodide of Mercury.*

Plumbi Iodidum, *U. S.*, *Br.* — *Iodide of Lead.*

Unguentum Plumbi Iodidi, *Br.* — *Ointment of Iodide of Lead.*

Potassii Iodidum, *U. S.*, *Br.* — *Iodide of Potassium.*

Unguentum Potassii Iodidi, *U. S.*, *Br.* — *Ointment of Iodide of Potassium.*

IV. Associated with iodide of potassium.

Linimentum Iodi, *Br.* — *Liniment of Iodine.*

Linimentum Potassii Iodidi cum Sapone, *Br.* — *Liniment of Iodide of Potassium with Soap.*

Liquor Iodinii Compositus, *U. S.*; Liquor Iodi, *Br.* — *Compound Solution of Iodine.*

Tinctura Iodinii Composita, *U. S*; Tinctura Iodi, *Br.* — *Compound Tincture of Iodine.*

Unguentum Iodinii, *U. S.; Iodine Ointment.*
Unguentum Iodinii Compositum, *U. S.;* Unguentum Iodi, *Br.— Compound Iodine Ointment.*

V. IN THE STATE OF VAPOUR.
Vapor Iodi, *Br.— Vapour of Iodine.* B.

IODOFORMUM. *U. S.*

Iodoform.

"In yellow scaly crystals, having the odour of saffron. It is insoluble in water, but soluble in alcohol, ether, and the fixed and volatile oils. By a heat above 250° it is decomposed, giving off violet vapours." *U. S.*

Syn. Iodoform, periodide of formyl. (C_2HI_3).

This compound, discovered by Sérullas in 1822, was introduced as a remedy, about the year 1837, by Dr. R. M. Glover, of London, and M. Bouchardat, of Paris; and was first adopted as officinal at the late revision of the U. S. Pharmacopœia.

Preparation. It may be obtained, according to the process of MM. Cornélis and Gille, of Liege, by adding to an alcoholic solution of iodide of potassium, heated to 104°, chlorinated lime, in successive portions, stirring after each addition, until the liquid ceases to assume a dark-red colour. On cooling, a confused mass of crystals is deposited, consisting of iodoform and iodate of calcium. By treating these with boiling alcohol of 90 per cent., the iodoform alone is dissolved; and the alcoholic solution, as it cools, deposits the iodoform in crystals. (*Journ. de Pharm.*, Sept. 1852, p. 196.) Another method is that of Wittstein, which is probably among the best. Take two parts of carbonate of potassium, two of iodine, one of alcohol, and five of water, mix them in a retort, and heat the mixture by means of a water-bath, until perfectly colourless; then, after the cooling of the liquid, pour it into a suitable vessel, and allow it to settle. The yellow scaly mass deposited is collected on a filter, washed thoroughly with water, and dried between folds of bibulous paper. As iodoform is very volatile, it must be prepared in closed vessels. The liquid remaining after the deposition of iodoform contains iodate and iodide of potassium, with some formiate and carbonate of the same base; and may be made to yield iodide of potassium, so as materially to cheapen the process.

Properties. It is in the form of small, pearly, yellow, six-sided scales, having a strong saffron-like odour, and sweet taste, insoluble in water, but readily soluble in alcohol and ether. It is a volatile substance, soft to the touch, and totally devoid of corrosive properties. With potassa in solution, it is decomposed, yielding formiate and iodide of potassium. Hence these two principles are incompatible in prescriptions.

Effects on the inferior animals. Given to the inferior animals, it destroys them in a smaller dose than iodine does, producing depression, followed by a stage of excitement, with convulsions, contractions, &c. M. Maitre, who has studied its physiological effects on men, states that from a dose of 30 or 40 centigrammes (about 5 or 6 grains) no effects are observed except a slight increase of appetite. Two hours after it has been taken, the presence of iodine can be detected in the urine and the saliva, and nearly three days elapse before the whole is eliminated. It passes off also with the lacteal secretion. Given to animals in much larger doses, several grammes, for example, it produces narcotic effects; and two stages in its operation have been noticed; the first marked with more or less prostration, with symptoms of intoxication, the animal tottering, inclining to one side with the head falling, with loss of appetite, but without vomiting. The next day, unless a very large dose has been given, complete recovery takes place. A still larger dose induces the second stage, characterized by a remarkably intense excitation, with anxious breathing, strong and short pulse, a true opisthotonos, sometimes very striking, and convulsive movements of the paws, especially the hinder. The animal seeks an obscure spot, the breath is strongly charged with the smell of iodoform, and death takes place. Dissection reveals nothing to explain the phenomena; though a sensible smell of the drug is exhaled from any part that may be cut, and iodine is found in all the viscera and all the secretions. As to the fatal dose, it varies from 2 grammes in a guinea-pig, to 4 grammes in a dog of

medium size. Introduced into the rectum, iodoform, in the shape of a suppository, causes unconsciousness of the act of defecation. (*Journ. de Pharm.*, Juillet, 1867, p. 64.)

Remedial effects and application. Iodoform, though containing 29 parts in 30 of its weight of iodine, has not the least local irritant action. In the form of vapour, it possesses anæsthetic properties, but inferior to those of chloroform. On account of its large proportion of iodine, it is supposed to be capable of replacing that element and the iodides as a remedy, with the advantages of being non-irritant, and of having an organic nature, qualities which favour its absorption and assimilation. Besides the virtues it possesses in common with iodine, it is capable of acting as an anodyne, and is useful in neuralgic affections. The principal diseases in which it has been tried are goitre, rickets, scrofula, phthisis, amenorrhœa, syphilis, glandular tumours, inflammatory disease of the fauces, with or without venereal taint, &c., and cutaneous eruptions. More recently it has been used in croup (*Am. Journ. of Pharm.*, April, 1871, p. 168), periodic neuralgia, and intermittent fever with decided success. (Kennedy, *Ann. de Thérap.*, 1871–1872, p. 171.) In chronic enlargements of the prostate gland, M. Morétin recommends the employment of iodoform as a suppository, made of a scruple of iodoform to an ounce of cacao butter. The dose of iodoform is from one to three grains, three times a day, given in the form of pill. In the treatment of cutaneous diseases and tumours it is applied in the form of ointment, made by mixing from half a drachm to a drachm with an ounce of lard. M. Besnier recommends it as a valuable application to soft chancres and cancerous ulcers, being sprinkled in the state of powder on the surface. It has been recommended as a local application to all ulcers indisposed to heal, cicatrization of which it is thought to favour. Its cicatrizing power in ulcers whether syphilitic or non-syphilitic, is surprising. It is also highly useful as an anæsthetic in all painful wounds and ulcers. (*Ann. de Thérap.*, 1870, p. 184.) It is strongly recommended as a local application to syphilitic ulcers. In this as well as in cancroidal ulcers, Dr. John Ashhurst, Jr., has used it with very gratifying results. He employed it in the form of powder, ointment, or solution in glycerin and alcohol (iodoform, ℥ss, glycerin, ℥vi, alcohol, f℥ij., (*Am. J. of Med. Sci.*, July, 1873, p. 139.) M. G. Voelker has employed it, at the suggestion of M. Demarquay, with great relief in cancer of the uterus; the medicine being applied in the form of a suppository, made with 7·5 grains of iodoform and 2·5 drachms of butter of cacao, introduced into the vagina. To maintain the relief it was necessary to repeat the application frequently; but no unpleasant symptom followed. (*Journ. de Pharm.*, Fev. 1868, p. 151.) M. Demarquay has used it largely as an anodyne in cancer of the uterus, and in diseases of the bladder and prostate, introducing it, in the form of suppository; into the vagina in the former case, and into the rectum in the latter. (*Bullet. Gén. de Thérap.*, Mai 15, 1867.) Dr. Francesco Parona, an Italian physician, speaks of it from experience in the highest terms as a local remedy in fissures of the anus. (*New Remedies*, July, 1873, p. 226.) B.

IPECACUANHA. *U. S., Br.*

Ipecacuanha. Ipecacuan.

The root of Cephaëlis Ipecacuanha. *U. S.* The dried root. *Br.*

Ipecacuanha, *Fr.;* Brechwurzel, Ipecacuanha, *Germ.;* Ipecacuana, *Ital., Span.*

The term *ipecacuanha*, derived from the language of the aborigines of Brazil, has been applied to various emetic roots of South American origin.* The U. S. and British Pharmacopœias recognise only that of *Cephaëlis Ipecacuanha;* and no other is known by the name in the shops of this country. Our chief attention will, therefore, be confined to this root, and the plant which yields it; but, as others are employed in South America, are occasionally exported, and may possibly reach our markets mingled with the genuine drug, we shall, in a note, give a succinct account of those which have attracted most attention.

The botanical character of the ipecacuanha plant was long unknown. Pison and Maregrav, who were the first to treat of this medicine, in their work on the Natural

* M. Weddell states that the word ipecacuanha is nowhere in Brazil used to designate the Cephaëlis, which is generally called *poaya*. (*Journ. de Pharm.*, 3e sér., xvi. 34.)

History of Brazil, published at Amsterdam, A.D. 1648, described in general terms two plants; one producing a whitish root, distinguished by the name of white ipecacuanha, the other, a brown root, which answers in their description precisely to the officinal drug. But their account was not sufficiently definite to enable botanists to decide upon the character of the plants. The medicine was generally thought to be derived from a species of *Viola*, which Linnæus designated as *V. Ipecacuanha.* Opinion afterwards turned in favour of a plant, sent to Linnæus by Mutis from New Granada, as affording the ipecacuanha of that country and of Peru. This was described in the *Supplementum* of the younger Linnæus, A.D. 1781, under the name of *Psychotria emetica*, and was long erroneously considered as the source of the true ipecacuanha. Dr. Gomez, of Lisbon, was the first who accurately described and figured the genuine plant, which he had seen in Brazil, and specimens of which he took with him to Portugal; but Brotero, professor of Botany at Coimbra, with whom he had left specimens, having drawn up a description, and inserted it with a figure in the Linnæan Transactions without acknowledgment, enjoyed for a time the credit due to his countryman. In the paper of Brotero the plant is named *Callicocca Ipecacuanha;* but the term *Callicocca*, having been applied by Schreber, without sufficient reason, to the genus already established and named, has been universally abandoned for the *Cephaëlis* of Swartz, though this, also, it appears, is a usurpation upon the previous rights of Aublet.

Cephaëlis. *Sex. Syst.* Pentandria Monogynia. — *Nat. Ord.* Rubiaceæ, *Juss.* Cinchonaceæ, *Lindley.*

Gen. Ch. Flowers in an involucred head. *Corolla* tubular. *Stigma* two-parted. *Berry* two-seeded. *Receptacle* chaffy. *Willd.*

Cephaëlis Ipecacuanha. Richard, *Hist. Ipecac.* p. 21, t. i.; Martius, *Spec. Mat. Med. Brazil*, p. 4, t. i.; *Curtis's Bot. Mag.*, N.S., vol. xvii. pl. 4083, A.D. 1844. — *Callicocca Ipecacuanha.* Brotero, *Linn. Trans.* vi. 137. This is a small shrubby plant, with a root from four to six inches long, about as thick as a goose-quill, marked with annular rugæ, simple or somewhat branched, descending obliquely into the ground, and here and there sending forth slender fibrils. The stem is two or three feet long; but, being partly under ground, and often procumbent at the base, usually rises less than a foot in height. It is slender; in the lower portion leafless, smooth, brown or ash-coloured, and knotted, with radicles frequently proceeding from the knots; near the summit, pubescent, green, and furnished with leaves seldom exceeding six in number. These are opposite, petiolate, oblong-obovate, acute, entire, from three to four inches long, from one to two broad, obscurely green and somewhat rough on their upper surface, pale, downy, and veined on the under. At the insertion of each pair of leaves are deciduous stipules, embracing the stem, membranous at the base, and separated above into numerous bristle-like divisions. The flowers are very small, white, and collected to the number of eight, twelve, or more, each accompanied with a green bracte, into a semi-globular head, supported upon a round, solitary, axillary footstalk, and embraced by a monophyllous involucre, deeply divided into four, sometimes five or six obovate, pointed segments. The fruit is an ovate, obtuse berry, which is at first purple, but becomes almost black when ripe, and contains two small plano-convex seeds.

The plant is a native of Brazil, flourishing in moist, thick, and shady woods, and abounding most within the limits of the eighth and twentieth degrees of south latitude. According to Humboldt, it grows also in New Granada. It flowers in January and February, and ripens its fruit in May. The root is usually collected during the period of flowering, though equally good at other seasons. By this practice the plant is speedily extirpated in places where it is most eagerly sought. Were the seeds allowed to ripen, it would propagate itself rapidly, and thus maintain a constant supply. Weddell, however, states that the remains of the root, often left in the ground when it is collected, serve the purpose of propagation, each fragment giving rise to a new plant. The root is collected chiefly by the Indians, who prepare it by separating it from the stem, cleaning it, and hanging it up in bundles to dry in the sun. The Brazilian merchants carry on a very brisk trade in this drug. According to Weddell, most of it was, at the time he wrote, A.D. 1851, collected in

the interior province of Matto-Grosso, upon the upper waters of the Paraguay, where it was discovered in the year 1824. The chief places of export are Rio Janeiro, Bahia, and Pernambuco. It is brought to the United States in large bags or bales.

The experiment is now in progress by the British Government, of introducing the cultivation of ipecacuanha into the East Indies; and there is good ground for the hope that it will be successful; for, though the climate of Calcutta was found to be unsuitable to the growth of the plant, and the attempt to cultivate it in the Botanical Garden of that place, which was at first made, has been abandoned, yet it has been found that the Tikkim Himalaya, where the Cinchona plant has been successfully introduced, offers similar advantages for the ipecacuanha, and large numbers of the plant have been forwarded to that locality by the government, where their cultivation will be prosecuted under similar conditions with that of the Peruvian bark tree. (*Pharm. Journ.*, Oct. 1872, p. 325.)

Properties. Genuine ipecacuanha is in pieces two or three lines thick, variously bent and contorted, simple or branched, consisting of an interior slender, light straw-coloured, ligneous cord, with a thick cortical covering, which presents on its surface a succession of circular, unequal, prominent rings or rugæ, separated by very narrow fissures, frequently extending nearly down to the central fibre. This appearance of the surface has given rise to the term *annelé*, or *annulated*, by which the true ipecacuanha is designated by French pharmaceutists. The cortical part is hard, horny, and semi-transparent, breaks with a resinous fracture, and easily separates from the tougher ligneous fibre, which possesses the medicinal virtues of the root in a much inferior degree. Attached to the root is frequently a smoother and more slender portion, which is the base of the stem, and should be separated before pulverization. Pereira has met, in the English market, with distinct bales composed of these fragments of stems, with occasionally portions of the root attached. Much stress has been laid upon the colour of the external surface of the Ipecacuanha root; and diversity in this respect has even led to the formation of distinct varieties. Thus, the epidermis is sometimes deep-brown, or even blackish, sometimes reddish-brown or reddish-gray, and sometimes light-gray or ash-coloured. Hence the distinction into *brown*, *red*, and *gray ipecacuanha*. But these are all derived from the same plant, are essentially the same in properties and composition, and probably differ only in consequence of difference in age, place of growth, or mode of desiccation. The colours in fact are often so intermingled, that it would be impossible to decide in which variety a particular specimen should be placed. The *brown* is the most abundant in the packages brought to our market. The *red*, besides the colour of its epidermis, presents a rosy tint when broken, and is said to be somewhat more bitter than the preceding variety. The *gray* is much lighter-coloured externally, usually rather larger, with less prominent rings and wider furrows, and is still more decidedly bitter. Many years since we saw in this market bales of gray ipecacuanha, with very imperfectly developed rings, which were said to have come from Caracas. This commercial variety afterwards quite disappeared; but, under the name of *Carthagena Ipecacuanha*, it would seem to have been again imported into New York. (*Am. Journ. of Pharm.*, xxv. 474.) When the bark in either variety is opaque, with a dull amylaceous aspect, the root is less active. As the woody part is nearly inert, and much more difficult of pulverization than the cortical, it often happens that, when the root is powdered, the portion last remaining in the mortar possesses scarcely any emetic power; and care should be taken to provide against any defect from this cause. The colour of the powder is a light grayish-fawn.

Ipecacuanha has little smell in the aggregate state, but when powdered has a peculiar nauseous odour, which in some persons excites violent sneezing, in others dyspnœa resembling an attack of asthma. The taste is bitter, acrid, and very nauseous. Water and alcohol extract its virtues, which are injured by decoction. Its emetic property resides in a peculiar alkaline principle called *emetia*, discovered by Pelletier in the year 1817. The cortical portion of the brown ipecacuanha, analyzed by this chemist under the erroneous name of *Psychotria emetica*, yielded, in 100 parts, 16 of an impure salt of emetia, which was at first considered the pure emetic principle, 2 of an odorous fatty matter, 6 of wax, 10 of gum, 42 of starch, 20 of

lignin, with 4 parts loss. The woody fibre was found to contain only 1·15 per cent. of the impure emetia. M. A. Richard detected in the cortical part traces of gallic acid. The bark of red ipecacuanha was found by Pelletier to contain but 14 per cent. of impure emetia. In addition to these principles, Bucholz found extractive, sugar, and resin; and Erwin Willigk, afterwards, traces of a disagreeably smelling volatile oil, phosphatic salts, and a peculiar acid which he named *ipecacuanhic acid*, and which had previously been mistaken for the gallic. It would seem to belong to the tannic acid group. (See *Am. Journ. of Pharm.*, xxiii. 352.) Good ipecacuanha contains about 80 per cent. of cortical and 20 of ligneous matter.

Attempts have been made to adulterate powdered ipecacuanha with the powder of almonds; but the fraud is readily detected by forming a paste with a little water, and putting it into a hot place for half an hour, when, if the ipecacuanha is pure, only its own odour will be perceived, but, if adulterated, a decided odour of almonds will be noticed. (*Journ. de Pharm.*, Juin, 1874, p. 479.)

Emetia, when perfectly pure, is whitish, inodorous, slightly bitter, pulverulent, unalterable in the air, very fusible, sparingly soluble in cold water and ether, more soluble in hot water, and very soluble in alcohol and chloroform, and in solution of potassa and soda, though less so in water of ammonia. With muriatic, sulphuric, phosphoric, and acetic acids, it forms very soluble and uncrystallizable salts; but nitric acid has the remarkable property of forming with it a nitrate, at first bulky, and very slightly soluble in water, but soon agglutinating into a brown, pitch-like matter, very soluble in water, and uncrystallizable. (*Lefort.*) According to Lefort, this insoluble nitrate, which equally forms by double decomposition between the acetate or sulphate of emetia and nitrate of potassium, forms the most distinctive character of emetia. (*Journ. de Pharm.*, Avril, 1869, p. 244.) It is precipitated by gallic and tannic acids from its solutions, and contains nitrogen. It is, however, very difficult to procure it in this state of purity, and the proportion afforded by the root is exceedingly small. M. Lefort, after much careful investigation, gives its formula, in the anhydrous state, as $C_{60}H_{44}Az_2O_{16}$. (*Ibid.*, p. 246.) As originally obtained it was very impure, probably in the condition of a salt, and in this state was directed by the French Codex of 1837. *Impure emetia* is in transparent scales of a brownish-red colour, almost inodorous, of a bitterish acrid taste, deliquescent, very soluble in water and alcohol, insoluble in ether, precipitated from its solutions by gallic acid and the acetates of lead, but not by tartar emetic or the salts of iron. The Codex directed it to be prepared by evaporating a filtered aqueous solution of an alcoholic extract of ipecacuanha. According to the original method it was obtained by treating powdered ipecacuanha with ether to remove the fatty matter, exhausting the residue with alcohol, evaporating the alcoholic solution to dryness, and subjecting the extract to the action of cold water, which dissolves the emetia with some free acid, and leaves the wax and other matters. To separate the acid, the watery solution is treated with carbonate of magnesium, filtered, and then evaporated. If *pure emetia* is required, magnesia is used instead of the carbonate. The salt is thus decomposed, and the organic alkali, being insoluble, is precipitated with the excess of the earth. The precipitate is washed with cold water, and digested in alcohol, which dissolves the emetia; the alcoholic solution is then evaporated, the residue redissolved in a dilute acid, and the alkali again precipitated by a salifiable base. To deprive it of colour it is necessary to employ animal charcoal. Berzelius has obtained emetia by treating the powdered root with very dilute sulphuric acid, precipitating with magnesia, and treating the precipitate in the manner above directed. Pure emetia has at least three times the strength of the impure.*

* Non-officinal Ipecacuanhas. When ipecacuanha began to be popular in Europe, the roots of several other plants were imported and confounded with the genuine; and the name came at length to be applied to almost all emetic roots derived from America. Several of these are still occasionally met with, and retain the name originally given to them. The two most worthy of notice are the ipecacuanha of New Granada and Peru, and the white ipecacuanha of Brazil. On each of these we shall offer a few remarks.

1. *Peruvian Ipecacuanha. Striated Ipecacuanha. Black Ipecacuanha.* This is the root of *Psychotria emetica*, formerly supposed to produce the genuine Brazilian ipecacuanha. This plant, like the Cephaëlis, belongs to the class and order Pentandria Monogynia, and to the natural order Rubiaceæ of Jussieu. A description of it, sent by Mutis, was published by Linnæus, the younger, in

Various other methods of separating pure emetia from the root have been proposed, among the latter, and probably one of the best, being that of M. J. Lefort, published

his Supplement. It has since been described in the *Plant. Æquin.* of Humb. and Bonpl.; and has been figured by A. Richard in his History of the Ipecacuanhas, and by Hayne in the eighth volume of his Medical Botany published at Berlin. It is a small shrub, with a stem twelve or eighteen inches high, simple, erect, round, slightly pubescent, and furnished with opposite, oblong-lanceolate, pointed leaves, narrowed at their base into a short petiole, and accompanied with pointed stipules. The flowers are small, white, and supported in small clusters towards the end of an axillary peduncle. The plant flourishes in Peru and New Granada, and was seen by Humboldt and Bonpland growing in abundance near the river Magdalena. The dried root is said to have been exported from Carthagena. It is cylindrical, somewhat thicker than the root of the Cephaëlis, usually simple, but sometimes branched, not much contorted, wrinkled longitudinally, presenting here and there deep circular intersections, but without the annular rugæ of the true ipecacuanha. The longitudinal direction of the wrinkles has given it the name of *striated ipecacuanha*. It consists of an internal woody cord, and an external cortical portion; but the former is usually larger in proportion to the latter than in the root of the Cephaëlis. The bark is soft and easily cut with a knife, and when broken exhibits a brown, slightly resinous fracture. The epidermis is of a dull reddish-gray colour, which darkens with age and exposure, and ultimately becomes almost black. Hence the root has sometimes been called *black ipecacuanha*. The ligneous portion is yellowish, and perforated with numerous small holes visible by the microscope. Peruvian ipecacuanha is nearly inodorous, and has a flat taste, neither bitter nor acrid. From 100 parts Pelletier obtained 9 of impure emetia, 12 of fatty matter, with an abundance of starch, besides gum and lignin. The dose, as an emetic, is from two scruples to a drachm.*

2. *White Ipecacuanha. Amylaceous Ipecacuanha. Undulated Ipecacuanha.* This variety was noticed in the work of Pison; but the vegetable which produced it was not satisfactorily ascertained till a recent date. Gomez, indeed, in the memoir which he published at Lisbon, A.D. 1801, gave a figure and description of the plant; but the memoir was not generally known, and botanists remained uncertain upon the subject. By the travels of M. Saint Hilaire and Dr. Martius in Brazil, more precise information has been obtained; and the white ipecacuanha is now confidently referred to different species of *Richardsonia*, the *Richardia* of Linnæus. *R. scabra*, or *R. Braziliensis* of Gomez, and *R. emetica* are especially indicated by Martius. For the root usually called *white ipecacuanha*, Guibourt has proposed the name of *undulated ipecacuanha*, derived from the peculiar character of the surface, which presents indentations or concavities on one side, corresponding with prominences or convexities on the other, so as to give a wavy appearance to the root. It differs little in size from the genuine; is of a whitish-gray colour externally; and, when broken, presents a dull-white farinaceous fracture, offering by the light of the sun shining points, which are nothing more than small grains of fecula. Like the other varieties it has a woody centre. It is inodorous and insipid, and contains, according to Pelletier, a very large proportion of starch, with only 6 per cent. of impure emetia, and 2 of fatty matter. Richard found only 3·5 parts of emetia in the hundred. It is said to be sometimes mixed with the genuine ipecacuanha; but we have discovered none in the bales that we have examined.

According to Martius, different species of *Ionidium* (Viola, Linn.) also produce what is called *white ipecacuanha*. The roots of all the species of Ionidium possess emetic or purgative properties, and some of them have been reported to be equal to the genuine ipecacuanha. The root of *I. Ipecacuanha* is described by Guibourt as being six or seven inches long, as thick as a quill, somewhat tortuous, and exhibiting at the point of flexion semicircular fissures, which give it some resemblance to the root of the Cephaëlis. It is often bifurcated at both extremities, and terminates at the top in a great number of small ligneous stalks. It is wrinkled longitudinally, and of a light yellowish-gray colour. The bark is thin, and the interior ligneous portion very thick. The root has little taste or smell. According to Pelletier, it contains, in 100 parts, 5 of an emetic substance, 35 of gum, 1 of azotized matter, and 37 of lignin. (*Hist. Abrég. des Drogues Simples*, i. 514.)

The root of a species of Ionidium growing in Quito has attracted some attention as a remedy in elephantiasis, under the South American name of *cuichunchulli*. The plant, being considered an undescribed species by Dr. Bancroft, was named by him *I. Marcucci*; but Sir W. Hooker found the specimen, received from Dr. Bancroft, to be identical with the *I. parviflorum* of Ventenat. Lindley thinks a specimen he received under the same name from Quito, to be the *I. microphyllum* of Humboldt. If useful in elephantiasis, it is so probably by its emeto-purgative action. (See *Am. Journ. of Pharm.*, vii. 186.)

The reader is referred to a paper on Ipecacuanha by the late R. E. Griffith, M.D., in the *Journ. of the Philad. Col. of Pharm.* (iii. 181), for a more extended account of the roots which have been used under that name.—*The above notes are to editions previous to the present or fourteenth.*

Recent investigations into the pharmacology of *striated ipecacuanha*, present new views upon this subject, with which our readers should be made acquainted. They are presented in a paper by M. Planchon, in the *Journal de Pharmacie* for the month of December, 1872 (p. 204), and January, 1873 (p. 19).

M. Planchon, having satisfied himself that our knowledge of the *striated ipecacuanhas* was imperfect, induced several of the students to investigate by the microscope the structure of the different specimens at command, with a view to the preparation of their theses, and, from the results of these examinations, became satisfied that there were two kinds of striated ipecacuanhas, hitherto

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* See end of the note, page 517, for recent investigations in relation to *striated ipecacuanha*, by M. Planchon, by a comparison of which with the statements above made, the reader will, perhaps, be better able to appreciate the existing state of our knowledge on the subject than were we to attempt to present him with an abstract of our own views. Feb. 1875.

in the *Journal de Pharmacie* (Avril, 1869, p. 241), an abstract of which is introduced, in order to save space, in the form of a note beneath.*

confounded by authors, differing greatly in their anatomical characters. As one of the most marked differences was in their size, he distinguished them by the names of the larger and the less.

1. *Larger striated ipecacuanha.* This presents itself in rather long fragments, sometimes 9 or 10 centimetres (3 or 4 inches), with a thickness of from 5 to 9 millimetres ($\frac{1}{5}$ to $\frac{1}{3}$ of an inch). The pieces are for the most part almost straight, sometimes sinuous, more rarely tortuous. At distant intervals they are marked by contractions, or simply circular furrows. Their whole surface is largely striated longitudinally. At their upper part are often attached one or more remaining portions of the stem, distinguished from the root by their much smoother surface. Their colour is a grayish-brown, tending sometimes to reddish-brown. Like other ipecacuanhas they have an outer cortical, and central ligneous portion. The former is soft, so that it may even be penetrated by the nail. It has a horny aspect, and a variable colour, passing from whitish, by shades of rose, violaceous, and blackish-violet. Its thickness is at least two-thirds of the root, and becomes still greater when this is immersed in water. The central part is yellowish-white. The root has little odour, and a taste scarcely nauseous, sometimes flat, and often sweetish. As to the microscopic characters, the most striking is probably the total absence of the starch granules, and the relatively very small diameter of the vessels in the central part. In relation to other properties, see the paper referred to (Dec. 1872, p. 406). Chemically this variety is characterized by the presence of a principle, capable of reducing the cupro-potassic reagent. It is so abundant in the cortical part, that a simple digestion in water, gives a liquid very strongly reductive, but without deviating action on polarized light. The larger striated ipecacuanha comes from New Granada. It contains very little emetia; according to Mr. Attfield, only 2·5 per cent.

2. *Lesser striated ipecacuanha.* At first sight this is distinguished by its very small dimensions. It is in very short fragments, 2 or 3 centimetres at most long, and 2 or 3 millimetres in thickness; some nearly cylindrical, others narrowly fusiform; others again formed of roundish or pyriform segments, somewhat thicker than the preceding, placed end to end. The colour is generally of a gray-brown, darker than that of the other kind. The longitudinal striæ are fine, and regular on the transverse section. The cortical potion is as it were horny, and its consistence firmer than in the larger kind; the central part is yellowish, and under the microscope exhibits numerous pores. The ligneous centre is at once distinguished by the size of its vessels, which give it a porous appearance. The presence of the starch granules is another of the distinguishing characters of this variety. It contains a larger proportion of emetia than the preceding, yielding, according to the analysis of Pelletier, 9 per cent., to that of Mr. Attfield 6 per cent.

As to the botanical origin of the two varieties; it is known that striated ipecacuanha has been attributed by authors to the *Psychotria emetica*, growing in New Granada; and the question now is which of the two varieties belong to this plant; for the two are so distinct in their character, that they could not proceed from the same. As specimens of the root of the Psychotria, as to the origin of which there could be no doubt, came into the possession of M. Planchon, he was enabled to decide the question at once in favour of the larger variety, which, both in exterior aspect, and anatomical character, was identical with the roots of Psychotria belonging to him. The origin of the lesser kind is still in doubt. In anatomical characters it approaches near to the white or undular ipecacuanha, and as this is ascribed to a species of *Richardsonia*, it is not impossible that the *lesser striated* may be the product of another variety of that genus.

The commercial variety of ipecacuanha examined by Mr. Attfield, of London, which had been sent to London from Bogota, and was no doubt the root of *Psychotria emetica*, was probably identical with the larger variety of M. Planchon, although its highly elastic quality, which induced Mr. Attfield to give it the distinctive name of *elastic striated ipecacuanha*, had not been given as a property of the larger striated by Planchon. In its very small yield of emetia, only 2·75 per cent., it corresponds with the large variety. At all events, this commercial variety, the product of *Psychotria emetica*, sent from New Granada, should not be allowed to enter our markets. (*Note to the fourteenth edition.*)

* *M. Lefort's method of preparing emetia.* The powdered root is exhausted by percolation, first by alcohol at 86°, then with alcohol at 56° centes; the tinctures, being mixed, are introduced into a percolator, so as to separate the greater portion of the vehicle, and the residue is concentrated by a water-bath to a syrupy consistence. This residue, containing the emetia, combined with ipecacuanhic acid, is poured into a small stoppered bottle; and there is added to it, for every 100 parts of the powder employed, 2 parts of caustic potassa dissolved in a little water, and a volume of chloroform nearly equal to that of the mixture. As the emetia is very soluble in potassa, and the alkaline solution rapidly absorbs oxygen from the air, the bottle should always be kept quite full. The mixture is shaken briskly, and allowed to rest for several days. The chloroform, which had at first formed by agitation a kind of emulsion, gradually becomes clear, and seeks the bottom of the vessel, holding the emetia in solution. It is thence removed by a pipette, and its place supplied by a new portion of the vehicle. As soon as the alkaline mixture becomes colourless, or nearly so, it may be considered as containing no more emetia. The solutions are mixed, and filtered, and then submitted to distillation by a water-bath, in order to regain all the chloroform. The residue in the retort, which has a dark-brown colour, consists chiefly of emetia and a resinous matter, which is not emetia. The two substances are separated by means of a weak acid, which dissolves only the alkaloid; and the solution, thus resulting, is decomposed by water of ammonia exactly sufficient to precipitate the organic base, which is but slightly soluble in the ammoniacal water. The emetia is deposited as a voluminous grayish powder, which, after being sufficiently washed by decantation with distilled water, is placed upon a filter. In this state it still retains a little resinous matter, which is separated by digestion with sulphuric ether. The alkaloid is now left of great purity. (*Journ. de Pharm.*, Avril, 1869, p. 242.)—*Note to the fourteenth edition.*

Medical Properties and Uses. Ipecacuanha is in large doses emetic, in smaller, diaphoretic and expectorant, and in still smaller, stimulant to the stomach, exciting appetite and facilitating digestion. In quantities not quite sufficient to vomit, it produces nausea, and frequently acts on the bowels. As an emetic, it is mild but tolerably certain, and, being usually thrown from the stomach by one or two efforts, is less apt to produce dangerous effects, when taken in an overdose, than some other substances of the same class. It is also recommended by the absence of corrosive and narcotic properties.

It was employed as an emetic by the natives of Brazil, when that country was first settled by the Portuguese; but, though described in the work of Pison, it was not known in Europe till 1672, and did not come into use till some years afterwards. John Helvetius, grandfather of the famous author of that name, having been associated with a merchant who had imported a large quantity of ipecacuanha into Paris, employed it as a secret remedy, and with so much success in dysentery and other bowel affections, that general attention was drawn to it; and the fortunate physician received from Louis XIV. a large sum of money and public honours, on the condition that he should make it public.

As an emetic it is peculiarly adapted, by its mildness and efficiency, to cases in which the object is merely to evacuate the stomach, or a gentle impression only is desired; and, in most other cases in which emetics are indicated, it may be advantageously combined with the more energetic medicines, which it renders safer by insuring their discharge. It is especially useful where narcotic poisons have been swallowed; as, under these circumstances, it may be given in almost indefinite doses, with little comparative risk of injury. In dysentery it has been supposed to exercise peculiar powers; and is highly esteemed by some as a remedy, in small doses, in diarrhœa. As a nauseating remedy it is used in asthma, hooping-cough, and the hemorrhages; as a diaphoretic combined with opium, in numerous diseases. (See *Pulvis Ipecacuanhæ Compositus.*) Its expectorant properties render it useful in catarrhal and other pulmonary affections. It has been given, also, with supposed advantage, in very minute doses, in dyspepsia, and in chronic disease of the gastro-intestinal mucous membrane. It has been found especially useful in winter coughs and asthmatic catarrh, inhaled in the form of spray; the wine of ipecacuanha being the preparation used.*

Ipecacuanha is most conveniently administered, as an emetic, in the form of powder suspended in water. The dose is about twenty grains, repeated, if necessary, at intervals of twenty minutes till it operates. In some persons much smaller quantities prove emetic, and we have known an individual who was generally vomited by the fraction of a grain. The operation may be facilitated, and rendered milder, by draughts of warm water, or warm chamomile tea. An infusion in boiling water, in the proportion of two drachms to six fluidounces, may be given in the dose of a fluidounce repeated as in the former case. For the production of nausea, the dose in substance may be two grains, repeated more or less frequently according to circumstances. As a diaphoretic it may be given in the quantity of a grain; as an alterative, in diseases of the stomach and bowels, in that of a quarter or half a grain two or three times a day. A fluid extract is officinal in the U.S. Pharmacopœia, having been introduced at the late revision of that work. (See *Extractum Ipecacuanhæ Fluidum.*) One fluidrachm of this preparation represents a drachm of the root.

Emetia has been used on the continent of Europe as a substitute, but with no great advantage. Its operation on the stomach is apt to be more violent and continued than that of ipecacuanha; and, if given in overdoses, it may produce dangerous and even fatal consequences. From the experiments of Magendie, it appears to have a peculiar direction to the mucous membranes of the alimentary canal and the bronchial tubes. Ten grains of impure alkali, administered to dogs, were generally found to destroy life in twenty-four hours, and the mucous membranes mentioned were observed to be inflamed throughout their whole extent. The same result took place when emetia was injected into the veins, or absorbed from any part of the body. The dose of impure emetia is about a grain and a half, of the pure not more than a

* Sidney Ringer, M.D., and Wm. Murrell. The *Lancet*, Sept. 5, 1874, p. 338.

quarter of a grain, repeated at proper intervals till it vomits. In proportional doses, it may be applied to the other purposes for which ipecacuanha is used. It will excite vomiting, when applied to a blistered surface after the removal of the cuticle.

Dr. Turnbull recommends the external use of ipecacuanha as a counter-irritant. An ointment, made with one part of the powder, one of olive oil, and two of lard, rubbed once or twice a day for a few minutes upon the skin, produces a copious eruption, which continues out for many days, without pain or ulceration. (*London Lancet*, May, 1842.) It has, however, been found by others of little efficacy in the great majority of cases.

Off. Prep. Extractum Ipecacuanhæ Fluidum, *U. S.;* Pilula Conii Composita, *Br.;* Pilula Ipecacuanhæ cum Scilla, *Br.;* Pulvis Ipecacuanhæ Compositus; Trochisci Ipecacuanhæ; Trochisci Morphiæ et Ipecacuanhæ; Vinum Ipecacuanhæ, *Br.* W.

IRIS FLORENTINA. *U. S. Secondary.*

Florentine Orris.

The rhizome of Iris Florentina. *U. S.*

Iris de Florence, *Fr.;* Florentinische Violenwurzel, *Germ.;* Ireos, *Ital.;* Liro Florentina, *Span.*

IRIS. *Sex. Syst.* Triandria Monogynia.—*Nat. Ord.* Iridaceæ.

Gen. Ch. Corolla six-parted; the alternate segments reflected. *Stigmas* petal-shaped. *Willd.*

In all the species belonging to this genus, so far as examined, the roots are more or less acrid, and possessed of cathartic and emetic properties. In Europe, *Iris fœtidissima*, *I. Florentina*, *I. Germanica*, *I. pseudo-acorus*, and *I. tuberosa* have at various times been admitted into use. Of these *I. Florentina* is the only one officinal in this country.

Iris Florentina. Willd. *Sp. Plant.* i. 226; Woodv. *Med. Bot.* p. 776, t. 262. The root (rhizome) of the Florentine Iris is perennial, horizontal, fleshy, fibrous, and covered with a brown epidermis. The leaves, which spring directly from the root, are sword-shaped, pointed, nerved, and shorter than the stem, which rises from the midst of them more than a foot in height, round, smooth, jointed, and bearing commonly two large white or bluish-white terminal flowers. The calyx is a spathe with two valves. The corolla divides into six segments or petals, of which three stand erect, and the remaining three are bent backward, and bearded within at their base with yellow-tipped white hairs. The fruit is a three-celled capsule, containing many seeds.

This plant is a native of Italy and other parts of the south of Europe, where it is also cultivated. The root, which is the officinal portion, is dug up in spring, and prepared for the market by the removal of its cuticle and fibres. It is cultivated for commerce chiefly in the neighbourhood of Florence, and is exported from Leghorn in large casks.

Properties. Florentine orris is in pieces of various form and size, often branched, usually about as thick as the thumb, knotty, flattened, white, heavy, of a rough though not fibrous fracture, an agreeable odour resembling that of the violet, and a bitterish, acrid taste. The acrimony is greater in the recent than in the dried root; but the peculiar smell is more decidedly developed in the latter. The pieces are brittle and easily powdered, and the powder is of a dirty-white colour. Vogel obtained from Florentine orris, gum, a brown extractive, fecula, a bitter and acrid fixed oil or soft resin, a volatile crystallizable oil, and vegetable fibre. According to Landerer, the acrid principle is volatile, separating in the form of a stearoptene from water distilled from the root. (*Arch. der Pharm.*, lxv. 302.) In order to preserve the root from the attacks of insects, Mr. Maisch recommends to put a little ether in the bottle in which it may be kept. (*Am. Journ. of Pharm.*, July, 1858, p. 310.)

Medical Properties. This medicine is cathartic, and in large doses emetic, and was formerly employed to a considerable extent on the continent of Europe. It is said also to be diuretic, and to have proved useful in dropsies. At present it is valued chiefly for its agreeable odour. Great efficiency, however, has been claimed

for it as a febrifuge by M. Allisiardi of Saluzzo, in Italy, who states that it has been tried in many cases, and has been found a sure as well as economical substitute for cinchona. For this purpose it is given in the form of watery extract, in the quantity of from two and a half to six drachms, in two doses, with an interval of two hours. (*Ann. de Thérap.*, 1867, p. 126; from *Bullet. Pharmaceut.* of Milan.) It is occasionally chewed to conceal an offensive breath, and enters into the composition of tooth-powders. In the form of small round balls, about the size of a pea, it is used by the French for maintaining the discharge from issues, a purpose to which it is adapted by its odour, by the slight acrimony which it retains in its dried state, and by the property of swelling very much by the absorption of moisture. W.

IRIS VERSICOLOR. *U.S. Secondary.*

Blue Flag.

The rhizome of Iris versicolor. *U.S.*

Iris. See IRIS FLORENTINA.

Iris versicolor. Willd. *Sp. Plant.* i. 233; Bigelow, *Am. Med. Bot.* i. 155. This indigenous species of Iris has a perennial, fleshy, horizontal, fibrous root or rhizome, and a stem two or three feet high, round on one side, acute on the other, and frequently branching. The leaves are sheathed at the base, sword-shaped, and striated. The flowers are from two to six in number, and are usually blue or purple, though varying much in colour. The capsule has three valves, is divided into three cells, and when mature is oblong, three-sided, with obtuse angles, and contains numerous flat seeds.

The blue flag is found in all parts of the United States, flourishing in low wet places, in meadows, and on the borders of swamps, which it serves to adorn with its large and beautiful flowers. These make their appearance in June. The root is the medicinal portion. The flowers afford a fine blue infusion, which serves as a test of acids and alkalies.

The recent root is without odour, and has a nauseous, acrid taste, which is imparted to water by decoction, and still more perfectly to alcohol. The acrimony as well as medicinal activity is impaired by age. If cut when fresh into slices, dried at the temperature of about 100°, and then powdered and kept in bottles excluded from the air, the root retains its virtues unimpaired for a considerable time. (*Andrews.*)

Blue flag possesses the cathartic, emetic, and diuretic properties common to most of its congeners. It was said by Mr. Bartram to be much esteemed by the southern Indians; and Dr. Bigelow states that he has found it efficacious as a purgative, though inconvenient from the distressing nausea and prostration which it is apt to occasion. Dr. M. H. Andrews, of Michigan, has employed it frequently as a cathartic, and found it, when combined with a grain of Cayenne pepper, or two grains of ginger, not less easy and effectual in its operation than the ordinary more active cathartics, and preferable on account of its less disagreeable taste. (*N. Y. Journ. of Med.*, ix. 129.) Dr. Macbride found it useful in dropsy. It is, however, little used by the profession at large, and seldom kept in the shops. It may be given in substance, decoction, or tincture. The do e of the dried root is from ten to twenty grains. Under the unscientific name of *iridin* or *irisin*, which should be reserved for the pure active principle when discovered, the "Eclectics" have for some time used an oleoresin, obtained by precipitating a tincture of the root with water, and mixing the precipitate with an equal weight of some absorbent powder, for which purpose powdered liquorice root would probably answer well. This may be given in the form of pill, in the dose of three or four grains. It is thought to unite cholagogue and diuretic with aperient properties; and a writer in the *London Lancet* states that he has found it to produce effects similar to those caused by a mixture of blue pill, rhubarb, and aloes. (Aug. 30, 1862, p. 239.) W.

JALAPA. *U.S., Br.*

Jalap.

The tuber of Exogonium purga (Bentham, *Botanical Register*), Ipomæa Jalapa (*Nuttall*). *U. S.* The dried tubercles of Exogonium Purga. *Bentham, Bot. Mag.*, vol. lxxiii. plate 4280. Imported from Mexico. *Br.*

Jalap, *Fr.;* Jalappenwurzel, *Germ.;* Sciarappa, *Ital.;* Jalapa, *Span.*

The precise botanical origin of jalap remained long unknown. It was at first ascribed by Linnæus to a Mirabilis, and afterwards to a new species of Convolvulus, to which he gave the name of *C. Jalapa.* The correctness of the latter reference was generally admitted; and, as the *Ipomæa macrorrhiza* of Michaux, growing in Florida and Georgia, was believed to be identical with the C. Jalapa of Linn., it was thought that this valuable drug, which had been obtained exclusively from Mexico, might be collected within the limits of the United States. But the error of this opinion was soon demonstrated; and it is now an admitted fact, that jalap is the product of a plant first made known to the scientific world by Dr. John R. Coxe, of Philadelphia, and described by Mr. Nuttall under the name of *Ipomæa Jalapa.* When this Dispensatory was first published, opinion in relation to the botanical history of the drug was unsettled, and it was deemed proper to enter at some length into the consideration of the subject; but the subsequent general admission of the views then advocated renders an equal degree of minuteness now unnecessary. It is sufficient to state that Dr. Coxe received living roots of jalap from Mexico in 1827, and succeeded in producing a perfect flowering plant, of which a description, by Mr. Nuttall, was published in the *Am. Journ. of Med. Sci.* for January, 1830; that the same plant was afterwards cultivated in France and Germany from roots transmitted to those countries from Mexico; and that one of the authors of this work has produced, from roots obtained in the vicinity of Xalapa, and sent to him by the late Dr. Marmaduke Burrough, then United States consul at Vera Cruz, luxuriant plants, which he was enabled to compare with others descended from the plant of Dr. Coxe, and found to be identical with them.* In the United States and British Pharmacopœias this origin of jalap is now recognised. J. H. Balfour (*Curtis's Bot. Mag.*, Feb. 1847) maintains that the plant belongs to the genus *Exogonium* of Choisy, as defined in De Candolle's Prodromus, being distinguished from Ipomæa by its exserted stamens; and this view has been taken by the framers of the British Pharmacopœia; but Dr. Meisner has restored the plant to Ipomæa. (*Am. J. of Pharm.*, July, 1870, p. 332.)

Ipomæa. *Sex. Syst.* Pentandria Monogynia. — *Nat. Ord.* Convolvulaceæ.

Gen. Ch. Sepals five. *Corolla* campanulate. *Stamens* included. *Style* one. *Stigma* two-lobed; the lobes capitate. *Ovary* two-celled; cells two-seeded. *Capsule* two-celled. Lindley.

Ipomæa Jalapa. Nuttall. *Am. Journ. of Med. Sciences*, v. 300; Carson, *Illust. of Med. Bot.* ii. 13, pl. 61. — *Ipomæa Purga.* Hayne, *Darstel. und Beschreib.* &c. xii. 33 and 34; Lindley, *Flor. Med.* 396. — *Exogonium Purga.* Balfour, *Curtis's Bot. Mag.*, 3d ser.; vol. iii. tab. 4280. The root of this plant is a roundish somewhat pear-shaped tuber, externally blackish, internally white, with long fibres proceeding from its lower part, as well as from the upper rootstalks. A tuber produced by Dr. Coxe was, in its third year, between two and three inches in diameter. The stem is round, smooth, much disposed to twist, and rises to a considerable height upon neighbouring objects, about which it twines. The leaves are heart-shaped, entire, smooth, pointed, deeply sinuated at the base, prominently veined on their under surface, and supported upon long footstalks. The lower leaves are nearly hastate, or with diverging angular points. The flowers, which are large and of a lilac-purple colour, stand upon peduncles about as long as the petioles. Each peduncle supports two, or, more rarely, three flowers. The calyx is without bractes, five-leaved, obtuse, with two of

* The plant has for some years been cultivated in the Botanical Gardens at Dublin, with no other protection from cold than that afforded by its position against a wall with a southern aspect. The root yielded on analysis to Mr. W. G. Smith, 11·97 of resin, which proved actively purgative in the dose of three grains taken before breakfast. (*Pharm. Journ.*, Feb. 1869, pp. 463–4.)—*Note to the fourteenth edition*

the divisions external. The corolla is funnel-form. The stamens are five in number, with oblong, white, somewhat exserted anthers. The stigma is simple and capitate. The above description is taken from that of Mr. Nuttall, published in Dr. Coxe's paper in the *American Journal of the Med. Sciences.*

The jalap-plant is a native of Mexico, and derives its name from the city of Xalapa, in the state of Vera Cruz, in the neighbourhood of which it grows, at the height of about 6000 feet above the ocean. The drug is brought from the port of Vera Cruz in bags, containing usually between 100 and 200 pounds.

Properties. The tuber comes either whole, or divided longitudinally into two parts, or in transverse circular slices. The entire tubers are irregularly roundish, or ovate and pointed, or pear-shaped, usually much smaller than the fist, and marked with circular or vertical incisions, made to facilitate their drying. The root is preferred in this state, as it is less apt to be defective, and is more easily distinguished from the adulterations than when sliced. A much larger proportion comes entire than formerly, indicating a greater scarcity of the older roots, which it is necessary to slice in order to dry them properly. The tuber is heavy, compact, hard, brittle, with a shining undulated fracture, exhibiting numerous resinous points, distinctly visible with the microscope. It is externally brown and wrinkled, internally of a grayish colour, diversified by concentric darker circles, in which the matter is denser and harder than in the intervening spaces. Jalap is always kept in the shops in the state of powder, which is of a yellowish-gray colour, and when inhaled irritates the nostrils and throat, and provokes sneezing and coughing. The odour of the root, when cut or broken, is heavy, sweetish, and rather nauseous; the taste is sweetish, somewhat acrid, and disagreeable. It yields its active properties partly to water, partly to alcohol, and completely to diluted alcohol. M. Cadet de Gassicourt obtained from 500 parts of jalap, 24 of water, 50 of resin, 220 of gummy extract, 12·5 of fecula, 12·5 of albumen, 145 of lignin, 16·3 of saline matters, 2·7 of silica, with a loss of 17 parts. Buchner and Herberger supposed that they had discovered a basic substance, which they called *jalapin*. G. A. Kayser found that the resin of jalap consists of two portions, one of which, amounting to seven parts out of ten, is hard and insoluble in ether, the other is soft and soluble in that menstruum. The hard resin he named *rhodeoretin*, and found to be identical with the jalapin of Buchner and Herberger. By reaction with the alkalies it is converted into an acid, called *rhodeoretinic acid*. Rhodeoretin is slightly soluble in water, freely so in alcohol, and insoluble in ether, chloroform, or benzole; and the alcoholic solution is precipitated both by ether and water. It is dissolved by solutions of the alkalies, more quickly if heated, and is not precipitated by acids, having become soluble by conversion into the acid above referred to. It purges violently in the dose of three or four grains, and is supposed to be the active principle of jalap. Mayer has confirmed and extended the observations of Kayser. The formula of rhodeoretin, according to the latter chemist, is $C_{42}H_{35}O_{20}$, according to the former, $C_{72}H_{60}O_{36}$. (See *Chem. Gaz.*, iii. 15, and xi. 21.) Rhodeoretin and rhodeoretinic acid are both glucosides, being convertible by the action of acids into glucose and a peculiar substance named *rhodeoretinol*. (*Pelouze* and *Frémy.*) The proportion of resin to the other ingredients of the root varies considerably in different specimens. According to Gerber, the root contains 7·8 per cent. of hard resin, 3·2 of soft resin, 17·9 of extractive, 14·5 of gummy extract, 8·2 of a colouring substance which becomes red under the influence of the alkaline carbonates. 1·9 of uncrystallizable sugar, 15·6 of gum mixed with some saline matters, 3·2 of bassorin, 3·9 of albumen, 6·0 of starch, 8·2 of lignin, with some water, and various salts. For the method of obtaining the resin of jalap pure, see *Resina Jalapæ.**

Jalap is apt to be attacked by worms, which, however, are said to devour the amylaceous or softer parts, and to leave the resin; so that the worm-eaten drug is more powerfully purgative than that which is sound. Thus, out of 397 parts of the former, M. Henry obtained 72 parts of resin, while from an equal quantity of

* True jalap varies much in the proportion of resin, and consequently in purgative power. Dr. E. R. Squibb has found the proportion to vary from 11 per cent. in the lower grades up to 16·25 per cent. in the best (*Am. Journ. of Pharm.*, Jan. 1868, p. 65); but others have obtained a considerably greater proportion than the largest mentioned; and Mr. Charles Umney states that, in a fine selected specimen, he had found 21·5 per cent. (*Pharm. Journ. and Trans.*, Dec. 1867, p. 282.)

the latter he procured only 48 parts. Hence worm-eaten jalap should be employed for obtaining the resin, but should not be pulverized, as it would afford a powder of more than the proper strength. The drug is also liable to various adulterations, or fraudulent substitutions, which, however, can usually be detected without difficulty. Those which have attracted particular attention are mentioned in the note below.*

* *Adulterations, Substitutions, &c.* The original source of jalap seems to be failing, while, from increased population, the demand in the general market has been increasing; so that the supply of the genuine drug is insufficient; and other substances, more or less allied to jalap in appearance or medicinal properties, have been introduced to supply the deficiency. The consequence is that great care is requisite to avoid deception; and there is reason to believe that the quality of the medicine, as found in the shops, is deteriorating from the fraudulent admixture of these inferior substances with the genuine drug in pulverization. The only sure remedy for this great evil is increased production; and this can be accomplished only by the cultivation of the plant, either in its native Mexico, or in other countries adapted to its growth. From some little experience with the propagation of the true jalap plant, the author has no doubt that it would grow well in some of our Southern States, especially in the interior high grounds. It is said that some isolated attempts have been made by the native Mexicans to cultivate the plant, and that the products of this cultivation have reached the European market. In a communication from Dr. G. Naphegyi, in the *Med. and Surg. Reporter* (April 18, 1868, p. 342), it is stated that some of the European gardeners, in the vicinity of the city of Mexico, are making its cultivation a subject of speculation; and an order was issued by the late Emperor Maximilian, to the Prefects of the province of Jalapa, recommending its cultivation. There is, therefore, some reason to hope that the supply of this valuable medicine may be augmented.

Among the inferior kinds of jalap are specimens of the genuine root which appear to have been partially exhausted in their aggregate state before pulverization. From a pound of this kind, Dr. Squibb obtained only 1·8 per cent. of resin. The rootlets of the tubers are sometimes mixed in large proportion with the tubers themselves. The same chemist found in a lot of this kind 2·2 per cent. of resin. (*Am. Journ. of Pharm.*, Jan. 1868, pp. 65–6.)

Jalap of Tampico. Considerable quantities of a tuberous root have recently been imported into Europe, and probably also into this country, under the name of Tampico jalap; being distinguished by the name of the port from which it comes from the true jalap, which is brought exclusively from Vera Cruz. At the time we write its botanical source is unknown, but from its resemblance to the true jalap, it is probably the product of a plant belonging to the same family of Convolvulaceæ. According to M. Ambrose Andouard, it is the same as the false jalap described by M. Guibourt as the *larger digitate jalap* (*jalap digité majeur*). It is inferior to the true jalap, as its resin is invariably in smaller proportion, and chemically differs from that of the true jalap; as it is almost wholly soluble in ether, while the genuine yields only 12 per cent. to that menstruum. The odour of the Tampico jalap is said closely to resemble that of peat, and is very adhesive, being perceptible even in the extract and resin. This odour has been conjecturally ascribed to the drying of the tubers by a peat fire. The finest specimens of this drug yield 14 per cent. of resin, while inferior kinds give only 5 per cent. The resin is said to be purgative. The facts in this note in relation to Tampico jalap have been derived from a paper by Mr. Charles Umney, in the *Pharm. Journ. and Trans.* (Decemb. 1867, p. 282); as the author has been unable to procure a specimen of the drug on the genuineness of which he could rely. (*Note to the thirteenth edition.*)

Since the publication of the preceding edition of the Dispensatory, the history of Tampico jalap has been much improved through the researches of Mr. Daniel Hanbury, of London, aided by two Prussian officials in Mexico, Mr. Hugo Finck, vice-consul at Cordova, and Mr. E. Bonecke, consul-general at Mexico. The origin of the drug was traced to the state of Guanajuato, where it grows along the Sierra Gorda, near San Luis de La Paz. In this place it is purchased from the Indians, and conveyed by mules to Tampico, where it enters into commerce. Through the agency of the same gentlemen, Mr. Hanbury, after some failures, succeeded in obtaining a living tuber, from which he raised a flourishing plant. This he found to belong to the same genus as that from which genuine jalap was obtained, and was accordingly designated as an *Ipomæa;* the genus Exogonium of Choisy, to which it had been transferred, having been reunited to Ipomæa by Dr. Meisner. That this plant was really the source of the Tampico drug, was shown not only by its origin, above detailed, but by its exact correspondence with pressed and dried specimens sent him from the same source. After considerable research, Mr. Hanbury, having been unable to find that the plant had been specifically designated, gave it the name of *Ipomæa simulans;* the specific designation having been adopted from the close resemblance of the new plant to that producing genuine jalap. For its botanical description, drawn up by Mr. Hanbury, the reader is referred to the *Linnæan's Society's Journal* (Botany, vol. xi.), or to the *American Journ. of Pharm.* (July, 1870, p. 332). But the botanical history of the drug is not the only point on which light has been thrown. Prof. A. Springalis, of Königsberg, has also investigated its chemistry, and stated the results in a paper, read before the Munich Academy of Sciences. He obtained a resin by preparing a tincture of the Tampico jalap, evaporating, washing, boiling the residue in water, redissolving in alcohol, and decolorizing by charcoal. He gave it the name of *tampicin.* Its physical properties are similar to those of the jalap resin. It is brittle, tasteless, inodorous, insoluble in water, soluble in ether and alcohol, and in solution has a feeble acid reaction. By strong alkalies it is changed into a soluble acid, which Prof. Springalis calls tampicic acid. By the action of dilute sulphuric, nitric, or muriatic acid, it is converted, slowly if cold, but rapidly with heat, into a peculiar acid called *toxopicolic,* with sugar. For the mode of preparing these acids and their properties, the reader is referred to an article in *New Remedies* (July, 1871, p. 50). The melting point of tampicin is 130° C.; its formula $C_{34}H_{54}O_{14}$. (*Note to the fourteenth edition.*)

Mechoacan. Jalap is said to be sometimes adulterated with *bryony root;* but no instance of the

Jalap should be rejected when it is light, of a whitish colour internally, of a dull fracture, spongy, or friable. Powders of calomel and jalap, taken on long voyages to

kind has come under our notice; and the two drugs are so widely different that the fraud would be instantly detected. (See *Bryony*, in *Part Third.*) It is probable, however, that the adulteration which has been considered as bryony root is the *mechoacan*, which in Europe is sometimes called American bryony, and was formerly erroneously supposed to be derived from a species of Bryonia. Mechoacan is a product of Mexico, which was taken to Europe even before the introduction of jalap. The plant producing it has been conjectured to be *Ipomæa macrorrhiza* of Michaux, which is believed to grow in Mexico near Vera Cruz, as well as in our Southern States, and the root of which is said to weigh, when of full size, from fifty to sixty pounds, and, according to Dr. Baldwin, has little or no purgative power. But this origin is quite uncertain; and Guibourt states, in one of his most recent communications to the journals, that what is sold in Europe under the name of mechoacan is certainly the product of *Asclepias Contrayerva* of the Mexican flora. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 98, A.D. 1866.) Mechoacan is in circular slices, or fragments of various shapes, white and farinaceous within, and, as found in the European markets, generally destitute of bark, of which, however, portions of a yellowish colour sometimes continue to adhere. The larger slices are sometimes marked with faint concentric striæ; and upon the exterior surface are brown spots and ligneous points, left by the radicles after removal. (*Guibourt.*) Though tasteless when first taken into the mouth, it becomes after a time slightly acrid. It is very feebly purgative. We have seen flat circular pieces of root, mixed with jalap, altogether answering this description, except that the cortical portion still remained, between which and the starchy parenchyma there was an evident line of division.

Male Jalap. Fusiform Jalap. Jalap Stalks. A drug, formerly known in our markets as spurious jalap, sometimes comes mingled with the genuine, and has been imported, unmixed, in mistake for that root. It is the same with that referred to by French writers as the product of a plant denominated *male jalap* in Mexico, and named by M. Ledanois *Convolvulus Orizabensis*, from the city of Orizaba, in the neighborhood of which it grows abundantly. In the shops of Paris the drug is called *light jalap*, and, in Guibourt's *Histoire des Drogues*, is described under the title of *fusiform jalap*. A description of it was first published in this country by Mr. D. B. Smith, in a paper upon Ipomæa Jalapa, in the *Am. Journ. of Pharm.* (ii. 22). For an account of the plant, the reader is referred to the same journal (x. 224). The recent root is large, spindle-shaped, sometimes twenty inches in length, branched at its lower extremity, yellow on its outer surface, and white and milky within. The drug, as described by Guibourt, is in circular pieces, two or three inches in diameter, or in longer and more slender sections. As we have seen it, the shape of the pieces is often such as to indicate that the root was sliced transversely, and each circular slice divided vertically into quarters. The horizontal cut surface is dark from exposure, unequal from the greater shrinking in desiccation of some parts than others, and presents the extremities of numerous fibres, which are often concentrically arranged, and run in the longitudinal direction of the root. Internally the colour is grayish, and the texture, though much less compact than that of jalap, is sometimes almost ligneous. The taste is at first slight, but after a time becomes somewhat acrid and nauseous. The root, analyzed by M. Ledanois, yielded, in 1000 parts, 80 of resin, 256 of gummy extract, 32 of fecula, 24 of albumen, and 580 of lignin. It has cathartic properties similar to those of the true jalap, but feebler, requiring to be given in a dose of from thirty to sixty grains in order to operate effectively. The proportion of resin, which in both is the purgative principle, is considerably less in the male jalap; while that of lignin, which is wholly inert, is about double. (*Journ. de Pharm.*, xxiv. 166.) This resin, according to G. A. Kayser, differs from jalap resin in consisting of only one principle, which is entirely soluble in ether. But both resins are distinguished from all others by being gradually dissolved in concentrated sulphuric acid, and deposited again after some hours in a soft state. (*Chem. Gaz.*, No. 53; from Liebig's *Annalen.*) The resin of C. Orizabensis, which has been unfortunately named *jalapin* by Meyer, is, according to that chemist, changed by boiling with baryta-water into an acid called *jalapic* acid; and both jalapin and jalapic acid are glucosides, being resolved by boiling dilute acid into glucose, and a peculiar substance which he designates as *jalapinol*. (See *Journ. de Pharm.*, 3e sér., xxix. 123.)

Rose-scented Jalap. Overgrown Jalap. A false jalap was some years since brought into the United States, different from anything before seen in our market. It was said to have been imported from Mexico into New York in considerable quantities, and was offered for sale under the name of *overgrown jalap*. A specimen, brought to Philadelphia, and examined by a Committee of the College of Pharmacy, presented the following characters. It was in light, entire or vertically sliced tubers, of different form and magnitude, spindle-shaped, ovate and kidney-form, some as much as six inches long and three thick, others much smaller, externally somewhat wrinkled, with broad flattish light-brown ridges, and shallow darker furrows, internally grayish-white, with distant darker concentric circles, sometimes uniformly amylaceous, of a dull rough fracture, a loose texture, a slight, peculiar, and sweetish odour, and a feeble jalap-like taste. The powder was of a light-gray colour, and did not irritate the nostrils or throat during pulverization. The root differed from mechoacan by the absence of the marks of rootlets, and from male jalap by the want of a fibrous structure. It yielded by analysis, in 100 parts, 3 of a soft and 4 of a hard and brittle resin, 17 of gummy extractive, 28 of starch and inulin, 10 of gum and albumen, 23·2 of lignin, and 14·8 of saccharine matter and salts of lime, including loss. In doses of from fifteen to twenty grains it produced no effect on the system. A similar root was described by Guibourt by the name of *rose-scented jalap*. It was taken to France from Mexico, mixed with genuine jalap. It proved equally inefficacious as a purgative, and probably had the same origin. This spurious drug is probably the product of a Convolvulus or Ipomæa. See report by Messrs. Ellis, Duhamel, and Ecky, in the *Am. Journ. of Pharm.* (xiv. 289).

Two varieties of false jalap, imported into New York, are described by Mr. John H. Currie in the *N. Y. Journ. of Pharm.* for Jan. 1852. The first corresponds with the root above described as that

southern climates, are said, when brought back, to have become consolidated, and so far chemically altered as plainly to exhibit globules of mercury. This change is ascribed by Schacht and Wackenroder to a fungous growth. (*Arch. der Pharm.*, xxxix. 239.) The best criterion of good quality in jalap is the proportion of its resinous constituent; and all specimens intended for use in the powdered form, or in any liquid preparation, should be rejected if they contain less than 11 or 12 per cent. of resin.

Medical Properties and Uses. Jalap is an active cathartic, operating briskly and sometimes painfully upon the bowels, and producing copious watery stools. The aqueous extract purges moderately, without much griping, and is said to increase the flow of urine. The portion not taken up by water gripes severely. The watery extract obtained from jalap, previously exhausted by rectified spirit, is said to have no cathartic effect, but to operate powerfully by urine. (*Duncan.*) The alcoholic extract, usually called resin of jalap, purges actively, and often produces severe griping. From these facts, it would appear that the virtues of this cathartic do not depend exclusively upon any one principle. Experiments, however, by Mr. John C. Long, of Philadelphia, seem to show that the gummy extract, which he took in the quantity of a drachm without any effect, is inert; while the soft resin, or that soluble in ether, which was thought to have but feeble power, if any, acted powerfully as a hydragogue cathartic, in the dose of three grains. (*Am. Journ. of Pharm.*, Nov. 1861, p. 489.) Jalap was introduced into Europe in the latter part of the sixteenth, or beginning of the seventeenth century, and now ranks among the purgative medicines most extensively employed. It is applicable to most cases in which an active cathartic is required, and from its hydragogue powers is especially adapted to the treatment of dropsy. It is generally given in connection with other medicines, which assist or qualify its operation. In dropsical complaints it is usually combined with bitartrate of potassium; and the same mixture is much employed in the treatment of the hip disease, and scrofulous affections of other joints. With calomel it forms a cathartic compound, which has long been highly popular, in the United States, in bilious fever and other complaints attended with congestion of the liver or portal circle. In overdoses it may produce dangerous hypercatharsis. It is said to purge when applied to a wound.

The dose of jalap in powder is from fifteen to thirty grains; of the resin, or alcoholic extract, from four to eight grains; of the extract of the U. S. and Br. Pharmacopœias from ten to twenty grains. The latter extract is preferable to the alcoholic, as it more completely represents jalap itself. The dose of calomel and jalap is ten grains of each; of bitartrate of potassium and jalap, two drachms of the former and ten or fifteen grains of the latter.

Off. Prep. Extractum Jalapæ; Pulvis Jalapæ Compositus; Pulvis Scammonii Comp., *Br.;* Resina Jalapæ; Tinctura Jalapæ. W.

of Convolvulus Orizabensis, or *male jalap*, both in appearance and in the character of its resinous ingredient. The second is a tuberous root, resembling in shape, colour, and size, the butternut, or fruit of Juglans cinerea, being black or nearly so externally, dull over most of the surface but glossy in spots, with deep longitudinal incisions, internally yellow or yellowish-white, with a horny fracture, and upon the transversely cut surface marked with sparse dots, as if from delicate fibres. It contains no resin, and appears to be inert.

In the numbers of the *Journal de Pharmacie*, &c. for Dec. 1863 (p. 477), and for March, 1864 (p. 212), three other tubers are described by M. Guibourt, which have been offered in the market for jalap; one named *false jalap of New Orleans*, because imported into France from that city, the second *digitate jalap* (*jalap digité*) from the arrangement of its component tubers, and the third *radiated false-jalap* (*faux-jalap rayonné*) from the stellate appearance of the cut surface. Our space will not permit a particular description of these substances, which is the less important, as they are not likely to be mistaken for the true jalap by one at all acquainted with the characters of the latter; and, besides, do not appear in themselves to possess any valuable properties. We must, therefore, content ourselves with referring to the original papers. (*Notes to former editions.*)

Another false jalap, some tubers of which were exhibited to Prof. Procter by Mexicans, who stated that they were produced on grounds in Mexico belonging to them, is described by him in the *Am. Journ. of Pharm.* (Sept. 1868, p. 389), to which the reader is referred for a particular account of it. Though differing in shape and interior structure from genuine jalap, they had precisely the odour of that product, and a similar wrinkled appearance and mottled brown colour externally, and were probably derived from a plant either of the same genus as jalap or one closely related to it. (*Note to the thirteenth edition.*)

JUGLANS. *U.S.*

Butternut.

The inner bark of the root of Juglans cinerea. *U. S.*

JUGLANS. *Sex. Syst.* Monœcia Polyandria. — *Nat. Ord.* Juglandaceæ.

Gen. Ch. MALE. *Amentum* imbricated. *Calyx* a scale. *Corolla* six-parted. *Filaments* four to eighteen. FEMALE. *Calyx* four-cleft, superior. *Corolla* four-cleft. *Styles* two. *Drupe* coriaceous, with a furrowed nut. *Willd.*

Several products of *Juglans regia*, or common *European walnut*, are used medicinally in Europe. The hull of the fruit has been employed as a vermifuge from the times of Hippocrates, and has been recommended in syphilis and old ulcers. The expressed oil of the fruit has been deemed efficacious against the tape-worm, and is also used as a laxative injection. The *leaves*, long occasionally employed for various purposes both in regular and domestic practice, have been found by Professor Négrier, of Angers, in the highest degree efficacious in scrofula. He gave to children a teacupful of a pretty strong infusion, or six grains of the aqueous extract, or an equivalent dose of a syrup prepared from the extract, two, three, or four times a day; and at the same time applied a strong decoction to the ulcers, and as a collyrium when the eyes were diseased. No injury ever resulted from a long-continued use of the remedy. It appears to act as a moderately aromatic bitter and astringent. (*Arch. Gen.*, 3e série, x. 399 and xi. 41.) They are said also to have proved useful as a topical application in malignant pustule. (*Ibid.*, 5e sér., x. 609.)* The leaves of our *J. nigra*, or common *black walnut*, and those of *J. cinerea*, the only officinal species, probably possess the same properties.

Juglans cinerea. Willd. *Sp. Plant.* iv. 456; Bigelow, *Am. Med. Bot.* ii. 115; Carson, *Illust. of Med. Bot.* ii. 42, pl. 86. — *J. cathartica.* Michaux, *N. Am. Sylva*, i. 160. This is an indigenous forest tree, known in different sections of the country by the names of *butternut*, *oilnut*, and *white walnut*. In favourable situations it attains a great size, rising sometimes fifty feet, with a trunk three or four feet in diameter at the distance of five feet from the root. The stem divides, at a short distance from the ground, into numerous nearly horizontal branches, which spread widely, and form a large tufted head. The young branches are smooth and of a grayish colour, which has given origin to the specific name of the plant. The leaves are very long, and consist of seven or eight pairs of sessile leaflets, and a single petiolate leaflet at the end. These are two or three inches in length, oblong-lanceolate, rounded at the base, acuminate, finely serrate, and somewhat downy. The male and female flowers are distinct upon the same tree. The former are in large aments, four or five inches long, hanging down from the sides of the shoots of the preceding year's growth, near their extremity. The fertile flowers are at the end of the shoots of the same spring. The germ is surmounted by two large feathery, rose-coloured stigmas. The fruit is sometimes single, suspended by a thin pliable peduncle; sometimes several are attached to the sides and extremity of the same peduncle. The drupe is oblong-oval, with a terminal projection, hairy, viscid, green in the immature state, but brown when ripe. It contains a hard, dark, oblong, pointed nut, with a rough, deeply and irregularly furrowed surface. The kernel is thick, oily, and pleasant to the taste.

The butternut grows in Upper and Lower Canada, and throughout the whole

* *Nucitannic Acid.* In the walnut, between the kernel and the shell, is a thin membrane, which closely embraces the cotyledon, called the *episperm*, which consists of two layers, the inner very thin, colourless, translucent, and perfectly tasteless, the outer coarser, somewhat coloured, and of a bitter, disagreeable taste. The latter, examined chemically by Dr. T. L. Phipson, was found to contain, among other principles, as gallic and Mazic acid, &c., a new variety of tannic acid, which he proposes to name *nucitannic acid* or *nucitannin*, to which the outer membrane chiefly owes its unpleasant taste. It is a glucoside; as when boiled for some hours, with dilute muriatic acid, it splits into glucose and a peculiar red acid substance, which he calls *rothic acid*, and the properties of which he has pretty thoroughly investigated. This has little interest especially for the pharmaceutist: but they who are disposed to press inquiries in this direction, are referred to the paper of Dr. Phipson in the *Chemical News*, Sep. 3, 1869, p. 116. (*Note to the fourteenth edition.*)

northern, eastern, and western sections of the old United States. In the Middle States, the flowers appear in May, and the fruit ripens in September. The tree, if pierced immediately before the leaves unfold, yields a richly saccharine juice, from which sugar may be obtained, nearly if not quite equal to that from the sugar maple. The wood, though neither strong nor compact, is useful for some purposes on account of its durability, and exemption from the attacks of worms. The fruit, when half-grown, is sometimes made into pickles, and, when ripe, affords in its kernel a grateful article of food. The bark is used for dyeing wool a dark-brown colour, though inferior for this purpose to that of the black walnut. It is said, when applied to the skin, to be rubefacient. The inner bark is the medicinal portion, and that of the root, being considered most efficient, is directed by the Pharmacopœia. It should be collected in May or June.

On the living tree, the inner bark, when first uncovered, is of a pure white, which becomes immediately on exposure a fine lemon colour, and ultimately changes to deep brown. It has a fibrous texture, a feeble odour, and a peculiar, bitter, somewhat acrid taste. Its medical virtues are extracted by boiling water. Dr. Bigelow could detect no resin in the bark; and the presence of tannin was not evinced by the test of gelatin, though a brownish-black colour was produced by sulphate of iron.

The bark, submitted to chemical examination by Mr. Charles O. Thiebaut, was found to be destitute of tannic acid, and of any vegetable alkaloid, but to contain bitter extractive oily matter in large proportion, a volatilizable acid, crystallizing in bright, orange-yellow crystals, and appearing to bear some analogy with chrysophanic acid, named *juglandic* acid, another acid crystallizing in tabular colourless crystals, a volatile acid with ashes, potassium largely, with traces of sodium, calcium, and aluminium. (*Am. Journ. of Pharm.*, June, 1872, p. 253.) In a subsequent analysis by Mr. E. S. Dawson, G. P., there were also found resin in very small proportion and a volatile acid, and in the ashes, in addition to the basis discovered by Mr. Thiebaut, magnesium, combined, as were the other bases, with carbonic, muriatic, phosphoric, and silicic acids. Prof. Maisch has no doubt that the juglandic acid of Mr. Thiebaut is identical with the *neucin* of A. Vogel, Jun., found in green walnut peel. (*Ibid.*, April, 1874, p. 167.)

Medical Properties and Uses. Butternut is a mild cathartic, operating without pain or irritation, and resembling rhubarb in the property of evacuating without debilitating the alimentary canal. It was much employed, during our revolutionary war, by Dr. Rush and other physicians attached to the army. It is especially applicable to cases of habitual costiveness and other bowel affections, particularly dysentery, in which it has acquired considerable reputation. In connection with calomel it has sometimes been used in our intermittent and remittent fevers, and other complaints attended with congestion of the abdominal viscera. It is given in the form of decoction or extract, never in substance. The extract is officinal, and is almost always preferred. The dose of it is from twenty to thirty grains as a purge, from five to ten grains as a laxative. Mr. E. S. Dawson, G. P., states as the result of his own experience, that a tincture containing the virtues of two troyounces of the bark in a pint of diluted alcohol, will act decidedly as a cathartic in the dose of from one to two fluidrachms. (*Am. Journ. of Pharm.*, April, 1874, p. 169.)

Off. Prep. Extractum Juglandis, *U. S.* W.

JUNIPERUS. *U. S.*

Juniper.

The fruit of Juniperus communis. *U. S.*

Genevrier commun, Baies de Genièvre, *Fr.;* Gemeiner Wachholder, Wach holderbeeren, *Germ.;* Ginepro, *Ital.;* Enebro, Bayas de Enebro, *Span.*

JUNIPERUS. *Sex. Syst.* Dicœcia Monadelphia.—*Nat. Ord.* Pinaceæ or Coniferæ.

Gen. Ch. MALE. *Amentum* ovate. *Calyx* a scale. *Corolla* none. *Stamens* three. FEMALE. *Calyx* three-parted. *Petals* three. *Styles* three. *Berry* three-seeded, irregular, with the three tubercles of the calyx. *Willd.*

Juniperus communis. Willd. *Sp. Plant.* iv. 853; Woodv. *Med. Bot.* p. 13, t. 6. This

is an erect evergreen shrub, usually small, but sometimes twelve or fifteen feet high, with numerous very close branches. The leaves are narrow, longer than the fruit, entire, sharply pointed, channeled, of a deep-green colour, somewhat glaucous on their upper surface, spreading, and attached to the stem or branches in threes, in a verticillate manner. The flowers are diœcious, and disposed in small, ovate, axillary, sessile, solitary aments. The fruit is formed of the fleshy coalescing scales of the ament, and contains three angular seeds.

The common juniper is a native of Europe; but has been introduced into this country, in some parts of which it has become naturalized. It is not uncommon in the neighbourhood of Philadelphia. The plant described in Bigelow's American Medical Botany, under the title of *J. communis*, and very common in certain parts of New England, deserves, perhaps, to be considered a distinct species. It is a trailing shrub, seldom more than two or three feet high, spreading in all directions, throwing out roots from its branches, and forming beds which are often many rods in circumference. The name of *J. depressa* has been proposed for it. The common juniper flowers in May, but does not ripen its fruit till late in the following year. All parts of the plant contain a volatile oil, which imparts to them a peculiar flavour. The wood has a slight aromatic odour, and was formerly used for fumigation. A terebinthinate juice exudes from the tree and hardens on the bark. This has been erroneously considered as identical with *sandarach*. The peasantry in the south of France prepare a sort of tar, which they call "*huile de cade*," from the interior reddish wood of the trunk and branches, by a distillation *per descensum*. (See *Oil of Cade*, in *Part III.*) The fruit and tops of juniper are the only officinal parts.

The berries, as the fruit is commonly called, are sometimes collected in this country, and parcels are occasionally brought to the Philadelphia market from New Jersey. But, though equal to the European in appearance, they are inferior in strength, and are not much used. The best come from the south of Europe, particularly from Trieste and the Italian ports. They are globular, more or less shrivelled; about as large as a pea; marked with three furrows at the summit, and with tubercles from the persistent calyx at the base; and covered with a glaucous bloom, beneath which they are of a shining blackish-purple colour. They contain a brownish-yellow pulp, and three angular seeds. They have an agreeable somewhat aromatic odour, and a sweetish, warm, bitterish, slightly terebinthinate taste. These properties, as well as their medical virtues, they owe chiefly to a volatile oil. (See *Oleum Juniperi.*) The other ingredients, according to Trommsdorff, are resin, sugar, gum, wax, lignin, water, and various saline substances. The proportion of these ingredients varies according to the greater or less maturity of the berries.* The volatile oil is most abundant in those which have attained their full growth and are still green, or in those which are on the point of ripening. In the latter, Trommsdorff found one per cent. of the oil. In those perfectly ripe it has been partly changed into resin, and in those quite black, completely so. The berries impart their virtues to water and alcohol. They are very largely consumed in the preparation of gin.

The tops of juniper were formerly directed by the *Edinburgh* and *Dublin Colleges*. Their odour is balsamic, their taste resinous and bitterish, and they possess similar virtues with the berries.

* Franz Steer of Cashau, in a more recent analysis, found the sugar to be glucose, and, besides the principles discovered by Trommsdorff, obtained pectin, malic acid, and a peculiar resin-like substance, which he names *juniperin*. This is black, with a yellow tint in thin layers by transmitted light, brittle, easily pulverizable, tasteless, insoluble in water and ether, but soluble in alcohol, and without acid or alkaline reaction. A singular property is that, when rubbed with a little water, it changes into a yellow powder, which is perfectly soluble in 66 parts of water, and has in solution an unpleasant bitter taste. It is obtained by distilling a tincture of the berries until nearly all the alcohol has passed over, pouring the residue while hot into a vessel, in which it deposits a gum-resin on cooling, decanting the clear liquid and reducing it with a gentle heat to a small volume, and allowing it to stand. A yellow powder separates, resembling powdered rhubarb, which disappears by further evaporation, and is followed by resinous drops, which, separated and washed, constitute the substance in question. (*Chem. Cent. Blatt.*, Dec. 31, 1856, p. 951.)

M. E. Donath gives as the composition of the berries, 29·44 of water, 0·91 of volatile oil, 1·86 of formic, 0·94 acetic, 0·21 malic, and traces of oxalic acid, 0·64 was like fatty matter, 8·46 green resin, 1·29 brown resin, 0·37 bitter matter (the juniperin of Steer), 0·73 of pectin, 4·45 of protein substances, 29·65 sugar, 15·83 of cellulose, and 2·33 of mineral substances. (*Journ. de Pharm.*, Janv. 1874, p. 84.)

Medical Properties and Uses. Juniper berries are gently stimulant and diuretic, imparting to the urine the smell of violets, and producing occasionally, when largely taken, disagreeable irritation in the urinary passages. They are chiefly used as an adjuvant to more powerful diuretics in dropsical complaints; but have been recommended also in scorbutic and cutaneous diseases, catarrh of the bladder, and atonic conditions of the alimentary canal and uterus. They may be given in substance, triturated with sugar, in the dose of one or two drachms three or four times a day. But the infusion is more convenient. It is prepared by macerating an ounce of the bruised berries in a pint of boiling water, the whole of which may be taken in the course of twenty-four hours. Extracts are prepared from the berries, both bruised and unbruised, and given in the dose of one or two drachms; but, in consequence of the evaporation of the essential oil, they are probably not stronger than the berries in substance.

Off. Prep. Infusum Juniperi, *U. S.;* Oleum Juniperi. W.

JUNIPERUS VIRGINIANA. *U. S. Secondary.*

Red Cedar.

The tops of Juniperus Virginiana. *U. S.*

JUNIPERUS. See JUNIPERUS.

Juniperus Virginiana. Willd. *Sp. Plant.* iv. 853; Bigelow, *Am. Med. Bot.* iii. 49; Michaux, *N. Am. Sylv.* iii. 221. This species of Juniper, commonly called *red cedar*, is an evergreen tree of slow growth, seldom very large, though sometimes rising forty or fifty feet, with a stem more than a foot in diameter. It has numerous very close branches, which, in the young tree, spread out horizontally near the ground; but, as the tree advances, the lower branches slowly decay, leaving the trunk irregular with knots and crevices. The leaves are very small, fleshy, ovate, concave, pointed, glandular on their outer surface, ternate or in pairs, and closely imbricated. Those of the young shoots are often much longer and spreading. The leaves closely invest the extreme twigs, increasing with their growth, till ultimately lost in the encroachments of the bark. "The barren flowers are in oblong aments, formed by peltate scales with the anthers concealed within them. The fertile flowers have a proper perianth, which coalesces with the germ, and forms a small, roundish berry, with two or three seeds, covered on its outer surface with a bright blue powder." (*Bigelow.*)

The red cedar grows in all latitudes of the United States, from Burlington, in Vermont, to the Gulf of Mexico; but it is most abundant and vigorous in the southern section. The interior wood is of a reddish colour, and highly valuable on account of its great durability. Small excrescences, which are sometimes found on the branches of the tree, are popularly used as an anthelmintic, under the name of *cedar apples*, in the dose of from ten to twenty grains three times a day. The tops or leaves only are officinal.

They have a peculiar not unpleasant odour, and a strong, bitterish, somewhat pungent taste. These properties reside chiefly in a volatile oil, and are readily imparted to alcohol. The leaves, analyzed by Mr. Wm. J. Jenks, were found to contain volatile oil, gum, tannic acid, albumen, bitter extractive, resin, chlorophyll, fixed oil, lime, and lignin. (*Am. Journ. of Pharm.*, xiv. 235.) They bear a close resemblance to the leaves of *Juniperus Sabina*, from which they can be certainly distinguished only by the difference of odour.

Medical Properties and Uses. The resemblance of red cedar to savine is said also to extend to their medical properties; the former being considered, like the latter, stimulant, emmenagogue, diuretic, and, under certain circumstances, diaphoretic. It is, however, much less energetic; and, though advantage may, as has been asserted, have accrued from it in amenorrhœa, chronic rheumatism, and dropsy, it has not acquired the confidence of the profession generally. Externally applied it acts as an irritant; and an ointment, prepared by boiling the fresh leaves for a short time in twice their weight of lard, with the addition of a little wax, is employed as a substitute for savine cerate in maintaining a purulent discharge from blistered surfaces.

Sometimes the dried leaves in powder are mixed with six times their weight of resin cerate, and used for a similar purpose. But neither of these preparations is as effectual as the analogous preparation of savine.* W.

KINO. *U. S., Br.*

Kino.

The inspissated juice of Pterocarpus Marsupium (*De Candolle*), and of other plants. *U. S.* The inspissated juice obtained from incisions made in the trunk of Pterocarpus Marsupium *D. C.* Imported from Malabar. *Br.*

Kino, *Fr., Germ., Ital.;* Quino, *Span.*

The term kino was originally applied to a vegetable extract or inspissated juice, taken to London from the western coast of Africa, and introduced to the notice of the profession by Dr. Fothergill. Vegetable products obtained from various other parts of the world, resembling kino in appearance and properties, afterwards received the same name; and much confusion and uncertainty have existed, and in some degree still exist, in relation to the botanical and commercial history of the drug. We shall first give an account of the general properties of the medicines denominated kino, and then treat of the several varieties.

General Properties. Kino, as found in the shops, is usually in small, irregular, angular, shining fragments, seldom so large as a pea, of a dark reddish-brown or blackish colour, very brittle, easily pulverizable, and affording a reddish powder, much lighter coloured than the drug in its aggregate state. If in large masses, it may be reduced without difficulty into these minute fragments. It is without odour, and has a bitterish, highly astringent taste, with a somewhat sweetish after-taste. It burns with little flame, and does not soften with heat. It imparts its virtues and a deep-red colour to water and alcohol. Cold water forms with it a clear infusion. Boiling water dissolves it more largely; and the saturated decoction becomes turbid on cooling, and deposits a reddish sediment. The tincture is not disturbed by water. When long kept it often gelatinizes, and loses its astringency. (See *Tinctura Kino.*) Kino has been supposed to consist chiefly of a modification of tannic acid or tannin, with extractive, gum, and sometimes probably a little resin; but we need a careful analysis of the different well-ascertained varieties. The aqueous solution is precipitated by gelatin, the soluble salts of iron, silver, lead, and antimony, bichloride of mercury, and sulphuric, nitric, and muriatic acids. The precipitate with iron is of an olive or greenish-black colour. The alkalies favor the solubility of kino in water, but essentially change its nature, and destroy its astringency.

1. *East India Kino.* This is the variety at present probably most used, and most highly esteemed, and the only one recognised by the British Pharmacopœia. Its origin was long unknown. It is now ascertained, through the united researches of Drs. Pereira, Royle, Wight, and others, to be the product of *Pterocarpus Marsupium*, a lofty tree, growing upon the mountains of the Malabar coast of Hindostan. Kino is the juice of the tree, extracted through longitudinal incisions in the bark, and afterwards dried in the sun. Upon drying it breaks into small fragments, and is put into wooden boxes for exportation. It is collected near Tellicherry, and exported from Bombay. It is sometimes imported into this country directly from the East Indies, but more commonly from London. From a communication in the Journal of the Asiatic Society of Bengal, by the Rev. F. Mason, it appears that kino is also collected in the Tenasserim provinces, in Further India, and has been exported

* In the *Boston Medical and Surgical Journal* (xl. 469), several cases of poisoning are recorded by Dr. S. C. Watt, of Gouverneur, New York, resulting from the use of "*cedar oil,*" which we presume to be the volatile oil procured by distillation from the red cedar, though no information on that point is given. It appears that this oil has the reputation of producing abortion, and was taken, in three of the cases described, with a view to that effect. In one instance, a fluidrachm was taken, in another a fluidounce, and in both of these cases recovery took place. Two of the cases were fatal. The symptoms were burning in the stomach, sometimes vomiting, violent convulsions, coma, and a very slow pulse. The operation of the poison was mainly on the brain. No abortive effect was experienced in either case. The stomach, on examination after death, showed marks of inflammation, but not violent. (*Note to the ninth edition.*)

from Maulmain to Europe. It is produced by a tree called *Pa-douck*, which is supposed to be a species of Pterocarpus; but its precise character was not certainly known. (*Am. Journ. of Pharm.*, xxi. 134.) Dr. Christison has subsequently recognised, in a description of this tree furnished to him by Mr. Begbie, of Maulmain, the precise characters of Pterocarpus Marsupium; so that this kino has the same origin with that from Malabar.

East India kino is in small, angular, glistening fragments, of a uniform consistence, appearing as if formed by the breaking down of larger masses. The larger fragments are opaque and nearly black; but minute splinters are sometimes translucent, and of a deep garnet redness when viewed by transmitted light. This variety of kino is very brittle, readily breaking between the fingers, and easily pulverized, affording a dark-reddish powder, a portion of which, resulting from the mutual attrition of the fragments, is often found interspersed among them. When chewed, it softens in the mouth, adheres somewhat to the teeth, and tinges the saliva of a blood-red colour. In odour, taste, and chemical relations, it corresponds with the account already given of kino in general. According to Vauquelin, it contains 75 per cent. of tannin and peculiar extractive, 24 of red gum, and 1 of insoluble matter. But new views have been advanced as to its composition. When kino is boiled in water, the decoction deposits on cooling a bright-red substance; and a similar deposition takes place when a cold filtered aqueous solution is long exposed with a broad surface to the air. Dr. Gerling considers this deposit as the result of the combination of oxygen with kino-tannic acid, and calls it *kino-red*. (*Chem. Gaz.*, ix. 260; from Liebig's *Annalen.*) Hennig, who has examined East India kino with some care, considers this kino-red as a colouring matter in intimate combination with the tannic acid, which he is disposed to think identical in its pure state with the tannic acid of galls; and he extends the same views to the other forms of this astringent principle which give greenish precipitates with the salts of sesquioxide of iron, and which are generally believed to be somewhat different as they occur in different plants. Finding this red colouring matter to possess acid properties, he has named it *kinoic acid*. According to Hennig, kino consists of tannic acid with a trace of gallic acid, kinoic acid, pectin, ulmic acid, and inorganic salts with excess of earthy bases. (See *Am. Journ. of Pharm.*, xv. 544.)

2. *West India or Jamaica Kino.* This is believed to be the product of the *Coccoloba uvifera*, or *sea-side grape*, a tree twenty feet or more in height, bearing beautiful broad shining leaves, and large bunches of purple berries, to which it owes its vernacular name. It grows in the West Indies and neighbouring parts of the continent. The kino is said to be obtained by evaporating a decoction of the wood and bark, which are very astringent. Many years since, a thick reddish-brown liquid was imported into Philadelphia from the West Indies, which, when dried by exposure to the air in shallow vessels or by heat, afforded an extract having all the properties of kino, for which it was sold by the druggists. This has been long exhausted; but some years since, a considerable quantity of West India kino was brought into this market, which may still enter into the consumption of the country. It was contained in large gourds, into which it was evidently poured while in a liquid or semi-liquid state, and then allowed to harden. We have specimens of this kino in our possession.

When taken from the gourd, it breaks into fragments of various sizes, upon an average about as large as a hazelnut, and having some tendency to the rectangular form. The consistence of these fragments is uniform, their surface smooth and shining, and their colour a dark reddish-brown, approaching to black. They are, however, not so glistening, nor so black as the East India kino. In mass they are quite opaque, but in thin splinters are translucent and of a ruby redness. They are readily broken by the fingers into smaller fragments, are easily pulverized, and yield a dull-reddish powder, considerably lighter-coloured than that of the former variety. The West India kino is without odour, and has a very astringent, bitterish taste, with a scarcely observable sweetish after-taste. It adheres to the teeth when chewed, though rather less than the East India variety, and colours the saliva red. The solubility of Jamaica kino was very carefully examined, at our request, by Dr. Robert Bridges, of this city, who found that cold water dissolved 89 per cent., and ordinary officinal

alcohol 94 per cent. The portion dissolved by alcohol and not by water was probably of a resinous nature; as it appeared to be viscid, and very much impeded the filtration of the watery solution. Considering the nature of this substance, the form of kino in which it was found is probably, like that from the East Indies, an inspissated juice. Guibourt, who states that Jamaica kino is but slightly dissolved by cold water, must have operated on a different product.

3. *South American Kino. Caracas Kino.* In 1839, when the 4th edition of this Dispensatory was published, an astringent extract was described, which had recently been introduced into our market, derived, as we were informed, from Caracas, and known by that name to the druggists. Since that period it has come much more extensively into use. It is probably the same as that described by Guibourt, in the last edition of his History of Drugs, as the kino of *Columbia.* As imported, this variety of kino is in large masses, some weighing several pounds, covered with thin leaves, or exhibiting marks of leaves upon their unbroken surface, externally very dark, and internally of a deep reddish-brown or dark port-wine colour. It is opaque in the mass, but translucent in thin splinters, very brittle, and of a fracture always shining, but in some masses wholly rough and irregular, in others rough only in the interior, while the outer portion, for an inch or two in depth, breaks with a rather smooth and uniform surface, like that of the West India kino. This outer portion is easily broken into fine angular fragments, while the interior crumbles quite irregularly. Some of the masses are very impure, containing pieces of bark, wood, leaves, &c.; others are more homogeneous, and almost free from impurities. The masses are broken up by means of a mill so as to resemble East India kino, from which, however, this variety differs in being more irregular, less sharply angular, more powdery, and less black. On comparing the finer and more angular portions of the masses with the West India kino, we were strongly struck with their resemblance; and in fact could discover no difference between the two varieties either in colour, lustre, taste, the colour of the powder, or other sensible property. South American kino was found by Dr. Bridges to yield 93·5 per cent. to cold water, and 93 per cent. to alcohol; so that, while it has almost the same solubility as Jamaica kino in alcohol, it is somewhat more soluble in cold water. The aqueous solution, in this case, was not embarrassed by the adhesive matter which impeded the filtration in the former variety; and the want of a minute proportion of resinous matter in the South American kino is the only difference we have discovered between the two drugs. It is not improbable that they are derived from the same plant; and there is no difficulty in supposing that this may be the Coccoloba uvifera, as that tree grows as well upon the continent as in the islands.

4. *African Kino.* The original kino employed by Dr. Fothergill was known to be the produce of a tree growing in Senegal, and upon the banks of the Gambia, on the western coast of Africa; but the precise character of the tree was not ascertained until a specimen, sent home by Mungo Park during his last journey, enabled the English botanists to decide that it was the *Pterocarpus erinaceus* of Lamarck and Poiret.* The Edinburgh and Dublin colleges accordingly referred kino in chief to this plant, but, in so doing, overlooked the fact that not one of the varieties now used is brought from Africa. The importation of African kino has long ceased; and the most experienced pharmacologist cannot speak with certainty of having seen a specimen. That described by Guibourt has turned out to be the *Butea gum*;† and the

*A particular account of Pterocarpus erinaceus and its concrete juice, with a figure by Dr. W. F. Daniell, is contained in the *Pharm. Journ.* for August, 1854 (vol. xiv. p. 55).

†*Butea gum* is the concrete juice of the *Butea frondosa* or *Dhak-tree* of Hindostan. The juice flows from natural fissures, and from wounds made in the bark of the tree, and quickly hardens. It is in small elongated tears, or irregular angular masses, less in size than a grain of barley, apparently black and opaque, but translucent and of a ruby-red colour, when examined in small fragments by transmitted light. Many of the tears have small portions of bark adhering to them. They are very brittle, and readily pulverizable, yielding a reddish powder. They are very astringent to the taste, do not adhere to the teeth when chewed, and tinge the saliva red. The relations of this product to water, alcohol, and other chemical reagents are nearly the same as those of ordinary kino. When freed from impurities, consisting of from 15 to 25 per cent. of wood, bark, sand, &c., it contains, according to Mr. E. Solly, 73·26 per cent. of tannin, 5·05 of soluble extractive, and 21·67 of gum and other soluble substances. It is used in the arts in India, and might undoubtedly

description in the first edition of Christison's Dispensatory evidently applies to the common East India kino. A specimen given to Dr. A. T. Thomson as African kino, and described in his Dispensatory, is certainly not the drug spoken of by Fothergill, but rather resembles the Butea gum.

As described by Fothergill, the African kino, for which he proposed the name of *gummi rubrum astringens Gambinense*, was in lumps of about the size of those of gum Senegal or dragon's blood, and so similar in appearance to the latter that a good judge might easily be deceived. These lumps were hard, brittle, opaque, and almost black; but minute fragments were reddish and transparent like garnet. The drug was inodorous, of a strongly astringent and sweetish taste, and soluble in water to the extent of about five or six parts out of seven, forming a deep-red astringent infusion. There can be little doubt that this variety of kino is a concrete juice, which exudes either spontaneously or from wounds in the bark, and hardens in the air. (*Med. Obs. and Inq.*, i. 358.)

5. *Botany Bay Kino.* This is the concrete juice of *Eucalyptus resinifera*, or brown gum tree of New Holland, a lofty tree, belonging to the class and order *Icosandria Monogynia*, and the natural order *Myrtaceæ*. This tree attains a very great size, individuals sometimes rising as high as three hundred and forty feet; and an instance is known in which the diameter of the trunk, four feet from the ground, exceeded nineteen feet. The wood, notwithstanding the rapid growth of the tree, is hard and heavy, and well adapted to cabinet work. A specimen of the tree taken to Algeria is flourishing there; and there is little doubt that it might be introduced into our Southern States. (*Am. Journ. of Pharm.*, Sept. 1865, p. 393.) When the bark is wounded, the juice flows very freely, and hardens in the air. According to Mr. White, a single tree is capable of furnishing 500 pounds of kino in one year. (*White's Voyage.*) Duncan states that specimens of the juice have reached Great Britain in the fluid form, and that, when he first examined kino in 1802, it was common, and was the finest kind in commerce. According to information received by Dr. Thomson, its importation into Great Britain must have ceased soon after that period (*Thomson's Dispensatory*, 1826, p. 506); but Dr. Pereira speaks of it as imported in boxes, and has himself met with a parcel of it from Van Diemen's land. Ainslie informs us that he has seen it in the markets of Hindostan. Until after the publication of the tenth edition of this Dispensatory, we had never met with it in this country; but a specimen was afterwards presented to us by Mr. S. W. Osgood, druggist, of New York, with the information that it had been brought to that city in a vessel directly from western Australia.*

be employed as kino in medicine. It is, however, very seldom imported into England, and never, at present, into this country. Dr. Pereira found a quantity in an old drug store in London, and sent a portion to Guibourt, from which that writer drew up his description of African kino. It is possible that the kino which formerly reached us, full of small pieces of wood, bark, &c., may have been the *Butea gum.*

* Of the specimen presented to us by Mr. Osgood, one portion is in the liquid state, consisting, I presume, of the juice of the tree not yet inspissated, another portion is concrete. The *liquid*, which is contained in a corked and sealed bottle, is of a deep reddish-brown colour, transparent and redder in very thin layers, and somewhat viscid, with a slight solid deposit. The *concrete parcel* consists, for the most part, of very small grains, from the size of powdery particles up to that of a pea. But with these are mixed pieces of a larger size, two of them comparatively very large, being not less than two or three inches long by an inch, more or less, in breadth and thickness. These latter consist of a thick irregular deposit of the concrete juice on pieces of a thick, spongy, soft, and very brittle bark, which may be easily broken by the nail, and fragments of which of all sizes are mixed with the proper kino, which it resembles in colour, though somewhat lighter. In the irregular angular form of its granules, their dark reddish-brown colour and shining surface, their extreme brittleness and ready pulverization, the reddish colour of their powder, and their astringent bitterish taste, this drug corresponds closely with the more common varieties of kino; and, if deprived of the cortical matter with which it is mingled, might, I have no doubt, be used advantageously for the general purposes of the medicine. If the juice could be imported in quantities, and inspissated here, a pure product might be ensured. Examined at our request by Prof. Procter, this kino formed, when rubbed with water, a soft adhesive mass, and yielded to the water 67 per cent. of its weight in solution; though, as it was very slowly dissolved, more might have been taken up by the water, had the treatment been longer continued. Alcohol of sp. gr. 0·835 dissolved the whole with the exception of 1·5 grains, which might well have been impurity; as particles of the bark may have been embedded in the fragments examined. The tincture was not precipitated by water. The watery solution gave precipitates with gelatin, lime-water, ses-

The specimen examined by Pereira was in irregular masses, many of them in the form of tears as large as those of Senegal gum. "The purer pieces were vitreous, almost black in the mass, but transparent and of a beautiful ruby-red in small and thin fragments. Some of the pieces, however, were opaque and dull, from the intermixture of wood and other impurities." This variety of kino is brittle, with a resinous unequal fracture, and yields a reddish-brown powder. It is infusible, without odour, of an astringent taste followed by sweetness, and when long chewed adheres to the teeth. (*Duncan.*) It swells up and becomes gelatinous with cold water, yielding a red solution, which gives precipitates with lime-water, gelatin, and sesquichloride of iron, but not with alcohol or tartar emetic. With rectified spirit it also becomes gelatinous, and forms a red tincture, which is not precipitated by water. (*Pereira.*) White states that only one-sixth of this kino is soluble in water; Guibourt found it wholly soluble with the exception of foreign matters; and Dr. Thomson informs us that water at 60° dissolves more than one-half. These writers must have experimented with different substances. According to Dr. Duncan, alcohol dissolves the whole except impurities; and the tincture, with a certain proportion of water, lets fall a copious red deposit, but with a large proportion it only becomes slightly turbid.

It is said that catechu, broken into small fragments, has sometimes been sold as kino. Fortunately, little injury can result from the substitution, as the medical virtues of the two substances are very nearly the same.

Medical Properties and Uses. Kino is powerfully astringent, and in this country is much used for the suppression of morbid discharges. In diarrhœa, not attended with febrile excitement or inflammation, it is often an excellent adjunct to opium and the absorbent medicines, and is a favorite addition to the chalk mixture. It is also used in chronic dysentery when astringents are admissible; in leucorrhœa and diabetes; and in passive hemorrhages, particularly those from the uterus and intestines. It was formerly used in intermittent fever.

It may be given in powder, infusion, or tincture. The dose of the powder is from ten to thirty grains. The infusion, which is a very convenient form for administration, may be made by pouring eight fluidounces of boiling water on two drachms of the extract, and straining when cool. Aromatics may be added, if deemed advisable. The dose is a fluidounce. The proportion of alcohol in the tincture renders it frequently an unsuitable preparation.

Locally applied, kino is often productive of benefit. Its infusion is useful as an injection in leucorrhœa and obstinate gonorrhœa, and thrown up the nostrils we have found it very efficacious in suppressing epistaxis. A case of obstinate hemorrhage from a wound in the palate, after resisting various means, yielded to the application of powdered kino, which was spread thickly on lint, and pressed against the wound by the tongue. The powder is also a very useful application to indolent and flabby ulcers.

Off. Prep. Pulvis Catechu Compositus, *Br.;* Pulvis Kino Compositus, *Br.;* Tinctura Kino. W.

quichloride of iron, and sulphate of copper, and slight ones with corrosive sublimate and tartar emetic. (*Note to the eleventh edition.*)

The liquid referred to in the preceding paragraph was afterwards examined by Prof. Procter, with the following results. Evaporated to dryness, it yielded 13 per cent. of solid product, resembling kino in appearance and taste. With reagents it acted like a solution of kino, being precipitated copiously by gelatin, acetate of lead, and lime-water, and yielding a greenish-black colour with the salts of sesquioxide of iron. Dr. Pereira found in Botany Bay kino a peculiar pectin-like substance, which he named *eucalyptin*, a characteristic property of which was that it was precipitated from the tincture by solution of ammonia; and Prof. Procter found this juice to act similarly when treated in the same manner. (*Am. Journ. of Pharm.*, May, 1859, p. 228.)—*Note to the twelfth edition.*

A similar liquid is now taken to Europe from Australia, and has been briefly noticed, after M. Stanislas Martin, in the *Journal de Pharmacie* (4e sér., iv. 51, A.D. 1866). It is found, he says, in English commerce, in which it is known by the name of *kino juice*. It has a fine deep-red colour, a slightly aromatic odour, and a decidedly astringent taste, and on evaporation yields a genuine kino. It is not, however, always equally strong, the richest yielding 40 per cent. of extract. Now as this product is in commerce, it has already been made the subject of adulteration; a certain proportion of catechu being sometimes added to it during evaporation. The fraud, however, is revealed by the sweet taste imparted to the mixture. (*Note to the thirteenth edition.*)

KRAMERIA. *U.S.*

Rhatany.

The root of Krameria triandra (*De Candolle*). *U.S.*

Off. Syn. KRAMERIÆ RADIX. *Rhatany Root.* The dried root of Krameria triandra (Ruiz and Pavon, *Flor. Peruv.*). Imported from Peru. *Br.*

Ratanhia, *Fr.;* Ratanhiawurzel, *Germ.;* Ratania, *Ital., Span.*

KRAMERIA. *Sex. Syst.* Tetrandria Monogynia.—*Nat. Ord.* Polygaleæ, *De Cand.* Krameriaceæ, *Lindley.*

Gen. Ch. Calyx none. *Corolla* four-petaled; the superior nectary three-parted, and inferior two-leaved. *Berry* dry, echinated, one-seeded. *Willd.*

Krameria triandria. Ruiz and Pavon, *Flor. Peruv.* i. 61. The rhatany plant is a shrub, having a long, much branched, spreading root, of a blackish-red colour; with a round, procumbent, very dark-coloured stem, divided into numerous branches, of which the younger are leafy and thickly covered with soft hairs, giving them a white, silky appearance. The leaves are few, sessile, oblong-ovate, pointed, entire, presenting on both surfaces the same silky whiteness with the young branches. The flowers are lake-coloured, and stand singly on short peduncles at the axils of the upper leaves. There are only three stamens. The nectary consists of four leaflets, of which the two upper are spatulate, the lower roundish and much shorter: it does not correspond with the generic character of Willdenow, which was drawn from the *Krameria Ixina.* The fruit is globular, of the size of a pea, surrounded by stiff reddish-brown prickles, and furnished with one or two seeds. The name *rhatany* is said to express, in the language of the Peruvian Indians, the creeping character of the plant.

This species of Krameria is a native of Peru, growing in dry argillaceous and sandy places, and abundant about the city of Huanuco. It flowers at all seasons, but is in the height of its bloom in October and November. The root is dug up after the rains. Tschudi states that most of the rhatany now exported is obtained in the southern provinces of Peru, particularly in Arica and Islay. (*Trav. in Peru*, Am. ed., p. 214.)

The *K. Ixina*, growing in the West Indies and northern parts of South America, affords a root closely analogous in appearance and properties to that of the Peruvian species; but the latter only is officinal. This root is occasionally imported into Europe, and is known in England by the name of *Savanilla rhatany*, derived from the port of New Granada from which it was imported. It has been described by Dr. Mettenheimer of Giessen, and more recently by Dr. Schuchardt of Dresden, whose accounts of it are more particularly referred to in the note below.*

* *Savanilla Rhatany.* Mettenheimer describes a *false rhatany*, which has occurred in German commerce, as follows. The body of the root is from 1 to 2 inches thick and 4 long, knotty, with many branches; but these are generally separate, from 4 to 12 inches long, and nearly half an inch thick. The body resembles the genuine; but the branches are smoother, in parts somewhat shining, with deeper longitudinal furrows, and transverse fissures, which sometimes divide the bark quite around the root. They are more undulating, and, as well as the body, have more frequent wart-like elevations. The false root is more bitter than the genuine, with a thicker bark, and in mass has a dirty violet reddish-brown colour. Exteriorly the bark is of a dirty dark brownish-red, with a granular fracture; interiorly it is lighter coloured, with a fibrous fracture; and when cut with a knife has a shining surface. The ligneous part is pale-red, hard, of a short-fibrous fracture, and, when cut across, dull, and without the dark central point of the genuine root. The false root is inodorous. Its taste is more astringent than that of the genuine. Its source is unknown. (*Pharm. Cent. Blatt*, March 24, 1852, p. 221.)

The foregoing description, which we leave entire, corresponds closely with that of a variety of the drug, known in English commerce as *Savanilla rhatany*, given by Dr. Schuchardt of Dresden, by whom it is referred, in all probability correctly, to *Krameria Ixina.* In addition to what has been stated above, it may be mentioned that, in this variety of rhatany, the bark adheres more firmly to the root than in the genuine, that it has a more abrupt and less fibrous fracture, and consequently is more readily pulverized, and that both the wood and bark contain a large proportion of tannic acid. (*Pharm. Journ. and Trans.*, xvi. 29 and 132; from *Botanische Zeitung.*) A root, sent to this city from London, as a specimen of the rhatany known there as Savanilla, corresponds exactly with the description here given. (*Note to the tenth and eleventh editions.*)

Para Rhatany. A third variety of rhatany was described by Berg in 1865, and has since been

We receive rhatany in pieces of various shapes and dimensions, some being simple, some more or less branched, the largest as much as an inch in thickness, derived from the main body of the root, the smallest not thicker than a small quill, consisting of the minute ramifications. The pieces are often nearly cylindrical, and as much as two or three feet in length. Sometimes many of the radicles are united in a common head, which is short, and from half an inch to two inches or more in diameter. The roots are composed of a dark reddish-brown, slightly fibrous, easily separable bark, and a central woody portion, less coloured, but still reddish or reddish-yellow. Rhatany is without smell, but has a bitter, very astringent, slightly sweetish taste, which is connected with its medical virtues, and is much stronger in the cortical than the ligneous part. The smallest pieces are therefore preferable, as they contain the largest proportion of the bark. The powder is of a reddish colour. The virtues of the root are extracted by water and alcohol, to which it imparts a deep reddish-brown colour. From the researches of Vogel, Gmelin, Peschier, and Trommsdorff, it appears to contain tannic acid, lignin, and minute quantities of gum, starch, saccharine matter, and an acid which Peschier considered as peculiar, and named *krameric acid.* The tannic acid is in three states; 1st. that of purity, in which it is without colour; 2d. that of apotheme, in which it has lost its astringency, and been rendered insoluble by the action of the air, and 3d. that of extractive, which is a soluble combination of tannin and its apotheme, and is the substance which imparts to the infusion and tincture their characteristic reddish-brown colour. (Soubeiran, *Journ. de Pharm.*, xix. 596.) The tannic acid of rhatany (*krameria-tannic* or *rhatania-tannic acid*) is separated by treating the ethereal extract of the bark with alcohol, and evaporating the alcoholic solution. It gives a dark-green precipitate with sesquichloride of iron, a flesh-coloured one with gelatin, and none with tartar emetic. (Gmelin, *Handbook*, xv. 529.) The tannin of rhatany, in the presence of melted potassa, is transformed into *protocatechuic acid* and *phloroglucine*, and with dilute acids gives glucose and a peculiar red colouring principle, called *ratanhia red.* (*Journ. de Pharm. et de Chim.*, Janv. 1868, p. 73.) The proportion of red astringent matter obtained by Vogel was 40 per cent. The mineral acids and most of the metallic salts throw down precipitates with the infusion, decoction, and tincture of rhatany, and are incompatible in prescription.

In examining a specimen of extract of rhatany from America, Wittstein discovered an alkaloid, apparently identical with tyrosine. An analogous result has been obtained by M. Ruge, with the difference, however, that the new alkaloid is not identical with tyrosine, having the formula $C_{26}H_{12}NO_6$, while that of tyrosine is $C_{18}H_{12}NO_6$. (*Journ. de Pharm.*, 4e sér., i. 235; from *Chem. Centralblatt*, 1864, p. 1054.) But much more precise information on the point is required, before it can be admitted that krameria contains an alkaloid.

Cold water, by means of displacement or percolation, extracts all the astringency of rhatany, forming a clear deep-red infusion, which, upon careful evaporation, yields an almost perfectly soluble extract. The root yields its virtues also to boiling water by maceration; but the resulting infusion becomes turbid upon cooling, in consequence of the deposition of apotheme taken up by the water when heated. By boiling with water a still larger proportion of the apotheme is dissolved, and a considerable quantity of the pure tannin becomes insoluble in cold water, and medicinally inert, either by combining with the starch which is also dissolved, or by conversion into apotheme through the agency of the atmosphere. The decoction is,

recognised by Dr. F. A. Flückiger, under the name of *Brazilian* or *Para rhatany*, the former from the country where it is procured, the latter from the port whence it is exported. It is in long pieces (some 16 to 20 inches), from an eighth to three-quarters of an inch in thickness, of a dark-gray or brownish colour, and, like the Savanilla, becoming bluish-black when immersed in a solution of sulphate of iron, owing to the presence of tannic acid in the bark. In this variety, the root has a peculiar elasticity distinguishing it from the Peruvian and Savanilla varieties. Some of the pieces exhibited numerous corky warts. There are also microscopical characters which distinguish it. The botanical source of Para rhatany is not known. Two forms of rhatany which M. Cotton has described as *black and brown Antilles Rhatany*, because produced in these islands, though admitted also to be derived from different places on the neighbouring continent, have been pronounced by Dr. Flückiger, after a careful examination, to be in fact identical with the Para rhatany. (*Pharm. Journ.*, July, 1870, p. 84.)—*Note to the fourteenth edition.*

therefore, an ineligible preparation, and the extract resulting from its evaporation, though greater in weight than that from the cold infusion, contains much less soluble and active matter. Alcohol dissolves a larger proportion of the root than water; but this excess is owing to the solution of apotheme, and the alcoholic extract contains little if any more of the astringent principle than that prepared by cold water, while it is encumbered with much inert matter. (See *Extractum Krameriæ.*)

Medical Properties and Uses. Rhatany is gently tonic and powerfully astringent; and may be advantageously given in chronic diarrhœa, passive hemorrhages, especially menorrhagia, some forms of leucorrhœa, and in all those cases in which kino and catechu are beneficial. It has long been used in Peru as a remedy in bowel complaints, as a corroborant in cases of enfeebled stomach, and as a local application to spongy gums. Ruiz, one of the authors of the Peruvian Flora, first made it known in Europe. It was not till after the year 1816 that it began to come into general use. It has the advantage over the astringent extracts imported, that, being brought in the state of the root, it is free from adulteration, and may be prescribed with confidence.

The dose of the powder is from twenty to thirty grains; but in this form the root is little used. The infusion or decoction is more convenient. The proportions are an ounce of the bruised or powdered root to a pint of water, and the dose one or two fluidounces. The extract, tincture, and syrup are officinal, and may be given in the dose, the first of fifteen or twenty grains, the second of two or three fluiddrachms, and the third of half a fluidounce. In the form of infusion, tincture, and extract, rhatany has been highly recommended as a local remedy in fissure of the anus, prolapsus ani, and leucorrhœa.

Off. Prep. Extractum Krameriæ; Extractum Krameriæ Fluidum, *U. S.;* Infusum Krameriæ; Pulvis Catechu Compositus, *Br.;* Syrupus Krameriæ, *U. S.;* Tinctura Krameriæ. W.

LAC. *Br.*

Milk.

"The fresh milk of the Cow, Bos Taurus, *Linn.*" *Br.*

As it is the cow's milk which the British Pharmacopœia exclusively designates by the name of milk, we shall, in the observations which follow, exclude all other varieties of this product from consideration. The natural history, mode of obtaining, and ordinary sensible properties of milk are so well known, that the insertion of them here would be quite superfluous; and we pass on directly to a description of the chemical and physical characters of milk; more especially as a knowledge of these is necessary to a proper understanding of several of the more important properties of milk, as its coagulability, the formation of cream, and production of butter.

Properties. When examined with the aid of the microscope, milk is seen to contain a vast number of extremely small opaque corpuscles floating in a transparent liquid. These corpuscles have been found to consist of fatty matter surrounded by a very delicate coating of an albuminoid substance. To them the milk owes its opacity and whiteness; and, as they are slightly lighter than the liquid portion, they rise when the milk is allowed to stand, and form a layer on the surface, which is cream. The interior fatty matter, when caused to separate from its envelopes, aggregates in small masses, and forms butter. Thus it is that, in preparing butter, the milk is agitated, by churning or otherwise, so as to break the corpuscular coating. But in the formation of both cream and butter, the residuary liquid still contains a number of unbroken corpuscles, which give it more or less whiteness; and in skimmed milk, notwithstanding the quantity of corpuscles lost, enough remain to give it almost the whiteness and opacity of the milk just from the cow. It has been denied that the corpuscles are really enveloped by a distinct membrane; but the effect of mechanical agency in the preparation of butter seems to afford indisputable proof of the existence of a coating which is broken in the process; and there is a chemical proof, as appears to me, not less decisive. Sulphuric ether dissolves the fatty matter constituting butter; and if a liquid, having oil globules floating in it free, be agitated with ether, the oily

matter is dissolved, and the liquid quite deprived of it. Now if milk be agitated with ether, and the mixture be allowed to stand, the two liquids separate, and the ether rises in consequence of its levity, and floats unaltered on the surface. But if, before the addition of ether, acetic acid, which dissolves the envelopes of the fatty matter, be made to act on the milk, the interior fatty matter of the corpuscles is set free; and then ether added to it takes up the butter thus liberated. (Dumas, *Chem. News*, July 12, 1872, p. 15.)

The composition of normal milk, as given by Fownes, is as follows: in 1000 parts 873·00 of water, 30 of butter, 48·20 of casein, 43·90 of sugar of milk, 2·31 of phosphate of calcium, 0·42 of phosphate of magnesium, 0·07 of phosphate of iron, 1·44 of chloride of potassium, 0·24 of sodium, and 0·42 of a compound of sodium and casein. (*Chem. News*, Jany 7, 1870, p. 5.) As milk often constitutes the exclusive diet of infants for months, it must contain all the materials necessary for the support of the body; the butter yielding the fatty matters; the casein, the albuminoid ingredients; the sugar, the saccharine principle with the lactic acid, etc.; the phosphate of calcium, the chief material of the bones; the phosphate of iron, an essential constituent of the blood; both phosphates, phosphorus to the brain; and the various salts mentioned, the saline, alkaloid, and acid ingredients.

The following method of estimating the quantity of the different ingredients in milk is given by Dr. C. F. Chandler, of New York. 1. The water may be determined by evaporating a weighed quantity of milk, drying the residue carefully at 212° F., and weighing what remains. The loss represents the water. 2. The salts are estimated by burning all that is combustible in the solid residue, and weighing the ash. 3. To ascertain the proportion of butter and casein, a portion of milk, having been coagulated by a few drops of acetic acid, is boiled; the precipitate is washed with water, and finally the butter is separated by ether, leaving the casein behind. The ethereal solution yields the butter on evaporation. 4. The sugar is generally estimated by deducting the weight of the other ingredients from 100.

The fatty matter of milk, or butter, consists, according to Chevreul, of stearin, margarin, and olein, with small proportions of butyrin, caproin, and caprin, to which it owes its smell. Butyrin is a compound of butyric acid and glycerin, and is inodorous. On exposure of butter for some time to the air, the butyrate of glycerin is decomposed, and the butyric acid being set free, causes the disagreeable odour characteristic of rancid butter. The proportion of fatty matter in milk is estimated by Mr. John Horsley by means of the joint solvent powers of alcohol and ether; the mixed menstrua being allowed to stand, and the oil as it rises to the surface removed. For minute particulars, see the *Chemical News* (May 2, 1874, p. 224).*

The casein of milk is a peculiar and most important ingredient, bearing a close resemblance to animal albumen, but differing from it slightly in composition, and also in some of its chemical relations with other substances. A little phosphorus is contained in albumen, which has not been found in casein. (*Chem. News*, Jany. 7, 1870, p. 6.) Nevertheless, there is reason for believing that it is the source of all the albuminoid substances in the body, when supported by milk alone.

The sugar of milk is peculiar. Under the name of *Saccharum Lactis*, it will be found treated of, as to the mode of procuring it, its characteristic properties, and its application, in *Part I.* of the present work, in its proper alphabetical position.

Preservation of Milk. Milk is so important as an article of diet both in health and disease, that ships bound on long voyages have often been supplied with cows in order that this essential article may be supplied. But a much more convenient

* The following method of estimating the quantity of fatty matter in milk, published by Mr. F. N. Macnamara, in the *Chemical News* (May 16, 1873, p. 242), may sometimes, perhaps, be found useful. Take a glass tube of 50 c.c., and drawing out one end, introduce 10 c.c. of milk, and as much of alcohol and ether. Seal the tube, and keep it for two hours in a water-bath at 180° F. Allow it to cool, break off one end, and permit the fluid portion of its contents to drain into a small flask. Exhaust the residue in the tube by boiling ether, and add the washings to the liquid in the flask. Evaporate the contents of the flask to about 10 c.c.; then, when the flask is cool, add ether, and by means of a separating tube, draw off the ethereal solution of fat from the watery fluid. Let the ethereal solution evaporate to dryness, in a very small weighed beaker; heat to 212° in a water oven for two hours, and when cool weigh. Finally test the residue as to its solubility before calculating the result. (*Note to the fourteenth edition.*)

method is to treat fresh milk in such a manner that it will keep unaltered at least during the time of the voyage. The readiest mode, probably, of effecting this, is to introduce milk into a bottle so that it shall be quite filled, then place the bottle thus filled in a vessel of boiling water for some time, so as to destroy any organic germs, which might cause fermentation, and to expel atmospheric air; next to close the bottle tightly, and make it quite secure against the access of air. To obviate any danger of rupture of the vessel, in consequence of the shrinking of the milk on cooling, it might be well to adopt the plan of the fruit-canners, of using a tin vessel for the purpose of holding the milk, having a closed cover, with an opening capable of being closed by soldering, filling it, exposing it as before to heat; then, when the vapour or gas ceases to escape, soldering and allowing it to cool, and finally unsealing the aperture, filling the vacant space with fresh milk, again heating, and soldering while hot. It appears to me that, in the canning establishments, milk for sale might be advantageously added to their list of substances canned. Milk which had been preserved by Appert's method, and kept thirteen years, was examined by Prof. Bouchardat, and found in three layers, the lowest consisting of a thin white deposit (probably the pellicles of the corpuscles); the middle, which was largest, an aqueous liquid, not perfectly transparent, and of a yellowish colour; the third and uppermost a fatty matter, partly liquid at 15 C., which was the butter. When the flask was opened there was a faint odour of boiled milk; and, though the taste of the butter was not agreeable, there was no evidence of putrefaction. (*Am. Journ. of Pharm.*, Dec. 1871, p. 544.)

Another method of preservation recommended is to add to every litre (1 pint 13 oz.) of unskimmed milk, in a well-annealed glass bottle, 40 centigrammes (about 6 grs.) of bicarbonate of sodium. The bottle containing the milk, being well corked, is placed, for about four hours, in a water-bath heated to 194° F. On being taken out, the bottle is varnished over with tar; and in that state, it is said, the milk it contains will keep sound and sweet for several weeks. (*Chem. News*, March 18, 1870, p. 131.)

Milk is also made to keep for a considerable time by simply concentrating it somewhat by boiling. Under the name of "preserved milk," Mr. Borden, inventor of the "meat biscuit," and a peculiar extract of beef, has for some time prepared, and sold in this country, a concentrated form of milk. This is probably the same as that prepared, under the same name, by an American company, in Switzerland, on the Lake of Zug, by evaporating, with the aid of a vacuum operator, fresh cow's milk, with the addition of sugar, to the consistence of syrup. Examined by Liebig, it was found to contain 77·56 per cent. of solid matter, of which nearly one-half was sugar. Excluded from the air, the preparation may be kept indefinitely without change; and, properly diluted with water, has the taste of the best milk sweetened.

Concentrated Milk. Various processes have been employed for preparing concentrated milk, in a form capable of being preserved for an indefinite time, and of being diluted, at any time when wanted, so as to have the ordinary condition of fresh milk. The following process of M. Martin de Lignac, is among the most satisfactory yet made public. Milk immediately from the cow is put in shallow boilers with a flat bottom, to the depth of about two inches, and heated by a water-bath. For every pint of milk an ounce of white sugar is added; and, so long as the heat is continued, the contents of the boilers are constantly stirred, so as to favour evaporation. When the volume is reduced four-fifths, the concentrated liquid is poured into cylindrical cans, the opening of which is hermetically closed by tin solder. These cans are arranged in a boiler constructed like steam-boilers, so as to support a pressure within, and vapour is introduced at the temperature of 218° or 219° F. As soon as the boxes have thus been exposed to heat, the preparation is completed. When the can is opened, it will be found filled with a pasty substance, somewhat translucent, and yellowish-white. Diluted with five times its weight of water, this substance has all the exterior and nutritive characters of ordinary milk. When thus exposed, the milk will keep readily ten days or more, especially if a little is taken every day from the can, so as to change the surface in contact with the air. The sugar used contributes to the preservation of the milk. The high temperature employed for a short time contributes greatly to the same end, by destroying the ferments which may

be in the milk. M. Payen recommends, when the taste of boiled milk is objectionable, that the evaporation be carried on in vacuo by means of vapour, aided by agitation with mechanical stirrers. (*Journ. de Pharm.*, Mars, 1868, p. 195.)*

Injury from exposure. Milk is liable to various changes which more or less diminish its value as food or medicine, and, therefore, require to be guarded against. One of these is spontaneous, occurring on the exposure of milk to the air, and at an earlier or later period after being drawn from the cow, according to the weather; the greater being the heat, the surer and greater the amount of change. The milk becomes sour to the taste and smell, imperfect coagulation takes place, the envelope opens and the oil escapes; and altogether the milk becomes unfit for any delicate use. Against such alterations the milk may be protected in bottles closed so as to exclude the air; and it is desirable to keep the bottles in as cold a place as convenient.

Microscopic alteration. There is another injurious change to which milk is often exposed, sooner or later after being taken from the cow; that is, the presence in it of various organic germs or growths, derived generally from the atmosphere. In a paper by M. V. Essling, giving the result of his microscopic observation on milk, it is stated that, in less than a day in summer, and in two or three days in winter, after milking, milk if examined, will be found to contain, among its proper corpuscles, a number of minute spherical or oblong bodies, that rapidly increase, and ultimately become developed into a kind of mushroom growth, which no doubt proves very deleterious to children who live on the milk as food, and may cause some of their infantile diseases. Mr. J. B. Dancer, however, examined milk microscopically with somewhat different results. Of several portions which had been exposed to the air, some time after they had become sour, only one out of three was affected by these organic bodies from the air, and that not till after the third day, when a cup of milk placed in a closet which was known to be favourable to the growth of fungi, was seen to have become affected; patches of mould being visible on its surface, which the microscope proved to be *Mucor Mucedo*. The inference from this latter observation is that little apprehension need be entertained of fresh milk, if not exposed to a bad atmosphere, and even then not till after some days. (*Chem. News*, Jany. 7, 1870, p. 6.)

There can be no doubt that, by being exposed to putrescent effluvia and otherwise bad air, or derived from a diseased cow, milk may become infected with noxious matter, whether chemical or organic, and may thus, when used as food, be the cause of serious disease. In a prevalence of enteric fever in London or its neighbourhood, the disease was traced, in the opinion of some, to the use of infected milk.

Adulteration. Milk is liable to adulteration. The most common, and perhaps the most important, is dilution with water. This, within certain limits, is very easily effected, is very difficult to discover, and, moreover, very profitable in a pecuniary point of view. The temptations to its practice are so great and universal, that constant watchfulness is necessary to one who would guard himself against it. Very copious addition of water is recognised at once by the thinness, blueness, and in some degree the translucency of the milk. But much adulteration may take place short of this; and to detect the fraud, it is necessary to prove a decided excess of water; for, even in perfectly normal milk, there is often some disproportion of this ingredient above or below the mean; owing to the mode of living and health of the cow. This deviation, however, is small. Observations made in Sweden by Alexander Muller and Eisenstuck, on a herd of fifteen cows, with daily analysis in every case throughout the year, resulted in the statement, that in no instance did the solids of the milk fall short of 11·5 per cent., and only in four instances below 12; while the highest was 14·05; the average being 12·8 per cent. In England, of ten cows, from different parts of the country, the milk of which was examined by Mr. J. Alfred Wanklyn, that of only one contained so little as 11·80 per cent., while the highest was 14·34, and the mean was 12·7. With the aid of these figures it will be easy to detect any

* It would not be proper to leave the subject of condensed milk without referring to the opinion of Dr. H. Daly, of London, founded on a large experience of his own, that condensed milk, though children fed on it look plump and hearty, has the effect of impairing their powers of resistance to disease, and that children, thus fed, are very apt to perish when attacked by diarrhœa, even though slightly. (*Lancet*, Nov. 2, 1872, p. 653.)—*Note to the fourteenth edition.*

considerable amount of adulteration by water; for all besides the amount of solids may be considered as consisting of this fluid. All that is necessary, therefore, is to weigh very carefully a given quantity of milk, say 1000 grains, in thin platinum or silver dishes, and maintain it by means of a water-bath, at the temperature of 212°, for three hours, or until evaporated to dryness. The residue when weighed will give the amount of the solids; and the difference between it and the 1000 grains will be the weight of the water. If the solids fall short of 11·8, the proportion of the deficiency to the whole weight of the milk may be considered as representing the quantity of water added. Other methods of estimating the proportion of water in excess have been based on the specific gravity of the milk, which it was supposed would be lighter than the normal. Upon this principle it was that lactometers were formed. But it has been found that this method is not entirely reliable; as the specific gravity of the milk varies with other causes besides an excess of water; for the removal of the cream increases the density of the milk, the former being the lighter of the two. Starch or farinaceous substances have been used apparently for giving substance to milk rendered too fluid by dilution. This may be detected by the usual reagent for starch; but it must be recollected that, when iodine is added to milk containing starch, it acts on the latter only after the milk has been completely saturated with the iodine, after which the blue colour is produced by a further addition of the reagent. Chalk has, we believe, been used in the adulteration of milk, in like manner with the starch, for giving it whiteness and increasing its opacity; but this and all similar mineral bodies may be detected by their subsidence, if insoluble, and by remaining behind, when the milk is incinerated, if more or less soluble.

Medical Properties and Uses. Few remedies are more important than milk for the sick, considered in its relations, whether as an article of food or of medicine. In the former capacity, its easy digestibility, nutritious character, and entire want of stimulant or irritant properties, render it peculiarly useful, as an exclusive article of diet, in many cases of chronic irritation or inflammation of the alimentary mucous membrane. In obstinate chronic diarrhœa, chronic dysentery, and chronic gastritis, it will probably effect cures, as an exclusive diet, with but little aid from medicine. In persistent vomiting, in which the stomach will retain little or nothing for days, weeks, and even months, I have repeatedly been able to effect cures by this remedy, especially by associating the milk with a certain portion, say one-fourth or one-third, of lime-water. As before stated, milk contains all the principles necessary for the support of the human body; as many infants live on it exclusively, and even adults have done the same for a considerable time; perhaps, occasionally, with the addition of a little bread or other farinaceous matter, for years. Hence it is applicable to many cases in which the blood has become depraved, partly, perhaps, from errors of diet; and I believe that I have repeatedly found it useful in that way. In some febrile cases, especially enteric fever in its somewhat advanced stages, where support from nutritive matter becomes necessary, I was many years, while still in practice, in the habit of giving a tablespoonful of milk every hour, as the main if not exclusive nutriment, and had every reason to be satisfied with the treatment.

As a remedy in nausea and vomiting, either alone, or attendant, as they often are, on other diseases, milk associated with lime-water in the dose of a tablespoonful of each every half hour, one, or two hours, according to the severity of the case, has long been esteemed one of our most efficient remedies.

In the form of wine-whey it has from time immemorial been used as a gentle stimulant, applicable to febrile diseases beginning to assume a low form; and still later, in conditions of great debility, it is, with brandy, the remedy upon which reliance is placed beyond all others. For the mode of preparing and using wine-whey, see the article on *Vinum* in *Part I.* of this book.

Externally milk is much used in making one of the most convenient and effectual emollient applications, that of the bread and milk poultice, prepared by mixing bread thoroughly with boiling hot milk over the fire; and a little perfectly fresh lard may often be advantageously applied upon the surface of the poultice when spread, in order to prevent it from becoming dry, and sticking to the skin at the edges.

Off. Prep. Mistura Scammonii, *Br.* W.

LACTUCA. *Br.*

Lettuce.

The flowering herb of Lactuca virosa, *Linn. Br.*

LACTUCARIUM. *U. S.*

Lactucarium.

The concrete juice obtained from Lactuca sativa, by incision and spontaneous evaporation. *U. S.*

Lactuca. *Sex. Syst.* Syngenesia Æqualis.—*Nat. Ord.* Compositæ Cichoraceæ, *De Cand.* Cichoraceæ, *Lindley.*

Gen. Ch. Receptacle naked. *Calyx* imbricated, cylindrical, with a membranous margin. *Pappus* simple, stipitate. *Seed* smooth. *Willd.*

The plants of this genus yield when wounded a milky juice, to which, indeed, they owe their generic name. In some of them this juice possesses valuable narcotic properties. This is the case, among others, with *L. sativa*, *L. virosa*, and *L. altissima*. It was supposed that our native *L. elongata*, or *wild lettuce*, might have similar virtues; and Dr. Bigelow was informed by physicians who had employed it, that it acts as an anodyne, and promotes the secretion from the skin and kidneys. But, according to M. Aubergier, who experimented with different species of Lactuca, in order to ascertain from which of them lactucarium might be most advantageously obtained, the milky juice of this plant is of a flat and sweetish taste without bitterness, contains much mannite, but no bitter principle, and is destitute of narcotic properties. (*Ann. de Thérap.*, 1843, p. 18.) The probability is that it is nearly or quite inert.* Therefore, though formerly holding a place in our national Pharmacopœia, it has been discarded.

Lactuca sativa. Willd. *Sp. Plant.* ii. 1523. The garden lettuce is an annual plant. The stem, which rises above two feet, is erect, round, simple below, and branching in its upper part. The lower leaves are obovate, rounded at the end, and undulating; the upper are smaller, sessile, cordate, and toothed; both are shining, and of a yellowish-green colour. The flowers are pale-yellow, small, and disposed in an irregular terminal corymb. Before the flower-stem begins to shoot, the plant contains a bland, pellucid juice, has little taste or smell, and is much used as a salad for the table; but during the period of inflorescence it abounds in a milky juice, which readily escapes from incisions in the stem, and has been found to possess decided medicinal as well as sensible properties. The juice is more abundant in the wild than the cultivated plants. Inspissated by exposure to the air, it constitutes the lactucarium of our Pharmacopœia. This was formerly recognised by all the British Pharmacopœias; but has been discarded, we think upon insufficient grounds, in the new code.

The original native country of the garden lettuce is unknown. The plant has been cultivated from time immemorial, and is now employed in all parts of the civilized world. It flourishes equally in hot and temperate latitudes. Some botanists suppose that *L. virosa* of the old continent is the parent of all the varieties of the cultivated plant.

Lactuca virosa. Willd. *Sp. Plant.* iii. 1526; Woodv. *Med. Bot.* p. 75, t. 31. The

* An investigation into the subject of our native *Lactuca elongata* by Prof. Maisch, of the Philad. College of Pharmacy, has led to conclusions, differing so essentially from those of M. Aubergier, as to justify the conclusion that the latter author was mistaken as to the source of the milky juice with which he experimented. The milky juice collected by Prof. Maisch himself from plants in his neighbourhood, was converted quickly into a gelatinous mass, that shrunk much in drying, and, so far from a flat taste had a persistent bitterness, and a heavy nauseous, narcotic odour. Having prepared a syrup from this concrete juice, he gave portions of it for trial to Drs. Da Costa and August Muller, who found it decidedly useful, and by the latter physician, who had the opportunity of using it among the patients in the German hospital, was pronounced quite equal to the imported German lactucarium. Nevertheless Prof. Maisch is not prepared to substitute the concrete juice of the American species growing wild, for the German lactucarium from cultivated plants. (*Am. Journ. of Pharm.*, March, 1869, p. 145.)—*Note to the fourteenth edition.*

acrid or *strong-scented lettuce* is biennial, with a stem from two to four feet high, erect, prickly near the base, above smooth and divided into branches. The lower leaves are large, oblong-ovate, undivided, toothed, commonly prickly on the under side of the midrib, sessile, and horizontal; the upper are smaller, clasping, and often lobed; the bractes are cordate and pointed. The flowers are numerous, of a sulphur-yellow colour, and disposed in a panicle. The plant is a native of Europe.

L. virosa is lactescent, and has a strong disagreeable smell like that of opium, and a bitterish, acrid taste. It was admitted by the late Edinburgh and Dublin Pharmacopœias as one of the sources of lactucarium, which it is said to yield in greater quantity, and of better quality, than the garden lettuce. Mr. Schutz, of Germany, obtained only 17 grains, on the average, from a single plant of the garden lettuce, while a plant of L. virosa yielded 56 grains. The British Pharmacopœia recognises it, but not for the sake of its inspissated juice, which it has discarded.

The milky juice of these species of Lactuca undergoes little alteration, if confined in closely stopped bottles from which the air is excluded. But, when exposed to the air, it concretes, and assumes a brownish colour somewhat like that of opium. The following mode of collecting it from L. sativa was recommended by Mr. Young, of Edinburgh. When the stem is about a foot high, the top is cut off, and the juice which exudes, being absorbed by cotton or a piece of sponge, is pressed out into a cup or other small vessel, and exposed till it concretes. In order to obtain all the juice which the plant is capable of affording, it is necessary to cut off five or six successive slices of the stem, at short intervals, and to repeat the process two or three times a day. The juice may also be collected by the finger as it flows from the incisions.

A plan proposed by Mr. Probart, of London, is to collect the milky juice on pieces of woven cotton about half a yard square, to throw these when fully charged into a vessel containing a small quantity of water, and allow the water thus impregnated to evaporate in shallow dishes at the ordinary atmospheric temperature. The lactucarium is left in the form of an extract.

Another method of extracting the virtues of the lettuce has been recommended by Mr. Probart. When the plant begins to assume a yellow hue, the white juice concretes in the bark of the stem, and in the old leaves, which become very bitter. These parts, being separated, are macerated for twenty-four hours in water, then boiled for two hours; and the clear decoction, having been allowed to drain off through a sieve, is evaporated in shallow vessels by simple exposure. The resulting extract, according to Mr. Probart, has half the strength of lactucarium, and may be obtained at one-sixth of the cost.*

The inspissated expressed juice of L. sativa was formerly officinal; but this must be exceedingly uncertain, from the variable quantity of the milky juice contained in the plant; and, as the young leaves, which contain little or none of it, were often employed, the preparation was liable to be quite inert. The *thridace* of Dr. François, at one time supposed to be identical with lactucarium, is in all probability nothing more than the inspissated expressed juice of lettuce, and, indeed, was directed as such in the French Codex of 1837; the leaves being rejected, and the stalks alone, near the flowering period, being subjected to pressure. The present Codex wisely discards the thridace, and admits the proper lactucarium. The Br. Pharmacopœia directs an extract of L. virosa.

M. Aubergier, of Clermont, in a treatise presented to the French Academy of Sciences in November, 1842, states that lactucarium, identical with that of the garden lettuce, can be abundantly and cheaply procured from *Lactuca altissima*, which is a large plant, with a stem more than nine feet high, and an inch and a half in diameter. (*Annuaire de Thérap.*, 1843, p. 18.)

Lactucarium, as brought from England, is in small, irregular lumps, about the size of a pea or larger, of a reddish-brown colour externally, and of a narcotic odour and bitter taste. As prepared near Edinburgh, it is commonly in roundish, compact, and rather hard masses, weighing several ounces. (*Christison.*) A variety, known

* For the mode of cultivating and preparing lactucarium in England, see a communication by Mr. Thos. Fairgrieve to the *Pharm. Journ.*, June, 1873, p. 972. (*Note to the fourteenth edition.*)

in our market as *German lactucarium*, is in pieces about an inch and a half by an inch in thickness, four-sided, with one side convex and the three others flat, or slightly concave from shrinking, as if quarter sections of a saucer-shaped cake, which had been divided before it was quite dry. The colour on the outer or convex surface is darkish-brown, that of the cut surfaces light yellowish-brown. From experiments by Messrs. Parrish and Bakes, the German appears to be inferior to the English; as 44 per cent. of spirituous extract was obtained from the latter, and only 36 per cent. from the former, while the two extracts were about equal in their sensible properties. (*Am. Journ. of Pharm.*, May, 1860, p. 226.) In colour, taste, and smell lactucarium bears considerable resemblance to opium, and has sometimes been called *lettuce opium*. It does not attract moisture from the air. It yields nearly half its weight to water, with which it forms a deep-brown infusion. From its resemblance in sensible properties and therapeutical effects to opium, it was conjectured to contain morphia, or some analogous principle; but this conjecture has not yet been verified. Buchner, Aubergier, and Walz claim severally to have discovered the active principle, which has been named *lactucin;* but the substances obtained by these different chemists are not exactly identical in properties; and the lactucin of Walz and Aubergier is considered by M. Lenoir as owing its bitterness to impurities, separated from which it is without taste and inert. It is at least doubtful whether the constituent upon which the medical virtues of lactucarium depend has yet been isolated. We give in a note the results of various analyses of this medicine. They all relate to the lactucarium obtained from Lactuca virosa.*

* Buchner published experiments on lactucarium in 1832. His results are not essentially different from those subsequently obtained. The principle, named by him *lactucin*, is bitter, soluble in water, more soluble in alcohol, less so in ether, without alkaline reaction though precipitated by tannic acid, destitute of nitrogen, capable of forming with acids very soluble bitter combinations, and not easily obtained perfectly white and crystallized. (See *Pharm. Journ.*, vii. 74.)

Dr. Walz, in an inaugural thesis published at Heidelberg in 1839, gives the following constituents of lactucarium from L. virosa; viz., a peculiar principle denominated *lactucin*, volatile oil, a fatty matter easily dissolved by ether, and another of difficult solubility in that fluid, a reddish-yellow tasteless resin, a greenish-yellow acrid resin, common sugar, uncrystallizable sugar, gum, pectic acid, a brown humus-like acid, a brown basic substance, albumen, oxalic, citric, malic, and nitric acids, potassa, lime, and magnesia. Lactucin, as obtained by Walz, is in yellow crystalline needles, inodorous, of a strong and durable bitter taste, easily fusible, soluble in from 60 to 80 parts of cold water, freely soluble in alcohol, less so in ether, soluble in very dilute acids, and without alkaline or acid reaction. (*Annal. der Pharm.*, xxxii. 97.) It was obtained by treating lactucarium with alcohol acidulated with one-fifteenth of concentrated vinegar, adding an equal volume of water, precipitating by subacetate of lead, separating the excess of lead by sulphuretted hydrogen, filtering, evaporating by a gentle heat, treating the residuum by ether, and allowing the solution to evaporate.

M. Aubergier, in his memoir presented to the French Academy in 1842, gives the following as the result of his analysis:—1. a bitter crystallizable substance (*lactucin*), soluble in alcohol and boiling water, scarcely soluble in cold water, insoluble in ether, without alkaline reaction, and supposed to be the active principle; 2. mannite; 3. asparamide; 4. a crystallizable substance having the property of colouring green the sesquisalts of iron; 5. an electro-negative resin, combined with potassa; 6. a neuter resin; 7. ulmate of potassium; 8. cerin, myricin, pectin, and albumen; 9. oxalate, malate, nitrate, and sulphate of potassium, chloride of potassium, phosphate of calcium and magnesium, oxides of iron and manganese, and silica. The bitter principle above referred to separates from its solution in boiling water, upon cooling, in pearly scales. By the action of alkalies it loses its bitterness, which is not restored by acids. The lactescence of the fresh juice of lettuce is owing to a mixture of wax and resin, and not to caoutchouc. (*Ann. de Thérap.*, 1843, p. 19.) The bitter principle of Aubergier differs from that of Dr. Walz in being less soluble in cold water, and insoluble in ether.

M. Lenoir considers the lactucin of these two chemists as impure, and denies that it is the active principle, which, he thinks, is probably an organic alkali. He obtained the lactucin pure by treating the lactucarium of L. virosa with boiling alcohol, and filtering while hot. It was deposited on the cooling of the liquid, and afterwards purified by frequent crystallization from alcohol, and treatment with animal charcoal. Thus obtained, it was without taste or smell, and without effect upon the system. It was nearly insoluble in water, but readily dissolved by alcohol, ether, and the volatile and fixed oils. He proposed to name it *lactucone*, leaving the former name for the active principle when isolated. (*Ann. de Chim. et de Phys.*, Feb. 1847.) According to Walz, the lactucone of Lenoir is only the fatty matter discovered by himself. Thieme could not divide this into the two kinds noticed by Walz as differing in their solubility in ether, and, considering it as peculiar, proposed for it the name of *lactucerin*.

The most recent analysis of lactucarium is by Ludwig. That chemist found, in 100 parts, 48·63 of substances insoluble in water, and 51·37 of those soluble in water. Of the insoluble matter 42·64 parts were of *lactucerin* or *lactucone*, which he obtained by first exhausting lactucarium with water, then treating the insoluble residue several times with hot alcohol of 0·833, allowing the alcoholic solution to evaporate slowly, washing the yellowish substance thus procured with water, and purifying it by re-solution in alcohol, and crystallization. Thus obtained, it is in snow-white aggre-

Medical Properties and Uses. That lettuce possesses soporific properties is a fact which was known to the ancients; but the credit belongs to the late Dr. J. R. Coxe, of Philadelphia, of having first proposed the employment of its inspissated milky juice as a medicine. From experiments with a tincture prepared from lactucarium, Dr. Coxe obtained the same results as usually follow the administration of laudanum. Dr. Duncan, senior, of Edinburgh, afterwards paid particular attention to the subject, and, in his treatise on pulmonary consumption, recommended lactucarium as a substitute for opium, the anodyne properties of which it possesses, without being followed by the same injurious effects. From this recommendation, the medicine came into extensive use, and was adopted as officinal in several of the Pharmacopœias. Dr. François, a French physician, also investigated the medicinal properties of the inspissated juice of lettuce. According to that author, it is sedative, diminishing the rapidity of the circulation, and consequently the temperature of the body, without producing that disturbance of the functions which often follows the use of opium. The general inference which may be drawn from the recorded experience in relation to lactucarium is, that it has, in a much inferior degree, the anodyne and calming properties of opium, without its disposition to excite the circulation, to produce headache and obstinate constipation, and to derange the digestive organs. In this country the medicine is occasionally employed to allay cough, and quiet nervous irritation. It may be given in all cases in which, while opium is indicated in reference to its anodyne or soothing influence, it cannot be administered from idiosyncrasy of the patient. It is, however, very uncertain. The dose is from five to fifteen or twenty grains. An alcoholic extract would be a good preparation. It may be given in the dose of from two to five grains. A syrup is directed in the U. S. Pharmacopœia. (See *Syrupus Lactucarii*, Part II.)*

Water distilled from lettuce (*eau de laitue*) is used in France as a mild sedative,

gated granules, dissolves in strong hot alcohol which deposits it on cooling, is readily soluble in ether but insoluble in water, becomes transparent and tenacious when moderately heated in a platinum dish, melts completely at a higher heat with the escape of white odorous vapours, is incapable of saponification by caustic potassa, and is therefore not properly a fat, and in alcoholic solution faintly reddens litmus-paper. It consists of carbon, hydrogen, and oxygen ($C_{40}H_{34}O_5$). Besides this principle there were 3·99 parts of *wax*, and 2·00 of *lignin* and of a substance which swelled in ammonia, and was insoluble in water, alcohol, and ether. Of the 51·37 parts soluble in water, 6·98 were *albumen*, 1·75 *lactucerin* held in solution by other substances, 27·68 *bitter extract soluble in water and in alcohol*, and 14·96 *watery extract* insoluble in alcohol of 0·830. The former of these extracts was found to contain a peculiar acid substance called *lactucic acid*, and the lactucin of Aubergier. To obtain these principles, 80 parts of lactucarium, in fine powder, were triturated with 80 of pure cold diluted sulphuric acid, and then mixed with 400 parts of alcohol of 0·851; the liquor was filtered, shaken with hydrate of lime till it yielded no precipitate with baryta-water or oxalate of potassium, then decolorized with pure animal charcoal, and evaporated; the brown tenacious mass thus obtained (alcoholic extract) was treated with boiling water, which left behind a viscid substance; the aqueous solution was treated with animal charcoal, and on being evaporated yielded a mixture of lactucic acid and lactucin; these were separated by dissolving the mixture in boiling water, which on cooling deposited the latter in white crystalline scales, and gave up the former on subsequent evaporation. *Lactucic acid* is of difficult crystallization, light-yellow, strongly bitter, without sour taste, of an acid reaction, and readily soluble in alcohol and water. It has as much claim as any other discovered substance to be considered the active principle of lactucarium. *Lactucin*, purified by animal charcoal, is in white pearly scales, the solution of which exhibits no reaction with subacetate of lead, or solution of iodine. It is dissolved without change of color by concentrated sulphuric acid. Besides the above ingredients, Ludwig found also in lactucarium *a substance resembling mannite, oxalic acid, another organic acid* not well determined, *a soft resin, potassa, magnesia*, and *oxide of iron*. Distilled with diluted sulphuric acid, it gave an acid product smelling like lactucarium, which, saturated with carbonate of calcium, and again distilled with bisulphate of potassium, yielded an acid fluid having the odour of valerian. (*Pharm. Cent. Blatt*, June, 1847, p. 438; from *Arch. der Pharm.*, ii. 1 and 129. See also *Am. Journ. of Pharm.*, xx. 57.)—*Note to the eighth edition.*

*Mr. Wm. Hodgson has recommended that lactucarium should be prepared for use by freeing it from a caoutchouc-like principle, which, without possessing any medicinal virtues, interferes with its convenient exhibition. He recommends chloroform for this purpose, but found benzole to answer better, as it removes this tenacious matter without affecting the active principle.

Fluid Extract of Lactucarium.—Messrs. Parrish and Bakes propose a *fluid extract*, prepared by completely exhausting lactucarium with diluted alcohol, evaporating the tincture till each fluid-ounce represents a troyounce of the drug, separating the resinous matter deposited in the course of the evaporation, rubbing this with a little strong alcohol till dissolved, and adding the solution to the fluid extract before the entire completion of the process. Thus prepared, the fluid extract is black, of a heavy narcotic odour, and intensely bitter. Each minim of it represents a grain of the lactucarium. (*Am. Journ. of Pharm.*, May, 1860, p. 229.)—*Note to the twelfth edition.*

in the quantity of from two to four ounces. The fresh leaves boiled in water are sometimes employed in the shape of cataplasm. It is said that in Egypt a mild oil is derived from the seeds, fit for culinary use.

The extract or inspissated expressed juice of L. virosa is a sedative narcotic, said also to be gently laxative, powerfully diuretic, and somewhat diaphoretic. It is employed in Europe, particularly in Germany, in the treatment of dropsy, and is especially recommended in cases attended with visceral obstruction. It is usually, however, combined with squill, digitalis, or some other diuretic; and it is not easy to decide how much of the effect is justly ascribable to the lettuce. The medicine is never used in this country. The dose is eight or ten grains, which may be gradually increased to a scruple or more. *Lactuca Scariola*, another European species, possesses similar properties, and is used for the same purposes.

Off. Prep. of Lactuca, *Br.* Extractum Lactucæ, *Br.*

Off. Prep. of Lactucarium, *U. S.* Syrupus Lactucarii, *U. S.* W.

LAPPA. *U. S. Secondary.*

Burdock.

The root of Lappa minor (*De Candolle*). *U. S.*

Bardane, *Fr.;* Gemeine Klette, *Germ.;* Bardana, *Ital., Span.*

ARCTIUM. *Sex. Syst.* Syngenesia Æqualis. — *Nat. Ord.* Compositæ Cinareæ, *De Cand.* Cynaraceæ, *Lindley.*

Gen. Ch. Receptacle chaffy. *Calyx* globular; the scales at the apex with inverted hooks. *Seed-down* bristly, chaffy. *Willd.*

Arctium Lappa. Willd. *Sp. Plant.* iii. 1631; Woodv. *Med. Bot.* p. 32, t. 13.— *Lappa major.* De Cand. *Prodrom.* vi. 661. Burdock is biennial, with a simple spindle-shaped root, a foot or more in length, brown externally, white and spongy within, furnished with thread-like fibres, and having withered scales near the summit. The stem is succulent, pubescent, branching, and three or four feet in height, bearing very large cordate, denticulate leaves, which are green on their upper surface, whitish and downy on the under, and stand on long footstalks. The flowers are purple, globose, and in terminal panicles. The calyx consists of imbricated scales, with hooked extremities, by which they adhere to clothes, and the coats of animals. The seed-down is rough and prickly, and the seeds quadrangular.

This plant, which is the one intended in the Pharmacopœia, is a native of Europe, and is abundant in the United States, where it grows on the roadsides, among rubbish, and in cultivated grounds. Pursh thinks that it was introduced. The root, which should be collected in spring, loses four-fifths of its weight by drying. The odour of the root is weak and unpleasant, the taste mucilaginous and sweetish, with a slight degree of bitterness and astringency. Among its constituents, inulin has been found by Guibourt, and sugar by Fée.

The seeds are aromatic, bitterish, and somewhat acrid.

Medical Properties and Uses. The root is considered aperient, diaphoretic, and diuretic, without irritating properties; and has been recommended in gouty, scorbutic, venereal, rheumatic, scrofulous, leprous, and nephritic affections. Dr. J. Adolphus, of Hastings, Michigan, speaks of burdock in the strongest terms as a remedy in cutaneous diseases. He has treated with it successfully herpes, lepra, psoriasis, prurigo, lupus, and obstinate acne, and thinks nothing equal to it in the cutaneous diseases of children. (*Med. and Surg. Reporter*, March 7, 1868, p. 214.)

To prove effectual its use must be long continued. It is administered in the form of decoction, which may be prepared by boiling two ounces of the recent bruised root in three pints of water to two, and given in the quantity of a pint during the day. A fluid extract and syrup have also been prepared from it.* The seeds are diuretic,

* *Fluid Extract of Burdock.* This is prepared by Mr. I. J. Graham in the following manner. Sixteen ounces of the root, in moderately fine powder, are first moistened with diluted alcohol, and then submitted to percolation with the same menstruum until exhausted; one and a half fluidounces of the tincture which first passes being reserved. The remainder of the filtrate is evaporated, by means of a water-bath, to nine fluidounces, to which four ounces of sugar, and, after

and have been used in the same complaints, in the form of emulsion, powder, and tincture. The dose is a drachm. The leaves have been employed both externally and internally in cutaneous eruptions and ulcerations. W.

LARICIS CORTEX. *Br.*

Larch Bark.

"The bark, deprived of its outer layer, of Larix Europæa *D.C.;* Abies Larix *Rich.;* the common Larch." *Br.*

For all that relates to the botanical history of the common larch, Larix Europæa, see the article on *Terebinthina*, Part I. of this work. It is the inner bark of the tree that is officinally recognised, having been introduced into the last edition of the British Pharmacopœia, that of 1867, among the additions made to the second reprint in 1874. It was first brought to the notice of the profession in Great Britain by Dr. Charles Frigel, of Dublin.

Examined by Prof. Aldridge, it was found to contain, among other substances, gum, starch, resin, and tannic acid of the kind which precipitates the salts of iron olive-green. Dr. John Stenhouse has obtained from it a peculiar volatile principle, which he has not found in other trees of the Pine family, and which, as it has acid properties, though extremely feeble, he proposes to name *larixinic acid* (*larixine*). It is obtained by evaporating an infusion of the bark to the consistence of syrup, and submitting the residue to distillation in a glass retort or silver alembic, by means of a sand-bath cautiously heated. A portion of the larixinic acid comes over and condenses in crystals, but the greater part is dissolved in the liquid distillate. This on careful distillation deposits the impure acid, which may be purified by pressing it in bibulous paper, again crystallizing from a strong watery solution, and lastly subliming once or twice.

Larixinic acid is most abundant in the young bark. It is in beautiful white, lustrous crystals, often more than an inch long, of a peculiar somewhat empyreumatic smell, and a slightly bitter and astringent taste, inflammable, sublimable at about 200°, soluble in 87·88 parts of water at 56° F., very soluble in boiling water, soluble in cold but much more so in hot alcohol, and sparingly soluble in ether. It readily crystallizes from its solutions. A very singular and characteristic property, is that of forming, when added, in strong solution, in excess, to baryta-water, a bulky, transparent, gelatinous precipitate, occupying the whole measure of the liquids if concentrated. The probable formula of the acid is $C_{20}H_{10}O_{10}$.

Medical Properties and Uses. The inner larch bark possesses astringent and gently stimulant properties, and is supposed to have a special tendency to the mucous membranes. It has been found particularly efficacious in purpura and other hemorrhagic affections, especially hæmoptysis; and has been given in bronchitis with copious expectoration, and in diseases of the urinary passages. It has been used also, mixed with soap and glycerin, as a local remedy in psoriasis, chronic eczema, and other cutaneous affections. The usual forms of exhibition are those of extract and tincture, the former in the dose of from three to five grains, the latter from thirty minims to a fluidrachm or more, every three or four hours.* The British Pharmacopœia, in its "Additions" (1874), gives the mode of preparing the tincture, which will be found among the Preparations in this work; an extract may be made according to the U. S. formula for Extract of Rhubarb.†

Off. Prep. Tinctura Laricis, *Br.* W.

filtration, the reserved portion, are added. A fluidrachm, representing eighty grains of the root, may be given for a dose. (*Am. Journ. of Pharm.*, March, 1860, p. 178.) A *syrup* may be prepared by mixing four fluidounces of this fluid extract with twelve fluidounces of simple syrup, and given in the dose of a tablespoonful. (*Note to the twelfth edition.*)

* It is a curious circumstance, says the *London Pharmaceutical Journal*, that just at the period of the introduction of the Larch Bark into the Pharmacopœia, the Larch tree itself appears to be rapidly disappearing in Great Britain, in consequence of a disease with which it has been attacked, and which appears to be extending its ravages, with increasing malignancy. (*Pharm. Journ.*, Oct. 1874, p. 328.)—*Note to the fourteenth edition.*

† From *Dub. Hosp. Gaz.*, April 15, 1858, and Jan. 15, 1859; *Med. Times and Gaz.*, Nov. 1859, p. 476; and *Am. Journ. of Pharm.*, Nov. 1862, p. 556, &c.

LAUROCERASI FOLIA. *Br.*

Cherry-laurel Leaves.

The fresh leaves of Prunus Laurocerasus, *Linn.;* the Common or Cherry Laurel. *Br.* Laurier cerise, *Fr.;* Kirschlorbeer, *Germ.;* Lauro ceraso, *Ital.*

CERASUS. *Sex. Syst.* Icosandria Monogynia. — *Nat. Ord.* Amygdaleæ.

Gen. Ch. Differing from Prunus only in its fruit being destitute of bloom, with the stone round instead of acute, and the leaves when in bud folded flat, not rolled up. (Lindley, *Flor. Med.*, 232.)

Cerasus Lauro-cerasus. De Cand. *Prodrom.* ii. 540. — *Prunus Lauro-cerasus.* Willd. *Sp. Plant.* ii. 988; Woodv. *Med. Bot.* p. 513, t. 185. This is a small evergreen tree, rising 15 or 20 feet, with long spreading branches, which, as well as the trunk, are covered with a smooth, blackish bark. The leaves, standing alternately on short strong footstalks, are oval-oblong, from five to seven inches in length, acute, finely-toothed, firm, coriaceous, smooth, beautifully green and shining, with oblique nerves, and yellowish glands at the base. The flowers are small, white, strongly odorous, and disposed in simple axillary racemes. The fruit is an oval drupe, very similar in shape and structure to a small black cherry.

The cherry-laurel is a native of Asia Minor, but has been introduced into Europe, throughout which it is cultivated both for medical use, and for the beauty of its shining evergreen foliage. Almost all parts of it are more or less impregnated with the odour, supposed to indicate the presence of hydrocyanic acid. The leaves only are officinal.

In their recent and entire state they have scarcely any smell; but, when bruised, they emit the characteristic odour of the plant in a high degree. Their taste is somewhat astringent and strongly bitter, with the flavour of the peach kernel. By drying they lose their odour, but retain their bitterness. They yield a peculiar oil and hydrocyanic acid by distillation with water, which they strongly impregnate with their flavour. One pound, avoirdupois, of the fresh leaves yields 40·5 grains of the oil. (*Cent. Blatt*, A.D. 1855, p. 205.) The oil resembles that of bitter almonds, for which it is said to be sometimes sold in Europe, where it is employed to flavour liquors and various culinary preparations; but, as it is highly poisonous, danger may result from its careless use. It has not been determined how far the mode of production of this oil resembles that of bitter almonds. (See *Amygdala Amara.*) Chemists have failed in obtaining amygdalin from the leaves. That the oil exists already formed, to a certain extent, in the fresh leaves, is rendered probable by the fact, stated by Winckler, that they yield it in considerable quantity when distilled without water. (*Journ. de Pharm.*, xxv. 195.) The fresh leaves are used to flavour milk, cream, &c., and more safely than the oil; though they also are poisonous, when too largely employed.

Medical Properties and Uses. The leaves of the cherry-laurel possess properties similar to those of hydrocyanic acid; and the water distilled from them is much employed in various parts of Europe for the same purposes as that active medicine. But it is deteriorated by age, and, therefore, as kept in the shops, must be of variable strength. Hence, while Hufeland directs only twenty drops for a dose every two hours, to be gradually increased to sixty drops, M. Fouquier has administered several ounces without effect. Another source of inequality of strength must be the variable quality of the leaves according to the time they have been kept after separation from the tree, and probably also to their age and degree of development. Mr. J. Bröker, a Dutch pharmacologist, has satisfied himself, by numerous experiments, that the proportion of hydrocyanic acid in the leaves varies with the season, the age of the plant, the character of the soil and of the weather; and thinks that, in consequence of this variability, they are inferior for medical use to bitter almonds, which in this respect have a more steady constitution. He found the proportion of the acid in the leaves greatest in July, and least in February. (*B. and F. Medico-chir. Rev.*, Oct. 1868, p. 517.) It is not, therefore, to be regretted that the want

of the plant in this country has prevented the general introduction of the distilled water into use.

Off. Prep. Aqua Laurocerasi, *Br.* W.

LAVANDULA. *U.S.*

Lavender.

The flowers of Lavandula vera (*De Candolle*). *U.S.*

Lavande, *Fr.;* Lavandelblumen, *Germ.;* Lavandoia. *Ital.;* Espliego, Alhucema, *Span.*

LAVANDULA. *Sex. Syst.* Didynamia Gymnospermia. — *Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Calyx ovate, somewhat toothed, supported by a bracte. *Corolla* resupine. *Stamens* within the tube. *Willd.*

Lavandula vera. De Cand. *Flor. Fr. Sup.* p. 398.—*L. Spica.* Willd. *Sp. Plant.* iii. 60; Woodv. *Med. Bot.* p. 321, t. 114. The *Lavandula Spica* of Linnæus includes two distinct species, which were considered by him merely as varieties of the same plant, but have been separated by subsequent botanists. Of these, the officinal plant, the narrow-leaved variety of Linnæus, has been denominated by De Candolle *L. vera*, while the broad-leaved variety still retains the title of *L. Spica.* The latter is scarcely cultivated in the United States.

Common lavender is a small shrub, usually not more than two or three feet high, but sometimes as much as six feet. The stem is woody below, and covered with a brown bark; above, is divided into numerous, slender, straight, herbaceous, pubescent, quadrangular branches, furnished with opposite, sessile, narrow, nearly linear, entire, and green or glaucous leaves. The flowers are small, blue, and disposed in interrupted whorls around the young shoots, forming terminal cylindrical spikes. Each whorl is accompanied with two bractes. The corolla is tubular and labiate, with the lower lip divided into three segments, the upper larger and bifid. The filaments are within the tube.

The plant is a native of Southern Europe, and covers vast tracts of dry and barren land in Spain, Italy, and the south of France. In England it is very largely cultivated for commercial purposes, often covering many acres; and in the county of Surrey alone, it is said that 350 acres of land are devoted to its growth.* It is cultivated in our gardens, and in this country flowers in August. It is said that in fields, when too thickly planted, it is apt to suffer from a disease consequent on the noxious influence of its own aroma, which is relieved by thinning the plants. (*Pharm. Journ.*, x. 119.) All parts of it are aromatic; but the flowers only are officinal. The spikes should be cut when they begin to bloom.

Lavender flowers have a strong fragrant odour, and an aromatic, warm, bitterish taste. They retain their fragrance long after drying. Alcohol extracts their virtues; and a volatile oil upon which their odour depends rises with that liquid in distillation. The oil may be procured separate by distilling the flowers with water. (See *Oleum Lavandulæ.*) Hagan obtained from a pound of the fresh flowers from half a drachm to two drachms of the oil.

Medical Properties and Uses. Lavender is an aromatic stimulant and tonic, esteemed useful in certain conditions of nervous debility, but seldom given in its crude state. The products obtained by its distillation are much used in perfumery, and as adjuvants to other medicines, which they render at the same time more acceptable to the palate, and cordial to the stomach.

Off. Prep. Oleum Lavandulæ; Spiritus Lavandulæ, *U.S.* W.

* For accounts of the cultivation of lavender at Hitchin, in England, see *Pharm. Journ.*, Nov. 1859, p. 276, and the *Boston Med. and Surg. Journ.*, Jan. 14, 1864, p. 481. (*Note to the twelfth edition.*)

See also the same journal, Aug. 1873 (page 165) for a representation, in glowing terms, of this variety of agricultural industry in England, taken from *Chambers's Journal* for Aug. 16, 1873. (*Note to the fourteenth edition.*)

LEPTANDRA. *U.S.*

Leptandra.

The root of Leptandra Virginica (*Nuttall*). *U.S.*

LEPTANDRA. *Sex. Syst.* Diandria Monogynia.—*Nat. Ord.* Scrophulariaceæ.

Gen. Ch. Calyx five-parted, segments acuminate. *Corolla* tubular-campanulate, border four-lobed, a little ringent, unequal, the lower lamina narrower. *Stamens* and at length the *pistils* much exserted; filaments below, and tube of the corolla pubescent. *Capsule* ovate, acuminate, two-celled, many-seeded, opening at the summit. *Nuttall.*

The genus Leptandra was separated by Nuttall from the Veronica of Linnæus; and, though the new genus is not universally admitted, and has been rejected in the Manual of Gray, and the Flora of Chapman, yet it has in its favour the distinctive character of its medical properties, and is retained here on this and other considerations.

Leptandra Virginica. Nuttall, *Genera of N. Am. Plants*, i. 7; Rafinesque, *Med. Flora*, vol. ii.— *Veronica Virginica*, Linn.; Gray, *Man. of Bot. &c.* p. 290. This plant, commonly called *Culver's root*, or *Culver's physic*, is a herbaceous perennial, with a simple, erect stem, three or four feet high, smooth or downy, furnished with leaves in whorls, and terminating in a long spike of white flowers. The leaves, of which there are from four to seven in each whorl, are lanceolate, pointed, and minutely serrate, and stand on short footstalks. A variety was seen by Pursh with purple flowers, which was described and figured as a distinct species by Rafinesque, under the name of *L. purpurea.* The plant flowers in July and August. It grows throughout the United States east of the Mississippi, affecting mountain meadows in the South, and rich woods in the North, and not unfrequently cultivated.

The root is the part employed. Under the title of *Veronica*, it was recognised in the first and second editions of the U. S. Pharmacopœia, holding a place in the secondary catalogue; was omitted in the third and fourth editions; and so rapidly had it gained favour in the intervening decennial period, that in the fifth edition it was not only readmitted with the name of Leptandra, but took a place in the primary list.

Properties. The root consists of a rhizome or root-stalk several inches in length, sometimes branched, with numerous long slender radicles. As brought dried to the shops, the rhizome is usually broken into pieces an inch or more long, from two to four lines in thickness, either beset with the rootlets or very rough from their remains when broken, very hard and firm, and of difficult fracture, dark-brown externally, light-coloured and ligneous within. The rootlets are round, smooth, slender, generally broken, but, when not so, six inches or more in length, and almost black, being much darker-coloured than the caudex. The odour is feeble and not disagreeable, the taste bitterish, somewhat nauseous, and feebly acrid. Water and alcohol extract the virtues of the root. According to Mr. E. S. Wayne, of Cincinnati, it contains volatile oil, extractive, tannin, gum, resin, and a peculiar crystalline principle, to which the virtues of the medicine may be ascribed. To this principle the name of *leptandrin* properly belongs. Mr. Wayne obtained it by treating an infusion of the root with subacetate of lead, filtering, precipitating the excess of lead by carbonate of sodium, filtering to separate the carbonate of lead, passing the filtered liquid through animal charcoal which absorbed all the active matter, washing the charcoal with water till the washings began to be bitter, then treating it with boiling alcohol, and allowing the alcoholic solution to evaporate spontaneously. By dissolving the powder thus obtained in water, treating this with ether, and allowing the ether to evaporate, needle-shaped crystals were obtained, which had the bitter taste of the root. The resinous matter obtained by making a tincture of the root and precipitating this with water, has been improperly called leptandrin, and considered the active principle. The pure resin is probably inert; and the preparation referred to owes what activity it may possess to some of the true leptandrin associated with it. Leptandrin is soluble in water, alcohol, and ether. It has not been isolated for use. (*Proceedings of the Am.*

Pharm. Assoc., 1856, p. 34.) Subsequently Mr. Wayne has obtained from the root a saccharine principle, which he found to have the properties of *mannite* (*Am. Journ. of Pharm.*, Nov. 1859, p. 557); and Prof. F. F. Mayer has extracted a saponaceous principle, closely resembling senegin, which he ascertained to be a glucoside. (*Ibid.*, July, 1863, p. 298.) The chemistry, however, of leptandra needs further investigation.

Medical Properties. The recent root is said to act violently as a cathartic, and sometimes as an emetic. In the dried state it is much milder, but less certain. The practitioners calling themselves Eclectics consider it an excellent cholagogue, and use both the impure resin, which they call leptandrin, and the root itself as a substitute for mercurials. Dr. A. P. Dutcher, of Cleveland, Ohio, after considerable experience with leptandrin, has not found it to act decidedly on the liver, and thinks it, in this respect, a very unsatisfactory substitute for mercury; but believes that it has a special influence on the muciparous follicles of the intestines, and acts very advantageously in cases of duodenal indigestion and chronic constipation. (*Med. and Surg. Reporter*, March 28, 1868, p. 275.) The full cathartic dose of the powder is from twenty grains to a drachm; that of the impure resin referred to, from two to four grains. Dr. J. Adolphus says that, in the dose of one or two grains, the powder acts like rhubarb. On the same authority, from five to ten drops of a strong tincture, given every two hours, produce a mild aperient effect. (*Ibid.*, Jan. 11, 1868, p. 23.) Prof. Procter has prepared a fluid extract of leptandra, which probably contains all its virtues, and may be given as an aperient cholagogue in the dose of from twenty to sixty minims.* W.

LIMONES.

Lemons.

The fruit of Citrus Limonum.

Limons, Citrons, *Fr.;* Limonen, Citronen, *Germ.;* Limoni, *Ital.;* Limones, *Span.*

LIMONIS CORTEX. *U. S., Br.*

Lemon Peel.

The rind of the fruit of Citrus Limonum (*De Candolle*). *U. S.* The outer part of the rind of the fresh fruit of Citrus Limonum (*D. C.*). Lemons are imported from Southern Europe. *Br.*

LIMONIS SUCCUS. *U S., Br.*

Lemon Juice.

The juice of the fruit of Citrus Limonum (*De Candolle*). *U. S.* The freshly expressed juice of the ripe fruit of Citrus Limonum (*D. C.*). *Br.*

For some general remarks on the genus CITRUS, see *Aurantii Cortex.*

Citrus medica. Willd. *Sp. Plant.* iii. 1426; Woodv. *Med. Bot.* p. 582, t. 189. This tree closely resembles *Citrus Aurantium*, before described. The leaves, however, are larger, slightly indented at the edges, and stand upon footstalks which are destitute of the winged appendages that characterize the other species. The flowers, moreover, have a purplish tinge on their outer surface, and the fruit is entirely different in appearance from the orange. There are several varieties of *Citrus medica*, which some botanists consider as distinct species, but which scarcely differ except in

* The following is the formula referred to in the text. Moisten sixteen troyounces of the powdered root with three fluidounces of a mixture consisting of two parts of alcohol by measure and one of water, pack it in a glass percolator, and pour upon it the diluted alcohol. When a pint of the tincture has passed, set this aside in a warm place, so that it may evaporate to one-half. Continue the percolation until three pints more are obtained, which are to be evaporated on a water-bath to a pint. To this add four ounces of sugar, and, having continued the evaporation till the liquid is reduced to half a pint, add this while hot to the reserved liquid, so as together to make a pint (*Am. Journ. of Pharm.*, March, 1863, p. 112.)—*Note to the twelfth edition.*

the character of their fruit. Those particularly deserving of notice are the citron, lemon, and lime. 1. In the *citron*, *C. medica* of Risso, the fruit is very large, sometimes six inches in length, ovoidal, with a double rind, of which the outer layer is yellowish, thin, unequal, rugged, with innumerable vesicles filled with essential oil; the inner is white, very thick, and spongy. It is divided in the interior into nine or ten cells, filled with oblong vesicles, which contain an acid juice precisely like that of the lemon, and used for the same purposes. The rind is applied to the preparation of conserves, to which it is adapted by its thickness. The fruit is called *cédrat* by the French. 2. The *lemon* (*C. medica*, var. *limon* of Linn., *Citrus Limonium* of Risso) is smaller than the preceding, with a smoother and thinner rind, a pointed nipple-shaped summit, and a very juicy, acid pulp. In other respects it closely resembles the citron, to which, however, it is usually preferred in consequence of the greater abundance of its juice. 3. The *lime* is still smaller than the lemon, with a smoother and thinner rind, oval, rounded at the extremities, of a pale-yellow or greenish-yellow colour, and abounding in a very acid juice, which renders it highly useful for the purposes to which the lemon is applied. It is the product of the variety *C. acris* of Miller.

The *Citrus medica*, like the orange-tree, is a native of Asia. It was introduced into Europe from Persia or Media, was first cultivated in Greece, afterwards in Italy, so early as the second century, and has now spread over the whole civilized world, being raised by artificial heat where the climate is too cold to admit of its exposure during winter to the open air.

We are supplied with lemons and limes chiefly from the West Indies and the Mediterranean. Though the former of these fruits only is directed by the United States Pharmacopœia, both kinds are employed indiscriminately for most medicinal purposes; and the lime affords a juice at least equal, in proportional quantity and acidity, to that obtained from the lemon.

As lemons rapidly deteriorate on keeping, if exposed to the air, the suggestion of protecting them by a varnish of shellac dissolved in alcohol, made by Mr. George Mee, of London, is not without value. Mr. Mee found that lemons thus covered with varnish continued sound for many months. (See *Am. Journ. of Pharm.*, Sept. 1866, p. 474.)

Properties. The exterior rind of the lemon has a fragrant odour, and a warm, aromatic, bitter taste, somewhat similar to that of the orange, though less agreeable. It contains a bitter principle, and yields, by expression or distillation, an essential oil, which is much used for its flavour. Both this and the rind itself are recognised in the Pharmacopœias. (See *Oleum Limonis.*) When the white spongy portion of the rind is boiled in water, and the decoction evaporated, crystals are deposited, of a substance called *hesperidin*. This is bitter, but, as it is found most largely in the spongy and comparatively tasteless part of the rind, it may be doubted whether it is entitled to be considered as the active bitter principle. (See *Am. Journ. of Pharm.*, xxvi. 553.) Lemon peel yields its virtues to water, wine, and alcohol.

The juice is the part for which the fruit is most esteemed. It is sharply acid, with a peculiar grateful flavour, and consists chiefly of citric acid, mucilage, and extractive, dissolved in water. As lemons cannot always be obtained, the juice is often kept in a separate state; but, from its liability to spontaneous decomposition, it speedily becomes unfit for medical use; and, though various means have been resorted to for its preservation, it can never be made to retain for any length of time its original flavour unaltered. The best medicinal substitute for lemon juice is a solution of crystallized citric acid in water, in the proportion of about an ounce to the pint, with the addition of a little oil of lemons.* One of the most effectual methods of preserving the juice is to allow it to stand for a short time after expression, till a coagulable matter separates, then to filter, and introduce it into glass bottles, with a stratum of almond oil or other sweet oil upon its surface. It will keep still better, if the bottles containing the filtered juice be suffered, before being closed, to stand for fifteen minutes

* Nine drachms and a half, dissolved in a pint of water, form a solution of the average strength of lime juice; but, where precision is not requisite, the proportion mentioned in the text is most convenient.

in a vessel of boiling water. Another mode is to add one-tenth of alcohol, and to filter. The juice may also be preserved by concentrating it either by evaporation with a gentle heat, or by exposure to a freezing temperature, which congeals the watery portion, and leaves the acid much stronger than before. When used, it may be diluted to the former strength; but, though the acid properties are retained, the flavour of the juice is found to have been deteriorated. Lemon syrup is another form in which the juice is preserved.

The British Pharmacopœia gives the average sp. gr. of lemon juice at 1·039, and the average quantity of citric acid in a fluidounce of it, 32·5 grains. According to Mr. W. W. Stoddart, these quantities do not correspond; the sp. gr. being too great for the weight of the acid. Mr. Stoddart himself found, in lemons from six different sources, an average of 42·53 grains in an ounce of the juice, and a mean sp. gr. of 1·044. By other authorities the proportions are given very differently. Thus Mr. Watts gives 20·5 grains to the ounce, or 4·7 per cent. of the juice. But the fact is that the quantity of acid varies very greatly. Mr. Stoddart found it to diminish rapidly with the advance of summer, with little change in the sp. gr. (*Pharm. J. and Trans.*, Oct. 1868, p. 203.)

A solution of tartaric acid in water, with the addition of a little sulphuric acid, and flavoured with the oil of lemons, has been fraudulently substituted for lemon juice, particularly as an antiscorbutic on long voyages, for which purpose it is quite useless. An application of the tests for tartaric and sulphuric acid will at once detect the fraud.

Medical Properties and Uses. The rind of the lemon is sometimes used to qualify the taste and increase the power of stomachic infusions and tinctures. The juice is refrigerant, and, properly diluted, forms a refreshing and agreeable beverage in febrile and inflammatory affections. It may be given with sweetened water in the shape of lemonade, or may be added to the mildly nutritive drinks, such as gum-water, barley-water, &c., usually administered in fevers. It is also much employed in the formation of those diaphoretic preparations known by the names of *neutral mixture* and *effervescing draught.* (See *Mistura Potassii Citratis.*) One of the most beneficial applications of lemon juice is to the prevention and cure of scurvy, for which it may be considered almost a specific. For this purpose, ships destined for long voyages should always be provided with a supply of the concentrated juice, or of crystallized citric acid with the oil of lemons. In England every foreign-going ship is required by law to take such a supply of lemon juice, that every seaman should have a daily allowance of an ounce, after having been ten days at sea. (*Am. Journ. of Pharm.*, Jany. 1869, p. 75.) Lemon juice is sometimes prescribed in connection with opium and Peruvian bark, the effects of which it has been thought to modify favourably, by substituting the citrate of their respective alkaloids for the native salts. It has recently been employed with great supposed advantage in acute rheumatism, having been given in quantities varying from one to four fluidounces, from four to six times a day. It has been used with benefit as a local application in pruritus of the scrotum, and in uterine hemorrhage after delivery; and a French physician, named Revillout, recommends it as a gargle in diphtheric affections of the fauces, though he states that it is without action on the white lenticular patches, which rapidly disappear under chlorate of potassium. (*Ann. de Thérap.*, 1866, p. 213.)

Off. Prep. of the Peel. Infusum Aurantii Compositum, *Br.;* Infusum Gentianæ Comp., *Br.;* Oleum Limonis, *Br.;* Spiritus Limonis, Tinctura Limonis, *Br.*

Off. Prep. of the Juice. Acidum Citricum, *Br.;* Mistura Potassii Citratis, *U. S.;* Syrupus Limonis. W.

LINUM. *U. S.*

Flaxseed.

The seed of Linum usitatissimum. *U. S.*

Off. Syn. LINI SEMINA. *Linseed.* The seeds of Linum usitatissimum, *Linn.;* cultivated in Britain. *Br.*

Linseed; Grains de lin, *Fr.;* Leinsame, *Germ.;* Semi di lino, *Ital.;* Linaza, *Span.*

LINI FARINA. *U.S., Br.*

Flaxseed Meal. Linseed Meal.

The meal prepared from the seed of Linum usitatissimum. *U. S.* The cake of linseed from which the oil has been pressed, reduced to powder. *Br.*

Linum. *Sex. Syst.* Pentandria Pentagynia. — *Nat. Ord.* Linaceæ.

Gen. Ch. Calyx five-leaved. *Petals* five. *Capsule* five-valved, ten-celled. *Seeds* solitary. *Willd.*

Linum usitatissimum. Willd. *Sp. Plant.* i. 1533; Woodv. *Med. Bot.* p. 565, t. 202. Common flax is an annual plant, with an erect, slender, round stem, about two feet in height, branching at top, and, like all other parts of the plant, entirely smooth. The leaves are small, lanceolate, acute, entire, of a pale-green colour, sessile, and scattered alternately over the stem and branches. The flowers are terminal, and of a delicate blue colour. The calyx is persistent, and composed of five ovate, sharp-pointed, three-nerved leaflets, which are membranous on their border. The petals are five, obovate, striated, minutely scalloped at their extremities, and spread into funnel-shaped blossoms. The filaments are also five, united at the base; and the germ, which is ovate, supports five slender styles, terminating in obtuse stigmas. The fruit is a globular capsule, about the size of a small pea, having the persistent calyx at the base, crowned with a sharp spine, and containing ten seeds in distinct cells.

This highly valuable plant, now almost everywhere cultivated, is said by some to have been originally derived from Egypt, by others from the great elevated plain of central Asia. It flowers in June and July, and ripens its seeds in August. The seeds, and an oil expressed from them, are officinal.

The seeds are oval, oblong, flattened on both sides with acute edges, somewhat pointed at one end, about a line in length, smooth, glossy, brown externally, and yellowish-white within. They are inodorous, and have an oily mucilaginous taste. Meyer found in them fixed oil, wax, resin, extractive, tannin, gum, azotized mucilage, starch, albumen, gluten, and various salts. M. Meurein could find no starch, but detected phosphates, which had escaped the notice of Meyer. (*Journ. de Pharm.*, 3e sér., xx. 97.) Their investing coat abounds in a peculiar gummy matter or mucilage, which is readily imparted to hot water, forming a thick viscid fluid, that lets fall white flakes upon the addition of alcohol, and affords a copious dense precipitate with subacetate of lead. By Berzelius the term *mucilage* was applied to a proximate vegetable principle, distinguished from gum by being insoluble in cold, and but slightly soluble in boiling water, in which it swells up and forms a mucilaginous, viscid body, which loses its water when placed upon filtering paper, or other porous substance, and contracts like starch in the gelatinous state. The name, however, is unfortunate; as it is generally applied to the solution of gum, and must inevitably lead to confusion. Nor is it strictly a distinct proximate principle; as it embraces a number of different bodies, such as bassorin, cerasin, &c. According to Guerin, the mucilage of flaxseed, obtained at a temperature of from 120° to 140°, and evaporated to dryness, by means of a salt-water bath, contains, in 100 parts, 52·70 of a principle soluble in cold water, 29·89 of a principle insoluble in that liquid, and 10·30 of water, and yields 7·11 per cent. of ashes. The soluble part he believes to be arabin or pure gum; the insoluble he found not to afford mucic acid with the nitric, and, therefore, to differ from both bassorin and cerasin. There was also a small proportion of azotized matter which he did not isolate. (*Ann. de Chim. et de Phys.*, xlix. 263.) Vauquelin found free acetic acid, silica, and various salts of potassa and lime. Meurein discovered in the mucilage extracted by cold water, albumen, and a very small proportion of an oleo-resin, which resides in the coats of the seeds, and to which they owe their peculiar odour and taste. The interior of the seed, or nucleus, is rich in a peculiar oil, which is separated by expression, and extensively employed in the arts. (See *Oleum Lini.*) According to Franck, the mucilage of flaxseed, and various other similar products, as the mucilage of the quince, the cherry, &c., are not distinct proximate principles,

but consist partly of gum and partly of cellulose. (*Journ. de Pharm. et de Chim.*, Dec. 1867, p. 447.)

The ground seeds are kept in the shops under the name of *flaxseed meal.* This is of a dark-gray colour, highly oleaginous, and when mixed with hot water forms a soft adhesive mass, much employed for luting by practical chemists. The cake remaining after the expression of the oil, usually called *oil-cake*, still retains the mucilaginous matter of the envelope, and affords a nutritious food for cattle. This is the *Lini Farina* of the British Pharmacopœia.

Flaxseed is sometimes accidentally or fraudulently mixed with other seeds, especially of plants growing among the flax. We have seen a parcel containing a considerable portion of the seeds of a species of garlic.*

Medical Properties and Uses. Flaxseed is demulcent and emollient. The mucilage obtained by infusing the entire seeds in boiling water, in the proportion of half an ounce to the pint, is much and very advantageously employed in catarrh, dysentery, nephritic and calculous complaints, strangury, and other inflammatory affections of the mucous membrane of the lungs, intestines, and urinary passages. By decoction water extracts also a portion of the oleaginous matter, which renders the mucilage less fit for administration by the mouth, but superior as a laxative enema. The meal mixed with hot water forms an excellent emollient poultice.

Off. Prep. of the Seeds. Farina Lini, *Br.;* Infusum Lini, *Br.;* Infusum Lini Compositum, *U. S.*

Off. Prep. of the Meal. Cataplasma Carbonis, *Br.;* Catap. Conii, *Br.;* Catap. Lini, *Br.;* Catap. Sinapis, *Br.;* Catap. Sodæ Chloratæ, *Br.* W.

LIRIODENDRON. *U. S. Secondary.*

Tulip-tree Bark.

The bark of Liriodendron tulipifera. *U. S.*

LIRIODENDRON. *Sex. Syst.* Polyandria Polygynia.—*Nat. Ord.* Magnoliaceæ.

Gen. Ch. Calyx three-leaved. *Petals* six. *Samaræ* sublanceolate, one or two-seeded, imbricated in a cone. *Nuttall.*

Liriodendron tulipifera. Willd. *Sp. Plant.* ii. 1254; Bigelow, *Am. Med. Bot.* ii. 107; Barton, *Med. Bot.* i. 92. This noble tree is the boast of American landscape. Rising on an erect, straight, cylindrical stem, which is often of nearly equal thickness for the distance of forty feet, it attains, in favourable situations, an elevation seldom less than fifty and sometimes more than one hundred feet, with a diameter of trunk varying from eighteen inches to three feet; and individuals are occasionally met with which greatly exceed these dimensions. The bark is of a brown or grayish-brown colour, except in the young branches, on which it is bluish or of a reddish tinge. The leaves, which stand on long footstalks, are alternate, somewhat fleshy, smooth, of a beautiful shining green colour, and divided into three lobes, of which the upper one is truncated and notched at its summit, so as to present a two-lobed appearance, and the two lower are rounded at the base and usually pointed. In the larger leaves, the lateral lobes have each a tooth-like projection at some distance below their apex. This peculiar form of the leaf serves to distinguish the tree from all others inhabiting the American forests. On isolated trees the flowers are very numerous. They are large, beautifully variegated with different colours, among which yellow predominates, and in appearance bear some resemblance to the tulip, which has given a name to the species. Each flower stands on a distinct terminal peduncle. The calyx is double, the outer two-leaved and deciduous, the inner consisting

**Light-coloured Flaxseed.* A variety of flax has recently originated, and is now largely cultivated in Ohio, the seeds of which, instead of having the brown colour of ordinary flaxseed, are of a greenish-yellow, and the flower white instead of blue. According to information obtained by Mr. E. L. Wayne, of Cincinnati, the plant is more productive than the common flax; and the seeds are preferred by some in the manufacture of oil. Professor Procter states that, so far as he could judge from a somewhat superficial examination, they differ from the common seeds chemically only in the absence of the brown colouring matter. (*Am. Journ. of Pharm.*, xxvi. 493.)—*Note to the eleventh edition.*

of three large, oval, concave leaves, of a pale-green colour. The corolla is composed of six, seven, or more obtuse, concave petals. The stamens are numerous, with short filaments, and long linear anthers. The pistils are collected into the form of a cone, the upper part of which is covered with minute stigmas. The fruit consists of numerous long, narrow scales, attached to a common axis, imbricated in a conical form, and containing each two seeds, one or both of which are often abortive.

The tulip-tree extends from New England to the borders of Florida, but is most abundant, and attains the greatest magnitude, in the Middle and Western States. It delights in a rich strong soil, and luxuriates in the exhaustless fertility of the banks of the Ohio and its tributaries. Throughout the United States it is known by the inappropriate name of *American Poplar*. When in full bloom, about the middle of May, it presents, in its profusion of flowers, its shining, luxuriant foliage, its elevated stature, and elegant outline, one of the most magnificent objects which the vegetable kingdom affords. The interior or heart-wood is yellowish, of a fine grain, and compact without being heavy; and is much employed in the making of furniture, carriages, door-panels, &c. It is recommended by its property of resisting the influence of atmospheric moisture, and the attacks of worms. The bark is the officinal portion. It is taken for use indiscriminately from the root, trunk, and branches; though that of the root is thought to be the most active.

Deprived of the epidermis, it is yellowish white; the bark of the root being somewhat darker than that of the stem or branches. It is very light and brittle, of a feeble, rather disagreeable odour, strongest in the fresh bark, and of a bitter, pungent, and aromatic taste. These properties are weakened by age, and we have found specimens of the bark, long kept in the shops, almost insipid. The peculiar properties of liriodendron appear to reside in a volatile principle, which partially escapes during decoction. The late Professor Emmet, of the University of Virginia, believed that he had isolated this principle, and gave it the name of *liriodendrin*. As described by Professor Emmet, it is, in the pure state, solid, white, crystallizable, brittle, insoluble in water, soluble in alcohol and ether, fusible at 180°, volatilizable and partly decomposed at 270°, of a slightly aromatic odour, and a bitter, warm, pungent taste. It does not unite either with acids or with alkalies; and the latter precipitate it from the infusion of the bark by combining with the matter which renders it soluble in water. Water precipitates it from its alcoholic solution. It is obtained by macerating the root in alcohol, boiling the tincture with magnesia till it assumes an olive-green colour, then filtering, concentrating by distillation till the liquid becomes turbid, and finally precipitating the liriodendrin by the addition of cold water. (*Journ. of the Phil. Col of Pharm.*, iii. 5.) The virtues of the bark are extracted by water and alcohol, but are injured by long boiling.

Medical Properties. Liriodendron is a a stimulant tonic, with diaphoretic properties. It has been used as a substitute for Peruvian bark in intermittent fevers, and has proved serviceable in chronic rheumatism, dyspepsia, and other complaints in which a gentle stimulant and tonic impression is desirable. The dose of the bark in powder is from half a drachm to two drachms. The infusion and decoction are also used, but are less efficient. They may be prepared in the proportion of an ounce of the bark to a pint of water, and given in the quantity of one or two fluidounces. The dose of the saturated tincture is a fluidrachm. W.

LITHII CARBONAS. *U. S.*

Carbonate of Lithia.

"A white powder, sparingly soluble in water, and having a feeble alkaline reaction. It dissolves with effervescence in dilute sulphuric acid, and forms a freely soluble salt. It imparts to the flame of burning alcohol a carmine-red colour." *U. S.*

Off. Syn. LITHIÆ CARBONAS, *Br.*

This salt was for the first time made officinal in the editions of the U. S. and Br. Pharmacopœias preceding the present, and was placed in the Materia Medica list, as an article to be obtained from the manufacturer. The alkali *lithia*, so far as has yet been ascertained, is rare in nature; for, though extensively diffused, it exists but

in very small proportion, except in a few scarce minerals. It was discovered by Arfwedson in 1817, in certain minerals from the iron mines of Utön, as the *petalite*, *triphane*, and a variety of *tourmaline*. (*Berzelius.*) It has since been found in other minerals, as the *lepidolite*, *spodumene*, *amblygonite*, *mica*, &c., and in numerous mineral waters, as those of Carlsbad, Pyrmont, Kissingen, Kreuznach, Aix-la-Chapelle, Vichy, &c., in Europe, and the Gettysburg spring in the United States, in which it exists generally as a carbonate or bicarbonate. By the spectrum analysis, it has been detected in the waters of the Atlantic and the Thames, the ashes of plants grown on a granite soil, and even in milk and human blood. In the mother-waters of tartaric acid, in the factories, it has been found in a proportion to justify extraction. It has been most largely obtained from a *phosphatic tryphylene*, found in Bavaria, in which it existed as a phosphate; but this source is said to be exhausted.

There are several methods of extracting lithia from the minerals containing it, an account of which may be seen in Gmelin's *Handbook* (iii. 123). They contain the alkali in various proportions, from 3·6 per cent. in lepidolite to 11 per cent. in amblygonite. Carbonate of lithium is prepared from lepidolite in the following manner. One part of the mineral is ignited with two parts of lime; water is added so as to form a paste; this is treated with dilute sulphuric acid, and water is added; the solution is filtered and concentrated; carbonate of sodium is added to precipitate earths and metals; the liquor is again concentrated, and, while boiling hot, is treated with carbonate of sodium dissolved in twice its weight of water, by which carbonate of lithium is precipitated somewhat impure. To obtain it pure, it is dissolved in very dilute muriatic acid, and the solution precipitated by carbonate of ammonium. (*Gmelin.*)

Lithia, LO, is the oxide of the metal lithium, and ranks in chemical properties with the fixed alkalies. In the form of hydrate, LO,HO, it is white and translucent; does not deliquesce in the air, but absorbs carbonic acid, and becomes opaque; is fusible below ignition, but not volatilizable at a white heat; is soluble in water, but less so than potassa or soda; is sparingly soluble in alcohol; and in solution has an acrid alkaline taste, caustic properties, and a strong alkaline reaction. The salts of lithia are generally freely soluble, with the exception of the neutral carbonate and phosphate, the latter of which is nearly insoluble. *Lithium*, which was first obtained by MM. Bunsen and Matthiessen, in 1855, is silver-white, brilliant, softer than lead, ductile, capable of welding, and the lightest known solid. Its sp. gr. is 0·594, melting point 356° F., equivalent 7, and symbol L. (*Brande and Taylor.*) The eq. of lithia, therefore, is $L=7+O=8$, or $LO=15$; which is the lowest combining number of the fixed alkalies.

Carbonate of lithium may be prepared directly from one of the lithia minerals, in the manner already described, or from sulphate or chloride of lithium in concentrated solution by adding carbonate of ammonium. The precipitated salt should be washed with alcohol and dried. It is a white powder, of a mild alkaline taste, fusible at a high temperature, soluble in about 100 parts of water, more soluble in carbonic acid water, and insoluble in alcohol. Its aqueous solution has an alkaline reaction. It consists of one eq. of lithia, and one of carbonic acid, LO,CO_2, and its eq. is 37. It is known by imparting a carmine-red colour to the flame of alcohol, and by dissolving in dilute sulphuric acid with effervescence; the latter property distinguishing it from the salts of strontia, which also colour the flame of alcohol red. In the British Pharmacopœia, the following test is given. "Ten grains, neutralized with sulphuric acid, and heated to redness, leave 14·86 grains of dry sulphate, which, when dissolved in distilled water, yields no precipitate with oxalate of ammonia or lime-water."

Medical Properties and Uses. Carbonate of lithium has the ordinary remedial properties of the alkaline carbonates, over which, however, it possesses advantages, under certain circumstances, which render it a valuable addition to the Materia Medica. In the year 1843, Mr. Alexander Ure, of London, called attention to the extraordinary solvent power of a solution of lithia over uric acid, with which, unlike the other alkalies, it forms a very soluble salt, and suggested its injection into the bladder, for the solution or disintegration of uric acid calculi. In 1857, Dr. Garrod, of London, gave it internally in cases of gout and gouty diathesis, in reference to the

same property, as well as in consideration of its low combining number, and consequent extraordinary neutralizing power. From these properties, it is admirably adapted to cases in which it is desirable to eliminate uric acid from the system, and especially to cases of gout, in which there is a strong indication to prevent the formation of insoluble salts of uric acid, and their deposition in the bladder, kidneys, or joints, and to favour the solution of such salts when already formed, as in the chalky deposits in the joints and ligamentous tissues of gouty patients, consisting chiefly of urate of sodium. Dr. Garrod has, moreover, found the carbonate of lithium, in dilute solution, not only to exceed the other alkalies in rendering the urine neuter or alkaline, but also to act powerfully as a diuretic, probably more so than the corresponding salts of potassa and soda. (*Med. Times and Gaz.*, March, 1864, p. 303.) The dose of carbonate of lithium is from three to six grains, and is most advantageously given in carbonic acid water.

Off. Prep. Liquor Lithiæ Effervescens, *Br.;* Lithiæ Citras, *Br.;* Lithii Citras, *U. S.* W.

LOBELIA. *U. S., Br.*

Lobelia.

The leaves and tops of Lobelia inflata. *U. S.* The dried flowering herb. *Br.*

Lobelia. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Lobeliaceæ.

Gen. Ch. Calyx five-cleft. *Corolla* irregular, five-parted, cleft on the upper side nearly to the base. *Anthers* united into a tube. *Stigma* two-lobed. *Capsule* inferior or semi-superior, two or three-celled, two-valved at the apex. *Torrey.*

Lobelia inflata. Willd. *Sp. Plant.* i. 946; Bigelow, *Am. Med. Bot.* i. 177; Barton, *Med. Bot.* i. 181; Carson, *Illust. of Med. Bot.* i. 60, pl. 51. This species of Lobelia, often called *Indian tobacco*, is an annual or biennial indigenous plant, usually a foot or more in height, with a fibrous root, and a solitary, erect, angular, very hairy stem, much branched about midway, but rising considerably above the summits of the highest branches. The leaves are scattered, sessile, oval, acute, serrate, and hairy. The flowers are numerous, small, disposed in leafy terminal racemes, and upon short axillary footstalks. The segments of the calyx are linear and pointed. The corolla, which is of a delicate blue, has a labiate border, with the upper lip divided into two, the lower into three segments. The united anthers are curved, and enclose the stigma. The fruit is an oval, striated, inflated capsule, crowned with the persistent calyx, and containing, in two cells, numerous very small, brown seeds.*

Lobelia inflata is a very common weed, growing on the roadsides, and in neglected fields, throughout the United States. Its flowers begin to appear towards the end of July, and continue to expand in succession till the occurrence of frost. All parts of it are medicinal; but, according to Dr. Eberle, the root and inflated capsules are most powerful. The plant should be collected in August or September, when the capsules are numerous, and should be carefully dried. It may be kept whole, or in powder. As found in the shops, it is often in oblong compressed cakes, prepared by the Shakers.

Dried lobelia has a slight irritating odour, and when chewed, though at first without much taste, soon produces a burning acrid impression upon the posterior parts of the tongue and palate, very closely resembling that occasioned by tobacco, and attended, in like manner, with a flow of saliva and a nauseating effect. The powder is greenish. The plant yields its virtues readily to water and alcohol. Water distilled from it has its odour without its acrimony. Prof. Procter found the plant to contain an odorous volatile principle, probably volatile oil; a peculiar alkaline prin-

* In case of poisoning by lobelia, it may be very desirable to be able to recognise the seeds. The following microscopic characters of them are given by Mr. Frederick Curtis in the *Lond. Med. Gaz.* for July, 1851 (p. 160). They are almond-shaped, about 1-30th of an inch long by 1-75th broad, puce-coloured, regularly marked with longitudinal ridges and furrows, and cross ridges generally at right angles with the former; so that the surface presents the appearance of basket-work. No other seeds examined by the author could be mistaken for them, except those of *Lobelia cardinalis*, which, however, are larger, coarser, of a lighter colour, and with the superficial rectangular chequering less distinct. (*Note to the tenth edition.*)

ciple named lobelina; a peculiar acid, first noticed as distinct by Pereira, called *lobelic acid;* besides gum, resin, chlorophyll, fixed oil, lignin, salts of lime and potassa, and oxide of iron. The seeds contain at least twice as much of lobelina, in proportion, as the whole plant, which yielded only one part in five hundred. They contain also 30 per cent. of a nearly colourless fixed oil, having the drying property in an extraordinary degree. *Lobelina* was obtained by Prof. Procter by the following process. The seeds were treated with alcohol acidulated with acetic acid, until deprived of acrimony, and the tincture was evaporated; the resulting extract was triturated with magnesia and water, and, after repeated agitation for several hours, the liquor, holding lobelina in solution, was filtered; this was then shaken repeatedly with ether until no longer acrid; and the ethereal solution, having been decanted, was allowed to evaporate spontaneously. The residue, which was reddish-brown and of the consistence of honey, was deprived of colouring matter by dissolving it in water, adding a slight excess of sulphuric acid, boiling with animal charcoal, saturating with magnesia, filtering, agitating with ether until this fluid had deprived the water of acrimony, and finally decanting, and allowing the ether to evaporate. Thus obtained, *lobelina* is a yellowish liquid, lighter than water, of a somewhat aromatic odour, and a very acrid durable taste. It is soluble in water, but much more copiously in alcohol and ether; and the latter fluid readily removes it from its aqueous solution. It has an alkaline reaction, and forms soluble and crystallizable salts with sulphuric, nitric, and muriatic acids, and a very soluble but not crystallizable salt with acetic acid. It forms an insoluble compound with tannic acid, which instantly precipitates it from its solution. By a boiling heat it is entirely decomposed, losing all its acrimony; but, when combined with acids, it may be subjected to ebullition with water without change. Prof. Procter introduced a grain of it diluted with water into the stomach of a cat, which became immediately prostrate, remained for an hour nearly motionless, with dilated pupils, and had not wholly recovered at the end of fifteen hours. It did not occasion vomiting or purging. There can be little doubt that it is the narcotic principle of lobelia. (*Am. Journ. of Pharm.*, ix. 105, and xiii. 1.)* The late Dr. S. Colhoun, of Philadelphia, was the first to announce the existence of a peculiar principle in lobelia, capable of forming salts with the acids; but he did not obtain it in an isolated state. An important inference from the effects of heat upon lobelina is, that, in preparing lobelia for use, the plant should never be heated in connection with a salifiable base.

Medical Properties and Uses. Lobelia is emetic, and, like other medicines of the same class, is occasionally cathartic, and in small doses diaphoretic and expectorant. It is also possessed of narcotic properties. The leaves or capsules, chewed for a short time, occasion giddiness, headache, general tremors, and ultimately nausea and vomiting. When swallowed in the full dose, the medicine produces speedy and severe vomiting, attended with continued and distressing nausea, copious sweating, and great general relaxation. Its effects in doses too large, or too frequently repeated, are extreme prostration, great anxiety and distress, and ultimately death preceded by convulsions. Dr. Letheby found 110 grains of it in the stomach of a patient killed by this poison, and states that he has known much less to cause death. (*Lond. Med. Times and Gaz.*, March, 1853, p. 270.) From experiments made by Mr. Curtis and Dr. Pearson on hedgehogs and cats, it would appear that the poison produces inflammation of the alimentary mucous membrane in those animals, but that death mainly results from the suspension of respiration; the heart continuing to act after that process has ceased. It is probable that it paralyzes, by a directly depressing influence, the respiratory centres in the medulla oblongata. Death has often resulted from its empirical use. Its poisonous effects are most apt to occur, when, as sometimes happens, it is not rejected by vomiting. In its action upon the system, therefore, as well as in its sensible properties, lobelia bears a close resemblance to tobacco. It is

*Mr. William Bastick, of London, published in the *Pharmaceutical Journal and Transactions* for December, 1850, an account of lobelina and its mode of extraction, apparently in entire ignorance of the previous experiments and observations of Prof. Procter. His process does not differ essentially from that above given. In one magnesia is used to decompose the native salt of lobelina, in the other lime; the caustic alkalies not being applicable to the purpose, as they decompose this organic alkali with great facility. (*Note to the ninth edition.*)

among the medicines which were employed by the aborigines of this country, and was long in the hands of empirics before it was introduced into regular practice. The Rev. Dr. Cutler, of Massachusetts, first attracted to it the attention of the profession.

Merely as an emetic, it is too powerful and distressing, as well as too hazardous in overdoses, for ordinary use. The disease in which it has proved most useful is spasmodic asthma, the paroxysms of which it often greatly mitigates, and sometimes wholly relieves, even when not given in doses sufficiently large to vomit. It was from the relief obtained from an attack of this complaint in his own person, that Dr. Cutler was induced to recommend the medicine. It has been used also in catarrh, croup, pertussis, and other laryngeal and pectoral affections; and we have seen it apparently advantageous in some of these complaints, especially in severe croup, and in chronic bronchitis with dyspnœa; but it should always be used with caution. Administered by injection it produces the same distressing sickness of stomach, profuse perspiration, and universal relaxation, as result from a similar use of tobacco. Dr. Eberle administered a strong decoction of it successfully by the rectum in a case of strangulated hernia. It has been employed effectually, in small doses repeated so as to sustain a slight nausea, for producing relaxation of the os uteri. (*Am. Journ. of Med. Sci.*, xvii. 248.) A case is recorded in the *Charleston Med. Journ. and Rev.* (xi. 58), by Dr. Gaston, of Columbia, S. C., in which the tincture of lobelia was successfully used in tetanus.

It may be given in substance, tincture, or infusion. The dose of the powder as an emetic is from five to twenty grains, to be repeated if necessary. The tincture is most frequently administered. The full dose of this preparation for an adult is half a fluidounce; though in asthmatic cases it is better administered in the quantity of one or two fluidrachms, repeated every two or three hours till its effects are experienced.*

Two other species of Lobelia have attracted some attention from medical writers. *L. cardinalis* or *cardinal flower*, distinguished for its showy red flowers, is supposed to possess anthelmintic properties; but is seldom used. *L. syphilitica* is said to have been used by the Indians in the cure of syphilis, but has been found wholly inefficacious in that complaint. It is emetic and cathartic, and appears also to possess diuretic properties; whence it has been conjectured that it might have proved serviceable in gonorrhœa. Dr. Chapman states that it has been employed, as he has been informed, by some practitioners of the western country in dropsy, and not without success. The root is the part used. Both these species of Lobelia are indigenous. For a more detailed account of them, the reader is referred to Dr. W. P. C. Barton's Medical Botany.

Off. Prep. Acetum Lobeliæ, *U. S.*; Tinctura Lobeliæ; Tinct. Lobeliæ Ætherea, *Br.* W.

LUPULINA. *U. S.*

Lupulin.

The yellow powder separated from the strobiles of Humulus Lupulus. *U. S.*
Lupulina is described under HUMULUS, p. 477.

LYCOPODIUM. *U. S.*

Lycopodium.

The sporules of Lycopodium clavatum, and of other species of Lycopodium. *U. S.*
Pied de Loup, *Fr.*; Gemeiner Bärlapp, Kolbenmoos, *Germ.*; Licopodio, *Ital.*, *Span.*
LYCOPODIUM. *Sex. Syst.* Cryptogamia Filices. — *Nat. Ord.* Lycopodiaceæ.

* Professor Procter prepares a *fluid extract* by macerating eight ounces of finely bruised lobelia, mixed with a fluidounce of acetic acid, in a pint and a half of diluted alcohol, for twenty-four hours; then percolating with an equal quantity of diluted alcohol, and afterwards with water, until three pints of liquor are obtained; next evaporating to ten fluidounces, straining, adding six fluidounces of alcohol, and finally filtering through paper. Each teaspoonful of this preparation is equal to half a fluidounce of the tincture, which represents about 30 grains of the powder. (*Am. Journ. of Pharm.*, xxiv. 207.)—*Note to the tenth edition.*

Gen. Ch. Thecæ unilocular, of one or two forms; that containing powder somewhat reniform and two-valved, the other roundish, three or four-valved. *Lindley.*

Lycopodium clavatum. Linn. *Sp. Plant.* 1564; Smith, *Engl. Flor.* iv. 331. This plant, commonly called *club-moss*, has a trailing, branching stem, several feet long, and thickly beset with linear-lanceolate, flat, ribless, smooth, partly serrate leaves, with a capillary point, curved upward, and of a deep-green colour. The flowers are in terminal spikes, single or in pairs, with crowded ovate, entire, pointed scales, and yellow thecæ or capsules. The plant is a native of Europe and this country.

The capsules of this moss, and of others belonging to the same genus, contain a fine dust or powder, which is collected in Switzerland and Germany, and used in the shops of Europe under the name of *lycopodium* or *vegetable sulphur*. It is this that constitutes the officinal part of the plant, of which it is the seeds or sporules. It is extremely fine, very light, of a delicate yellow colour, inodorous and tasteless, and exceedingly inflammable, so much so that it takes fire like gunpowder when thrown upon a burning body. Under the microscope, it is found to be composed of cells which, on pressure between glasses, give out a transparent fluid, resembling oil. (*Ed. Monthly Journ.*, Nov. 1854, p. 469.) It is said to be often adulterated with the pollen of the pines and firs, and sometimes with talc and starch. In Nashville, Tenn., a specimen came into the possession of Mr. Benj. Lillard, which was found to contain one-half of its bulk of dextrin. (*Journ. de Pharm.*, Dec. 1873, p. 498; from the *Pharmacist* of Chicago, Sept. 1873.) In medicine, it is used as an absorbent application to excoriated surfaces, especially those which occur in the folds of the skin in infants. In pharmacy, it answers the purpose of facilitating the rolling of the pilular mass, and of preventing the adhesion of the pills when formed. The moss itself has been esteemed diuretic, antispasmodic, &c.; and has been employed, in the form of decoction, in rheumatism, epilepsy, and complaints of the lungs and kidneys; and has been supposed to be of great service in the removal of plica Polonica. It has, however, fallen into discredit. W.

LYCOPUS. *U.S. Secondary.*

Bugle-weed.

The herb of Lycopus Virginicus (*Michaux*). *U.S.*

Lycopus. *Sex. Syst.* Diandria Monogynia. — *Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Calyx tubular, five-cleft or five-toothed. *Corolla* tubular, four-lobed, nearly equal; the upper segment broader, and emarginate. *Stamens* distant. *Seeds* four, naked, retuse. *Nuttall.*

Lycopus Virginicus. Michaux, *Flor. Boreal. Americ.* i. 14; Rafinesque, *Med. Flor.* vol. ii. The *bugle-weed* is an indigenous herb, with a perennial creeping root, which sends up an erect, nearly simple, obtusely quadrangular stem, from twelve to eighteen inches high, and furnished with opposite sessile leaves. These are broad-lanceolate, attenuated and entire at both extremities, remotely serrate in the middle, somewhat rough, purplish, and beset with glandular dots on their under surface. The flowers are minute, in small axillary whorls, with two small subulate bractes to each flower, and a white corolla. The seeds are longer than the calyx, which is spineless.

This plant grows in shady and wet places throughout the greater part of the United States. Its flowering period is August. The whole herb is used. It has a peculiar odour and a nauseous slightly bitter taste, and imparts these properties, as well as its medical virtues, to boiling water.

Lycopus Europæus is said to be frequently collected and sold for *L. Virginicus*. The former may be distinguished by its acutely quadrangular stem, its narrow lanceolate leaves, of which the lower are somewhat pinnatifid, its more crowded flowers, and the acute segments of its calyx, armed with short spines. It has been employed in Europe as a substitute for quinia.

Medical Properties and Uses. According to Dr. A. W. Ives, the bugle-weed is a very mild narcotic. It is said also to be astringent. It was introduced into

notice by Drs. Pendleton and Rogers, of New York, who obtained favourable effects from it in incipient phthisis and pulmonary hemorrhage. (*N. Y. Med. and Phys. Journ.*, i. 179.) It proves useful by diminishing the frequency of the pulse, quieting irritation, and allaying cough. The use of it has been extended with advantage to the hemorrhages generally. (*Transact. of the Am. Med. Assoc.*, i. 347.) It is most conveniently employed in the form of infusion, which may be prepared by macerating an ounce of the herb in a pint of boiling water. From half a pint to a pint may be taken daily. W.

MAGNESII CARBONAS. *U.S.*

Carbonate of Magnesium.

"A white substance in powder or pulverulent masses, wholly dissolved by dilute sulphuric acid, forming a solution which does not afford a precipitate with oxalate of ammonium. Distilled water which has been boiled with it does not change the colour of tumeric, and yields no precipitate with chloride of barium or nitrate of silver." *U.S.*

Off. Syn. MAGNESIÆ CARBONAS. *Carbonate of Magnesia. Br.*

Magnesia alba, *Lat.;* Carbonate de magnésie, *Fr.;* Kohlensaure Magnesia, *Germ.;* Carbonato di magnesia, *Ital.;* Carbonato de magnesia, *Span.*

Carbonate of magnesium sometimes though rarely occurs as a native mineral. That which is sold in the shops is prepared on a large scale by the manufacturer; and the article is, therefore, very properly placed in the list of Materia Medica of the U. S. Pharmacopœia. In the British Pharmacopœia directions are given for preparing it in two forms; that of MAGNESIÆ CARBONAS, or *Carbonate of Magnesia;* and that of MAGNESIÆ CARBONAS LEVIS, or *Light Carbonate of Magnesia.* The following are the directions.

1. MAGNESIÆ CARBONAS. *Carbonate of Magnesia. Br.* "Take of Sulphate of Magnesia *ten ounces* (avoirdupois); Carbonate of Soda *twelve ounces* (avoird.); Boiling Distilled Water a *sufficiency.* Dissolve the Sulphate of Magnesia and Carbonate of Soda, each, in a pint [Imp. Meas.] of the Water, mix the two solutions, and evaporate the whole to perfect dryness, by means of a sand-bath. Digest the residue for half an hour with two pints [Imp. Meas.] of the Water, and, having collected the insoluble matter on a calico filter, wash it repeatedly with Distilled Water, until the washings cease to give a precipitate with chloride of barium. Finally, dry the product at a temperature not exceeding 212°." *Br.*

This is essentially the old process of the Dublin College for MAGNESIÆ CARBONAS PONDEROSUM, or *Heavy Carbonate of Magnesia*, and yields a product which is characterized, in the British Pharmacopœia, as "a white granular powder, which dissolves with effervescence in the dilute mineral acids, yielding solutions which, when first treated with chloride of ammonium, are not disturbed by the addition of an excess of solution of ammonia, but yield a copious crystalline precipitate upon the addition of phosphate of soda. With excess of hydrochloric acid it forms a clear solution, in which chloride of barium causes no precipitate. Another portion of the solution, supersaturated with ammonia, gives no precipitate with oxalic acid or sulphuretted hydrogen. Fifty grains, calcined at a red heat, are reduced to twenty-two."

2. MAGNESIÆ CARBONAS LEVIS. *Light Carbonate of Magnesia. Br.* The same quantity of materials are taken as in the preceding formula, the Distilled Water being now cold instead of boiling. The two salts are dissolved separately, each in half a gallon (Imp. Meas.) of the Water, the solutions are mixed, and the mixture is boiled in a porcelain dish for fifteen minutes. The precipitate is then washed and dried as in the former process. The resulting carbonate is characterized, in the Br. Pharmacopœia, as "a very light powder, which, when examined under the microscope, is found to be partly amorphous with numerous slender prisms intermixed. The other characters and tests are the same as those of carbonate of magnesia."

Carbonate of potassium is less eligible than carbonate of sodium for the preparation of carbonate of magnesium. It is difficult to separate the last portions of sulphate

of potassium from the precipitate, and carbonate of potassium usually contains silica, which is thrown down with the magnesia. The consequence is that, when prepared with that salt, carbonate of magnesium is liable to be gritty to the touch, and to have a saline taste. The following method is said to be pursued by some of the best manufacturers. To a saturated solution of 100 parts of sulphate of magnesium, a solution of 125 parts of crystallized carbonate of sodium is gradually added, the solutions being constantly stirred. The mixture is heated to ebullition, to complete the precipitation of the magnesia, which is then washed with tepid and finally with cold water, until the washings no longer give a precipitate with barytic salts. When sufficiently washed, the carbonate is allowed to drain for one or two days on large linen filters, and is then placed in wooden moulds with a porous bottom of brick or gypsum, and subjected to pressure in order to give it a square and compact form.

The density of carbonate of magnesium is said to depend upon the strength of the solutions from which it is first precipitated, and its fineness and softness to the touch, upon the use of carbonate of sodium in its preparation.

Much of the carbonate of magnesium used in this country is imported from Scotland. In New England it is prepared from the bittern of salt-works, which consists chiefly of sulphate and chloride of magnesium; and it is manufactured in Baltimore from the sulphate of magnesium prepared in that city. The Scotch magnesia is generally put up in cases of 120 lbs. each, the American, in boxes containing 50 lbs.*

When made from the bittern of salt-works, carbonate of magnesium is contaminated with carbonate of calcium, salts of lime being contained in sea-water; and, when it is prepared from magnesite, or from magnesian schist, iron is almost always present. The only way in which these impurities can be avoided, is to prepare pure sulphate of magnesium by repeated crystallization, and to use a pure carbonate of sodium. It is also necessary that the water with which the precipitate is washed should be free from earthy salts, which would be decomposed and contaminate the magnesia.

Properties. Carbonate of magnesium is inodorous, nearly insipid, perfectly white, smooth to the touch, and nearly insoluble in water, requiring 2493 parts of cold, and 9000 parts of hot water for solution. It is decomposed by strong heat, by all the acids, by potassa, soda, lime, baryta, and strontia, and by acidulous and metallic salts.

Two kinds of carbonate of magnesium are distinguished, the light and the heavy. The *light carbonate* is the kind manufactured in Scotland. The British processes for both have been already given. The heavy may also, according to Dr. Pereira, be prepared as follows. "Add one volume of a cold saturated solution of carbonate of soda to a boiling mixture of one volume of a saturated solution of sulphate of magnesia, and three volumes of water. Boil until effervescence has ceased, constantly stirring with a spatula. Then dilute with boiling water, set aside, pour off the supernatant liquor, and wash the precipitate with hot water on a linen cloth; afterwards dry it by heat in an iron pot." Dr. Pereira states that the *light carbonate*, when examined with the microscope, is seen to consist of an amorphous powder, more or less intermingled with slender prismatic crystals, which appear as if they were eroded or efflorescent; the *heavy carbonate* consists of granules of various sizes, without any traces of the prismatic crystals observed in the former variety.

A solution in carbonic acid water, prepared by passing carbonic acid gas into a reservoir containing carbonate of magnesium suspended in water, has been introduced into use as a cathartic and antacid. *Dinneford's Magnesia* is a solution of this nature. According to Dr. Christison, it contains only nine grains of carbonate in the fluidounce, though alleged to contain twice that quantity. Its taste is more disagreeable than that of the undissolved carbonate. A formula for this preparation has been introduced into the British Pharmacopœia, with the name of "Liquor Magnesiæ Carbonatis," and will be found in *Part II.*

* Carbonate of magnesium is now largely prepared in Great Britain by submitting calcined magnesian limestone to the action of water and carbonic acid under pressure. The magnesia is dissolved in the state of bicarbonate, and heat is applied to the solution, so as to drive off a portion of the carbonic acid, and to cause thereby a precipitation of the insoluble carbonate. (*Chem. News*, Sept. 12, 1863, p. 128.)—*Note to the twelfth edition.* W.

Adulterations and Tests. Carbonate of magnesium may contain an alkaline carbonate or sulphate, or both, from insufficient washing; also chloride of sodium, alumina, and carbonate of calcium. If water boiled on it changes turmeric, an alkaline carbonate is indicated. If chloride of barium produces a precipitate in the water, the presence of a sulphate or carbonate is shown; and if nitrate of silver produces the same effect, a chloride is indicated. When dissolved in an excess of muriatic acid, an excess of ammonia will throw down alumina, which is almost always present in minute quantity; and oxalate of ammonium, afterwards added to the filtered muriatic solution, will throw down oxalate of calcium, if lime be present. If the same solution, nearly neutralized, be rendered blue by ferrocyanide of potassium, the presence of iron will be indicated.

Composition. According to Berzelius, carbonate of magnesium of the shops (*magnesia alba*) is a combination of three eqs. of carbonate of magnesium with one of hydrate of magnesia. Each eq. of carbonate contains an eq. of water, and the composition of the salt may be thus stated:—three eqs. of carbonate (acid 66, magnesia 60, water 27) = 153 + one eq. of hydrate (magnesia 20, water 9) = 29 = 182. This theoretic composition agrees nearly with the analysis of Berzelius, who fixes it at 44·75 magnesia, 35·77 acid, and 19·48 water. According to Phillips, whose analysis agrees with a subsequent one by Fownes, four eqs. of the carbonate are combined with one of the bihydrate, and four of water. (*Pharm. Journ.*, iii. 480.) The formula given by the British Pharmacopœia is $3(MgO,CO_2)+MgO,5HO$; in other words, a combination of three eqs. of carbonate of magnesium, one of magnesia, and five of water. The composition of this salt varies with the mode of preparation. Thus Bucholz, by decomposing sulphate of magnesium with 170 per cent. of carbonate of sodium, and using only cold water throughout, obtained a very light, spongy, somewhat coherent carbonate of magnesium, containing 32 acid, 33 base, and 35 water. By using 120 per cent. of the carbonate, and boiling for fifteen minutes, he obtained a heavy, granular precipitate, containing 35 acid, 42 base, and 23 water.

Medical Properties and Uses. Carbonate of magnesium is antacid, and, by combining with acid in the stomach, becomes generally cathartic. When it undergoes no change in the alimentary canal, it produces no purgative effect. Under these circumstances, it may usually be made to operate by following it with draughts of lemonade. It is useful in all cases which require a laxative antacid; and, though apt to produce flatulence in consequence of the extrication of its carbonic acid in the stomach and bowels, and therefore in ordinary cases inferior to calcined magnesia, it sometimes operates favourably, in consequence of this very property, in sick stomach attended with acidity. Carbonate of magnesium is also an excellent antilithic when uric acid is secreted in excess. The dose is from half a drachm to two drachms, which may be given in water or milk. In order that it may be accurately diffused through water, it should be previously rubbed down with syrup or ginger syrup.*

Carbonate of magnesium is a useful agent for diffusing camphor and the volatile oils through water, in preparing several of the medicated waters; and is also used with a similar purpose, as a diffusing agent in Syrupus Aurantii Corticis, *U. S.*; Syrupus Tolutanus, *U. S.*, and Syrupus Zingiberis, *U. S.*

Off. Prep. Liquor Magnesii Citratis, *U. S.*; Magnesia; Magnesia Levis, *Br.*; Trochisci Bismuthi, *Br.* D. B. S.

MAGNESII SULPHAS. *U. S.*

Sulphate of Magnesium.

"In colourless crystals, which slowly effloresce on exposure to the air, and are very soluble in water. The solution is not coloured nor precipitated by ferrocyanide of potassium, and gives off no muriatic acid upon the addition of sulphuric acid. One hundred grains of the salt dissolved in water, and mixed with sufficient boiling

* *Dalby's carminative* consists of carbonate of magnesium ℈ij, oil of peppermint ♏j, oil of nutmeg ♏ij, oil of aniseed ♏iij, tincture of castor ♏xxx, tincture of assafetida ♏xv, tincture of opium ♏v, spirit of pennyroyal ♏xv, compound tincture of cardamom ♏xxx, peppermint water f℥ij.

solution of carbonate of sodium to decompose it completely, yield a precipitate of carbonate of magnesium, which, when washed and dried, weighs thirty-four grains." *U. S. Off. Syn.* MAGNESIÆ SULPHAS. *Br. Sulphate of Magnesia.*

Epsom salt; Sulfate de magnésie, *Fr.;* Schwefelsaure Magnesia, *Germ.;* Solfato di magnesia, *Ital.;* Sulfato de magnesia, *Span.*

Sulphate of magnesium is a constituent of sea-water, and of some saline springs. It also occurs native, either crystallized in slender, prismatic, adhering crystals, or as an efflorescence on certain rocks and soils, which contain magnesia and a sulphate or sulphuret. In the United States it is found in the great caves, so numerous to the west of the Alleghany mountains. In one of these caves, near Corydon in Indiana, it formed a stratum on the bottom several inches deep; or appeared in masses sometimes weighing ten pounds, or disseminated in the earth of the cavern, one bushel of which yielded from four to twenty-five pounds of the sulphate. It also appeared on the walls of the cavern, and, if it was removed, acicular crystals again appeared in a few weeks. (*Cleveland.*)

Under the name of *kieserite*, a mineral is obtained from the saline deposits at Stassfurt, in Germany, which consists in part of impure sulphate of magnesium, of which it is said to contain 12 per cent. It is not used, so far as we have learned, for preparing medicinal sulphate of magnesium; but is exported from Germany into England, for manufacturing purposes. (*Journ. de Pharm.*, Mai, 1873, p. 403.)

Sulphate of magnesium was originally procured by evaporating the waters of saline springs at Epsom in England. Dr. Grew prepared it in this manner in 1675. It was afterwards discovered that the brine, remaining after the crystallization of common salt from sea-water, furnished by careful evaporation precisely the same salt; and, as this was a much cheaper product, it superseded the former. The residual brine or bittern consists of sulphate of magnesium, and the chlorides of magnesium and calcium. As the sulphate of magnesium crystallizes first, it may with proper care be obtained nearly pure, although most frequently the salt prepared in this way is deliquescent from the presence of chloride of magnesium. It may be freed from this impurity by washing the crystals with its own saturated solution. It was from this source that the greater part of the Epsom salt of commerce was long obtained in Europe. The salt works of New England supplied our own markets with an impure and deliquescent sulphate. With the improvements of chemistry, other and better processes have been adopted. In the neighbourhood of Genoa and Nice, sulphate of magnesium is prepared in large quantities from a schistose rock, containing magnesia and sulphuret of iron. The mineral is roasted, and exposed in heaps for some months to the action of air and water. It is then lixiviated, the sulphate of iron decomposed by lime-water, and the salt obtained pure by repeated solution and crystallization.

William Henry, of Manchester, whose calcined magnesia has become famous throughout the world, took out a patent for a mode of preparing magnesia and its salts from the double carbonate of magnesium and calcium—the *dolomite* of mineralogists. His process was to drive off the carbonic acid by heat, and to convert the remaining earth into hydrates. He treated these with a sufficient quantity of muriatic acid to dissolve out the lime, and then converted the magnesia into a sulphate either by sulphuric acid or sulphate of iron.

The salt is extensively manufactured in Baltimore and Philadelphia from the silicious hydrate of magnesia, or *magnesite*. This mineral occurs in veins in the serpentine and other magnesian rocks which abound in the neighbourhood of Baltimore, and in the southern counties of Pennsylvania. The advantage which it possesses over the dolomite, in the preparation of this salt, is the almost entire absence of lime, owing to which there is little or no waste of acid, and the operation is much simplified. The mineral is reduced to a fine powder and saturated with sulphuric acid. The mass is then dried and calcined at a red heat, in order to convert any sulphate of iron, which may be present, into red oxide. It is then dissolved in water, and sulphuret of lime added to separate any remaining portion of iron. The salt is crystallized and dissolved a third time, in order to purify it. The sulphate prepared by this process is generally very pure and clean, although it sometimes contains sulphate of iron.

Properties, &c. Sulphate of magnesium is a colourless transparent salt, without smell, and of a bitter, nauseous, saline taste. It crystallizes in quadrangular prisms, terminating in a four-sided pyramid or in a dihedral summit. It usually occurs in small acicular crystals, which are produced by agitating the solution while crystallizing. It slowly effloresces in the air. At 32° F. 100 parts of water dissolve 25·76 parts of the anhydrous salt, and, for every increased degree, 0·8597 parts additional are taken up. The crystals contain 51·22 per cent. of water of crystallization, and dissolve in their own weight of water at 60°, and in three-fourths of their weight at 212°. They melt in their water of crystallization, and at a high temperature fuse into an enamel. (*Berzelius.*) The salt consists of one eq. of acid 40, one of base 20, and seven of water 63 = 123.

Sulphate of magnesium is completely decomposed by potassa, soda, and their carbonates; by lime, baryta, and strontia, and their soluble salts. Ammonia partially decomposes it, and forms with the remainder a double sulphate. The bicarbonates of potassium and sodium do not decompose it, except by the aid of heat. "It gives copious white precipitates with chloride of barium, and with a mixed solution of ammonia, chloride of ammonium, and phosphate of soda." *Br.*

Sulphate of magnesium is liable to contain iron and chloride of magnesium, the former of which may be detected by ferrocyanide of potassium, and the latter by its rendering the salt moist. If the addition of sulphuric acid produce no extrication of muriatic acid gas, the fact will prove the absence of chlorides. An aqueous solution of 100 grains of the salt should yield, when completely decomposed by a boiling solution of carbonate of sodium, 34 grains of dry carbonate of magnesium, and, according to the British Pharmacopœia, 16·26 grains of the carbonate after having been well washed, dried, and heated to redness. If the dry precipitate is less, the specimen tested is not all sulphate of magnesium, and probably contains sulphate of sodium.

An economical use which has been recommended of sulphate of magnesium is the addition of a strong solution to ordinary whitewash, whereby a beautiful whiteness may be given to walls and ceilings. A little of it, moreover, added to starch considerably increases its stiffening properties, and at the same time in some degree resists the action of fire. (*Chem. News*, April 19, 1867, p. 196.)

Medical Properties and Uses. Sulphate of magnesium is a mild and safe cathartic, operating with little pain or nausea, and producing watery stools. It is more acceptable to the stomach than most medicines of its class, and will often be retained when others are rejected. Like many of the other neutral salts it is refrigerant, and may be made to act as a diuretic by keeping the skin cool, and walking about after it has been taken. It is well adapted to the treatment of fevers and inflammatory affections, especially after a previous thorough evacuation of the bowels by a more energetic cathartic. It is also useful in colic and obstinate constipation, and may be employed in most cases which require the use of a cathartic, without being attended with debility or relaxation of the stomach and bowels. The medium dose is an ounce; but advantage often results from its administration in divided doses, frequently repeated. It is often given in combination with other medicines, especially with senna, the griping effect of which it tends to obviate. The most agreeable form for administering the salt, and that in which it usually agrees best with the stomach, is a solution in carbonic acid water with lemon syrup. By Dr. Henry, of Dublin, it is highly recommended in connection with sulphuric acid. To seven ounces of a saturated aqueous solution of the salt he adds an ounce of the diluted sulphuric acid of the Pharmacopœias, and gives a tablespoonful of the mixture for a dose, in a wineglassful of water.*

* It is said that a solution of an ounce of the salt in about a pint of water, boiled for three minutes with a grain and a half of tannic acid, or with two or three drachms of roasted coffee, is entirely deprived of bitterness. The liquid prepared with coffee should be strained, and may be sweetened with sugar. (Combes, *Journ. de Pharm.*, 3e sér., xii. 110.)

Dr. Luton, of Rheims, in France, found that a solution of from 10 to 20 centigrammes (1½ to 3 grs.) of magnesia injected under the skin, produced a purgative effect; while M. Moreau demonstrated that this salt, injected into the veins, produced no purgative effect. At present these are only curious facts. Time may possibly render them important. (*Journ. de Pharm.*, Août, 1874, p. 132.) — *Note to the fourteenth edition.*

Off. Prep. Enema Magnesiæ Sulphatis, *Br.;* Liquor Magnesiæ Carbonatis, *Br.;* Magnesiæ Carbonas, *Br.;* Magnesiæ Carbonas Levis, *Br.;* Mistura Sennæ Composita, *Br.* D. B. S.

MAGNOLIA. *U.S. Secondary.*

Magnolia.

The bark of Magnolia glauca, M. acuminata, and M. tripetala. *U. S.*

Magnolia. *Sex. Syst.* Polyandria Polygynia.—*Nat. Ord.* Magnoliaceæ.

Gen. Ch. Calyx three-leaved. *Petals* six or more. *Capsules* two-valved, one-seeded, imbricated in a cone. *Seeds* berried, pendulous. *Bigelow.*

The medicinal properties of the Magnolia are common to most, if not all, of the species composing this splendid genus. Among the numerous trees which adorn the American landscape, these are most conspicuous for the richness of their foliage, and the magnificence as well as delicious odour of their flowers; and *M. grandiflora* of the Southern States rivals in magnitude the largest inhabitants of our forests. The Pharmacopœia designates *M. glauca*, *M. acuminata*, and *M. tripetala*, each of which we shall briefly describe.

1. *Magnolia glauca.* Willd. *Sp. Plant.* ii. 1266; Bigelow, *Am. Med. Bot.* ii. 67; Barton, *Med. Bot.* i. 77; Michaux, *N. Am. Sylv.* ii. 8. This species of Magnolia, which in the Northern States is often nothing more than a shrub, sometimes attains in the South the height of forty feet. The leaves are scattered, petiolate, oval, obtuse, entire, glabrous, thick, opaque, yellowish-green on their upper surface, and of a beautiful pale glaucous colour beneath. The flowers are large, terminal, solitary, cream-coloured, strongly and gratefully odorous, often scenting the air to a considerable distance. The calyx is composed of three leaves; the petals, from eight to fourteen in number, are obovate, obtuse, concave, and contracted at the base; the stamens are very numerous, and inserted on a conical receptacle; the germs are collected into a cone, and each is surmounted by a linear recurved style. The fruit is conical, about an inch in length, consisting of numerous imbricated cells, each containing a single scarlet seed. This escapes through a longitudinal opening in the cell, but remains for some time suspended from the cone by a slender thread.

M. glauca extends along the seaboard of the United States, from Cape Ann, in Massachusetts, to the shores of the Gulf of Mexico. It is abundant in the Middle and Southern States, usually growing in swamps; but is seldom met with in the interior, west of the mountains. It begins to flower in May, June, or July, according to the latitude. It is known by the name of *magnolia* simply in the Northern and Middle States, by that of *white bay* or *sweet bay* in the South, and is occasionally called *swamp sassafras*, *beaver tree*, &c.

2. *M. acuminata.* Willd. *Sp. Plant.* ii. 1257; Michaux, *N. Am. Sylv.* ii. 12. This species is much larger than the preceding, often growing to the height of seventy or eighty feet. The leaves are six or seven inches long, by three or four in breadth, oval, acuminate, and pubescent on their under surface. The flowers are five or six inches in diameter, bluish or cream-coloured, slightly odorous, with obovate rather obtuse petals from six to nine in number. Mingled with the splendid foliage, they give a magnificent aspect to the tree when large and in full bloom. The tree grows in the interior mountainous regions of the United States, extending along the Alleghanies from the State of New York to their termination in Georgia, and seldom existing in the low country far either to the east or west of that range. It is called *cucumber tree*, from the resemblance of its fruit in shape and size to the common cucumber.

3. *M. tripetala.* Willd. *Sp. Plant.* ii. 1258; Michaux, *N. Am. Sylv.* ii. 18. This is a small tree, sometimes though rarely reaching an elevation of thirty feet, and almost always having an inclined trunk. It is remarkable for the size of its leaves and flowers. The former are eighteen or twenty inches long by seven or eight in breadth, thin, obovate, somewhat wedge-shaped, entire, acute at both extremities, pubescent when young, and often disposed in rays at the extremity of the shoots, displaying a surface thirty inches in diameter. Hence has arisen the name of *umbrella tree*, by

which this species is distinguished. The flowers are terminal, seven or eight inches in diameter, white, with from five to twelve oval acute petals, of which the three outer are reflexed. This species extends from the Northern parts of New York to the Southern limits of the United States. It is found only in shady situations, with a strong, deep, and fertile soil.

The fruit of this species has been chemically investigated by Mr. Wallace Procter, who found in it a crystalline principle. When pure, this is without smell, and has at first little taste, in consequence of its insolubility in the liquids of the mouth, but after a time produces an irritant effect on the fauces. It is nearly insoluble in cold, but slightly soluble in hot water, very soluble in alcohol, ether, chloroform, bisulphide of carbon, and benzine. It is neutral to test-paper. Mr. Procter considers it analogous to the liriodendrin obtained by Prof. Emmet, but quite distinct. He proposes for it the name of *magnolin*, which is the more appropriate, as the principle seems to be the same with that obtained by Dr. Stephen Procter from the bark of *M. grandiflora*, and by Mr. W. D. Harrison from that of the *M. glauca*. (*Amer. Journ. of Pharm.*, xxxiv. 29.) For an account of its preparation, and a fuller statement of its properties, the reader is referred to Mr. Procter's paper in the *Amer. Journ. of Pharm.* (April, 1872, p. 145).

The leaves of this species are highly recommended by Dr. J. S. Wilson, of Alabama, as a dressing for blisters. He scalds them previously to their application, but presumes that they would answer as well in their natural state. (*South. Med. and Surg. Journ.*, July, 1854.)

The bark and fruit of all the species of Magnolia are possessed of similar medicinal properties; but the bark only is officinal, and that of the root is thought to be most efficient. It has an aromatic odour, and a bitter, pungent, spicy taste. The aromatic property, which resides in a volatile principle, is diminished by desiccation, and entirely lost when the bark is long kept. The bitterness, however, remains. The bark is destitute of astringency. The bark of Magnolia grandiflora, examined by Dr. Stephen Procter, was found to contain volatile oil, resin, and a principle analogous to the liriodendrin of Professor Emmet. (*Am. Journ. of Pharm.*, xiv. 95.)

Medical Properties and Uses. Magnolia is a gently stimulant aromatic tonic and diaphoretic, useful in chronic rheumatism, and capable, if freely given, of arresting the paroxysms of intermittent fever. It has been used advantageously in these complaints, and in remittents, especially of a typhoid character. The dose of the recently dried bark in powder is from half a drachm to a drachm, frequently repeated. The infusion may also be used, but is less efficient. Diluted alcohol extracts all the virtues of the medicine; and a tincture, made by macerating the fresh bark or fruit in brandy, is a popular remedy in chronic rheumatism. W.

MANGANESII OXIDUM NIGRUM. *U.S., Br.*

Black Oxide of Manganese.

Native impure deutoxide of manganese in powder, containing at least 66 per cent. of deutoxide of manganese, and should exhibit little or no effervescence, on the addition of dilute sulphuric acid. *U.S.* MnO_2. *Br.*

Manganese, Peroxide of manganese, Deutoxide of manganese, Black oxide of manganese, Pyrolusite; Oxide noir de manganèse, *Fr.*; Braunstein, *Germ.*; Manganese, *Ital., Span.*

The officinal oxide of manganese is the binoxide of a peculiar metal properly called manganese; though this name is commonly applied to the oxide itself. *Metallic manganese* was discovered by Scheele and Gahn in 1774, and is obtained from the native black oxide by intense ignition with charcoal. As obtained by C. Brunner, by decomposing the fluoride by sodium, manganese is brittle, grayish-white, and very hard, being capable of cutting glass, and scratching the best tempered steel. It is susceptible of the most perfect polish, and is not altered, even in moist air, at the ordinary temperature. Its sp. gr. varies from 7·1 to 7·2. (*Chem. Gaz.*, May 1, 1857.) Deville suspects that Brunner's manganese contains a little carbon. This chemist obtained the metal by heating the black oxide in excess with charcoal, in a

lime crucible. The metal, thus obtained, is more refractory than iron; while that procured by Brunner fused at the same heat as white cast iron. (*Ibid.*, June 1, 1857.) The eq. number of manganese is 27·7. With oxygen it forms five compounds, three regular oxides and two acids. The *protoxide* is of a light-green colour, and is the oxide present in the salts of manganese. The *sesquioxide* is black or dark-brown, and the *deutoxide* black. The two acids are formed by the action of potassa on the deutoxide, and are called *manganic* and *hypermanganic acids.* Assuming one eq. of manganese in each of these compounds, the protoxide contains one, the sesquioxide one and a half, the deutoxide two, manganic acid three, and hypermanganic acid three and a half equivalents of oxygen. Besides these, there exist a double oxide, of a brownish-red colour, called *red oxide*, consisting of one eq. of protoxide and one of sesquioxide, and invariably formed when any one of the other oxides of manganese is exposed to a white heat; and a native oxide, called *Varvicite*, composed of two eqs. of deutoxide and one of sesquioxide. Metallic manganese is an occasional constituent of organic matter. It has been detected in minute quantity in bone, hair, brain, epidermis, gastric juice, bile, urine, and pus, and has been found by Millon and others in the blood. M. Glénard, of Lyons, denies that it is a normal constituent of the blood, although sometimes present; but the evidence of numerous experimenters shows that it generally exists in that fluid; and, when not detected, it may be because the quantity present is too minute for discovery. According to Mr. E. Davy, caustic potassa, dissolved in an equal weight of water, forms a delicate test for manganese, not obscured by the presence of other metals. The smallest portion of matter, suspected to contain the metal, being finely pulverized or in solution, is placed upon a slip of silver foil, and a drop of the test added. Upon evaporating to dryness with a spirit-lamp, and raising the heat, the characteristic green manganate of potassium will appear on the foil. (*Chem. Gaz.*, March 15, 1854.) Manganese is a constituent of all arable land, and is found in the ashes of most of the vegetables which form the food of man and the inferior animals. In the mineral kingdom, it occurs sometimes as a sulphuret, rarely as a phosphate, but very abundantly as the black or deutoxide, called *pyrolusite.* It is the latter mineral which constitutes the officinal oxide.

Properties. Deutoxide of manganese, as it occurs in nature, is very diversified in its appearance. Its sp. gr. varies from 4·7 to 4·9. It is found sometimes in brilliant needle-shaped crystals, often in compact masses having the metallic lustre, but far more frequently in the form of a dull earthy-looking substance, of a black or brown colour. It is purest when crystallized. As it occurs in commerce, it is usually in the form of a black powder, insoluble in water, and containing more or less oxidized iron, carbonate of calcium, sulphate of barium, and earthy matter. Iron, which is rarely absent, is detected by the production of a greenish or blue tint on the addition of ferrocyanuret of potassium to its muriatic solution. When exposed to a red heat it yields half an equivalent of oxygen, and is reduced to the state of sesquioxide. Hence its use in obtaining that gas. Good samples, after being dried, lose, when heated to whiteness, 12 per cent. of oxygen. It is distinguished from sulphuret of antimony by its infusibility, and by causing the evolution of chlorine on being heated with muriatic acid. When of a brown colour, it is not of good quality.

But few mines of deutoxide of manganese exist; though the metal itself is very generally diffused throughout the mineral kingdom. It occurs most abundantly in Bohemia, Saxony, the Hartz, France, and Great Britain. In the United States no mines have been opened, except in Vermont, from which State an inferior brown ferruginous manganese is supplied through Boston. Besides this source, the mineral is received from Nova Scotia, France, Germany, England, and occasionally Scotland. It comes packed in casks or barrels, generally in lumps and coarse powder, just as it is dug out of the mines; though occasionally it is received from England ready pulverized. It is a good rule to buy it unpowdered; as its quality can be better judged of in that state. A dark shining crystalline appearance may be taken as an indication of good quality. The Nova Scotia manganese is better than the Vermont; but that from Germany, England, and Scotland is the best, and commands the highest price.

Medical Properties and Uses. Deutoxide of manganese is deemed tonic and al-

terative. When slowly introduced into the system, as happens to those engaged in grinding the mineral, it acts, according to Dr. Coupar, of Glasgow, as a cumulative poison, inducing a disease which begins with a staggering gait, and ends in paraplegia. It has been used in syphilis, chlorosis, scurvy, and various skin diseases, especially itch and porrigo. It has lately been employed, in a purified state, with great advantage by Dr. Arthur Leared, in stomachic pains, of a purely nervous character, such as are apt to come on after eating. He has also found it useful in pyrosis, and other irritable states of the stomach which are purely functional. It has the advantage over the preparations of bismuth, in these cases, that it does not constipate. (*Glasgow Med. Journ.*, Jan. 1865, p. 79.) The dose is from three to twenty grains, three times a day, given in the form of pill. Dr. Leared gave ten grains of the powder three times a day. For external use, an ointment may be made of one or two drachms of the oxide to an ounce of lard. The sulphate is officinal. For a notice of some other compounds of manganese which have been tried as medicines, see *Part II.*

This oxide is used in the arts for obtaining chlorine in the manufacture of bleaching powder, for giving a black glazing to pottery, and for freeing glass from the colour which it derives from iron. In the laboratory, it is employed to obtain oxygen and chlorine, and to form the salts of manganese. In pharmacy it is used for liberating chlorine from muriatic acid and from common salt, and iodine from iodide of sodium, contained in kelp.

Pharm Uses. In preparing Aqua Chlorinii, *U. S.;* Hydrargyri Perchloridum, *Br.;* Liquor Chlori, *Br.;* Liquor Sodæ Chloratæ, *Br.;* Potassæ Chloras, *Br.*

Off. Prep. Potassæ Permanganas, *Br.* B.

MANGANESII SULPHAS. *U. S.*

Sulphate of Manganese.

This salt was first made officinal in the immediately preceding edition of the U. S. Pharmacopœia, in which it had a place in the Materia Medica list, where it now stands. It may be prepared by heating the native black oxide with concentrated sulphuric acid. Oxygen is evolved, and the sulphate of the protoxide is formed. The product, when exhausted by water, furnishes a solution which must be heated to nearly the boiling point, and treated with carbonate of manganese, added by small portions at a time, which will precipitate any iron present, and change the colour of the liquid from a dark-red to a pale-rose tint. The liquid is then filtered, evaporated to the consistence of a thin syrup, and set aside to crystallize.*

* The following modification of the process given in the text has been published by Mr. C. Lewis Diehl, Jr., who has obtained by means of it an abundant product of the pure salt. A mixture of 5 parts of peroxide of manganese and 0·75 of coarsely powdered charcoal is exposed to a red heat, in a covered crucible, until all the charcoal is consumed. The contents of the crucible, after cooling, are put into a porcelain dish, and treated with 6·5 parts of sulphuric acid. The whole is then evaporated to dryness, and the residue, being returned to the crucible, is again heated to redness. When cool, the mass is rubbed to powder if necessary, and treated twice with eight parts of boiling water; and the liquors, having been mixed, are filtered, evaporated till a pellicle appears, and set aside to crystallize. It is important that the liquid should be removed from the sand-bath as soon as the pellicle begins to form; as, if the heat be continued longer, an insoluble sulphate is deposited. If the peroxide of manganese employed is of good quality, a pure sulphate will be obtained; any salt of iron or copper present being rendered insoluble by the heat. (*Am. Journ. of Pharm.*, March, 1867, p. 139.)

Another process, introduced into use by Mr. Laster, Chemist of the Charity Hospital, New Orleans, is highly praised by Dr. A. J. Semmes, visiting physician of the same hospital. The following is the formula. "Take of Binoxide of Manganese 40 parts, Commercial Hydrochloric Acid 200 parts. Dissolve the binoxide in the acid beneath a chimney-flue, and, when solution is complete, and chlorine no longer evolved, mix very gradually 53 parts of sulphuric acid with the reddish liquid; continue the evaporation beneath the flue until acid vapour is no longer driven off, and the mass becomes dry. Dissolve this mass in 350 parts of water heated to the boiling point. Treat the solution with carbonate of manganese until it becomes rose-red, filter or decant, evaporate and crystallize." (*Ibid.*, March, 1868, p. 175.)—*Note to the thirteenth edition.*

Mr. F. Mahla, of Chicago, after stating that the methods of preparing this salt, suggested in the manuals of chemistry, are not only unsatisfactory in their results, but are also difficult and exceedingly unpleasant in execution, offers a method of his own, which, we must presume, is not

Properties. Sulphate of manganese consists of one eq. of protoxide of manganese and one of sulphuric acid (MnO,SO_3). From its aqueous solution it crystallizes in rhombic prisms, which contain variable proportions of water of crystallization according to the temperature of the solution, and other circumstances. Obtained by evaporation at a gentle heat, they contain four eqs. of water; between 45° and 68°, five eqs.; under 42°, seven eqs.; and a concentrated solution, mixed with sulphuric acid, and evaporated, yields granular crystals with one eq. Heated to 240°, the crystals lose three eqs. of water, and at a red heat become anhydrous. (*Brande and Taylor.*) The crystals usually have a pale-rose or pink colour. The salt has an astringent and bitterish taste. It is very soluble in water; but its solubility varies with its water of crystallization. When anhydrous it is dissolved by two parts of water at 60°, and in its own weight at 212°. It is insoluble in alcohol. If carelessly prepared, it is apt to contain copper and arsenic, as well as iron. As it is the source of nearly all the preparations of manganese, it is of importance that it should be pure. Hence, the sulphate, as first obtained, should be calcined at a low red heat at least twice, to render the contaminating metals insoluble, and then tested in solution, to be sure of its purity. According to M. A. Gorgeu, copper and iron, as well as nickel and cobalt, are completely precipitated by sulphuret of manganese. In applying this reagent, the impure solution is shaken for about a quarter of an hour with the sulphuret, and then boiled for a few minutes. (*Chem. Gaz.*, July 1, 1853; p. 249.) In the description of it in the U. S. Pharmacopœia, the salt is stated not to be precipitated by tincture of nutgall, to give with alkalies a white precipitate soon becoming brown on exposure, and to throw down a flesh-coloured precipitate with hydrosulphate of ammonium, and a white one with ferrocyanide of potassium.

Medical Properties and Uses. C. G. Gmelin found sulphate of manganese to produce an extraordinary secretion of bile when given to the inferior animals, and its effects as a cholagogue have been observed in man. According to the late Dr. Thomas Thomson, of Glasgow, it resembles sulphate of sodium both in taste and effect, operating as a purgative in the dose of one or two drachms. From the circumstance that manganese had been found in small proportion in the blood, it was conjectured that this metal, like iron, might play an important part in the human economy; and trial was made of its various preparations in debilitated states of the system, and especially in anæmia, in which the hope was entertained that it might prove a useful adjuvant of the chalybeates as a reconstructive agent. When given with iron, its use was certainly in many instances followed by the most satisfactory results; but it may be questioned whether the beneficial effects were in any respect greater than those which the iron would have produced without such an auxiliary; and, where manganese has been used alone in anemic cases, it has generally failed. Dr. Garrod, of London, has recently reported the result of some trials made with it, in one of the hospitals of that city, in cases of anæmia, the inference from which is altogether unfavourable to manganese as a remedy in that disease. (*Med. Times and Gaz.*, Feb. 1863, p. 222.) Dr. Hammond, of New York, has found the sulphate of manganese successful in two cases of chorea, which had resisted other treatment. (*Med. & Surg. Reporter*, Aug. 1, 1868, p. 87; from *N. Y. Med. Gaz.*) The dose of sulphate of manganese as a tonic is from five to twenty grains. B.

liable, or at least less liable, to the same objections. He takes the liquid remaining in the retort after the preparation of chlorine, adds to it carbonate of sodium sufficient to precipitate all the metallic oxides, or at least to cause a slight alkalinity, collects the precipitate thus produced on a muslin filter, and washes it with pure water, until the filtrate produces no longer an obvious reaction with nitrate of silver. Three-fourths of the moist mass are removed from the filter to an evaporating dish, and dilute sulphuric acid is added sufficient completely to dissolve it. The solution is heated to near the boiling point, and the remaining fourth of the mass from the filter is gradually added to it, until the liquid, after being filtered, is no longer blackened by tannic acid. The whole solution is then filtered, and the filtrate, with the waters, after washing, is evaporated to crystallization. The first crop of crystals is sometimes contaminated with sulphate of calcium, from the carbonate of calcium in the commercial black oxide employed in the process. To separate this impurity, evaporate to dryness, redissolve the residue in a little water, which leaves the sulphate of calcium undissolved; and the pure solution of sulphate of manganese is obtained by filtration. (*Am. Journ. of Pharm.*, July, 1869, p. 351.)—*Note to the fourteenth edition.*

MANNA. *U.S., Br.*

Manna.

The concrete saccharine exudation, in flakes, of Fraxinus Ornus, and of Fraxinus rotundifolia. *U.S.* A concrete saccharine exudation from the stem of Fraxinus Ornus, *Linn.*, and F. rotundifolia, *D.C.* Obtained by making incisions in the stems. *Br.*

Manne, *Fr.;* Manna, *Germ., Ital.;* Mana, *Span.*

Manna is not the product of one plant exclusively. Besides the two species of Fraxinus indicated by the Pharmacopœias, it is said to be obtained also from several other trees, belonging to the genera *Ornus* and *Fraxinus*, among which *F. excelsior* and *F. parviflora* have been particularly designated. Many saccharine substances, generally exudations from plants, have, from their resemblance to this substance, obtained the name of manna, and attracted more or less attention from writers. They are described in a note.*

ORNUS. *Sex. Syst.* Diandria Monogynia. — *Nat. Ord.* Oleaceæ.

Gen. Ch. Calyx very small, four-cleft. *Corolla* divided to the base into linear segments. *Pericarp* a winged key not dehiscing. *Lindley.*

This genus was separated by Persoon from the Fraxinus of Linnæus.

Ornus Europæa. Persoon, *Synops.* i. 9; Lindley, *Flor. Med.* 547; Carson, *Illust. of Med. Bot.* ii. 8, pl. 61. — *Fraxinus Ornus.* Willd. *Sp. Plant.* iv. 1104. Woodv. *Med. Bot.* p. 589, t. 209. The *flowering ash*† is a tree of moderate height, usually from twenty to twenty-five feet, very branching, with opposite, petiolate, pinnate leaves, composed of three or four pairs of leaflets, and an odd one at the end. The leaflets are oval, acuminate, obtusely serrate, about an inch and a half in length,

* *False Mannas.* Burkhardt states that a species of manna, which exudes from the tamarisk of the north of Africa (*Tamarix Gallica*, Ehrenberg), is used by the Bedouin Arabs near Mount Sinai with their food. This substance, however, according to Mitscherlich, contains no mannite, but consists wholly of mucilaginous sugar. M. Berthelot found a sample of manna from Sinai to consist of 55 per cent. of cane sugar, 25 of *levulose* and glucose, and 20 of dextrin and analogous substances. (*Annales de Chim. et Phys.*, lxvii. 82.) The same chemist obtained from Turkish manna a new variety of sugar, which he named *trehalose.* (*Gaz. Méd. de Paris*, A.D. 1857, No. 49.) The manna used in India is said to be the product of *Hedysarum Alhagi* of Linn., *Alhagi Maurorum* of De Candolle, a thorny shrub which grows abundantly in the deserts of Persia and Arabia. It is much inferior to that obtained from the Ornus. A substance closely resembling manna is procured by exudation from *Eucalyptus mannifera*, growing in New South Wales. It contains a saccharine matter, called *melitose*, different from mannite, and from all the varieties of sugar in properties, though isomeric with glucose. It is susceptible of the vinous fermentation. (See *Am. Journ. of Pharm.*, xxviii. 157.) Another manna found in New Holland is produced upon the leaves of *Eucalyptus dumosa*, when very small, and sometimes appears spread over large extents of country like a kind of snow. The natives use it for food. It is a complex body, containing sugar, gum, starch, inulin, and lignin. (*Journ. de Chim. et de Pharm.*, xvi. 240.) It is said to be a secretion from an insect, formed into minute cells, each of which is the abode of one of the insects. It is called *lerp* by the natives. (See *Am. Journ. of Pharm.*, Nov. 1862, p. 547.) The substance known in France by the name of *Briançon manna*, is an exudation from the common European larch (*Larix Europæa* or *Pinus Larix*), and differs chemically from ordinary manna in containing no mannite. Berthelot found in it a peculiar sugar, analogous to that of the cane, which he named *melezitose.* (See *Am. Journ. of Pharm.*, Jan. 1859, p. 61.) *Larix Cedrus*, of Mount Lebanon, yields a similar product, which has some repute in Syria as a remedy in phthisis. (*Pharm. Journ. and Trans.*, xiii. 411.) A substance resembling manna, of a sweet, slightly bitter, and terebinthinate taste, and actively purgative, exudes from incisions in *Pinus Lambertiana*, of Southern Oregon, and is used by the natives. (*Nar. of U.S. Expl. Exped.*, v. 232.) M. Berthelot has extracted from this product a peculiar saccharine principle, which he calls *pinite.* It is very sweet, but does not undergo the vinous fermentation. (See *Am. Journ. of Pharm.*, xxviii. 157.) In the neighbourhood of Diarbekir, in Asiatic Turkey, a saccharine substance, known as Diarbekir manna, is found on the leaves of dwarf oaks, from which it appears to be exuded. (*Ibid.*, Nov. 1862, p. 546.) The manna of the oak of Kurdistan, spoken of by Flückiger, is probably the same as that of Diarbekir, which may be its entrepot. According to Flückiger, this consists chiefly (90 per cent.) of a crystallizable sugar. It deviates to the right the plane of polarized light, and reduces in the cold the solution of oxide of copper in soda and glycerin. This manna contains a mucilage, but no cane-sugar or dextrin. (*J. de Pharm.*, Avril. 1873, p. 335.) Certain seaweeds, after their death, become covered, on exposure to the air, with an efflorescence of mannite, supposed not to pre-exist in the plant, but to be formed at the expense of their mucilaginous matter. (*Journ. de Pharm.*, Avril, 1859, p. 314.)

† A syrup prepared from the inner bark of this tree has been employed, in Europe, by Dr. Devergie, with supposed advantage, in chronic eczema and impetigo. The bark contains much tannin, and a mucilaginous principle, which renders diluted alcohol a better menstruum than boiling water. (*Journ. de Pharm.*, 3e sér., ix. 347.)

smooth, of a bright-green colour, and supported on short footstalks. The flowers are white, and usually expand with the leaves. They grow in close panicles at the extremity of the young branches, and have a very short calyx with four teeth, and four linear lanceolate petals.

Both this species of *Ornus* and *O. rotundifolia* are natives of Sicily, Calabria, and Apulia; and both contribute to supply the manna of commerce. The former is cultivated in Sicily, yields manna after the eighth year, and continues to yield it for ten or twelve years, when it is usually cut down, and young sprouts allowed to grow up from the root. (Stettner, *Archiv der Pharm.*, liii. 194.) During the hot months the juice exudes spontaneously from the bark, and concretes upon its surface; but, as the exudation is slow, it is customary to facilitate the process by making deep longitudinal incisions on one side of the trunk. In the following season these are repeated on the other side, and thus alternately for the whole period during which the trees yield manna, extending sometimes, it is said, to thirty or even forty years. Straw or chips are frequently placed so as to receive the juice, which concretes upon them. The manna varies in its character according to the mode of collection, nature of the season, and period of the year in which the exudation takes place. That procured in Sicily is said to be the best. From a communication by Mr. Daniel Hanbury to the *Pharm. Journ.* of London, it appears that the production of manna in Calabria as an article of commerce has nearly ceased; Mr. Hanbury having himself travelled through the old manna region, and satisfied himself of the fact. The collection of manna for commercial purposes seems to be confined at present almost exclusively to Sicily. (*Pharm. Journ.*, Nov. 1872, p. 421.) Three varieties are distinguishable in commerce.

1. The purest is that named *flake manna*, or *manna cannulata*. It exudes spontaneously, or by incisions, during the hottest and dryest weather in July and August. According to Stettner, it is furnished by the upper incisions upon the trunk; while the lower incisions yield the inferior varieties. It is in irregular, unequal pieces, often several inches long, resembling stalactites, rough, light, porous, brittle, whitish or yellowish-white, and frequently concave on the surface by which they were attached to the trunk, and which is often soiled by impurities, sometimes by adherent fragments of the bark. When broken, these pieces exhibit a crystalline or granular structure. This variety is sometimes in small fragments, generally less than an inch in length.

2. *Common manna* — *manne en sorte* of French pharmacy — is next in quality, and is collected in September and the beginning of October, when the heat of the weather has begun to moderate. The juice does not now concrete so readily, and a portion, falling on the ground at the root of the tree, becomes more or less mixed with impurities, and forms imperfectly solid masses, which require to be further dried in the sun. Common manna consists of whitish, or yellowish fragments, similar to the pieces of flake manna, but much smaller, mixed with a soft, viscid, uncrystallized brownish matter, identical with that which constitutes the following variety.

3. *Fat manna* is collected in the latter part of October and November, when the weather is cooler and rains more common. The juice is now still less disposed to concrete, and flowing down the trunk is received in a small excavation at its base. As found in commerce, it is in the form of a soft, viscous mass, containing few crystalline fragments, of a brown or yellowish-brown colour, and full of impurities.

Manna may be found in the shops, of every grade, from the most impure of the third variety to the purest of the first; but the worst kind is not often imported into this country.

Attempts have sometimes been made to counterfeit manna; but the facility of detection renders frauds of this kind unprofitable, and they are not often practised. Dr. R. P. Thomas described, in the *Am. Journ. of Pharm.* (xxiv. 208), a sophisticated drug, which was brought into our markets under the name of manna, but differed from the genuine drug both in sensible and chemical properties, not even containing mannite. Baumé describes a method in which common manna is purified so as to resemble flake manna. It consists in dissolving common manna in a little water, allowing the liquid to settle, decanting it in order to separate the impurities,

then inspissating it so that it will congeal on cooling, and immersing threads in the inspissated liquid, several times successively, in the manner practised by candle-makers. It may be still further purified by the use of animal charcoal. Thus prepared it contains less mannite than flake manna, and less of the nauseous principle; but is said not to operate less effectively as a laxative.*

Properties. Manna has a slight, peculiar odour, and a sweet taste, which in the impure kinds is also very nauseous, but, in the finest flake manna, scarcely so much so as to be disagreeable. It melts with heat, and takes fire, burning with a blue flame. When pure it is soluble in three parts of cold, and in its own weight of boiling water. From a boiling saturated aqueous solution, it separates in partially crystalline masses on cooling. Alcohol also dissolves it, and, if saturated by means of heat, deposits upon cooling a large proportion of the manna in a beautifully crystalline form. Fourcroy and Vauquelin found manna to consist of, 1. a peculiar sweet principle, called mannite, which constitutes 75 per cent.; 2. true sugar; 3. a yellow nauseous matter, upon which the purgative property is thought chiefly to depend: and 4. a little mucilage. Leuchtweiss obtained from 105 parts of manna 11·6 of water, 0·4 of insoluble matter, 9·1 of sugar, 42·6 of mannite, 40·0 of a mixture of mucilaginous matter containing mannite, resin, organic acid, and a nitrogenous substance, and 1·3 of ashes. Manna has recently been examined chemically by M. Buignet, who discovered in it, what had never before been detected, a considerable proportion of dextrin. He appears to have been led to this discovery by observing a very energetic right rotary power in flake manna, which could not be owing to the saccharine matter it contained, because the same power continued after all the sugar had been destroyed by fermentation. Dextrin forms about one-fifth part of flake manna, and a much larger part of the inferior kinds. It may be readily obtained separate by triturating 200 parts of flake manna with 400 of alcohol of 70° in successive portions, filtering the resulting mixture, by which the mannite is left behind, and then separating the sugar and dextrin contained in the clear liquor. This is done by concentrating the liquor to a syrupy consistence, and adding about 10 parts of alcohol at 90°. The mixture separates into two layers, the upper consisting of a strong alcoholic solution of sugar, the lower of a saturated solution of dextrin in weak alcohol. The latter is separated, washed repeatedly with alcohol at 90°, and then, after dilution with water, decolorization, and filtration, is evaporated gently by a water-bath till it ceases to lose weight. The substance remaining is dextrin. The saccharine matter of manna is a mixture of cane sugar and inverse or uncrystallizable sugar, which are in such proportion as almost to neutralize their reciprocal optic properties. All the forms of commercial manna contain both sugar and dextrin, and, though the quantity of the two jointly varies considerably, yet their relative proportion is invariable, being 2 eqs. of dextrin and 1 eq. of sugar. This is the same result which takes place in the saccharification of starch; and the inference is fair. that the dextrin and sugar in manna are the result of a transformation of starch in the plant. (*Journ. de Pharm. et de Chim.*, Juillet, 1868, pp. 5–16.) It is owing to the presence of true sugar and dextrin that manna is capable of fermenting.

Mannite is white, inodorous, crystallizable in semi-transparent needles, of a sweetish taste, soluble in five parts of cold water, scarcely soluble in cold alcohol, but readily dissolved by that liquid when hot, and deposited when it cools. Its composition is $C_{12}H_{14}O_{12}$. Unlike sugar, it does not undergo the vinous fermentation; but, if mixed with chalk and cream cheese, and kept for some weeks at the temperature of 104° F., it yields alcohol largely, with the disengagement of carbonic acid and hydrogen, and the production of lactic acid. No fungus is produced, as in the ordinary

* A fictitious manna is described by Mr. Edmond Histed, in the *Pharmaceutical Journal* (April, 1870), as having been taken from Paris to London, which bears a close resemblance to flake manna, for which it might be mistaken upon a hasty notice. The resemblance is moreover increased by the fact that it contains mannite, of which Mr. Histed obtained 40 per cent., while fine natural flake manna yielded him 70 per cent. Closely examined, it is found to differ essentially from genuine flake manna, showing no crystals of mannite when broken, not having the taste and smell characteristic of good manna, and, besides, cleaner, lighter coloured, more solid, and making a clearer solution in water. (See *Am. Journ of Pharm.*, July, 1870, p. 348.) May this not be a specimen of artificial flake manna, prepared from the inferior or common manna? (*Note to the fourteenth edition.*)

fermentation of sugar. (Berthelot, *Journ. de Pharm.*, xxx. 269.) With lime, baryta, and strontia, it forms definite compounds, soluble in water, and precipitable from their aqueous solutions by alcohol. (*Ibid.*, Jan. 1860, p. 56.) It does not reduce an alkaline solution of oxide of copper; and a test of its purity is thus presented. (*Am. Journ. of Pharm.*, Jan. 1861, p. 26.) Though, when uncombined, it exercises no influence on polarized light, yet all of its derivatives deviate the plane of polarization. (*Journ. de Pharm.*, Mars, 1874, p. 219.) It may be obtained by boiling manna in alcohol, allowing the solution to cool, and redissolving the crystalline precipitate. Pure mannite is now deposited. Another method is to dissolve flake manna in water, precipitate by solution of subacetate of lead, filter, throw down the excess of lead by sulphuric acid, evaporate the solution, and mix with alcohol. On cooling, the mannite is deposited. (Bonsall, *Arch. der Pharm.*, cxxxiv. 70.) This principle has been found in numerous vegetables. It is said to be gently laxative in the dose of one or two ounces.

Manna, when long kept, acquires a deeper colour, softens, and ultimately deliquesces into a liquid, which, on the addition of yeast, undergoes the vinous fermentation. This is probably owing to its conversion into sugar by the absorption of enough oxygen to neutralize the slight excess of hydrogen, which constitutes the only essential difference in composition between it and proper sugar. That which is dryest resists this change the longest. It is said that manna, recently gathered, is less purgative than it afterwards becomes.

Medical Properties and Uses. Manna is a gentle laxative, usually operating mildly, but in some cases producing flatulence and pain. Though peculiarly adapted to children and pregnant women, it may be given with advantage in ordinary cases of piles from constipation, unattended with dyspeptic symptoms. It is usually, however, prescribed with other purgatives, particularly senna, rhubarb, magnesia, and the neutral salts, the taste of which it conceals, while it adds to the purgative effect.

The dose for an adult is from one to two ounces; for children, from one to four drachms. It is usually given dissolved in water or some aromatic infusion; but the best flake manna may be administered in substance.

Manna forms a combination with iron, which it preserves against change on exposure. The mode of preparing it, suggested by M. Ghysen, of Liége, may be seen in the *Pharm. Journ.* (March, 1873, p. 764). W.

MARANTA, *U.S.*

Arrow-root.

The fecula of the rhizome of Maranta arundinacea. *U. S.*

Arrow-root, *Fr.*; Amerikanisches Stärkmehl, Arrowmehl, *Germ.*

MARANTA. *Sex. Syst.* Monandria Monogynia. — *Nat. Ord.* Marantaceæ.

Gen. Ch. Anther attached to the petal-like filament. *Style* petal-shaped. *Stigma* three-sided. *Flowers* panicled. *Loudon's Encyc.*

Maranta arundinacea. Willd. *Sp. Plant.* i. 13; Carson, *Illust. of Med. Bot.* ii. 53, pl. 97. The root (rhizome) of this plant is perennial, tuberous, fleshy, horizontal, nearly cylindrical, scaly, from six inches to a foot or more in length, and furnished with numerous long white fibres. It sends forth several tuberous, jointed, curved, white, scaly stoles, the points of which sometimes rise above the ground, and become new plants. The stems, of which several proceed from the same root, are annual, slender, branched, jointed, leafy, and about three feet in height. The leaves are ovate-lanceolate, about four inches long, alternate, and supported solitarily, at the joints of the stem, upon long, sheathing footstalks. The flowers are in a long, loose, spreading, terminal panicle, at each ramification of which is a solitary linear bracte. The calyx consists of three small lanceolate leaves. The corolla is white and monopetalous, with a tube longer than the calyx, and a double border, of which the three outermost segments are smallest, and the two inner obovate, and slightly emarginate.

The arrow-root plant is a native of the West Indies, where it is largely cultivated. It is cultivated also in the East Indies, Sierra Leone, the south of Africa, and our Southern States, especially Georgia and Florida. The plant is easily propagated by

cuttings of the root. The fecula is prepared in the following manner. The roots are dug up when a year old, washed, and then beaten into a pulp, which is thrown into water, and agitated so as to separate the amylaceous from the fibrous portion. The fibres are removed by the hand, and the starch remains suspended in the water, to which it gives a milky colour. The milky fluid is strained through coarse linen, and allowed to stand that the fecula may subside, which is then washed with a fresh portion of water, and afterwards dried in the sun. We obtain the officinal arrow-root from the West Indies, and the Southern Atlantic States. That from the Bermudas has in general been most highly esteemed.*

Other plants contribute to furnish the arrow-root of commerce. Lindley states that it is procured in the West Indies from *Maranta Allouya* and *M. nobilis*, besides *M. arundinacea*. Under the name of *M. Indica*, Tussac describes a distinct species, which he says was originally brought from the East Indies, and is now cultivated in Jamaica. This, however, is generally considered as a mere variety of M. arundinacea, from which it differs chiefly in having leaves more elongated at the point, and smooth on both sides. Very fine arrow-root is obtained in the East Indies from the root of *Curcuma angustifolia* of Roxburgh, which is cultivated in Travancore. But the product is lighter than the Maranta arrow-root, and does not so quickly make a jelly. Ainslie states that *M. arundinacea* has been introduced from the West Indies into Ceylon, where good arrow-root is prepared from it. A fecula, closely resembling that of the Maranta, is said by Guibourt to be prepared in the West Indies from the root of the cassava plant (*Janipha Manihot*); and it is not improbable that a variety of arrow-root brought to this country from Brazil has a similar origin. In fact, it often contains small lumps, as large as a pin's head, identical with tapioca, which is a product of *J. Manihot*. A variety of arrow-root has been imported from the Sandwich Islands. Mr. Nuttall, during a visit to these islands, found that it was obtained from a species of tacca, which he described by the name of *Tacca oceanica*. (*Am. Journ. of Pharm.*, ix. 305.) It is said that a similar product is afforded by *Tacca pinnatifida*, growing in the East India province of Arracan. (*Pharm. Journ.*, vi. 383.) Arrow-root has been brought from Florida, prepared near St. Augustine from the root of *Zamia integrifolia*, by a process similar to that employed for the fecula of the Maranta (Dr. J. Carson, *Am. Journ. of Pharm.*, xiv. 22); but care must be taken not to confound this with the genuine maranta from the same State. The tuberous roots of different species of Alstrœmeria, growing in S. America, yield a fecula, used for the same purposes as the maranta; and a specimen, under the name of *Talcahuana arrow-root*, was sent from Chili by Dr. Ruschenberger to Prof. Carson, of this city, who ascertained it to be the product of the *Alstrœmeria ligtu*. (*Ibid.*, xxxii. 289.) In the West Indies, substitutes for arrow-root are furnished by the roots of *Dioscorea sativa* or *yam*, and of *Colocasia esculenta*, and by the fruit of *Artocarpus incisa* or bread-fruit tree.† Attempts have been made to substitute finely prepared potato starch for arrow-root; and there is no doubt that in nutritive properties it is quite equal; but patients complain of an unpleasant taste of the potato which it is apt to retain.

Arrow-root is in the form of a light white powder, or of small pulverulent masses, without smell or taste. It has a firm feel when pressed between the fingers, and produces a faint crackling sound when rubbed. It is a pure starch, corresponding in chemical properties with that of wheat and the potato. It is very apt to be musty, and should then be rejected. The odour and taste are the best criteria of its purity. It should be perfectly free from smell and unpleasant flavour. Prof. Procter has rendered musty arrow-root sweet and fit for use by washing it thoroughly with two successive portions of cold water, and then drying it upon frames of muslin in a warm place. (*Am. Journ. of Pharm.*, xiii. 188.) Arrow-root is said to be sometimes adulterated with common starch, and that of the potato. These may be detected by

* For an account of the cultivation of the plant and the preparation of the fecula in Georgia, see a report by Mr. Robert M. Battey, of Rome, Georgia, on Maranta arundinacea, in the *Proceedings of the Am. Pharm. Association*, A.D. 1858, p. 332. (*Note to the twelfth edition.*)

† Specimens of these feculas were seen by the author in the *Palais d'Industrie* of Paris, among the French colonial products, in the autumn of 1860.

the aid of the microscope. Muriatic acid has been proposed as a test. A mixture of equal parts of that acid and of water, rubbed with about half its weight of potato or wheat starch, very quickly forms so thick a mucilage that the mortar in which the trituration is effected may be raised by the pestle; while the same result does not take place with rice flour or arrow-root under 25 or 30 minutes. So small a proportion as from 4 to 6 per cent. of the impurity may, it is asserted, be detected in this way. (*Journ. de Pharm.*, 3e sér., ii. 246.)

As the microscope offers the best means of distinguishing the different varieties of fecula sold as arrow-root, or used for its adulteration, it is proper to indicate the form of their granules as exhibited by this instrument. Those of the proper officinal or *Maranta arrow-root* are rarely oblong, somewhat ovate-oblong, or irregularly convex, with very fine rings, a circular hilum which cracks in a linear or stellate manner, and small mammillary processes occasionally projecting from them. (*Pereira.*) The largest are the 750th of an inch, but many not more than the 2000th of an inch long; and their breadth is generally two-thirds of their length. (*Christison.*) The granules of the *East India arrow-root* are, according to Pereira, of unequal size, ovate or oblong-ovate, flattened, and often furnished with a very short neck or nipple-like projection. The rings are numerous, close, and very fine; and the hilum, which is situated at the narrow extremity, is circular, small, and indistinct. The microscopic appearance of the *tapioca fecula* will be described under the head of *Tapioca*. The *Tacca fecula* from the South Sea Islands, examined by Pereira, consisted of circular, muller-shaped, or polyhedral granules, with few and not very distinct rings, and a small, circular hilum, which cracked in a linear or stellate manner. The *Florida* or *Zamia arrow-root* was found by Dr. Carson to consist of granules forming the half, third, or quarter of a solid sphere. The *potato starch* granules are of various shape and size, but generally ovate or elliptical, and from the 7000th to the 300th of an inch in length; the largest being inferior in size only to the largest of the canna starch or *tous-les-mois*. (See *Canna.*) They are strongly marked with concentric rings, and have a circular hilum, from which usually proceed the cracks observable in some of the larger grains. (*Pereira.*)

Medical Properties and Uses. Arrow-root is nutritious and demulcent, affording a light, very mild, and easily digested article of diet, well adapted for the sick and convalescent, and peculiarly suited, from its demulcent properties, to bowel complaints and diseases of the urinary passages. It is much used as food for infants after weaning, or when the mother's milk is insufficient. It is prepared by dissolving it in hot water, with which it forms a pearly gelatinous solution, and, if in sufficient quantity, a jelly-like mass on cooling. A tablespoonful will communicate sufficient consistence to a pint of water. It should first be formed into a paste with a little cold water, and the boiling water then gradually added with brisk agitation. The preparation may be rendered more palatable by lemon-juice and sugar, or in low forms of disease by wine and spices. For children, arrow-root is usually prepared with milk.

Off. Prep. Trochisci Ipecacuanhæ, *U. S.* W.

MARMOR. *U. S.*

Marble.

Native white granular carbonate of calcium. *U. S.*

Off. Syn. MARMOR ALBUM. *White Marble.* CaO,CO_2. Hard white crystalline native carbonate of lime, in masses. *Br.*

White Marble; Marbre, *Fr.;* Marmor, *Germ.;* Marmo, *Ital.;* Marmol, *Span.*

Marble is used for obtaining carbonic acid, and for making several officinal preparations. For the former purpose common marble is sufficiently pure; for the latter, the purer varieties must be selected.

The officinal marble is a white granular substance, having a sp. gr. varying from 2·7 to 2·8. It is brittle, pulverizable, and insoluble in water. It is wholly dissolved by dilute muriatic acid with effervescence. If magnesia be present, the neutral

muriatic solution will be precipitated by ammonia; and if baryta or strontia be an impurity, a similar effect will be produced by a solution of sulphate of calcium. When marble is exposed to a full red heat, it loses about 44 per cent. of carbonic acid, and is converted into lime. (See *Calx.*) In composition it agrees with chalk.

The purest kind of marble is that of *Carrara*, sometimes called *statuary marble;* but it is not necessary that this kind should be obtained for pharmaceutic operations. Marble, sufficiently pure for these purposes, is found in various parts of the United States. It is necessary, however, to reject the *dolomitic* marbles, which contain a considerable proportion of magnesia.

Marble is used in pharmacy, chiefly for furnishing carbonic acid gas.

Off. Prep. Aqua Acidi Carbonici, *U. S.;* Liquor Calcii Chloridi, *U. S.;* Potassæ Bicarbonas, *Br.;* Sodæ Bicarbonas, *Br.* B.

MARRUBIUM. *U. S.*

Horehound.

The leaves and tops of Marrubium vulgare. *U. S.*

Marrube blanc, *Fr.;* Weisser Andorn, *Germ.;* Marrubio, *Ital., Span.*

MARRUBIUM. *Sex. Syst.* Didynamia Gymnospermia.—*Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Calyx salver-shaped, rigid, ten-streaked. *Corolla* with the upper lip bifid, linear, and straight.

Marrubium vulgare. Willd. *Sp. Plant.* iii. 111; Woodv. *Med. Bot.* p. 332, t. 118. *White horehound* has a perennial fibrous root, and numerous annual stems, which are quadrangular, erect, very downy, and from twelve to eighteen inches high. The leaves are roundish-ovate, dentate or deeply serrate, wrinkled, veined, hoary on the under surface, and supported in pairs on strong footstalks. The flowers are white, and in crowded axillary whorls. The calyx is tubular, and divided at the margin into ten narrow segments, which are hooked at the end. The corolla is also tubular, with a labiate margin, of which the upper lip is bifid, the under reflected and three-cleft, with the middle segment broad and slightly scalloped. The seeds are four, in the bottom of the calyx. The plant is a native of Europe, but has been naturalized in this country, where it grows on the roadsides, and flowers in July and August.

The herb has a strong rather agréeable odour, which is diminished by drying, and lost by keeping. Its taste is bitter and durable. The bitterness is extracted by water and alcohol. It contains a volatile oil, bitter extractive, resin, tannin, and lignin.

Medical Properties and Uses. Horehound is tonic, in large doses laxative, and may be so given as to increase the secretion from the skin, and occasionally from the kidneys. It was formerly considered a valuable deobstruent, and recommended in chronic hepatitis, jaundice, amenorrhœa, phthisis, and various cachectic affections. By its gently tonic powers it may have proved advantageous in some of these complaints; but it exerts no specific influence over any, and has passed mainly from the hands of physicians into domestic use. It is employed chiefly in catarrh, and other chronic affections of the lungs, attended with cough and copious expectoration. The infusion made in the proportion of an ounce of the herb to a pint of boiling water may be given in wineglassful doses. The dose of the powder is from thirty grains to a drachm. The medicine is also much used in the shape of syrup and candy. W.

MASTICHE. *U. S., Br.*

Mastic.

The concrete resinous exudation from Pistacia Lentiscus. *U. S.* A resinous exudation obtained by incision from the stem of Pistacia Lentiscus, *Linn.* Produced in the island of Scio. *Br.*

Mastic, *Fr.;* Mastix, *Germ.;* Mastice, *Ital.;* Almastiga, *Span.;* Sakes, *Turk.;* Arah, *Arab.*

PISTACIA. *Sex. Syst.* Diœcia Pentandria.—*Nat. Ord.* Anacardiaceæ.

Gen. Ch. MALE. *Calyx* five-cleft. *Corolla* none. FEMALE. *Calyx* three-cleft. *Corolla* none. *Styles* three. *Drupe* one-seeded. *Willd.*

Pistacia Lentiscus. Willd. *Sp. Plant.* iv. 753; Woodv. *Med. Bot.* p. 26, t. 11. The *lentisk* is a shrub or small tree, seldom more than twelve feet in height, much branched towards the top, and furnished with petiolate, abruptly pinnate leaves. The leaflets are from eight to twelve, and usually alternate, with the exception of the two upper, which are opposite. They are ovate-lanceolate, entire, obtuse, often mucronate, and sessile upon the common footstalk, which has a narrow foliaceous expansion on each side. The flowers are diœcious, and very small. The male are in an axillary ament; the female are arranged alternately upon a common peduncle, which is also axillary. The tree is a native of the countries bordering upon the Mediterranean. The fruit yields by expression a fixed oil, of a deep-green colour, and liquid at about 90° F., which the Arabs of North Africa use both as an article of diet and for light. A resinous exudation from the stem and branches is the officinal part, but it does not appear to be collected in all places where the tree flourishes.

Mastic is obtained chiefly from the island of Scio or Chios, in the Grecian Archipelago, where the tree is cultivated for this product. Incisions are made in the trunk and principal branches, from which the juice slowly exudes, and either hardens in tears upon the bark, or drops on the ground, where it is received upon cloths, or the bare earth, and concretes in irregular masses. The tears are most esteemed. They are of various sizes, oval or roundish, often compressed, smooth, semi-transparent, of a pale-yellow colour, of a shining fracture, friable, and usually covered with a whitish powder, occasioned by their friction against each other. The masses consist of yellowish agglutinated tears, with others of a darker colour and less translucent, and often fragments of wood, bark, or earthy matter intermingled.*

Mastic is nearly inodorous, unless rubbed or heated, when it becomes fragrant. Its taste is weak, but agreeably terebinthinate, and, after long chewing, very slightly acrid. It is at first friable under the teeth, but soon becomes soft and ductile, and acquires a white opaque apppearance. Its sp. gr. is 1·074. It is fusible and inflammable by heat. Alcohol dissolves about four-fifths of it, leaving a viscid substance which becomes brittle when dried, and for which the name of *masticin* has been proposed. This substance, though not dissolved by alcohol, softens and swells up in it, as gluten does in water. According to Berzelius, it possesses the same general properties as copal, and should be considered as a variety of resin. Mastic is wholly soluble in ether, chloroform, and oil of turpentine, scarcely soluble in the fixed oils, and insoluble in water. It consists chiefly of resin, with *masticin*, and a minute proportion of volatile oil, which can scarcely be said to have been obtained in a separate state, though it imparts flavour to alcohol and water distilled from the mastic, especially when this has been previously triturated with an equal weight of carbonate of potassium.

Mastic is occasionally adulterated with olibanum, sandarach, and other resinous bodies; and, in seasons of scarcity, with sea-salt.

Medical Properties and Uses. Mastic was formerly thought to possess properties analogous to those of the turpentines, and was used in debility of the stomach, hæmoptysis from ulceration, leucorrhœa, chronic diarrhœa, &c.; but its virtues were overrated, and it is at present scarcely ever given internally. In the East, however, an aqueous infusion is said to be still used in infantile cholera; and the Greeks employ cataplasms made by mixing it with bread and red wine, which they apply to the lower abdomen. (*Landerer.*) It is sometimes employed to fill the cavities of carious teeth, for which purpose it is well fitted by its softness. Great quantities of it are consumed in Turkey, where it is habitually chewed by the women, under the

* In a more recent account by M. J. Léon Soubeiran, it is stated that the juice is obtained not only by incision, but by spontaneous exudation from the branches, where it concretes in drops, which, after hardening, are gathered under the name of tears, which constitute the most valued part of the drug. But the greater part of the resin comes from longitudinal incisions in the stem, made with a knife, close together, and extending from the root to the branches. In fifteen or twenty days, the resin has become concrete, and is collected in little paniers of white paper or cotton cloth. Great care is taken to prevent it from falling on the ground, and becoming soiled by the earth, and if any is thus soiled, it is immediately cleansed at the time of collection. (*Journ. de Pharm.*, Nov.-Dec. 1870, p. 359.)—*Note to the fourteenth edition.*

impression that it sweetens the breath, and preserves the gums and teeth. The alcoholic solution has been employed as a styptic in bleeding from the nose, leech-bites, &c., being applied by means of a camel's-hair pencil directly to the bleeding vessel. Dissolved in alcohol or oil of turpentine, it forms a brilliant varnish. A solution made by macerating half an ounce of mastic and fifteen grains of caoutchouc in two fluidounces of chloroform, and filtering in close vessels, forms a varnish highly esteemed by some microscopists.

The following mode of applying it to carious teeth has been recommended. Dissolve four parts of mastic in one of ether, in a bottle well stopped. With the solution thus formed, which is yellow and of an oily consistence, saturate a small piece of cotton of the size of the carious cavity, and, having well cleansed and dried the cavity, introduce the cotton, without painful pressure, so as to fill it exactly. The resin attaches itself to the diseased surface of the tooth, which it protects from the air, and from the food taken into the mouth.

Off. Prep. Pilulæ Aloës et Mastiches, *U. S.* W.

MATICO. *U. S.*

Matico.

The leaves of Artanthe elongata (*Miquel*). *U. S.*

Off. Syn. MATICÆ FOLIA. *Matico Leaves.* The dried leaves of Artanthe elongata *Miquel.* Imported from Peru. *Br.*

ARTANTHE. *Sex. Syst.* Diandria Trigynia.—*Nat. Ord.* Piperaceæ.

Gen. Ch. Spikes solitary, opposite the leaves. *Flowers* hermaphrodite. *Style* none. *Bractes* peltate or cucullate. *Miquel.*

This genus, separated by Miquel from Piper, is very extensive, embracing nearly a hundred species diffused through South and Central America. At least two of these have contributed to furnish their products to commerce; but it is to the A. elongata exclusively that the medicine called matico has been officinally ascribed.*

Artanthe elongata. Miquel; Lindley, *Med. and Œconom. Bot.* p. 133, fig. 195. —*Piper angustifolium.* Ruiz and Pavon, *Flor. Peruv.*—*Piper elongatum.* Vahl. This is a shrub with a jointed stem about twelve feet in height. In a dried specimen received from Dr. Ruschenberger, of the U. S. Navy, the leaves are sessile or very shortly petiolate, oval-lanceolate, acuminate, two or three inches long by about an inch in breadth, bright-green on the upper surface, paler and downy beneath, crenate, minutely and strongly reticulated, of an agreeable aromatic odour, and a strong spicy taste. The spikes are solitary, opposite the leaves, and cylindrical. The bractes are peltate or cucullate; the flowers hermaphrodite. The plant is a native of Peru.

The leaves, spikes, and stalks are mixed together, and more or less compressed, in the packages of the imported drug; and are all possessed of activity, though the leaves only are recognised by the Pharmacopœias. Their shape and general aspect have been described above, as well as their smell and taste. They are readily pulverized, forming a light, greenish, absorbent powder. According to Dr. Hodges, they contain chlorophyll, a soft dark-green resin, brown and yellow colouring mat-

* *Ava. Kava.* The root of another species of the old genus Piper, *P. methysticum* (*Macropiper methysticum,* Miquel), is used in the Sandwich Islands to form an intoxicating drink, under the name of *ava, kava,* or *kawa.* See an article by Mr. Morson in the *Pharm. Journ. and Trans.* (iii. 472), where the plant is figured. M. Gobley has discovered in this root a crystalline principle analogous to piperin which he calls *methysticin,* and which, possessing neither odour nor taste, is probably inert. He found also a greenish-yellow resin, of a strong aromatic smell, and an acrid pungent taste, to which he ascribes the powers of the root. (*Journ. de Pharm.,* Janv. 1860, p. 20.) The priority of this discovery having been disputed by M. Cuzent, the question was referred by the Society of Pharmacy of Paris to a committee, who, after investigating the subject, ascertained that the priority of the discovery was in fact due to Mr. Morson of London, who had announced it so early as 1844; though both the other chemists were ignorant of this fact. The name of *kawine* has been proposed for the acrid resin supposed to be the active principle of the kava. The root contains also a volatile oil, which probably participates with the resin in its effects. (*Ibid.,* Mars, 1862, p. 215.) It is said to be an excellent remedy in gonorrhœa (*Ann. de Thérap.,* 1857, p. 61); and a tincture of it has been recently strongly recommended by Dr. E. W. Pritchard, used internally and locally, as a remedy in gout. (*Med. Times and Gaz.,* Dec. 1854, p. 591.)

ters, gum, salts, lignin, a light-green, thickish volatile oil, and a peculiar bitter principle, soluble in water and alcohol, but not in ether, which he calls *maticin*. (*Philos. Mag.*, Sept. 1844, p. 206.) According to Mr. Wiegand, the maticin of Dr. Hodges is a salt of potassa. Mr. John J. Stell, who examined the drug in the expectation of discovering a principle analogous to cubebin or piperin, failed in the attempt. He found, however, the resin to be very acrid and pungent, and reasonably inferred that the virtues of matico reside in it and the volatile oil. (*Am. Journ. of Pharm.*, Sept. 1858, p. 392.)

Medical Properties and Uses. Matico is an agreeable aromatic tonic and stimulant, having a tendency, like cubebs, to act on the urinary passages. It has long been known as a medicine in Peru. Dr. Martius speaks of its use by the natives externally as a vulnerary, and internally as aphrodisiac. (*Pharm. Cent. Blatt*, 1843, p. 12); and, according to Dr. Scrivener, who practised medicine at Lima, it is much employed in Peru locally for arresting hemorrhage, and in the treatment of ulcers. (*Am. Journ. of Pharm.*, xviii. 175.) In 1839 it was taken to England, and was prescribed by Dr. Jeffreys, of Liverpool, with advantage, in diseases of the mucous membranes; as gonorrhœa, leucorrhœa, menorrhagia, catarrh of the bladder, hemorrhoids, and epistaxis. Others have employed it with benefit in similar cases and in diarrhœa; and it is said to have proved useful in hæmoptysis, hæmatemesis, dysentery, and hæmaturia. Dr. Ruschenberger gives strong testimony in its favour in several of the diseases mentioned. Its most useful internal application is probably as an alterative stimulant to the diseased mucous membranes. If efficient as a hæmostatic, it must be on principles similar to those upon which oil of turpentine acts; for it is not astringent. As a local styptic it probably acts mechanically in the same manner as agaric. The dose of the powder is from half a drachm to two drachms three times a day. The infusion and fluid extract are officinal.

Prof. Bentley, of London, describes a new variety of matico, brought from a port of Central America, consisting of broken leaves, spikes, and branches, which he referred to another species of the same genus, *Artanthe adunca*, growing in the W. Indies and various parts of S. America. The medicine is distinguishable from the genuine, by the want of the reticulated upper surface and downy under surface which characterize the latter. Prof. Bentley found the sensible properties of the new variety very similar to the old, and assumes that in medicinal virtues the two are nearly identical. (*Pharm. Journ.*, Jan. 1864, p. 290.)

Off. Prep. Infusum Maticæ, *Br.;* Extractum Matico Fluidum, *U. S.* W.

MATRICARIA. *U. S.*

German Chamomile.

The flowers of Matricaria Chamomilla. *U. S.*

Matricaria. *Sex. Syst.* Syngenesia Superflua.—*Nat. Ord.* Compositæ-Senecionideæ, *De Cand.* Asteraceæ, *Lindley.*

Gen. Ch. Calyx flat, imbricate, with scales having scarious margins. *Receptacle* naked, terete. *Pappus* none.

Matricaria Chamomilla. Linn. *Sp.* 1256. This is an annual plant, with a branching stem a foot or two in height, bearing alternate leaves about two inches long, the lower ones tripinnate, the upper bipinnate or simply pinnate, and all of them very green, and nearly or quite smooth. The leaflets are linear and very small. The flowers appear singly at the ends of the stem and branches. They are about three-quarters of an inch in diameter, with the ray spreading. The scales of the calyx are obtuse, green in the middle, and whitish, membranous, and translucent at the margin. The ray florets are white, at first spreading, and ultimately reflected. The disk is of a deep-yellow colour, at first flat, but in the end convex, and even somewhat conical.

The plant is a native of Europe, and is occasionally cultivated in our gardens. All parts of it are active; but the flowers only are officinal. These shrink in drying, so that they are scarcely half as large as in their recent state. Those found in our shops are imported from Germany.

The dried flowers of the Matricaria are considerably smaller than common chamomile, and exhibit a larger proportion of the disk florets compared with those of the ray. They have a strong, peculiar, rather unpleasant odour, and a disagreeable bitter taste. Their active constituents are volatile oil and bitter extractive, which are readily taken up by water and alcohol. The oil, which is obtained by distillation with water, is thick, somewhat tenacious, of a fine deep-blue colour becoming brown by age, and almost opaque in mass. Though supposed by Gerhardt to be identical with the oil of the proper chamomile (Anthemis nobilis), it has been shown to be distinct. (*Pharm. Journ.*, Feb. 1862, p. 429.) It congeals at —4° F. Diluted muriatic and nitric acids render it green, concentrated sulphuric acid reddish-yellow, chlorine yellowish-white and tenacious, iodine reddish-brown and thick, and bromine brown and elastic. (See *Am. Journ. of Pharm.*, March, 1864, p. 109.)

Medical Properties and Uses. Matricaria is a mild tonic, very similar to chamomile in medical properties, and, like it, capable, in large doses, of producing an emetic effect. It is esteemed also in Europe antispasmodic and anthelmintic. It is much employed in Germany; but in this country scarcely at all, unless by German practitioners. It may be given for the same purposes and in the same manner as chamomile. W.

MEL. *U.S., Br.*

Honey.

A saccharine liquid prepared by Apis mellifica. *U.S.* A saccharine secretion deposited in the honey-comb by Apis mellifica (*Linn.*), the hive bee. *Br.*

Miel, *Fr.;* Honig, *Germ.;* Miele, *Ital.;* Miel, *Span.*

Naturalists have not yet determined whether honey is a secretion of the bee, *Apis mellifica*, or whether it exists already formed in plants. It is certain that the nectaries of flowers contain a saccharine matter, which is extracted by the insect; and the fact is well known that the flavour and character of honey are very much affected by the nature of the plants which predominate in the vicinity of the hive; so much so that, when these plants are poisonous, the fluid sometimes partakes of their noxious qualities. Several cases of poisoning from eating honey from a particular source, are recorded in the *New Jersey Med. Reporter* for November, 185? (p. 46). Still, it probably undergoes change in the organs of the bee; as the saccharine matter of the nectaries, so far as it has been possible to examine it, wants some of the characteristic properties of honey.*

* *Propolis. Bee-bread.* The subjects considered in the present note would probably have been more properly treated under the head of Cera; but the observations recently made in the journals in relation to them did not come under the notice of the author until too late for insertion there. The object of this note is to call attention to two communications contained in the journals of the past and present years.

Propolis. In the *Med. and Surg. Reporter* for Nov. 2, 1867 (p. 382), extracted from the *Chicago Med. Journ.*, is a short paper by Dr. H. O. Hitchcock, of Kalamazoo, Michigan, giving an account of his experience with propolis as a remedy. This is a resinous substance, deposited by bees at the base of the hive, and in other parts which required protection from the outer air, of a nature entirely different from wax or honey, and supposed to be intended for the protection of the comb from injurious external agencies. Dr. Hitchcock considers it as one of the best remedies in simple mucous diarrhœa, even when severe, and attended with pain and vomiting. In many cases only a single dose is required. It appears to possess anodyne and soporific properties. He has found it also efficacious in dysentery in the early stage; but it has proved useless in the disease when fully established. In chronic diarrhœa, even of the kind contracted in camp, and remarkable for its obstinacy, it has seemed to act like a charm. It is of a dark reddish or yellowish brown colour, of a shining fracture, an aromatic taste and smell, quite insoluble in water, nearly so in ether, but readily dissolved by alcohol and solution of potassa. Dr. Hitchcock has used both a tincture and an alkaline solution; the former made with two drachms of propolis and four fluidounces of alcohol, and given to adults in doses of from thirty minims to a fluidrachm; the latter with two drachms of the resin to a fluidrachm of liquor potassæ and four fluidounces of a menstruum consisting of equal parts of water and simple syrup, and given in the dose of half a fluidrachm after each stool.

Bee-bread. This was brought to notice in the *Chicago Med. Examiner* (Sept. 1865) by Dr. Jas. S. Whitmire, who was led accidentally to the discovery of its possession of extraordinary diuretic powers. Trying the remedy upon himself, in the dose of a drachm three times a day, he found a great increase of the secretion produced; and, continuing to take it in the same quantities for a week, he passed during that time from four to six pints of urine daily. The effect was greatest during exercise in the open air; within-doors, the quantity per day was lessened by a pint or a

The finest honey is that which is allowed to drain from the comb. If obtained from hives that have never swarmed, it is called *virgin honey*. An inferior kind is procured by submitting the comb to pressure; and, if heat be employed previous to expression, the product is still more impure.

Honey is collected in different parts of the United States; but much also of that used in the shops is imported from the West Indies.

In the recent state honey is fluid; but, on being kept, it is apt to form a crystalline deposit, and to be ultimately converted into a soft granular mass. In the shops it is found of every consistence, from that of a viscid liquid like thin syrup or oil, to that of lard or soft suet. Its colour is sometimes white, but usually yellowish, and occasionally of a brown or reddish tinge. It has a peculiar agreeable odour, varying somewhat with the flowers from which it was collected, and a very sweet, feebly aromatic taste, which is followed by a slight prickling, or sense of acrimony in the fauces. Its sp. gr. is about 1·333. (*Duncan.*) Cold water dissolves it readily, alcohol with less facility. It contains crystallizable sugar analogous to that of grapes, and, according to Soubeiran, two other kinds of sugar, one of which is changed by acids, and has the property of turning to the right the plane of polarization; and the other, not acted on by acids, and possessed of a strong left-handed rotating power. The first of these two sugars is not always present; as there is reason to believe that it is in time wholly changed by acid into granular sugar. It is especially abundant in the honey taken from the comb. The second variety is very similar to the uncrystallizable sugar produced by the reaction of acids on cane sugar, being identical with it in composition, and like it incapable of crystallizing, and very sensitive to the action of alkalies. But it is distinguished by the impossibility of converting it into granular sugar, and by having nearly twice the rotating power of common uncrystallizable sugar. (*Journ. de Pharm.*, 3e sér., xvi. 252.) Honey contains, besides these saccharine principles, an aromatic principle, an acid, wax, and, according to Guibourt, a little mannite. The crystalline sugar may be obtained by treating granular honey with a small quantity of alcohol, which, when expressed, takes along with it the other ingredients, leaving the crystals nearly untouched. The same end may be attained by melting the honey, saturating its acid with carbonate of calcium, filtering the liquid, then setting it aside to crystallize, and washing the crystals with alcohol. Inferior honey usually contains a large proportion of uncrystallizable sugar and vegetable acid. Diluted with water, honey undergoes the vinous fermentation.

In warm weather, honey, if not very pure, sometimes ferments, acquiring a pungent taste and deeper colour. Starch is said to be occasionally added to the inferior kinds to give them a white appearance. The adulteration may be detected by dilution with water, which dissolves the honey and leaves the starch at the bottom of the vessel. The nature of the deposit may be tested by the tincture of iodine. Water is said to be sometimes added to honey to increase its bulk. Its presence may be suspected from the greater thinness of the liquid, and its want of disposition to crystallize.

Medical Properties and Uses. Honey possesses the same medical properties with sugar, but is more disposed to run off by the bowels, and to occasion griping pain. Though largely consumed as an article of food, it is seldom employed medicinally, except as the vehicle of more active substances. Its taste and demulcent qualities render it a useful addition to gargles; and it is sometimes employed as an application to foul ulcers, and in the form of enema.

Off. Prep. Mel Depuratum, *Br.;* Mel Despumatum, *U. S.* W.

pint and a half. He extended the experiment to his children, with the same result. No disagreeable effects followed its use, unless a slight flatulency and looseness of the bowels. It is entirely palatable and inoffensive to the stomach. (See *Am. Journ. of Pharm.*, Jan. 1866, p. 56.) Bee-bread is the name given to a material found in some of the cells of the comb, consisting mainly of the pollen of plants; and supposed to be intended specially for the food of the young bees, and necessary for their development. (*Note to the thirteenth edition.*)

MELISSA. *U.S. Secondary.*

Balm.

The leaves and tops of Melissa officinalis. *U.S.*

Mélisse, *Fr.;* Garten-Melisse, *Germ.;* Melissa, *Ital.;* Torongil, *Span.*

MELISSA. *Sex. Syst.* Didynamia Gymnospermia.—*Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Calyx dry, nearly flat above; with the upper lip sub-fastigiate. *Corolla*, upper lip somewhat arched, bifid; lower lip with the middle lobe cordate. *Willd.*

Melissa officinalis. Willd. *Sp. Plant.* iii. 146; Woodv. *Med. Bot.* p. 334, t. 119. Balm has a perennial root, which sends up annually several erect quadrangular stems, usually branched towards the base, and a foot or two in height. The leaves are opposite, ovate or cordate, deeply serrate, pubescent; the lower on long footstalks, the uppermost nearly sessile. The flowers are white or yellowish, upon short peduncles, and in axillary whorls, surrounding only half the stem. The calyx is tubular, pentangular, and bilabiate, with the upper lip tridentate and flattened, the lower cut into two pointed teeth. The corolla is also tubular and bilabiate, the upper lip less convex and notched, the lower three-cleft. The plant is a native of the south of Europe. It has been introduced into this country, where it is cultivated in gardens, and grows wild along the fences of our roads and lanes. For use the herb should be cut before the appearance of the flowers, which begin to expand in July.

In the fresh state, it has a fragrant odour very similar to that of lemons; but is nearly inodorous when dried. The taste is somewhat austere, and slightly aromatic. The herb contains a minute proportion of a yellowish or reddish-yellow essential oil, which has its peculiar flavour in a very high degree. It contains also tannin, bitter extractive, and gum.

Medical Properties and Uses. Balm scarcely produces any remedial effects upon the system. The quantity of oil which it contains is not more than sufficient to communicate an agreeable flavour to the infusion, which forms an excellent drink in febrile complaints, and when taken warm tends to promote the operation of diaphoretic medicines. W.

MENTHA PIPERITA. *U.S.*

Peppermint.

The leaves and tops of Mentha piperita. *U.S.*

Menthe poivrée, *Fr.;* Pfeffermünze, *Germ.;* Menta piperita, *Ital.;* Pimenta piperita, *Span.*

MENTHA. *Sex. Syst.* Didynamia Gymnospermia.—*Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Corolla nearly equal, four-cleft; the broader segment emarginate. *Stamens* upright, distant. *Willd.*

Several species of Mentha possess medicinal properties. Besides the two here described, M. piperita, namely, and M. viridis, the *Mentha Pulegium*, under the name of *pulegium* or *pennyroyal*, long held a place in the British Pharmacopœias. It has, however, been discarded, and in the present Br. Pharmacopœia is not recognised. As in the other species, the herb in flower was employed, both fresh and dried. The plant is specifically characterized by its roundish prostrate stems, its ovate, obtuse, somewhat crenate leaves, and its verticillate flowers. It is a native of Europe, and neither cultivated nor employed in this country; our native pennyroyal belonging to a different genus. (See *Hedeoma Pulegioides.*) Pulegium possesses similar properties, and has been employed for the same purposes, and in the same manner with the other mints. It was used in the forms of water, spirit, and volatile oil.

Mentha piperita. Willd. *Sp. Plant.* iii. 79; Woodv. *Med. Bot.* p. 336, t. 120; Carson, *Illust. of Med. Bot.* ii. 16, pl. 63. Peppermint is a perennial herbaceous plant, with a creeping root, and quadrangular, channeled, purplish, somewhat hairy stems, branched towards the top, and about two feet in height. The leaves are opposite, petiolate, ovate, serrate, pointed, smoother on the upper than the under surface,

and of a dark-green colour, which is paler beneath. The flowers are small, purple, and in terminal obtuse spikes, interrupted below. The calyx is tubular, furrowed, and five-toothed; the corolla is also tubular, with its border divided into four segments, of which the uppermost is broadest, and notched at its apex. The anthers are concealed within the tube of the corolla; the style projects beyond it, and terminates in a bifid stigma. The four-cleft germ is converted into four seeds, which are lodged in the calyx.

This species of mint is a native of Great Britain, whence it has been conveyed to the continent of Europe and to this country. In some parts of the United States, especially in New England and Michigan,* the western part of New York, Ohio, and New Jersey, it is largely cultivated for the sake of its volatile oil. We occasionally find it growing wild along the fences of our villages. The cultivators of this herb have observed that, in order to maintain its flavour in perfection, it is necessary to transplant the roots every three years. It should be cut for medical use in dry weather, about the period of the expansion of the flowers. These appear in August.

The herb, both in the recent and dried state, has a peculiar, penetrating, grateful odour. The taste is aromatic, warm, pungent, glowing, camphorous, bitterish, and attended with a sensation of coolness when air is admitted into the mouth. These properties depend on a volatile oil, which abounds in the herb, and may be separated by distillation with water. (See *Oleum Menthæ Piperitæ.*) The leaves are said to contain a little tannic acid. The virtues of the herb are imparted to water, and more readily to alcohol.

Medical Properties and Uses. Peppermint is a grateful aromatic stimulant, much used for all the purposes to which medicines of this class are applied. To allay nausea, relieve spasmodic pains of the stomach and bowels, expel flatus, and cover the taste or qualify the nauseating or griping effects of other medicines are among the most common of these purposes. The fresh herb, bruised and applied to the epigastrium, often allays sick stomach, and is useful in the cholera of children. The medicine may be given in infusion; but the volatile oil, either alone, or in some state of preparation, is generally preferred.

Off. Prep. Aqua Menthæ Piperitæ, *U. S.;* Oleum Menthæ Piperitæ; Spiritus Menthæ Piperitæ, *U. S.* W.

MENTHA VIRIDIS. *U. S.*

Spearmint.

The leaves and tops of Mentha viridis. *U. S.*

Menthe à épi, *Fr.;* Grune Münze, *Germ.;* Menta Romana, *Ital.;* Yerba buena puntiaguda, *Span.*

MENTHA. See MENTHA PIPERITA.

Mentha viridis. Willd. *Sp. Plant.* iii. 76; Woodv. *Med. Bot.* p. 338, t. 121. Spearmint, sometimes called simply *mint*, differs from *M. piperita* chiefly in having sessile or nearly sessile, lanceolate, naked leaves; elongated, interrupted, panicled spikes; setaceous bractes; and stamens longer than the tube of the corolla. Like the preceding species, it is a native of Europe. In this country it is cultivated in gardens for domestic use, and in some places more largely for the sake of its oil. It also grows wild in low grounds, in long-settled parts of the country. Its flowering season is August. According to Thomson, it should be cut in very dry weather, and, if intended for medical use, just as the flowers appear; if for obtaining the oil, after they have expanded.

* For an account of the cultivation of the plant in Michigan, from one county of which, that of St. Joseph, it is stated that, "for the last ten years, the largest proportion of the oil of peppermint, produced in the world, has been sent," see a paper by Mr. Frederick Stearns, of Detroit, in the *Am. Journ. of Pharm.*, Jan. 1859, p. 33.

For some interesting remarks in relation to the cultivation of peppermint in England, the reader is referred to the *Am. Journ. of Pharm.* (xxiii. 239).

This plant has recently become an object of special culture in France, and a pamphlet by M. Roze is devoted to the history of this industry, both in its agricultural and pharmaceutical relations. The reader is referred to the *Journ. de Pharm. et de Chim.* (Août, 1868, p. 125) for an abstract of the more interesting facts recorded in the work. (*Note to the thirteenth edition.*)

The odour of spearmint is strong and aromatic, the taste warm and slightly bitter, less pungent than that of peppermint, but considered by some as more agreeable. These properties are retained for some time by the dried plant. They depend on a volatile oil, which is obtained by distillation, and is imparted to alcohol and water by maceration. (See *Oleum Menthæ Viridis.*)

Medical Properties. The virtues and applications of this plant are the same as those of peppermint.

Off. Prep. Aqua Menthæ Viridis, *U. S.;* Oleum Menthæ Viridis; Spiritus Menthæ Viridis, *U. S.* W.

MEZEREUM. *U. S.*

Mezereon.

The bark of Daphne Mezereum, and of Daphne Gnidium. *U. S.*

Off. Syn. MEZEREI CORTEX. *Mezereon Bark.* The dried bark of Daphne Mezereum (*Linn.*), *Mezereon;* or of Daphne Laureola (*Linn.*), *Spurge Laurel. Br.* Bois gentil, *Fr.;* Kellerhals, *Germ.;* Mezereo, *Ital.;* Mecereon, *Span.*

DAPHNE. *Sex. Syst.* Octandria Monogynia.—*Nat. Ord.* Thymelaceæ.

Gen. Ch. Calyx none. *Corolla* four-cleft, withering, enclosing the stamens. *Drupe* one-seeded. *Willd.*

All the species of Daphne are possessed of active properties; but three only are officinal—*D. Mezereum*, *D. Laureola*, and *D. Gnidium*—the first two of which are recognised in the British Pharmacopœia, the last in the French Codex, and the first and last in the Pharmacopœia of the United States.

1. *Daphne Mezereum.* Willd. *Sp. Plant.* ii. 415; Woodv. *Med. Bot.* p. 717, t. 245, Carson, *Illust. of Med. Bot.* ii. 26, pl. 72. This is a very hardy shrub, three or four feet high, with a branching stem, and a smooth dark-gray bark, very easily separable from the wood. The leaves spring from the ends of the branches, are deciduous, sessile, obovate-lanceolate, entire, smooth, of a pale-green colour, somewhat glaucous beneath, and about two inches long. They are preceded by the flowers, which appear very early in spring, and sometimes bloom even amidst the snow. These are of a pale-rose colour, highly fragrant, and disposed in clusters, each consisting of two or three flowers, forming together a kind of spike at the upper part of the stem and branches. At the base of each cluster are deciduous floral leaves. The fruit is oval, shining, fleshy, of a bright-red colour, and contains a single round seed. Another variety produces white flowers and yellow fruit.

This species of Daphne is a native of Great Britain and the neighboring continent, in the northern parts of which it is particularly abundant. It is cultivated in Europe both for medicinal purposes and as an ornamental plant, and is occasionally found in our own gardens. It flowers in February, March, or April, according to the greater or less mildness of the climate.

2. *Daphne Gnidium.* Willd. *Sp. Plant.* ii. 420. In this species, called *garou* or *sain-bois* by the French, the leaves are linear-lanceolate, acute, entire, smooth, and irregularly but closely set upon the branches. The flowers are white, downy, odoriferous, and disposed in terminal panicled racemes. The fruit is globular, dry, at first green, but ultimately black. *D. Gnidium* grows in dry uncultivated places in the south of Europe, and flowers in June. In France its bark is used indiscriminately with that of the former species.

Besides the species above described, *Daphne Laureola*, or *spurge laurel*, is said to furnish a portion of the mezereon of commerce, and is recognised by the Br. Pharmacopœia; but its product is inferior in acrimony, and consequently in medicinal activity.

The bark of the root was formerly directed; but the mezereon with which our markets are supplied is evidently the bark of the stem; and the Pharmacopœias at present very properly direct the bark, without designating the part from which it must be taken. British writers state that the bark of the root is the most active. The berries and leaves of the plant are also active; and the former have sometimes proved fatal to children who have eaten them. Pallas states that they are used as a pur-

gative by the Russian peasants, and that thirty berries are required to act. French authors observe that fifteen are sufficient to kill a Frenchman. A tincture of them is used in Germany as a local application in neuralgia. (*Ann. de Thérap.*, 1854, p. 42.) Mezereon is brought to us chiefly from Germany.

Properties. Mezereon, as it comes to us, is usually in strips, from two to four feet long and an inch or less in breadth, sometimes flat, sometimes partially rolled, and always folded in bundles, or wrapped in the shape of balls. It is covered externally with a grayish or reddish-brown wrinkled epidermis, very thin, and easily separable from the bark. Beneath the epidermis is a soft, greenish tissue. The inner bark is tough, pliable, fibrous, striated, and of a whitish colour. When fresh it has a nauseous smell, but in the dry state is nearly inodorous. Its taste is at first sweetish, but afterwards highly acrid and even corrosive. It yields its virtues to water by decoction.

Vauquelin discovered a peculiar principle in the bark of *Daphne Alpina*. This has subsequently been found in other species, and has received the name of *daphnin*. Gmelin and Bär found it in the bark of *D. Mezereum*, associated with wax, an acrid resin, a yellow colouring matter, reddish-brown extractive, an uncrystallizable and fermentable sugar, a gummy matter containing azote, ligneous fibre, malic acid, and several malates. By J. B. Eng it has been discovered, together with a volatile oil, in the flowers of Daphne Mezereum. (*Wittstein's Viert. Schr.*, viii. 23.) *Daphnin* is in prismatic crystals grouped together, colourless, transparent, brilliant, slightly soluble in cold water, very soluble in boiling water and alcohol, without odour, and of a bitter, somewhat austere taste. By Zwenger it is said to be insoluble in ether. The same chemist states that it has an acid reaction, and acts like the glucosides, being resolvable by sulphuric or muriatic acid into sugar, and a peculiar crystallizable principle called *daphnetin*. He gives for daphnin the formula $C_{62}H_{34}O_{38}+8HO$. (*Annal. der Chem. und Pharm.*, cxv. 1.) It is obtained by treating the alcoholic extract of the bark with water, decanting the solution, precipitating with subacetate of lead, filtering, decomposing the excess of the subacetate by sulphuretted hydrogen, again filtering, evaporating to dryness, submitting the residue to the action of anhydrous alcohol, and evaporating the alcoholic solution to the point of crystallization. Though daphnin is probably not inert, it is not the principle upon which the virtues of mezereon chiefly depend. Vauquelin thinks that in the recent plant they reside in an essential oil, which by time and exposure is changed into a resin, without losing its activity. The acrid resin, observed by Gmelin and Bär, is probably the characteristic principle to which the bark owes its vesicating properties. It is obtained separate by boiling mezereon in alcohol, allowing the liquor to cool in order that it may deposit some wax which it has taken up, then distilling off the alcohol, and treating the residue with water, which leaves the resin. This is of a dark-green, almost black colour, hard and brittle, and of an exceedingly acrid and permanent taste. In the isolated state, it is slightly soluble in water; and it is much more so, when combined with the other principles of the bark. It appears, however, not to be a pure proximate principle, but rather a resinoid combination of an acrid fixed oil with another substance. The acrid principle of mezereon is partially given off by decoction with water, as proved by the irritating character of the vapour when inhaled; but none of it appears to escape when the bark is boiled with alcohol. (Squire, *Pharm. Transact.*, i. 395.)

Medical Properties and Uses. The recent bark applied to the skin produces inflammation followed by vesication, and has been popularly used as an epispastic, from time immemorial, in some of the southern countries of Europe. The dried bark, though less active, is possessed of a similar property, and is occasionally employed in France by regular practitioners for the purpose of forming issues. A small square piece, moistened with vinegar, is applied to the skin, and renewed twice a day till a blister is formed, and occasionally afterwards to keep up the discharge. It is slow in its operation, generally requiring from twenty-four to forty-eight hours to vesicate. An irritant ointment is prepared from mezereon, which is used for maintaining the discharge from blistered surfaces, and may be applied advantageously to obstinate, ill-conditioned, indolent ulcers. In the U. S. Pharmacopœia of 1850, it

was directed to be made by digesting the bark with melted lard, and straining; but was discarded at the succeeding revision of that work. This, we think, was unfortunate; for, though the method of preparing it was defective, another might have been adopted, which would have yielded a good preparation; and an irritating ointment of the kind is needed. At the recent revision of the Pharmacopœia, the propriety of this observation was recognized, and an ointment was directed to be prepared from the fluid extract of mezereon, which is unobjectionable. An alcoholic extract has also been employed to communicate irritant properties to issue peas.

Internally administered, mezereon is a stimulant capable of being directed to the skin or kidneys, and in large doses apt to excite purging, nausea, and vomiting. In overdoses it produces the fatal effects of the acrid poisons; and a case of apparently severe narcotic effects has been recorded. (*Am. Journ. of Med. Sci.*, xxi. 518.) It had at one time much reputation as a remedy in the secondary stages of syphilis, and still enters as an ingredient into the officinal compound decoction of sarsaparilla. It has also been thought to act favourably as an alterative in scrofulous affections, chronic rheumatism, and obstinate diseases of the skin. For this purpose it is usually administered in decoction. (See *Decoctum Mezerei.*) Dr. Withering cured a case of difficult swallowing from palsy, by directing the patient to chew frequently small pieces of the root. The dose of the bark in substance is ten grains; but it is seldom used in this way.

Off. Prep. Decoctum Sarsæ Compositum, *Br.;* Decoct. Sarsaparillæ Compositum, *U. S.;* Extractum Mezerii Æthereum, *Br.;* Extractum Mezerii Fluidum, *U. S.;* Extractum Sarsaparillæ Compositum Fluidum, *U. S.;* Unguentum Mezerii, *U. S.* W.

MICA PANIS. *Br.*

Crumb of Bread.

The soft part of bread made with wheat flour. *Br.*

Off. Prep. Cataplasma Carbonis. *Br.* See FARINA.

MONARDA. *U. S.*

Horsemint.

The leaves and tops of Monarda punctata. *U. S.*

MONARDA. *Sex. Syst.* Diandria Monogynia.— *Nat. Ord.* Lamiaceæ or Labiatæ. *Gen. Ch. Calyx* five-toothed, cylindric, striate. *Corolla* ringent, with a long cylindric tube; *upper lip* linear, nearly straight and entire, involving the filaments; *lower lip* reflected, broader, three-lobed, the middle lobe longer. *Nuttall.*

Monarda punctata. Willd. *Sp. Plant.* i. 126; *Am. Med. Recorder*, vol. ii. p. 496. This is an indigenous perennial or biennial plant, with herbaceous, obtusely angled, downy, whitish, branching stems, rising one or two feet in height, and furnished with oblong-lanceolate, remotely serrate, smooth punctate leaves. The flowers are yellow, spotted with red or brown, and disposed in numerous whorls, provided with lanceolate, coloured bractes, longer than the whorl.

The horsemint grows in light gravelly or sandy soils from New Jersey to Louisiana, and flowers from June to September. The whole herb is employed. It has an aromatic smell, and a warm, pungent, bitterish taste, and abounds in a volatile oil, which may be separated by distillation with water.

Medical Properties and Uses. Horsemint is stimulant and carminative; but is seldom used in regular practice. In the state of infusion it is occasionally employed in families as a remedy for flatulent colic and sick stomach, and for other purposes to which the aromatic herbs are applied. It was introduced into the primary catalogue of the U. S. Pharmacopœia, on account of the volatile oil which it affords. (See *Oleum Monardæ.*)

Off. Prep. Oleum Monardæ, *U. S.* W.

MORI SUCCUS. *Br.*

Mulberry Juice.

The juice of the ripe fruit of Morus nigra (*Linn.*). *Br.*

Mures, *Fr.;* Schwarze Maulbeeren, *Germ.;* Morone, *Ital.;* Moras, *Span.*

Morus. *Sex. Syst.* Monœcia Tetrandria.—*Nat. Ord.* Urticaceæ.

Gen. Ch. Male. *Calyx* four-parted. *Corolla* none. Female. *Calyx* four-leaved. *Corolla* none. *Styles* two. *Calyx* berried. *Seed* one. *Willd.*

Morus nigra. Willd. *Sp. Plant.* iv. 36; Woodv. *Med. Bot.* p. 712, t. 243. This species of Mulberry is distinguished by its cordate-ovate or lobed, unequally toothed, and scabrous leaves. It is a tree of middle size, supposed to have been brought originally from Persia into Italy, and thence spread over Europe and America. Its leaves afford food for the silk-worm; and the bark of the root, which is bitter and slightly acrid, has been employed as a vermifuge, especially in cases of the tape-worm, in the dose of two drachms infused in eight ounces of boiling water. The juice of the fruit is the officinal portion.

The fruit is oblong-oval, of a dark reddish-purple almost black colour, and consists of numerous minute berries, united together and attached to a common receptacle, each containing a single seed, the succulent envelope of which is formed by the calyx. It is inodorous, has a sweet, mucilaginous, acidulous taste, and abounds in a deep-red juice. The sourish taste is owing, according to Hermbstadt, to the presence of tartaric acid.

Medical Properties and Uses. Mulberries are refreshing and laxative, and serve to prepare a grateful drink well adapted to febrile cases. A syrup is made from their juice, and used as an agreeable addition to gargles in inflammation of the throat. They are, however, more used as food than medicine. Our native mulberry, the fruit of *Morus rubra*, is quite equal to that of the imported species. *Morus alba*, originally from China, and now extensively cultivated as a source of food for the silk-worm, bears a white fruit, which is sweeter and less grateful than the others.

Off. Prep. Syrupus Mori, *Br.* W.

MOSCHUS. *U. S., Br.*

Musk.

A peculiar concrete secretion obtained from Moschus moschiferus. *U. S.* The inspissated and dried secretion from the preputial follicles. *Br.*

Musc, *Fr.;* Bisam, *Germ.;* Muschio, *Ital.;* Almizcle, *Span.*

Moschus. *Class* Mammalia. *Order* Pecora.

Gen. Ch. Horns none. *Fore teeth* eight in the lower jaw. *Tusks* one on each side, in the upper jaw, projecting out of the mouth.

Moschus moschiferus. Gmelin, *Syst. Nat.* i. 172; Reese's *Cyclopædia.* This animal bears a close resemblance to the deer in shape and size. It is usually about three feet in length and two feet high, with haunches considerably more elevated than the shoulders. From its upper jaw two tusks project downwards out of the mouth, each about two inches long, curved backwards, and serving to extract the roots which are used as food by the animal. The ears are long and narrow, and the tail very short. The fleece, consisting of strong, elastic, undulated hairs, varies in colour with the season, the age of the animal, and perhaps the place which it inhabits. The general colour is a deep iron-gray. The individual hairs are whitish near the root, and fawn-coloured or blackish towards the tip. The musk is contained in an oval, hairy, projecting sac, found only in the male, situated between the umbilicus and the prepuce, from two to three inches long, and from one to two broad, opening by a small hairy orifice at its anterior part, and marked posteriorly by a groove or furrow which corresponds with the opening of the prepuce. It is lined internally by a smooth membrane, thrown into a number of irregular folds, forming incomplete

partitions. In the vigorous adult animal, the sac sometimes contains six drachms of musk; but in the old, seldom more than two drachms, and none in the young.* The musk is secreted by the lining membrane, and in the living animal forms a consistent mass, which, on the outside, is compact, and marked with the folds of the membrane, but is less firm towards the centre, where there is sometimes a vacant space. As first secreted it is probably liquid, and a portion is occasionally forced out by the animal, to which it communicates its odour.

The musk deer inhabits the vast mountainous regions of central Asia, extending from India to Siberia, and from the country of the Turcomans to China. It is an active and timid animal, springing from rock to rock with surprising agility, and frequenting the snowy recesses and most inaccessible crags of the mountains. Concealing itself during the day, it chooses the night for roaming in search of food; and, though said to be abundant in its native regions, is taken with difficulty. It is hunted for its hide, as well as for the musk. The natives often take it by snaring. As soon as the animal is killed, the sac is cut off, and dried with its contents; and in this state is sent into the market.

Musk varies in quality with the country inhabited by the animal. That procured from the mountains on the southern borders of Siberia, and brought into the market through Russia, is comparatively feeble. The best is imported from China, and is said to be the product of Tonquin. A variety intermediate between these is procured in the Himalaya Mountains and Thibet, and sent to Calcutta. This is sometimes enclosed in the membranous lining of the sac, without the hairy envelope, and in this condition is said to be quite equal if not superior to that surrounded by the skin, as, in the former condition, it dries readily in the sun, while, in the latter, the aid of artificial heat is deemed necessary, by which the musk may sometimes be injured. (F. Peake, *Pharm. Journ.*, Feb. 1861, p. 399.) We derive our chief supply from Canton, though portions are occasionally brought hither from Europe.

Two varieties are known in commerce, the Chinese and Russian. Both come in sacs, convex and hairy on one side, flat and destitute of hair on the other. The hairs are brownish-yellow, grayish, or whitish, stiff and short, and arranged concentrically around the orifice of the sac. The Chinese, which is the most highly valued, is in bags of a rounder shape, covered with brownish-yellow or reddish-brown hairs, and containing at most a drachm and a half of large-grained, dark, strong-scented musk, of an ammoniacal odour. The Russian is in longer and larger bags, small-grained, of a light yellowish-brown colour, and of a weaker and more fetid odour, with less smell of ammonia.

Properties. Musk is in grains or lumps concreted together, soft and unctuous to the touch, and of a reddish-brown or ferruginous colour resembling that of dried blood. Some hairs of the pod are generally mixed with it. The odour is strong, penetrating, and so diffusive, that one part of musk communicates its smell to more than 3000 parts of inodorous powder. (*Fée.*) In some delicate individuals, it produces headache and other disagreeable symptoms, and has even caused convulsions. The taste is bitter, disagreeable, and somewhat acrid. The colour of the powder is reddish-brown. Musk is inflammable, burning with a white flame, and leaving a light spongy charcoal. Reduced to ashes, it leaves about 5 per cent., containing potassa, lime, magnesia, iron, carbonic, phosphoric, and sulphuric acids, chlorine, and traces of ferrocyanide of potassium and sulphuret of ammonium. (*Prof. W. Bernatzik.*) It yields, upon analysis, a great number of proximate principles. Guibourt and Blondeau obtained water, ammonia, stearin, olein, cholesterin, an oily acid combined with ammonia, volatile oil, muriate of ammonium, chlorides of potassium and calcium, an uncertain acid combined with ammonia, potassa, and lime, gelatin, albumen, fibrin, a highly carbonaceous matter soluble in water, a soluble calcareous salt with a combustible acid, carbonate and phosphate of calcium, hair, and sand. (*Annal. de Chim.*

* According to Col. Frederick Markham, as much as two ounces are sometimes found, and the average for a full-grown animal is an ounce; but, as many of the deer are killed young, the pods in the market probably do not contain more than half an ounce upon an average. He states that the musk of the young animal, though not so strong as that of the old, has a much pleasanter smell. (*Pharm. Journ. and Trans.*, xv. 472; from "*Shooting in the Himalayas*," &c.) — *Note to the eleventh edition.*

et de Phys., ix. 327.) Besides these constituents, Geiger and Reinman found a peculiar bitter resin, osmazome, and a peculiar substance in part combined with ammonia. According to Guibourt and Blondeau, it contains 47 per cent. of volatile matter, thought by some to be chiefly ammonia, by others to be a compound of ammonia and volatile oil. Theimann obtained only from 10 to 15 per cent. But the quantity of volatile as well as of soluble matter varies exceedingly in different specimens. Thus, Theimann found from 80 to 90 per cent. of matter soluble in water, Buchner only 54·5 per cent., and other chemists intermediate proportions. The proportion soluble in alcohol, as ascertained by different experimenters, varies from 25 to 62 per cent. Ether is a good solvent. The watery infusion has a yellowish-brown colour, a bitterish taste, a strong smell of musk, and an acid reaction. The alcoholic tincture is transparent, and of a reddish-brown colour, with the peculiar odour of the medicine. The action of potassa upon musk is accompanied with the extrication of ammonia, and an increase of its peculiar odour. By the influence of heat and moisture long continued, ammonia is developed, which acts upon the fatty matter, producing a substance resembling adipocire, but, according to Guibourt, without diminishing the activity of the medicine. The correctness, however, of this opinion is perhaps questionable; and it is advisable to preserve the musk as much as possible unaltered. When kept in glass bottles, in a situation neither moist nor very dry, it remains for a great length of time without material change. The odour of musk is very much diminished by mixing it with emulsion or syrup of bitter almonds, or cherry-laurel water. From the experiments of Wimmer, it appears that musk loses its odour when rubbed with kermes mineral, or golden sulphur of antimony, and reacquires it on the addition of a little solution of ammonia. (*Pharm. Cent. Blatt*, A.D. 1843, p. 406.) Camphor rubbed up with musk is also said to destroy its odour.

Adulterations. The price of this medicine is so high, and its sources so limited, as to offer strong temptations to adulteration; and little genuine unmixed musk is to be found in the market. The sophistication commences in China, and is completed in Europe and this country. A common practice in the East is to open the sac, and to supply the place of the musk with an adulterated mixture. Sometimes the scrotum of the animal is filled with this mixture, and not unfrequently the sacs are made out of the skin. Dried blood, from its resemblance to musk, is among the most common adulterations; but, besides this, sand, lead, iron-filings, hair, animal membrane, tobacco, the dung of birds, wax, benzoin, storax, asphaltum, artificial musk, and other substances are introduced. These are mixed with a portion of musk, the powerful odour of which is diffused through the mass, and renders the discovery of the fraud sometimes difficult. It is said that the Chinese sometimes mix the musk of Tonquin with that of Siberia. The bags containing the drug should have the characters before described as belonging to the natural sac, and should present no evidence of having been opened. The slit is sometimes carefully sewed up, sometimes glued together. The former condition may be discovered by close inspection, the latter by immersion in hot water. When the bag is made from any other portion of the skin, the difference may be detected, according to Mr. Neligan, by a microscope which magnifies 300 diameters. The genuine hairs exhibit innumerable cells, which are wanting in the spurious. (*Chem. Gaz.*, Feb. 1846, p. 79.) Musk which burns with difficulty, has a feeble odour and a colour either pale or entirely black, feels gritty to the finger, is very moist so as to lose much weight in drying, or contains obvious impurities, should be rejected. Russian musk is said never to be adulterated before leaving Russia.*

Medical Properties and Uses. Musk is stimulant and antispasmodic, increasing the vigour of the circulation, and exalting the nervous energy, without producing, either as an immediate or secondary effect, any considerable derangement of the purely cerebral functions. Its medical uses are such as may be inferred from its general

* For an account of the effects of numerous reagents on musk, and other modes of identification as well as of detecting adulterations, see a paper by Prof. W. Bernatzik, translated in the *Am. Journ. of Pharm.* for Sept. 1861, p. 427. There is a discrepancy between Prof. Bernatzik's statement of the solubilities of musk and that of the text. According to the latter, ether is a good solvent; according to the former, ether and chloroform possess scarcely any solvent power. (*Note to the twelfth edition.*)

operation. In almost all spasmodic diseases, so far as mere relaxation of spasm is desirable, it is more or less efficacious; but peculiar advantage may be expected from it when a prostrate state of the system, attended with great nervous agitation, or irregular muscular action, call for the united influence of a highly diffusible stimulant and powerful antispasmodic. Such are low cases of typhous disease, accompanied with subsultus tendinum, tremors, and singultus. Such also are many instances of gout in the stomach, and other spasmodic affections of that organ. In very obstinate hiccough we have found it more effectual than any other remedy; and have seen great advantage from its use in those alarming convulsions of infants originating in spasm of the intestines. In the laryngismus stridulus or crowing disease of infants, M. Bouchut relies mainly on musk, having found it more efficacious than any of the narcotics. (*N. Y. Med. Journ.*, Sept. 1868, p. 545.) It is said to have done much good, combined with opium, and administered in very large doses, in tetanus. Epilepsy, hysteria, asthma, pertussis, palpitations, cholera, and colic are also among the spasmodic affections in which circumstances may render its employment desirable. The chief obstacles to its general use are its high price, and the uncertainty in regard to its purity. Musk was unknown to the ancients. Aëtius was the first writer who noticed it as a medicine. It was introduced into Europe through the Arabians, from whose language its name was derived.

It may be given in the form of pill or emulsion. In preparing mixtures of musk, it is recommended by M. Lailler, of France, to rub the musk up first with a very little boiling water, afterwards with a larger quantity, and to add the liquid thus prepared to whatever mixture may be prescribed. According to this writer, the insolubility of musk in cold water, and its much greater solubility in that liquid when boiling hot, render this mode of preparation much preferable to rubbing up with cold water. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 291.) The medium dose is ten grains, to be repeated every two or three hours. To children it may be administered with great advantage in the form of enema.* W.

MUCUNA. *U.S. Secondary.*

Cowhage.

The hairs of the pods of Mucuna pruriens (*De Candolle*). *U. S.*

Pois à gratter, *Fr.*; Kuhkrätze, *Germ.*; Dolico Scottante, *Ital.*

Mucuna. *Sex. Syst.* Diadelphia Decandria. — *Nat. Ord.* Fabaceæ or Leguminosæ.

Gen. Ch. Calyx campanulate, bilabiate; the lower lip trifid, with acute segments, the middle one longest; the upper lip broader, entire, obtuse. *Corolla* with the vexillum ascending, shorter than the wings and keel; the wings oblong, equal to the keel in length; the keel oblong, straight, acute. *Stamens* diadelphous, with five anthers oblong-linear, and five ovate, hirsute. *Legume* oblong, torose, bivalvular, with cellular partitions. *Seeds* roundish, surrounded circularly by a linear hilum. (*De Candolle.*)

Mucuna pruriens. De Cand. *Prodrom.* ii. 405; Lindley, *Flor. Med.* p. 254. — *Dolichos pruriens.* Willd. *Sp. Plant.* iii. 1041; Woodv. *Med. Bot.* p. 422. — *Stizolobium pruriens.* Persoon. This is a perennial climbing plant, with an herbaceous branching stem, which twines round the trees in its vicinity, and rises to a considerable height. The leaves are pinnately trifoliate, and stand on long footstalks, placed alternately on the stem at the distance of a foot from each other. The leaflets are

* *Vegetable Musk.* It has been proposed to substitute for musk the volatile oil of certain plants, having the characteristic odour of that product. The *Malva moschata* and *Mimulus moschatus* have been used for this purpose. Dr. Hanon, of Belgium, has experimented with the distilled oil of these plants, and found it, in the dose of two or three drops, to be an energetic excitant of the primæ viæ and encephalon, producing a sense of weight at the epigastrium, with excitation, vertigo, headache, dryness of the pharynx and œsophagus, general lassitude, yawning, somnolence, and sleep in five or six hours. The pulse is little affected, and no unpleasant symptoms are felt on awaking. He has found it an admirable remedy in hysterical disorders, and various nervous affections attendant on other diseases when not inflammatory, and thinks that it is in no respect inferior to musk in antispasmodic properties. (*Journ. de Pharm.*, xxv. 66.)—*Note to the eleventh edition.*

acuminate, smooth on their upper surface, and hairy beneath. The lateral leaflets are oblique at the base, the middle one somewhat rhombodial. The flowers, which resemble those of the pea in form, are large, of a red or purplish colour, usually placed in threes on short peduncles, and hang from the axils of the leaves in pendent spikes about a foot in length. The fruit is a coriaceous pod, shaped like the Italic letter *f*, about four inches long, and covered with brown bristly hairs, which easily separate, and when handled stick in the fingers, producing an intense itching sensation.* The plant is a native of the West Indies, and other parts of tropical America. It has been supposed to grow also in the East Indies; but the plant of that region is now considered a distinct species, and entitled *Mucuna prurita*. The part usually imported is the pod, of which the hairs are officinal.

Medical Properties and Uses. The spicula are said to possess powerful vermifuge properties, and are thought to act mechanically, by penetrating the worms. That they do act in this manner is evinced as well by the result of direct experiment upon worms out of the body, as by the fact that neither the tincture nor the decoction is in the least degree anthelmintic. The medicine was first employed as a vermifuge in the West Indies, and thence passed into British practice. There can be no reasonable doubt of its efficiency. It has been chiefly employed against the round worm; but all the different species which infest the alimentary canal have been expelled by its use. It is best administered in some tenacious vehicle. The usual mode of preparing it is to dip the pods into syrup or molasses, and scrape off the hairs with the liquid, which is in a proper state for administration when it has attained the consistency of thick honey. The dose of this preparation is a tablespoonful for an adult, a teaspoonful for a child three or four years old, to be given every morning for three days, and then followed by a brisk cathartic. M. Blatin has proposed to employ cowhage as an external irritant; seven grains being mixed with an ounce of lard, and seven or eight grains of the ointment rubbed for ten, fifteen, or twenty minutes on the skin. A stinging and burning sensation is produced, followed by white elevations, which soon disappear, leaving no unpleasant effect.

The root of M. pruriens (*M. prurita*, figured in *Curtis's Bot. Mag.*, N.S., xii., Oct. 1856, tab. 4945) is said by Ainslie to be employed in the East Indies in the treatment of cholera; and both this part and the pods have been thought to possess diuretic properties. W.

MYRISTICA. *U.S., Br.*

Nutmeg.

The kernel of the fruit of Myristica fragrans (Houttuyn, *Nat. Hist.*). *U.S.* The kernel of the seed of Myristica officinalis. *Br.*

Noix muscade, *Fr.;* Muskatnuss, *Germ.;* Noce moschata, *Ital.;* Nuez moscada, *Span*

OLEUM MYRISTICÆ EXPRESSUM. *Br.*

Expressed Oil of Nutmeg.

Syn. MYRISTICÆ ADEPS. *Br.* 1864.

A concrete oil obtained by means of expression and heat from nutmegs. *Br.*

MACIS. *U.S.*

Mace.

The arillus of the fruit of Myristica fragrans (Houttuyn, *Nat. Hist.*). *U.S.*

Macis, *Fr.;* Muskatblüthe, *Germ.;* Macis, *Ital.;* Macias, *Span.*

MYRISTICA. *Sex. Syst.* Diœcia Monadelphia.—*Nat. Ord.* Myristicaceæ.

Gen. Ch. MALE. *Calyx* none. *Corolla* bell-shaped, trifid. *Filament* columnar.

* The intense and very disagreeable itching produced by cowhage, which resists most emollient applications, is said by Mr. J. Weichelsbaum to be relieved promptly by the application of camphor liniment. (*Med. and Surg. Reporter*, Dec. 24, 1870, p. 524.)—*Note to the fourteenth edition.*

Anthers six or ten united. FEMALE. *Calyx* none. *Corolla* bell-shaped, trifid, deciduous. *Style* none. *Stigmas* two. *Drupe* with a nut involved in an arillus with one seed. *Willd.*

Myristica moschata. Thunberg; Willd. *Sp. Plant.* iv. 869; Woodv. *Med. Bot.* p. 698, t. 238. — *M. officinalis.* Linn. *Suppl.* 265; Lindley, *Flor. Med.* p. 21. — *M. fragrans.* Houttuyn, *Nat. Hist.* vol. ii., part iii., p. 333. Of these botanical titles, that recognised by the U. S. Pharmacopœia of 1863 has the recommendation of priority of date; M. Moschata, that of most general usage since the times of Thunberg. The nutmeg tree is about thirty feet high, with numerous branches, and an aspect somewhat resembling that of the orange tree. The leaves stand alternately on short footstalks, are oblong-oval, pointed, entire, undulated, obliquely nerved, bright-green and somewhat glossy on their upper surface, whitish beneath, and of an aromatic taste. The flowers are male and female upon different trees. The former are disposed in axillary, peduncled, solitary clusters; the latter are single, solitary, and axillary; both are minute and of a pale yellowish colour. The fruit, which appears on the tree mingled with the flowers, is round or oval, of the size of a small peach, smooth, at first pale-green, but yellow when ripe, and marked with a longitudinal furrow. The external covering, which is at first thick and fleshy, and abounds in an austere, astringent juice, afterwards becomes dry and coriaceous, and, separating into two valves from the apex, discloses a scarlet reticulated membrane or arillus, commonly called *mace*, closely investing a thin, brown, shining shell, which contains the kernel or *nutmeg*. Not less than eight varieties of the plant are said by Crawford to be cultivated in the East Indies.

Myristica moschata is a native of the Moluccas and other neighbouring islands, and abounds especially in that small cluster distinguished by the name of Banda, whence the chief supplies of nutmegs were long derived. But the plant is now cultivated in Sumatra, Java, Singapore, Penang, Ceylon, and other parts of the East Indies; and has been introduced into the Isles of France and Bourbon, Cayenne, and several of the West India islands.

The tree is produced from the seed. It does not flower till the eighth or ninth year; after which it bears flowers and fruit together, without intermission, and is said to continue bearing for seventy or eighty years. Little trouble is requisite in its cultivation. A branch of the female tree is grafted into all the young plants when about two years old, so as to ensure their early fruitfulness. In the Moluccas the tree yields three crops annually. The fruit is gathered by the hand, and the outside covering rejected. The mace is then carefully separated, so as to break it as little as possible, is flattened, dried in the sun, and afterwards sprinkled with salt water, with the view of contributing to its preservation. Its fine red colour is much impaired by drying. The nuts are dried in the sun or by ovens, and exposed to smoke till the kernel rattles in the shell. They are then broken open; and the kernels, having been removed and steeped for a short time in a mixture of lime and water, probably in order to preserve them from the attack of worms, are next cleaned, and packed in casks or chests for exportation. Dr. Lumsdaine has found them to keep better, if rubbed over with dry lime, than when prepared in the moist way. (See *Am. Journ. of Sci. and Arts*, Nov. 1851.)

Nutmegs are brought to this country either directly from the East Indies, or indirectly through England and Holland. They are also occasionally imported in small quantities from the West Indies.

Properties. The nutmeg (*nux moschata*) is of a roundish or oval shape, obtuse at the extremities, marked with vermicular furrows, of a grayish colour, hard, smooth to the touch, yielding readily to the knife or the grater, but not very pulverulent. When cut or broken it presents a yellowish surface, varied with reddish-brown, branching, irregular veins, which give to it a marbled appearance. These dark veins abound in oily matter, upon which the medicinal properties depend. The odour of nutmeg is delightfully fragrant, the taste warm, aromatic, and grateful. Its virtues are extracted by alcohol and ether. M. Bonastre obtained from 500 parts, 120 of a white insoluble oily substance, 38 of a coloured soluble oil (olein), 30 of volatile oil, 4 of acid, 12 of fecula, 6 of gum, 270 of lignin; and 20 parts were lost. The

volatile oil is obtained by distillation with water. (See *Oleum Myristicæ.*) By pressure with heat an oily matter is procured from the kernels, which becomes solid on cooling, and is commonly though erroneously called *oil of mace.*

Nutmegs have been punctured and boiled in order to extract their essential oil, and the orifice afterwards closed so carefully as not to be discoverable unless by breaking the kernel. The fraud may be detected by their levity. They are also apt to be injured by worms, which, however, attack preferably the parts least impregnated with the volatile oil. The Dutch were formerly said to heat them in a stove in order to deprive them of the power of germinating, and thus prevent the propagation of the tree. The small and round nutmegs are preferred to the large and oval. They should be rejected when very light, with a feeble taste and smell, worm-eaten, musty, or marked with black veins.

A kind of nutmeg is occasionally met with, ascribed by some to a variety of *M. moschata*, by others to a different species (*Myristica fatua*), which is distinguished from that just described by its much greater length, its elliptical shape, the absence of the dark-brown veins, and its comparatively feeble odour, and disagreeable taste. It has been called *male*, *wild*, or *long nutmeg*, the other being designated as the *female* or *cultivated nutmeg.**

The *concrete* or *expressed oil of nutmeg* (Oleum Myristicæ Expressum, *Br.*), commonly called *oil of mace*, is obtained by bruising nutmegs, exposing them in a bag to steam, and then compressing them strongly between heated plates. A liquid oil flows out, which becomes solid when it cools. Nutmegs are said to yield from 10 to 12 per cent. of this oil.† The best is imported from the East Indies in stone jars. It is solid, soft, unctuous to the touch, of a yellowish or orange-yellow colour more or less mottled, with the odour and taste of nutmeg. It is composed, according to Schrader, of 52·09 per cent. of a soft oily substance, yellowish or brownish, soluble in cold alcohol and ether; 43·75 of a white, pulverulent, inodorous substance, insoluble in these liquids; and 4·16 of volatile oil. The pulverulent constituent, which received from Playfair the name of *myristicin*, has a silky lustre, melts at 88°, and yields on saponification glycerin and *myristicic acid.* It may be obtained directly from nutmeg by exhausting it by means of benzole, filtering the liquid, and allowing it to crystallize by spontaneous evaporation. To purify the product, it may be dissolved in a mixture of two parts of absolute alcohol and three of benzole with the aid of heat, then filtering the liquid while hot, and setting it aside. On cooling, it deposits the pure myristicin in crystals. (*Journ. de Pharm.*, Juin, 1859, p. 471.) Analyzed by Koller, the expressed oil was found to contain, in 100 parts, 6 of a volatile oil ($C_{20}H_{16}$) analogous with the oil of mace, 70 of myristicin, 20 of olein, 3 of resin, and 1 of salts, &c. (*Arch. der Pharm.*, clxxiii. 280.) An inferior kind of the oil is prepared in Holland, and sometimes found in the shops. It is in hard, shining, square cakes, lighter coloured than that from the East Indies, and with less smell and taste. It is supposed to be derived from nutmegs previously deprived of most of their volatile oil by distillation. An artificial preparation is sometimes sold for the genuine oil. It is made by mixing various fatty matters, such as suet, palm oil, spermaceti, wax, &c., adding some colouring substance, and giving flavour to the mixture by the volatile oil.

Mace (Macis, *U. S.*) is in the shape of a flat membrane irregularly slit, smooth,

* A few years since, attention was called to a California product, derived from *Torreya Californica*, and, from its resemblance to the fruit of the Myristica, called *California nutmeg.* It is, however, quite distinct in its characters from the true nutmeg, and cannot be substituted for it. At the same time a variety of nutmeg appeared in our markets, which was at first supposed to be the California product referred to; but, on examination by Prof. Jos. Carson, it was found to be the variety of drug mentioned in the text as the male or wild nutmeg, and to be wholly distinct from the fruit of the Torreya. (*Am. Journ. of Pharm.*, xxvi. 247 and 499.)—*Note to the eleventh edition.*

† A process for obtaining it by means of *bisulphuret of carbon* has been proposed by M. Lepage, of Gisors, in France, and has received the sanction of the Society of Pharmacy of Paris. It consists in treating the nutmeg, thoroughly comminuted, with three times its weight of the liquid referred to, well rectified, agitating the mixture frequently for 24 hours, expressing, repeating the process with two parts only of the menstruum, mixing the products of the two macerations, filtering in a covered vessel, and then distilling off the sulphuret, at a temperature of 160°, until the residue is entirely deprived of the menstruum. (*Journ. de Pharm.*, 3e sér., xxxi. 28.)—*Note to the twelfth edition.*

soft, flexible, of a reddish or orange-yellow colour, and an odour and taste resembling those of nutmeg. It contains, according to M. Henry, a volatile oil in small quantity; a fixed oil, odorous, yellow, soluble in ether, insoluble in boiling alcohol; another fixed oil, odorous, red, soluble in alcohol and ether in every proportion; a peculiar gummy matter, analogous to amidin and gum, constituting one-third of the whole; and a small proportion of ligneous fibre. Mace yields a volatile oil by distillation, and a fixed oil by pressure. Neumann found the former heavier than water. The latter is less consistent than the fixed oil of nutmeg. Mace is inferior when it is brittle, less than usually divided, whitish or pale-yellow, or with little taste and smell.

Medical Properties and Uses. Nutmeg unites, with the medicinal properties of the ordinary aromatics, considerable narcotic power. In the quantity of two or three drachms, it has been known to produce stupor and delirium; and dangerous if not fatal consequences are said to have followed its free use in India. It is employed to cover the taste or correct the operation of other medicines, but more frequently as an agreeable addition to farinaceous articles of diet, and to various kinds of drink in cases of languid appetite and delicate stomach. It is usually given in substance, and is brought by grating to the state of a powder. *Mace* possesses properties essentially the same with those of nutmeg; and, like that medicine, has been known, when taken in excess, to produce alarming sensorial disturbance. (G. C. Watson, *Prov. Med. and S. Journ.*, Jan. 26, 1848.) It is, however, less used as a medicine. The dose of either is from five to twenty grains. As the virtues of nutmeg depend chiefly if not exclusively on the volatile oil, the latter may be substituted, in the dose of two or three drops. The expressed oil is occasionally used as a gentle external stimulant, and is an ingredient in the *Emplastrum Picis* of the British Pharmacopœia.

The ancients were wholly unacquainted with the nutmeg; and Avicenna is said to be the first author by whom it is noticed.

Off. Prep. of Nutmeg. Acetum Opii, *U. S.;* Oleum Myristicæ; Oleum Myristicæ Expressum, *Br.;* Pulvis Aromaticus, *U. S.;* Pulvis Catechu Compositus, *Br.;* Pulvis Cretæ Aromaticus, *Br.;* Spiritus Armoraciæ Comp., *Br.;* Spiritus Lavandulæ Comp., *U. S.;* Syrupus Rhei Aromaticus, *U. S.;* Tinctura Lavandulæ Comp., *Br.;* Trochisci Cretæ, *U. S.;* Trochisci Magnesiæ, *U. S.;* Trochisci Sodii Bicarbonatis, *U. S.*

Off. Prep. of the Concrete Oil. Emplastrum Calefaciens, *Br.;* Emplastrum Picis, *Br.*

W.

MYRRHA. *U. S., Br.*

Myrrh.

A gum-resinous exudation from Balsamodendron Myrrha (Nees, *Bischreib. Offic. Pflanzen*). *U. S.;* A gum-resinous exudation from the stem of Balsamodendron Myrrha. *Br.*

Myrrhe, *Fr., Germ.;* Mirra, *Ital., Span.;* Murr, *Arab.;* Bowl, *Hindoost.*

Though myrrh has been employed from the earliest times, the plant which yields it was not determined till quite recently. The *Amyris Kataf* of Forskhal, seen by that traveller in Arabia, was supposed by him to be the myrrh tree, but without sufficient proof. Afterwards Ehrenberg met on the frontiers of Arabia Felix with a plant, from the bark of which he collected a gum-resin precisely similar to the myrrh of commerce. From specimens of the plant taken by Ehrenberg to Germany, Nees von Esenbeck referred it to the genus Balsamodendron of Kunth, and named it *Balsamodendron Myrrha.* This genus was formed by Kunth from *Amyris*, and includes the *Amyris Kataf* of Forskhal, which may possibly also produce a variety of myrrh. The new genus differs from *Amyris* chiefly in having the stamens beneath instead of upon the germ. It was not thought by De Candolle sufficiently distinct. Berg is said to have found another species in Ehrenberg's collection, to which was attached a label by the discoverer, stating that he had collected myrrh from it; and proposes for it the name of *Balsamodendron Ehrenbergianum.* (*Am. Journ. of Pharm.*, July, 1873, p. 314.)

Balsamodendron Myrrha. Fée, *Cours. d'Hist. Nat. Pharm.*, i. 641; Carson, *Illust.*

of Med. Bot. i. 28, pl. 20. This is a small tree, with a stunted trunk, covered with a whitish-gray bark, and furnished with rough abortive branches terminating in spines. The leaves are ternate, consisting of obovate, blunt, smooth, obtusely denticulate leaflets, of which the two latter are much smaller than the one at the end. The fruit is oval-lanceolate, pointed, longitudinally furrowed, of a brown colour, and surrounded at its base by the persistent calyx. The tree grows in Arabia Felix, in the neighbourhood of Gison, in dwarfish thickets, interspersed among the Acaciæ and Euphorbiæ. The juice exudes spontaneously, and concretes upon the bark.

Formerly the best myrrh was brought from the shores of the Red Sea by way of Egypt and the Levant, and hence received the name of *Turkey Myrrh;* while the inferior qualities were imported from the East Indies, and commonly called *India Myrrh.* These titles have ceased to be applicable; as myrrh of all qualities is now brought from the East Indies, whither it is carried from Arabia and the north-eastern coast of Africa. Aden in the former region, and Berbera in the latter, would appear, from the statements of Mr. James Vaughan, to be the chief entrepots of the trade. (*Pharm. Journ.*, xii. 226.) Great quantities are collected on the African coast, near the mouth of the Red Sea, whence it is taken to Aden. (*Ibid.*, Oct. 1859, p. 217.) It is usually imported in chests containing between one and two hundred weight. Sometimes the different qualities are brought separate; sometimes more or less mingled. Only the best kind should be selected for medical use.

Properties. Myrrh is in small irregular fragments or tears, or in larger masses, composed apparently of agglutinated portions differing somewhat in their shade of colour. The pieces are exceedingly irregular in shape and size, being sometimes not larger than a pea, and sometimes, though rarely, almost as large as the fist. They are often powdery upon the surface. When of good quality, myrrh is reddish-yellow or reddish-brown and translucent, of a strong peculiar somewhat fragrant odour, and a bitter aromatic taste. It is brittle and pulverizable, presenting, when broken, a shining surface, which in the larger masses is very irregular, and sometimes exhibits opaque whitish or yellowish veins. In powder it is of a light-yellowish colour. Under the teeth it is at first friable, but soon softens and becomes adhesive. It is inflammable, but does not burn vigorously, and is not fusible by heat. Its sp. gr. is stated at 1·36. The inferior kind, commonly called *India myrrh*, is in pieces much darker than those described, more opaque, less odorous, and often abounding with impurities. We have seen pieces of India myrrh enclosing large crystals of common salt; as if the juice might have fallen from the tree, and concreted upon the ground where this mineral abounds. Pieces of *bdellium*, and other gummy or resinous substances of unknown origin, are often mixed with it. Among these is a product which may be called *false myrrh.* It is in irregular pieces, of a dirty reddish-brown colour, a vitreous brownish-yellow fracture, semitransparent, of a faint odour of myrrh, and a bitter balsamic taste. Myrrh is best purchased in mass; as in powder it is liable to adulterations not easily detected.

Myrrh is partially soluble in water, alcohol, and ether. Triturated with water it forms an opaque yellowish or whitish emulsion, which deposits the larger portion upon standing. Its alcoholic tincture is rendered opaque by the addition of water, but throws down no precipitate. According to Neumann, alcohol and water severally extract the whole of its odour and taste. By distillation a volatile oil rises, having the peculiar flavour of myrrh, and leaving the residue in the retort simply bitter. The gum-resin is soluble in solutions of the alkalies, and, when triturated with them in a crystalline state, forms a tenacious liquid. Hence carbonate of potassium may be used to facilitate its suspension in water. Braconnot found 2·5 per cent. of volatile oil, 23 of a bitter resin, 46 of soluble, and 12 of insoluble gum. (*Ann. de Chim.*, lxvii. 52.) Pelletier obtained 34 per cent. of resin, with a small proportion of volatile oil, and 66 of gum. A more recent analysis by Ruickoldt gave 2·183 per cent. of volatile oil, 44·760 of resin, 40·818 of gum or arabin, 1·475 of water, and 3·650 of carbonate of calcium and magnesium, with some gypsum and sesquioxide of iron. The resin, which he calls *myrrhin*, is neuter, but becomes acid when kept for a short time in fusion. In the latter state, M. Ruickoldt proposes to call it *myrrhic acid.* (*Archiv. der Pharm.*, lxi. 1.) According to MM. Bley and Diesel, myrrh containing

little volatile oil always has an acid reaction, which they ascribe to the oxidation of the oil. They found formic acid in the specimen examined by them. (*Ibid.*, xliii. 304.) The same writers give, as a test of myrrh, the production of a transparent dirty-yellow liquid with nitric acid; while false myrrh affords a bright-yellow solution in the same fluid, and bdellium is not dissolved, but becomes whitish and opaque. (*Am. Journ. of Pharm.*, xviii. 228.) According to M. Righini, if powdered myrrh, rubbed for 15 minutes with an equal weight of chloride of ammonium, and fifteen times its weight of water gradually added, dissolve quickly and entirely, it may be considered pure. (*Journ. de Chim. Méd.*, 1844, p. 33.)

Medical Properties and Uses. Myrrh is a stimulant tonic, with some tendency to the lungs, and perhaps to the uterus. Hence it is employed as a tonic in dyspepsia, and as an expectorant and emmenagogue in debilitated states of the system, in the absence of febrile excitement or acute inflammation. The complaints in which it is usually administered are chronic catarrh, phthisis pulmonalis, other pectoral affections in which the secretion of mucus is abundant but not easily expectorated, chlorosis, amenorrhœa, and the various affections connected with this state of the uterine function. It is generally given combined with chalybeates or other tonics, and in amenorrhœa very frequently with aloes. It is used also as an application to spongy gums, the aphthous sore-mouth of children, and various kinds of unhealthy ulcers. The dose is from ten to thirty grains, and may be given in the form of powder or pill, or suspended in water, as in the famous antihectic mixture of Dr. Griffith, which has become officinal by the name of *Mistura Ferri Composita*. The infusion is also sometimes given, and an aqueous extract has been recommended as milder than myrrh in substance. The tincture is used chiefly as a local application.*

A *plaster of myrrh* is made by rubbing together powdered myrrh, camphor, and balsam of Peru, of each an ounce and a half, then adding the mixture to 32 ounces of lead plaster previously melted, and stirring well until the plaster thickens on cooling. It is then to be formed into rolls. This plaster may be employed in all cases where a gentle and long-continued rubefacient effect is desired.

Off. Prep. Decoctum Aloës Compositum, *Br.;* Mistura Ferri Comp.; Pilula Aloës et Myrrhæ, *Br.;* Pilulæ Aloës et Myrrhæ, *U. S.;* Pil. Assafœtidæ Comp., *Br.;* Pil. Ferri Comp., *U. S.;* Pil. Galbani Comp., *U. S.;* Pil. Rhei Comp.; Tinctura Aloës et Myrrhæ, *U. S.;* Tinctura Myrrhæ. W.

NECTANDRA. *U. S.*

Nectandra. Bebeeru Bark.

The bark of Nectandra Rodiei (*Schomburgk*). *U. S.*

Off. Syn. NECTANDRÆ CORTEX. *Bebeeru Bark.* The bark of Nectandra Rodiæi, *Schomburgh*, in *Hooker's Journ. of Bot.*, 2nd ser.; the Greenheart tree. Imported from British Guiana. *Br.*

NECTANDRA. *Sex. Syst.* Dodecandria Monogynia.—*Nat. Ord.* Lauraceæ.

Gen. Ch. Flowers hermaphrodite. *Calyx* six-parted, rotate, the three outer segments somewhat broader. *Stamens* twelve, in four series, the nine outer fertile; the anthers of the first and second series turned inwards, of the third outwards, all ovate, sub-sessile, four-celled. *Ovary* one-celled, with one ovule. *Style* short. *Stigma* short, truncated. *Berry* one-seeded, partly immersed in the tube of the calyx. *Endlicher.*

Nectandra Rodiæi. Schomburgk; *Hooker's Lond. Journ. of Bot.*, Dec. 1844, p. 624. The *bebeeru*, *bibiru*, or *sipiri*, as it has been differently named, is a tree sixty feet or more in height, branching near the top, with a smooth, ash-gray bark. The leaves, which are five or six inches long by two or three in breadth, are nearly oppo-

* A wine of myrrh has been strongly recommended, from experience of his own, by M. Delioux, as an excellent preparation, peculiarly useful in stomachic affections requiring a mild tonic influence. The formula is as follows. Take of Myrrh, of the best quality, in powder 20 grammes, Bitter Orange-peel 15 grammes, Malaga Wine 1 litre; allow them to macerate for ten days, and filter. He gives a wineglassful (two tablespoonfuls) of this wine, two or three times a day, before or after meals, according to the time at which the gastric pains make themselves felt. (*Annuaire de Thérap.*, 1871–2, p. 67.)—*Note to the fourteenth edition.*

site, coriaceous, oblong-elliptical, shortly acuminate, smooth, shining, and obscurely reticulate on the upper surface. The flowers are yellowish-white, in axillary panicles, much shorter than the leaves, and few-flowered. The fruit is a large, obovate or obcordate, somewhat compressed berry, of the size of a small apple, with a single seed about as large as a walnut. The tree inhabits Guiana and neighbouring regions of South America, where the wood is used in ship-building, under the name of *greenheart.* It received its specific name of *Rodiei* from Sir Robert Schomburg, in honour of Dr. Rodie, by whom it was first described. Though the fruit is very bitter, its seeds yield a starch which is said to be used as food by the Indians. The bark is officinal.

Properties. This is in large, flat, heavy pieces, from one to two feet long, from two to six inches broad, and three or four lines thick, with a rough and somewhat fibrous fracture, of a grayish-brown colour on its outer surface, and a dark-cinnamon on the inner. It has an intensely bitter, somewhat astringent taste. Analyzed by Dr. Maclagan, of Edinburgh, it was found to contain tannic acid of the kind that precipitates the salts of iron green, resin, gum, sugar, albumen, fibrin, various salts, and two peculiar alkaloids, named respectively *bebeerin* (bebeeria) and *sipeerin* (sipeeria). In the seeds, besides the foregoing principles, Dr. Maclagan found 53 per cent. of starch, and a peculiar white, crystalline, volatile acid, which he named *bebeeric acid.* The alkaloids are extracted together from the bark, in the form of impure sulphate, by a process similar to that for preparing sulphate of quinia. This preparation is known as the *commercial sulphate of bebeerin.* The sipeerin, which Dr. Maclagan believed to be a distinct alkaloid in the bark, he was afterwards induced to consider as the result of oxidation of bebeeria. (Pereira, *Mat. Med.*)*

Bebeeria, which, in accordance with the ordinary nomenclature of the alkaloids, should be called *nectandria*, was obtained pure by Messrs. Maclagan and Tilley by the following process. The impure sulphate is dissolved in water, and precipitated by ammonia. The precipitate, mixed with an equal weight of recently precipitated oxide of lead, and dried, is treated with absolute alcohol, which, being evaporated, leaves the two alkaloids in the form of a translucent resinoid mass. The bebeeria is separated by means of ether, which yields it by evaporation. Another process is to dissolve the precipitate obtained by ammonia, previously washed, in diluted acetic acid, add acetate of lead, precipitate by potassa, exhaust the precipitate by strong ether, evaporate the ether to the consistence of a syrup, dissolve the residue in absolute alcohol, and pour the solution gradually into water. A flocculent deposit is formed, which, when washed and dried, is the alkaloid in question. Bebeeria is pale-yellow, amorphous, of a resinous aspect, inodorous, very bitter, very slightly soluble in water, freely soluble in alcohol and ether, fusible at 356°, inflammable, and of an alkaline reaction. It forms uncrystallizable salts with the acids. Its formula is differently given $C_{35}H_{20}NO_6$, and $C_{38}H_{21}NO_6$. For a further account of the chemistry of bebeeria, see a paper by Flückiger in the *Pharm. Journ.*, Oct. 1869, p. 102.

Sipeeria (*sipeerin*) is left after the separation of the bebeeria by ether in the foregoing processes. This also is amorphous, very sparingly soluble in water, freely soluble in alcohol, but differing from bebeeria in being insoluble in ether.

Medical Properties and Uses. Nectandra is tonic, somewhat astringent, and febrifuge, resembling cinchona in its virtues, though much inferior, at least in antiperiodic power. It has generally been employed in the form of the impure sulphate of bebeeria,

* Drs. Douglas Maclagan and Arthur Gamgee have since examined the *wood*, and, besides bebeeria, have detected two other alkaloids, one of which they seem to have pretty thoroughly investigated, and propose to name *Nectandria.* It was obtained by treating the mixed alkaloids resulting from the same process applied to the wood, by which the British Pharmacopœia obtains sulphate of bebeeria from the bark, repeatedly with chloroform. The new alkaloid, being very soluble in chloroform, is thus extracted. It is a white powder, amorphous, and intensely bitter. It differs from bebeeria in being much less soluble in ether, and when treated with strong sulphuric acid and binoxide of manganese, giving rise to a magnificent green, slowly passing into a beautiful violet, and, lastly, in having a higher atomic weight; its formula being $C_{40}H_{23}NO_8$ (according to the notation followed in this work). After separating nectandria from the mixed bases, the authors succeeded in extracting another alkaloid, different from bebeeria, much more soluble in water than nectandria, but insoluble in chloroform. This they have not yet named. They ascertained the existence of a third; but have not investigated its properties. (See *Am. Journ. of Pharm.*, Sept. 1869, p. 453.)—*Note to the fourteenth edition.*

and sometimes with great asserted success, in the treatment of intermittent and remittent fevers. Dr. Rodie recommended it so early as 1834; but it did not attract general attention until brought into notice by Dr. Douglas Maclagan, of Edinburgh, who published a number of observations, tending to prove its possession of valuable antiperiodic properties. Others afterwards confirmed his statements in its favour, and it was hoped that a substitute had been found for the alkaloids of Peruvian bark; but the more recent published accounts by M. Becquerel, of France (*Journ. de Pharm.*, 3e sér., xx. 439), of Dr. Wm. Pepper, of Philadelphia (*Am. Journ. of Med. Sci.*, N. S., xxv. 13), and of Dr. E. D. Dailey, of Smyrna, Delaware (*Med. Exam.*, N. S., ix. 557), show satisfactorily that, though frequently successful, it often fails, and cannot be relied on as a substitute for quinia. From a scruple to a drachm may be given between the paroxysms, in doses of two grains. Prof. A. P. Merrill has employed the sulphate with advantage in menorrhagia, in the dose of five grains. (*N. Y. Journ. of Med.*, N. S., xv. 433; from the *Memphis Med. Recorder.*)

The *impure sulphate* (*commercial sulphate*) *of bebeeria* may be prepared by first boiling the powdered bark with a solution of carbonate of sodium, to remove the tannic acid and colouring matter, and afterwards with water acidulated with sulphuric acid which extracts the alkaloids in the form of sulphates. The solution is then filtered, the alkaloid precipitated by carbonate of sodium, the precipitate dissolved and neutralized with dilute sulphuric acid, the solution, decolorized with animal charcoal, then concentrated, filtered, and finally evaporated in open vessels, with a gentle heat. Thus obtained, the sulphate is fit for medical use, though it is not pure, containing sipeeria, a little sulphate of calcium, and colouring matter. It is in brownish, thin, shining scales, which become yellow in powder. It is freely soluble in alcohol, and sparingly in water, but is readily dissolved in the latter if acidulated. It may be given in the form of pill, or of solution in water acidulated with sulphuric acid, one minim of the officinal diluted or aromatic sulphuric acid being added for each grain of the sulphate. The dose is from two to five grains.

A new application of the sulphate of bebeeria has recently been made by Dr. A. P. Merrill, who has found it very useful in various uterine diseases, as dysmenorrhœa, menorrhagia, leucorrhœa, and all other conditions accompanied with enlargement and congestion of the uterus and its appendages. It has proved useful also in disorders of the kidneys and bladder and blenorrhœal discharges. (*N. Y. Med. Record*, March 1, 1867, p. 7.)

The pure sulphate may be readily prepared by dissolving bebeeria, obtained as above directed, in water with sulphuric acid to neutralization, and evaporating the solution.

Off. Prep. Beberiæ Sulphas, *Br.* W.

NUX VOMICA. *U.S., Br.*

Nux Vomica.

The seed of Strychnos Nux vomica. *U.S.* The seeds of Strychnos Nux vomica, *Linn.* Imported from the East Indies. *Br.*

Noix vomique, *Fr.;* Krähenaugen, Brechnüsse, *Germ.;* Noce vomica, *Ital.;* Nuez vomica, *Span.*

STRYCHNOS. *Sex. Syst.* Pentandria Monogynia. — *Nat. Ord.* Apocynaceæ.

Gen. Ch. Corolla five-cleft. *Berry* one-celled, with a ligneous rind. *Willd.*

Strychnos Nux vomica. Willd. *Sp. Plant.* i. 1052; Woodv. *Med. Bot.* p. 222, t. 79. This tree is of a moderate size, with numerous strong branches, covered with a smooth, dark-gray bark. The young branches are long, flexuous, smooth, and dark-green, with opposite, roundish-oval, entire, smooth, and shining leaves, having three or five ribs, and short footstalks. The flowers are small, white, funnel-shaped, and in terminal corymbs. The fruit is a round berry, about as large as an orange, with a smooth, yellow or orange-coloured, hard, fragile rind, and many seeds in a juicy pulp.

The tree is a native of the East Indies, growing in Bengal, Malabar, on the Coromandel Coast, in Ceylon, in many islands of the Indian Archipelago, in Cochin-China, and other neighbouring countries. The wood and root are very bitter, and are employed in the East Indies for the cure of intermittents. The *radices colu-*

brinæ and *lignum colubrinum* of the older writers, long known in Europe as narcotic poisons, have been ascribed to this species of Strychnos, under the impression that it is identical with *Strychnos Colubrina*, to which Linnæus refers them. They have been ascertained by Pelletier and Caventou to contain a large quantity of strychnia. The bark is said by Dr. O'Shaughnessy to answer exactly to the description given by authors of the *false angustura*, and, like that, to contain a large quantity of brucia. The identity of the two barks has been confirmed by Dr. Pereira, from a comparison of specimens. (See *Angustura.*) The seeds are the only officinal portion.

These are circular, about three-quarters of an inch in diameter, and two lines in thickness, flat, or slightly convex on one side, and concave on the other. They are thickly covered with fine, silky, shining, ash-coloured or yellowish-gray hairs, attached to a thin fragile coating, which closely invests the interior nucleus or kernel. This is very hard, horny, usually whitish and semitransparent, sometimes dark-coloured and opaque, and of very difficult pulverization. The powder is yellowish-gray, and has a faint sweetish odour. The seeds are destitute of odour, but have an acrid, very bitter taste, which is much stronger in the kernel than in the investing membrane. They impart their virtues to water, but more readily to diluted alcohol. Nux vomica has been analyzed by several chemists, but most accurately by Pelletier and Caventou, who discovered in it two alkaline principles, *strychnia* and *brucia*, united with a peculiar acid which they named *igasuric*. Its other constituents are a yellow colouring matter, a concrete oil, gum, starch, bassorin, a small quantity of wax, and, according to Prof. J. M. Maisch, several earthy phosphates. (*Am. Journ. of Pharm.*, Nov. 1860, p. 524.) Mr. Charles Bullock, in preparing the alcoholic extract of nux vomica with a moderate continuous heat, so as to dry it sufficiently to be pulverized, separated from it a considerable proportion of a liquid oil, of which 150 pounds of the seeds yielded 5 pints. (*Am. Journ. of Pharm.*, Sept. 1874, p. 405.) M. Desnoix has announced the discovery of another alkaloid, which he denominates *igasuria;* and M. Shutzenberger, in examining specimens of igasuria, separated nine alkaloids, each having a distinct composition, and all probably derived from brucia by oxidation under vital influences. These alkaloids are the active principles of nux vomica.

Strychnia was discovered by Pelletier and Caventou, A.D. 1818, both in the nux vomica and bean of St. Ignatius, and received its name from the generic title of the plants (*Strychnos*) to which these two products belong. According to these chemists, it exists much more abundantly in the bean of St. Ignatius than in the nux vomica, the former yielding 1·2 per cent., the latter only 0·4 per cent. of the alkaloid. For an account of its properties and mode of preparation, see *Strychnia*, in *Part II.* This alkaloid is stated to exist still more largely in the seeds of another species, the *Strychnos Tiute*, which is a native of Java. In the *Zeitschrift für Chemie* (A.D. 1866), M. Bernelot-Moens states that the seeds of this species, when dry, contain 1·469 per cent. of strychnia, with only traces of brucia. (*Am. Journ. of Pharm.*, Nov. 1866, p. 506.)

Brucia was discovered by Pelletier and Caventou, first in the bark called *false angustura*, in combination with gallic acid, and subsequently associated with strychnia in the form of igasurates, in the nux vomica and bean of St. Ignatius. It is crystallizable, and its crystals are said to contain 18·41 per cent. of water. It is without smell, but of a permanent, harsh, very bitter taste; soluble in 850 parts of cold, and 500 of boiling water; very soluble in alcohol, whether hot or cold; but insoluble in ether and the fixed oils, and only slightly dissolved by the volatile oils. It is permanent in the air, but melts at a temperature a little above that of boiling water, and on cooling congeals into a mass resembling wax. According to Mr. Wm. A. Guy, who has carefully experimented on the volatility of various proximate principles, it melts at 240°, and sublimes at 400°, changing colour, and depositing carbon. (*Pharm. J. and Trans.*, Feb. 1868, p. 375.) It forms crystallizable salts with the acids. Concentrated nitric acid produces with brucia or its salts an intense crimson colour, which changes to yellow by heat, and upon the addition of protochloride of tin becomes violet. A new test for brucia, given by M. Stanislas Cotton, consists in adding to a warm solution of brucia (40° to 50° C.) in nitric acid,

a concentrated solution of the sulphhydrate of sulphuret of sodium. The mixture first becomes violet, and then passes to green when the alkaline salt is in excess. (*J. de Pharm.*, Juillet, 1869, p. 18.) These effects serve to distinguish brucia from strychnia, and, if produced with the latter alkaloid, evince the presence of the former. According to MM. Larocque and Thibierge, chloride of gold produces, with solutions of the salts of brucia, precipitates at first milky, then coffee-coloured, and finally chocolate-brown. (*Journ. de Chim. Méd.*, Oct. 1842.) This alkaloid has been detected in the body three months after death, being present in all the solids and fluids, but especially the liver and kidneys. (*Boston M. and S. Journ.*, July 10, 1873, p. 36.) Brucia is analogous in its operation to strychnia, but possesses, according to M. Andral, only about one-twelfth of its strength, when the latter principle is entirely pure. It is therefore seldom employed. It may be procured from false angustura bark, in a manner essentially the same with that in which strychnia is procured from nux vomica; with this difference, that the alcoholic extract, obtained from the precipitate produced by lime or magnesia, should be treated with oxalic acid, and subsequently with a mixture of rectified alcohol and ether, which takes up the colouring matter, leaving the oxalate of brucia. This is decomposed by magnesia, and the brucia is separated by alcohol, which, by spontaneous evaporation, yields it in the state of crystals. According to Dr. Fuss and Professor Erdmann, brucia is nothing more than a compound of strychnia and resin.

Igasuria is found in the mother-waters from which strychnia and brucia have been precipitated by lime. It is strongly bitter; readily crystallizable, with 10 per cent. of water of crystallization; more soluble in water and weak alcohol than the two other alkaloids; reddened by nitric acid even more intensely than brucia; rendered by sulphuric acid at first rose-coloured, and afterwards yellowish and greenish-yellow; dissolved by the diluted acids, which form with it easily crystallizable salts; precipitated from its solution by the alkalies, and redissolved by them in excess, especially by potassa; precipitated yellow by bichloride of platinum, and white by tannic acid; slowly precipitated by iodide of potassium in light reddish-yellow crystals; and thrown down as crystalline needles by bicarbonate of sodium, in the presence of tartaric acid, in which property it resembles strychnia, but differs from brucia. One of its most distinguishing properties is its degree of solubility in water, of which it requires at 212° only 200 parts for solution; while brucia requires 500 parts, and strychnia 2000. M. Desnoix inferred from his experiments on animals that it is intermediate in power between the two other alkaloids of nux vomica.

The nine alkaloids into which Schutzenberger separated igasuria, he distinguished by affixing the letters of the alphabet, as *a* igasuria, *b* igasuria, &c. They may be separated by the agency of hot water, by taking advantage of their different solubility, and their several periods of crystallizing as the solution cools. They are all colourless, crystallizable in needles or tufts, of a persistent bitterness, and almost as energetic as strychnia in their influence on the system. All are coloured red by nitric acid, like brucia, which, moreover, they resemble in their characters, except their greater solubility in water and alcohol. (*Am. Journ. of Pharm.*, Nov. 1858, p. 537; from *Comptes Rendus.*) It is difficult to resist the conjecture that the alkaloids, instead of pre-existing, are formed by changes in the igasuria during the crystallizing process. Indeed, it is denied by some that there is any such distinct alkaloid as igasuria; and Jörgensen is said to have shown its identity with brucia. (See *Am. Journ. of Pharm.*, June, 1872, p. 257.)

As a test for nux vomica, Vielgruth proposes to treat a few grains of the suspected powder with proof spirit, evaporate the tincture to dryness at a heat not exceeding 96°, then add a drop or two of dilute sulphuric acid, and again raise to the heat mentioned. If nux vomica is present, a beautiful carmine-red colour is produced, which disappears in ten or fifteen minutes after cooling, and reappears, but less brightly, on the reapplication of the heat.

Medical Properties and Uses. Nux vomica is very peculiar in its action. In very small doses, frequently repeated, it is tonic, and is said to be diuretic, and occasionally diaphoretic and laxative. When it is given in larger doses, so as to bring the system decidedly under its influence, its action appears to be directed chiefly to the

nerves of motion, probably through the medium of the spinal marrow. Its operation is evinced at first by a feeling of weight and weakness, with tremblings in the limbs, and some rigidity on attempting motion. There seems to be a tendency to permanent involuntary muscular contraction, as in tetanus; but at the same time frequent starts or spasms occur, as from electric shocks. These spasms are first brought on by some exciting cause, as by a slight blow or an attempt to move; but, if the medicine is persevered in, they occur without extraneous agency, and are sometimes frequent and violent. In severe cases, there is occasionally general rigidity of the muscles. A sense of heat in the stomach, constriction of the throat and abdomen, tightness of the chest, and retention of urine are frequently experienced, to a greater or less extent, according to the quantity of the medicine administered. It sometimes, also, produces pain in the head, vertigo, contracted pupil, and dimness of vision. Sensations on the surface analogous to those attending imperfect palsy, such as formication, tingling, &c., are often experienced. The pulse is not materially affected, though sometimes slightly accelerated. Strychnia, given to the inferior animals, has been observed strikingly to lessen the bulk of the spleen. In overdoses, the medicine is capable of producing fatal effects. Given to the inferior animals in fatal doses, it produces great anxiety, difficult and confined breathing, retching to vomit, universal tremors, spasmodic action of the muscles, and ultimately violent convulsions. Death is supposed to take place from a suspension of respiration, resulting from a spasmodic constriction of the muscles concerned in the process. Yet it poisons animals which have no lungs. (*Am. Journ. of Med. Sci.*, N. S., xviii. 369.) Upon dissection, no traces of inflammatory action are observable, unless large quantities of the nux vomica have been swallowed, when the stomach appears inflamed. A division of the spinal marrow near the occiput does not prevent the peculiar effects of the medicine, so that the intervention of the brain is not essential. That it enters the circulation, and is brought into contact with the parts upon which it acts, is rendered evident by the experiments of Magendie and others. For further observations on the effects of this poison, and for the modes of obviating them, see *Strychnia* in *Part II.*

Nux vomica has long been employed in India, and was known as a medicine to the Arabian physicians. On the continent of Europe, it has at various times been recommended as an antidote to the plague, and as a remedy in intermittents, dyspepsia, pyrosis, gastrodynia, dysentery, diarrhœa of debility, colica pictonum, worms, mania, hypochondriasis, hysteria, rheumatism, and hydrophobia. It is said to have effectually cured obstinate spasmodic asthma. Its peculiar influence upon the nerves of motion, to which the public attention was first called by Magendie, suggested to M. Fouquier, a French physician, the application of the remedy to paralytic affections, in which he met with great success. Others have subsequently employed it with variable results; but the experience in its favour so much predominates, that it may now be considered a standard remedy in palsy. It is a singular fact, that its action is directed more especially to the paralyzed part, exciting contraction in this before it is extended to other muscles. The medicine, however, should be administered with judgment, and never given in cases depending on inflammation or organic lesion of the brain or spinal marrow, until after the removal of the primary affection. It has been found more successful in general palsy and paraplegia than in hemiplegia, and has frequently effected cures in palsy of the bladder, incontinence of urine from paralysis of the sphincter, prolapsus ani, amaurosis, and other cases of partial palsy, and has been employed with asserted success in prolapsus ani, spermatorrhœa, and impotence. Upon the same principles, it is said to have proved useful in obstinate constipation from deficient contractility of the bowels; and is thought to promote the action of cathartics, when added to them in small proportion. It has recently been recommended in neuralgia, chorea, and atonic dropsy, and has been found peculiarly useful in gastralgia, gastro-enteralgia, and other debilitated conditions of the alimentary canal. Dr. D. de Savignac, of the Maritime Hospital of Toulon, has found great advantage from this remedy in a variety of chronic dysentery, which he believes to depend on an affection of the spinal marrow, causing paralysis of the motor nerves supplying the muscular coat of the large intestines,

and which is apt to be accompanied with palsy of the limbs. (*Edin. Med. Journ.*, Jan. 1868, p. 657.)

Nux vomica may be given in powder in the dose of five grains, repeated three or four times a day, and gradually increased till its effects are experienced. In this form, however, it is very uncertain; and fifty grains have been given with little or no effect. It is most readily reduced to powder by filing or grating; and the raspings may be rendered finer by first steaming them, then drying them by stove heat, and lastly rubbing them in a mortar. The Edinburgh College directed that the seeds should be first well softened with steam, then sliced, dried, and ground in a coffee-mill. It has been recommended that, before being pulverized, they should be deprived of their exterior coating, which is easily done when they are exposed for a short time to the action of hot water.

The alcoholic extract is more convenient and more certain in its operation. From half a grain to two grains may be given in the form of pill, repeated as above mentioned, and gradually increased. (See *Extractum Nucis Vomicæ.*) The watery extract is comparatively feeble.

Strychnia has recently been much used, and possesses the advantage of greater certainty and uniformity of action. Its effects are precisely similar. With very few exceptions, it is the most violent poison in the catalogue of medicines, and should, therefore, be administered with great caution. The dose is from one-sixteenth to one-twelfth of a grain, repeated twice or three times a day, and gradually increased. Even the quantity mentioned often produces spasmodic symptoms, and these generally occur when the dose is augmented to half a grain three times a day; but in the latter quantity the remedy, if pure, is unsafe. The system is not so soon habituated to its impression as to that of the narcotics generally; so that, after its effects are experienced, it is unnecessary to go on increasing the dose. Strychnia has been applied externally with advantage in amaurosis. It should be sprinkled upon a blistered surface near the temples, in the quantity of from one-fourth to one-half a grain, morning and evening, which may be gradually augmented. The best form of administration is that of pill, in consequence of the excessive bitterness of the solution. Strychnia may, however, be given, dissolved in alcohol, or in water by the intervention of an acid.

Brucia may be used, for the same purposes with strychnia, in the dose of one grain twice or three times a day. Dr. Bardsley noticed that the quantity of two grains, three or four times a day, was seldom exceeded without the occurrence of the characteristic effects of the medicine. Magendie found this alkaloid very useful in small doses as a tonic. He employed for this purpose one-eighth of a grain frequently repeated. It is very important, in reference to the dose, that it should contain no strychnia.

Off. Prep. Extractum Nucis Vomicæ; Strychnia; Tinctura Nucis Vomicæ.

W.

OLEA.

Oils.

These are liquid or solid substances, characterized by an unctuous feel, inflammability, and the property of leaving a greasy stain upon paper. They are divided into two classes, the *fixed* and *volatile*, distinguished, as their names imply, by their different habitudes in relation to the vaporizing influence of caloric.

1. OLEA FIXA. *Fixed Oils.*

These are sometimes termed *expressed oils*, from the mode in which they are procured. Though existing in greater or less proportion in various parts of plants, they are furnished for use exclusively by the fruit; and, as a general rule, are most abundant in the dicotyledonous seeds. They are obtained either by submitting the bruised seeds to pressure in hempen bags, or by boiling them in water, and skimming off the oil as it rises to the surface. When pressure is employed, it is customary to

prepare the seeds for the press by exposing them to a moderate heat, so as to render the oil more liquid, and thus enable it to flow out more readily. Another mode of extracting certain oils is by means of liquids having the power of dissolving them. This method, however, is comparatively little used, because generally less easy of application and more expensive. Near Berlin, in Germany, however, is an establishment where the oil existing in various grains, as the colza, flaxseed, and mustard, is extracted by means of the sulphide of carbon, on a large scale. For the details of the process see the *Amer. Journal of Pharmacy* (Nov. 1868, p. 549).

The consistence of the fixed oils varies from that of tallow to perfect fluidity; but by far the greater number are liquid at ordinary temperatures. They are somewhat viscid, transparent, and usually of a yellowish colour, which disappears when they are treated with animal charcoal. When pure they have little taste or smell. They are lighter than water, varying in specific gravity from 0·913 to 0·936. (*Berzelius.*) They differ very much in their point of congelation; olive oil becoming solid a little above 32° F., while linseed oil remains fluid at 4° below zero. They are not volatilizable without decomposition. At about 600° they boil, and are converted into vapour, which, when condensed, is found to contain, besides other products, a large proportion of oleic and margaric acids, together with benzoic acid, sebacic acid proceeding from the decomposition of the olein, and the vapours of *acrolein*, a highly volatile liquid resulting from the decomposition of glycerin, upon which the fumes of oils depend mainly for their irritating effects on the eyes and nostrils. Exposed to a red heat, in close vessels, they yield, among other products of the destructive distillation of vegetables, a large quantity of the combustible compounds of carbon and hydrogen. Heated in the open air, they take fire, burning with a bright flame, and producing water and carbonic acid. When kept in air-tight vessels, they remain unchanged for a great length of time; but, exposed to the atmosphere, they attract oxygen, and ultimately become concrete. Some, in drying, lose their unctuous feel, and are converted into a transparent, yellowish, flexible solid. These are called *drying oils*. Others, especially such as contain mucilaginous impurities, become rancid, acquiring a sharp taste and unpleasant smell. This change is owing to the formation of an acid, from which the oil may be freed by boiling it for a short time with hydrate of magnesia and water.* The fixed oils are insoluble in water, but are miscible with that fluid by means of mucilage, forming mixtures which are called emulsions. They are in general very sparingly soluble in alcohol, but readily dissolved by ether, which serves to separate them from other vegetable proximate principles. By the aid of heat they dissolve sulphur and phosphorus. Chlorine and iodine are converted by them into muriatic and hydriodic acids, which, reacting upon the oils, increase their consistence, and ultimately render them as hard as wax. If to one of the fixed oils be added one-tenth of its volume of chloride of sulphur, a reaction speedily takes place, attended with an elevation of temperature and the escape of muriatic acid gas, and followed immediately by solidification of the oil, which is wholly converted into

* Results of experiments by M. S. Cloes show that the phenomena of the oxidation of the oils in the atmosphere are less simple than originally supposed by De Saussure, namely, that oxygen is absorbed and an equivalent quantity of carbonic acid is evolved. On the contrary, the quantity of carbonic acid produced represents but a fourth of the carbon eliminated; the remainder forming with hydrogen and oxygen various volatile compounds, which, when collected, have a suffocating smell, and among which were recognised acetic acid, acrylic acid, and a little acrolein. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 287, A.D. 1865.)

M. Cloes has made investigations also in relation to the influence of light in promoting oxidation, and obtained some curious results. The general influence of light is very great, as oils undergo comparatively little change in the dark for a long time; though, in relation to some of them, the change is at length as great as under the light. Thus, while the oil of poppies has in thirty days increased about 50 per cent. in weight under colourless light, and has gained only a 5000th in the dark; yet, at the end of 150 days, the weight in the former condition was rather lessened than augmented, and in the latter, or in the dark, had increased 64 per cent. The effect of the different coloured rays is also very different. The change is at first most rapid under the white light, less so under the blue, and much less under the red, yellow, and green, being least of all with the green; but, with the advance of time, the blue overtakes and even passes the white, and at the end of three or four months all are about equal in effect. Heat also accelerates the concretion of the oils, by favouring their oxidation; and the same effect is produced by introducing into the unchanged oil a little which has already been altered by exposure to the air. The oxidation of an oil may be very greatly hastened in this way without the aid of heat. (*Ibid.*, p. 345.)—*Note to the thirteenth edition.*

a firm elastic substance, bearing considerable resemblance to caoutchouc. (*Journ. de Pharm.*, Fev. 1859, p. 97.) The stronger acids decompose them, giving rise, among other products, to oleic and margaric acids. Boiled with diluted nitric acid, they are converted into malic and oxalic acids, besides other substances usually resulting from the action of this acid upon vegetable matter. Several acids are dissolved by them without producing any sensible change. They combine with salifiable bases; but at the moment of combination undergo a change, by which they are resolved into a peculiar substance called glycerin, and into the oleic and stearic or other fatty acids, which unite with the base employed. The compounds of these acids with potassa and soda are called soaps. (See *Sapo* and *Emplastrum Plumbi.*) By the addition of one part of carbonate of potassium or of sodium, 160 parts of oil may be brought with distilled water into the form of an emulsion. The potassa and soda soaps, and the alkaline sulphurets have a similar effect; but not the bicarbonates. The fixed oils also serve as good vehicles for various metallic bases and subsalts, which form soaps to a certain extent soluble in the oil, and thus become less irritant to the tissues. Oils thus impregnated may, like the pure oils, be brought to the state of emulsion with water, for convenient administration, by the addition of a small proportion of carbonate of potassium. (Jeannel et Monsel, *Revue Pharm.*, 1857, p. 48.) The fixed oils dissolve many of the organic alkalies, the volatile oils, resin, and other proximate principles of plants. The alkaloids are more readily dissolved in them by being first combined with oleic acid; the oleates being more soluble than the alkaloids themselves. (Attfield, *Pharm. Journ.*, March, 1863, p. 308.) According to Buignet, they are, with very few exceptions, indifferent to polarized light; of all those used in medicine, the only exceptions being the liver-oils of the ray and dog-fish, which have a very feeble left rotatory power, and castor oil, which is decidedly dextrogyrate. (*Journ. de Pharm.*, Octob. 1861, p. 264.)

The fixed oils, whether animal or vegetable, in their natural state, consist of at least two distinct oleaginous ingredients, one liquid at ordinary temperatures, and the other concrete. The liquid is a distinct proximate principle called *olein;* the concrete consists of *stearin* or *margarin*, the former being found most largely in animal, the latter in vegetable oils or fats, and the two not unfrequently existing together in the same oil. But several oils have peculiar constituents, differing in properties from either margarin or stearin, and specially named according to the substance containing them; as, *palmitin* in palm oil, *butyrin* in butter, &c. As the most frequent of these proximate constituents of the fixed oils, and existing in many different oleaginous substances, olein, margarin, and stearin merit a special notice. Preliminarily, however, to their individual consideration, it will be proper to refer to the existing views in relation to their nature and composition generally.

It is supposed that these oleaginous principles are of the nature of salts, consisting severally of an acid combined with a substance called glycerin, which acts the part of a base. When, therefore, one of them is treated with an alkaline solution, it is decomposed; its acid uniting with the alkali to form soap, and the glycerin being set free. The analogy between these fatty salts and those consisting of inorganic ingredients may be carried still further; as glycerin is supposed to be, like the inorganic bases, an oxide, and to consist of a compound radical called *glyceryl* (C_6H_7) with five eqs. of oxygen, united with one eq. of water; its formula being C_6H_7, O_5+HO. The fatty acids, existing in these oleaginous salts, are named severally from the oily principles containing them. Thus, the acid of olein is called *oleic acid*, that of stearin *stearic acid*, and that of margarin *margaric acid.* It must be admitted that this view of the nature of the oily principles was at first received with some hesitation; and many supposed that, when an alkali with water was made to act on the oils, the resulting fatty acids and glycerin were generated by the reactions set on foot between the oil and water, and did not pre-exist in the oil. In favour of this view was the fact, that the presence of water was necessary to the change. But this is explained by the supposition that the oxide of glyceryl cannot exist separately unless combined with water, the presence of which, therefore, is necessary to detach it from its combination with the fatty acid in the oils. Moreover, the received view has been synthetically confirmed; for M. Berthelot has succeeded in combining

glycerin with various acids, forming salts, and among others with oleic, stearic, and margaric acids, thus reconstructing olein, stearin, and margarin out of their constituents.

Olein. Elain. Liquid Principle of Oils. It is extremely difficult to obtain olein pure. Being the liquid menstruum which, in most oils, holds the concrete principles in solution, it has for the latter an affinity which retains portions of them with a tenacity not easily overcome. As ordinarily procured, therefore, olein contains more or less of margarin or stearin, or both. In this somewhat impure state, it is obtained either by the agency of alcohol or by expression. When one of the oils, olive oil, for example, is dissolved in boiling alcohol, the solution, on cooling, deposits the concrete principles, still retaining the olein, which it yields upon evaporation. The other method consists in compressing one of the solid fats, or of the liquid oils rendered concrete by cold, between folds of bibulous paper, which absorb the olein, and give it up afterwards by compression under water. Olein is a liquid of oily consistence, becoming concrete at 20° F., colourless when pure, with little odour and a sweetish taste, insoluble in water, soluble in boiling alcohol and ether, and composed of carbon, hydrogen, and oxygen. These elements are believed to be so combined as to form a salt, consisting, according to Berthelot, of one eq. of glycerin $C_6H_7O_5$ and three eqs. of oleic acid $3(C_{36}H_{33}O_3) = C_{114}H_{106}O_{14}$, the *teroleate of glycerin*, or *triolein* of Berthelot.* By reaction with nitric acid, olein is converted into a deep-yellow, butyraceous mass. If this be treated with hot alcohol, a deep orange-red oil is dissolved, and a peculiar fatty matter remains called *elaïdin*. This is white, fusible at 97°, insoluble in water, readily soluble in ether, and supposed to be isomeric with olein. It is resolved by saponification with the alkalies into *elaïdic acid* and glycerin; and is, therefore, *elaïdate of glycerin*. It is now generally thought that olein, as obtained from different oils, is not precisely identical in properties; and a distinct compound is recognised, consisting of one eq. of glycerin $C_6H_7O_5$ and one of oleic acid without water $C_{36}H_{33}O_3 = C_{42}H_{40}O_8$, the *oleate of glycerin*, or *monolein* of Berthelot.

Stearin. This exists abundantly in tallow and other animal fats. It may be obtained by treating the concrete matter of lard, free from olein, by cold ether so long as anything is dissolved. The margarin is thus taken up, and stearin remains. A better method is to dissolve suet in heated oil of turpentine, allow the solution to cool, submit the solid matter to expression in unsized paper, repeat the treatment several times, and finally dissolve in hot ether, which deposits the stearin on cooling. This is concrete, white, opaque in mass, but of a pearly appearance as crystallized from ether, pulverizable, fusible at about 143°, soluble in boiling alcohol and ether, but nearly insoluble in those liquids cold, and quite insoluble in water. It consists of glycerin and stearic acid; but there are several varieties of it, having different points of fusion, and somewhat differing in composition. Besides the natural stearin, which appears to consist of three eqs. of stearic acid and one of glycerin, Berthelot obtained two others by heating glycerin with stearic acid; one of them with one eq. of each of its components, the other with two of the acid and one of the base.

Margarin. This is obtained by treating the concrete matter of oil, previously deprived of olein, with cold ether, and allowing the liquid to evaporate; or by boiling a mixture of stearin and margarin with ether, which dissolves both, but deposits the former on cooling, and yields the latter upon subsequent evaporation. It resembles stearin closely, differing mainly in its lower melting point, in being soluble in cold ether, and in yielding margarates on saponification. The natural margarin is stated to consist of three eqs. of margaric acid and one of glycerin. Another has been produced artificially which is considered as a *monomargarin*, consisting of one eq. of each of its components.

As stated above, there is some reason to consider olein, stearin, and margarin, as being rather representatives of sets of proximate principles, than as quite distinct

* Oleic acid has been proposed as a solvent of the vegetable alkaloids for external use. Its supposed advantages are that it dissolves these principles more freely than the oils themselves, and that the compounds it forms with them would probably find ready entrance into the system. It is not, however, in general use. (See *Am. Journ. of Pharm.*, xxvii. 72.)

and peculiar; and this appears to have been the impression of Berzelius. It is possible, as may be inferred from the observations of Berthelot, that the several oleins, stearins, and margarins may differ in the proportion in which the acid constituent combines with the glycerin.*

As, besides oleic, stearic, and margaric acids, there are in certain oils other analogous fatty acids, such as the *palmitic*, for example, which united with glycerin forms *palmitin;* so, besides glycerin or oxide of glyceryl, there are other bases of fatty salts, as oxide of cetyl, oxide of propyl, &c. So far as these have particular interest for the pharmaceutist they will be considered under the several substances into the constitution of which they enter. To distinguish the oils having glycerin for their base, they are now denominated *glycerides.*

The fixed oils are liable to certain spontaneous changes, which have been investigated by MM. Pelouze and Boudet. It appears, from their researches, that the oils are accompanied, in the seeds which contain them, with principles which act as a ferment, and cause the oils to resolve themselves spontaneously into the several fatty acids which they afford on saponification, and into glycerin. This change takes place in the seeds as soon as the cells containing the oil are broken, so as to permit the contact of the fermenting principle existing in the grain. Sometimes the fermenting principle is to a certain extent separated from the seeds along with the oil. In such a case, the oil undergoes this resolution into the fatty acids and glycerin after expression. Such was ascertained to be the case with palm oil, in which, after long keeping, MM. Pelouze and Boudet detected the presence of glycerin, and of palmitic and oleic acids. They moreover proved that, under the continued influence of the ferment, the fatty acids themselves undergo changes, among which is the conversion of the oleic into sebacic acid; and it is probable that, with a still longer continuance of the same influence, the oil would be completely destroyed. (*Journ. de Pharm.*, Avril, 1856, p. 274.)

As this rancidity in fats renders them altogether useless for most practical purposes in pharmacy, and as it is not always readily discoverable by the senses in its earlier stages, it becomes desirable to possess a test by which it may be readily detected. Such a test is to be found, according to Mr. Thos. B. Groves, in iodide of potassium, which is rapidly decomposed by the new principles developed, and, by the orange-brown discoloration produced by the liberation of the iodine, indicates the existence of rancidity, and by the rapidity and degree of that discoloration approximatively the extent of the change. The alteration of colour is said by Mr. Groves to be plainly perceptible when only one-twentieth of rancid fat is present in any mixture of fats.

It is also extremely important to be able to protect fats against this change. The complete exclusion of air, light, and moisture; and, when in relation to air this may not be entirely practicable, the destruction by heat of the ferment-germs contained in the air, by which the decomposition is often originated, will go far to effect this object; but it would often be very inconvenient, if not impossible, to carry these measures into complete effect; and hence the discovery of substances which may have the effect of retarding, if not wholly preventing these fermenting processes, whether by the destruction of the ferment-germs or otherwise, is extremely desira-

* Some interesting results in relation to the fixed oils were obtained by MM. Pelouze and Boudet, and published in the *Journ. de Pharm.*, xxiv. 385. According to these chemists, the variable fusibility of the margarin and stearin of fixed oils, which has induced some chemists to believe that they are severally not entirely identical as obtained from different oils, is owing to the existence of definite combinations of margarin, and stearin respectively with olein; and each of these principles, in a state of purity, is probably the same from whatever source derived, whether from vegetable or from animal oils. Thus they found the same margarin in palm oil and in human fat. But there appear to be two distinct kinds of olein; one existing in the *drying oils*, as linseed oil, the oil of poppies, &c.; the other in the oils which are not drying, as olive oil, almond oil, human fat, and lard. These two forms of olein are different in their solubility in different menstrua, and in the circumstances that one is drying and the other not so, that one remains liquid under the action of nitric acid, while the other is converted by it into a solid substance called *elaïdin*, and finally that the former contains much less hydrogen than the latter. Besides, the oleic acid formed in the process of saponification from these two kinds of olein is decidedly different; inasmuch as, in the one case, it is converted by nitrous acid into *elaïdic* acid, and in the other it is not thus changed. (*Note to the fourth edition.*)

ble. It is now long since one or more substances having this preservative effect have been made known and practically used; and, since the principle upon which they are supposed to act has been discovered, the number has been much extended. Thus benzoin rubbed up with fats is well known to preserve them long against rancidity, and *benzoated lard*, made by mixing one part of benzoin with 44 parts of melted lard, is one of the preparations of the present British Pharmacopœia; and the buds of the poplar (*Populus nigra*) are perhaps still more effectual; as, according to M. Deschamps, lard impregnated with their virtues will keep good indefinitely. In the French Codex the poplar buds are employed for this purpose in the "*Pomade Populeum*," in which eight parts of the dried buds are used to 60 parts of the ointment, consisting of lard impregnated with the virtues of several narcotic substances; the fresh narcotic plants being boiled with lard until all their water is evaporated, and the buds afterwards digested in the strained liquid for 24 hours. Mr. Groves made experiments with many volatile oils and other analogous substances to test their preservative power; and, while many of them were found to have considerable effect, as cloves, Peruvian balsam, sassafras, guaiacum, and creasote, yet the one which appeared to act most efficiently was the *oil of pimento;* and he proposes to add to the officinal *prepared lard* of the British Pharmacopœia, either oil of pimento or balsam of Peru, in the proportion of two drops to the ounce, in order to contribute to its preservation. (See *Am. Journ. of Pharm.*, Jan. 1865, pp. 54, 61.)

Animal fats are especially liable to become rancid when kept; and it is very desirable to obviate this effect; for, instead of having the mild demulcent properties which constitute their chief value, they become irritant, and unfit as vehicles for other substances to be applied to the skin. Prof. Hirzel says that animal fats may be kept in a good condition for a year by the following plan. Mix 14 pounds of the recently melted fat with 5 drachms of common salt and 15 grains of alum, in fine powder, heat till a scum is formed on the surface, separate the scum, and, when the clear liquid has cooled, wash it many times with water with malaxation, so as to remove all the salt, then evaporate the water at a heat insufficient to injure the fat. (*Am. Journ. of Pharm.*, July, 1868, p. 334.)

It is sometimes desirable to deprive the fixed oils of colour. The following process for this purpose is recommended by M. Brunner. The oil is first brought to the state of emulsion by strongly agitating it with water rendered mucilaginous by gum or starch; the emulsion is treated for each part of oil with two parts of wood-charcoal, previously well heated, and coarsely powdered, the finer particles being sifted out; the pasty mass is then completely dried at a heat not exceeding 212° F., and exhausted by cold ether in a percolator; finally, the ethereal solution, having been allowed to stand in order that any charcoal present in it may subside, is submitted to distillation so as to separate the ether, and the oil remains colourless in the retort. (*Journ. de Pharm.*, Sept. 1858, p. 214.)

M. Berlandt recommends the following method of bleaching fixed oils. Shake strongly for some minutes 900 parts of the oil, with 120 parts of water holding in solution 3 parts of permanganate of potassium, allow the mixture to stand for some hours in a warm place, and then filter. The oil becomes colourless. (*Journ. de Pharm. et de Chim.*, Oct. 1867, p. 314.)

The ultimate constituents of the fixed oils are carbon, hydrogen, and oxygen; the hydrogen being in much larger proportion than is necessary to saturate the oxygen. Those which are least fusible contain most carbon and least oxygen; and, according to De Saussure, their solubility in alcohol is greater in proportion to their amount of oxygen. (*Berzelius.*) Some of them contain a very minute proportion of nitrogen.

2. OLEA VOLATILIA. *Volatile Oils.*

These are sometimes called *distilled oils*, from the mode in which they are usually procured; sometimes *essential oils*, from the circumstance that they possess, in a concentrated state, the properties of the plants from which they are derived. They exist in all odoriferous vegetables, sometimes pervading the plant, sometimes confined to a single part; in some instances contained in distinct cellules, and preserved after

desiccation, in others formed upon the surface, as in many flowers, and exhaled as soon as formed. Occasionally two or more are found in different parts of the same plant. Thus, the orange tree produces one oil in its leaves, another in its flowers, and a third in the rind of its fruit. In a few instances, when existing in distinct cellules, they may be obtained by pressure, as from the rind of the lemon and orange; but they are generally procured by distillation with water. (See *Olea Destillata.*) Some volatile oils, as those of bitter almonds and mustard, are formed, during the process of distillation, out of substances of a different nature pre-existing in the plant.

The volatile oils are usually yellowish, but often brown, red, green, or blue, and occasionally colourless. There is reason, however, to believe that, in all instances, the colour depends on foreign matter dissolved in the oils. Septimus Piesse has succeeded, by the fractional distillation of certain volatile oils, in separating a blue liquid, which, by repeated rectification, he has obtained quite pure. In this state, it has the sp. gr. 0·910, and a fixed boiling point of 576° F., and yields a dense blue vapour, having peculiar optical properties. He has named this principle *azulene*, and believes that upon it depends the blueness of volatile oils wherever existing. The yellowness of the oils he ascribes to the resin resulting from their oxidation, the green and brown colours to a mixture of azulene and resin in various proportions. The formula of azulene is $C_{16}H_{13}O$. (*Chem. News*, Nov. 21, 1863, p. 245.)

The volatile oils have a strong odour, resembling that of the plants from which they were procured, though generally less agreeable. Their taste is hot and pungent, and, when they are diluted, is often gratefully aromatic. The greater number are lighter than water; some are heavier; and their sp. gr. varies from 0·847 to 1·17. They partially rise in vapour at ordinary temperatures, diffusing their peculiar odour, and are completely volatilized by heat. Their boiling point is various, generally as high as 320° F., and sometimes higher; but most of them rise readily with the vapour of boiling water. When distilled alone, they almost always undergo partial decomposition. They differ also in their point of congelation. A few are solid at ordinary temperatures, several become so at 32° F., and may remain liquid considerably below that point. Heated in the open air, they take fire and burn with a bright flame attended with much smoke. Almost all those hitherto examined have the property of very decidedly deviating the plane of polarization of light, some in one direction, and some in the other; and advantage may sometimes be taken of this property to detect adulterations of one of these oils with another.

Exposed at ordinary temperatures, they absorb oxygen, assume a deeper colour, become thicker and less odorous, and are ultimately converted into resin.* This change takes place most rapidly under the influence of light. Before the alteration is complete, the remaining portion of oil may be recovered by distillation. Some of them form well characterized acids by combination with oxygen.†

The volatile oils are very slightly soluble in water. Agitated with this fluid they render it milky; but separate upon standing, leaving the water impregnated with their odour and taste. This impregnation is more complete when water is distilled with the oils, or from the plants containing them. Trituration with magnesia or its carbonate renders them much more soluble, probably in consequence of their minute division. The intervention of sugar also greatly increases their solubility, and affords a convenient method of preparing them for internal use. Most of them are very solu-

* Some interesting observations have been made by M. Auguste Houzeau, in reference to the chemical influence of the atmosphere, which go to prove that, in reference at least to the air at Rouen, in France, which was the site of these observations, this influence varies in degree with the season, being greatest in the advanced spring or early summer (May and June), diminishing sensibly in the summer and greatly in autumn, and increasing at the close of winter and the beginning of spring. If this be generally true, the change in oils, as well as in all other bodies oxidizible in the air, should be greatest at that period of the year when the atmospheric influence is greatest, namely, in May and June, and least when this is least, in the winter months. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. pp. 212–218.)—*Note to the thirteenth edition.*

† *Recovery of volatile oils from their resinified condition.* A process for this purpose, employed by M. Curieux, is to treat the old resinified oil with a solution of borax and animal charcoal; these being first mixed to form a magma, the oil then added, and the mixture shaken for fifteen minutes. The borax unites with the resinous matter; and the magma, adhering to the sides of the vessel, leaves the oil clear and possessed of its original properties. (*Am. Journ. of Pharm.*, Sept. 1858, p. 398; from *Journ. de Chim. Méd.*)—*Note to the twelfth edition.*

ble in alcohol, and in a degree proportionate to its freedom from water. The oils which contain no oxygen are scarcely soluble in diluted alcohol; and, according to De Saussure, their solubility generally in this liquid is proportionate to the quantity of oxygen which they contain. They are readily dissolved by ether.

The volatile oils dissolve sulphur and phosphorus with the aid of heat, and deposit them on cooling. By long boiling with sulphur, they form brown, unctuous, fetid substances, formerly called *balsams of sulphur*. They absorb chlorine, which converts them into resin, and then combines with the resin. Iodine produces a similar effect. They are decomposed by the strong mineral acids, and unite with several of those from the vegetable kingdom. When treated with a caustic alkali, they are converted into resin, which unites with the alkali to form a kind of soap. Several of the metallic oxides, and various salts which easily part with oxygen, convert them into resin. The volatile oils dissolve many of the proximate principles of plants and animals, such as the fixed oils and fats, resins, camphor, and several of the organic alkalies. Exposed to air and light, they acquire a decolorizing property, analogous to that of chlorine, which is ascribed by Faraday to their combination with the ozonized oxygen of the atmosphere. For some interesting observations on this property of the volatile oils, the reader is referred to papers by Dr. J. L. Plummer, of Richmond, Indiana, in the *American Journal of Pharmacy* (xxv. 398 and 508).*

The volatile, like the fixed oils, are mixtures of two or more principles, which differ in their point of volatilization or congelation, or in their composition. It is, however, impossible to separate them by distillation alone so as to obtain the several principles entirely pure. When, as often happens, the constituents congeal at different temperatures, they may be separated by compressing the frozen oil between folds of bibulous paper. The solid matter remains within the folds; and the fluid is absorbed by the paper, from which it may be separated by distillation with water. The name of *stearoptene* has been proposed for the former, that of *eleoptene* for the latter. The solid crystalline substances deposited by volatile oils upon standing are also called stearoptenes. Some of them are denominated *camphors*, from their resemblance to true camphor. Some are isomeric with the oils in which they are formed, others are oxides. Certain oils, under the influence of water, deposit crystalline hydrates of the respective oils.

In reference to their ultimate constituents, the volatile oils may be divided into three sets: 1. the *non-oxygenated*, consisting exclusively of carbon and hydrogen, as the oils of turpentine and copaiba; 2. the *oxygenated oils*, containing carbon, hydrogen, and oxygen, as oil of cinnamon and most of the aromatic oils; and 3. the *sulphuretted*, containing sulphur, as the oils of horseradish and mustard. In relation to the first division, or non-oxygenated oils, it is a remarkable fact, that, however differing in sensible properties, almost all of them contain carbon and hydrogen in the same proportion; their formulas being the same, or differing only in the whole number of equivalents; as C_5H_4, $C_{10}H_8$, and $C_{20}H_{16}$, of which the last two are simple multiples of the first.

The volatile oils are often sophisticated. Among the most common adulterations are fixed oils, resinous substances, and alcohol. The presence of the fixed oils may be known by the permanent greasy stain which they leave on paper, while that occasioned by a pure volatile oil disappears entirely when exposed to heat. They may also in general be detected by their comparative insolubility in alcohol. Both the fixed oils and resins are left behind when the adulterated oil is distilled with water. If alcohol is present, the oil becomes milky when agitated with water, and, after the separation of the liquids, the water occupies more space and the oil less than before. The following method of detecting alcohol was proposed by M. Beral. Put twelve drops of the suspected oil in a perfectly dry watch-glass, and add a piece of potassium about as large as the head of a pin. If the potassium remains for twelve or fifteen minutes in the midst of the liquid, there is either no alcohol present, or less

* See also the same journal (xxviii. 197) for some curious facts in relation to a repulsive influence exerted upon, and changes of colour produced in a mixture of chromate of potassium and sulphuric acid, by different volatile oils, at sensible and sometimes considerable distances from the mixture, effected probably through the vapour of the oils. (*Note to the eleventh edition.*)

than 4 per cent. If it disappears in five minutes, the oil contains more than 4 per cent. of alcohol; if in less than a minute, 25 per cent. or more. M. Borsarelli employs chloride of calcium for the same purpose. This he introduces in small pieces, well dried and perfectly free from powder, into a small cylindrical tube, closed at one end, and about two-thirds filled with the oil to be examined, and heats the tube to 212°, occasionally shaking it. If there is a considerable proportion of alcohol, the chloride is entirely dissolved, forming a solution which sinks to the bottom of the tube; if only a very small quantity, the pieces lose their form, and collect at the bottom in a white adhering mass; if none at all, they remain unchanged. (*Journ. de Pharm.*, xxvi. 429.) J. J. Bernoulli proposes as a test dry acetate of potassium, which remains unaffected in a pure oil, but is dissolved if alcohol is present, and forms a distinct liquid. (See *Am. Journ. of Pharm.*, xxv. 82.) Sometimes volatile oils of little value are mixed with the more costly. The taste and smell afford in this case the best means of detecting the fraud. The specific gravity of the oils may also serve as a test of purity. When two oils, of which one is lighter and the other heavier than water, are mixed, they are separated by long agitation with this fluid, and will take a place corresponding to their respective specific gravities; but it sometimes happens that an unadulterated oil may thus be separated into two portions. The difference of apparent effect produced by iodine with the several oils has been proposed as a test; and bromine has been employed for the same purpose by Prof. John M. Maisch. Mr. Maisch uses both these tests preferably in the state of ethereal solution; which, as it is liable to spontaneous change by keeping, should be prepared when wanted for use.* According to Liebig, when iodine is made to act on a volatile oil, a portion of it combines with the hydrogen of the oil forming hydriodic acid, while another portion takes the place of the lost hydrogen. Oil of turpentine may be detected by remaining in part undissolved, when the suspected oil is treated with three or four times its volume of alcohol of the sp. gr. 0·84; or, according to M. Mero, by causing the suspected oil, when agitated with an equal measure of poppy oil, to remain transparent, instead of becoming milky, as it would do if pure. The latter test will not apply to the oil of rosemary. (*Journ. de Pharm.*, 3e sér., vii. 303.) G. S. Heppe suggests a very delicate test of oil of turpentine and most other non-oxygenated oils, when used to adulterate one of the oils containing oxygen. A piece of nitroprusside of copper, of the size of a pin's head, is put into a little of the suspected oil in a test-tube, and heated until the liquid begins to boil. The boiling must be continued only a few seconds. If the oil be pure and oxygenated, the nitroprusside of copper will become black, brown, or gray; if oil of turpentine or other non-oxygenated oil be present, the deposit will be green or bluish-green, and the supernatant liquid colourless or yellowish. (*Chem. Gaz.*, April 15, 1857, p. 155.)†

The different relation of the volatile oils to polarized light may, to a certain extent, be made available for the detection of adulterations, especially where the action of the adulterating oil is in an opposite direction to that adulterated. Thus the oils of juniper, lavender, rosemary, rotate the plane of polarization to the left, while American oil of turpentine rotates to the right; and if this should be added to one of the other oils, it might in some degree neutralize their action, and thus offer one means for its detection. Unfortunately, the French oil of turpentine, from the juice of the Pinus maritima, acts strongly in the opposite direction. But the very strength of its left rotatory power may lead to its detection by the abnormal increase of this power which it might impart to the oils in question. An instrument called the *polariscope* is necessary in these investigations; and the reader is referred, for the description of such an instrument, with a table of the direction and degree of this rotating power in several of the oils most employed, to a paper, by Mr. H. Sugden Evans, in the *Pharmaceutical Journal and Transactions* (Oct. 1865, p. 220).

Volatile oils may be preserved without change in small well-stopped bottles, entirely filled with the oil, and secluded from the light. W.

* Mr. Maisch's paper on the application of these tests to the several volatile oils is contained in the *Proceedings of the American Pharm. Association*, A.D. 1859, p. 342.

† For an elaborate paper on the detection of adulterations in volatile oils, by Mr. John M Maisch, see *Proceedings of the Am. Pharm. Association*, A.D. 1858, p. 344.

OLEUM AMYGDALÆ AMARÆ. *U.S.*

Oil of Bitter Almond.

The volatile oil obtained from the kernel of the fruit of Amygdalus communis, variety amara. *U.S.*

When bitter almonds are expressed, they yield a bland fixed oil; and the residuary cake, reduced to powder by grinding, and submitted to distillation with water, gives over a volatile oleaginous product, commonly called oil of bitter almonds. This does not pre-exist in the almond, but is produced by the reaction of water upon the amygdalin contained in it, through the intervention of another constituent denominated emulsin. (See *Amygdala Amara.*) It is obtained also by the distillation of the leaves of the cherry-laurel, and of various products of the genera Amygdalus, Cerasus, Prunus, and others. (See *note*, *page* 122.) Mr. Whipple obtained, upon an average, from the ground bitter almond cake, 1·35 per cent. of the oil. (*Pharm. Journ.*, x. 297.) Pettenkoffer has ascertained that the product is greater, if the cake be macerated in water for forty-eight hours before being submitted to distillation. (*Journ. de Pharm.*, Mai, 1862, p. 432.)

Oil of bitter almonds has a yellowish colour, a bitter, acrid, burning taste, and the odour of the kernels in a high degree. It is heavier than water, soluble in alcohol and ether, slightly soluble in water, and deposits, upon standing, a white crystalline substance consisting chiefly of benzoic acid. Besides a peculiar volatile oil, it contains also hydrocyanic acid, with a small proportion of benzoic acid, and of a concrete principle called *benzoïne*. It may be obtained pure by agitating it strongly with hydrate of lime and a solution of protochloride of iron, submitting the mixture to distillation, and drying the oil which comes over by digestion with chloride of calcium. Mr. George Whipple states that, if crude oil be redistilled into a solution of nitrate of silver, and again distilled from a fresh solution of the same salt, it is obtained entirely free from hydrocyanic acid, which reacts with the silver, and remains behind as cyanuret of silver. (See *Am. Journ. of Pharm.*, xxvi. 348.) Thus purified it is colourless, but still retains its peculiar odour, with a burning, aromatic taste; and is destitute of the poisonous properties of the oil in its original state, dependent on hydrocyanic acid. The odour of the oil of bitter almonds has been erroneously ascribed to that acid, which, on examination, will be found to smell differently and more feebly. Like most other volatile oils, this may produce deleterious effects if taken very largely. Hippuric acid is found in the urine of animals to which it has been given freely. The sp. gr. of the crude oil varies from 1·052 to 1·082, and is said to be greater when the oil is distilled from salt water than in the ordinary mode. That of the purified oil is 1·043, and its boiling point 356°. It probably consists of a compound radical called *benzyl* ($C_{14}H_5O_2$) and one eq. of hydrogen, and is therefore a *hydruret of benzyl*. This radical is capable of uniting with other bodies, and forming a series of compounds. The benzoic acid which the oil of bitter almonds deposits on standing does not pre-exist in it, but results from the absorption of oxygen. The concrete substance above referred to by the name of *benzoïne* is isomeric with the oil, crystallizable in colourless shining prisms, without smell or taste, fusible at 248°, and volatilizable unchanged at a higher temperature. It is formed abundantly in the original impure oil by the reaction of alkalies; but cannot be produced in it when deprived of hydrocyanic acid.* Schönbein has satisfied himself that oil of bitter

* *Nitrobenzole, Nitrobenzine, or Artificial Oil of Bitter Almonds.* This substance was discovered by Mitscherlich, who obtained it by the reaction of nitric acid on *benzole*, a carbohydrogen originally procured by distilling benzoic acid with lime. (See *Part III.*) It is characterized by having an odour closely resembling that of the oil of bitter almonds, for which it has recently been substituted to a considerable extent in perfumery, in consequence of the discovery of benzole among the products of the distillation of coal tar, and the facility thus offered for preparing nitrobenzole cheaply. In its preparation a large glass worm is used, bifurcated at its upper end, so as to form two funnel-shaped tubes. Into one of these concentrated nitric acid is poured, and into the other benzole, and the two, meeting at the point of junction of the tubes, form the compound in question, which is cooled as it passes through the worm, and is afterwards fitted for use by washing it with water, or dilute solution of carbonate of sodium. Much of it is consumed, in London, for scenting

almonds has, like electricity and phosphorus, an ozonizing effect on oxygen. (*Chem. Central Blatt*, Dec. 15, 1858, p. 905.)

Zeller mentions, as characteristics of the officinal oil by which its genuineness and purity may be known, its peculiar odour and high specific gravity; its ready solubility in sulphuric acid, with the production of a reddish-brown colour, but without visible decomposition; the slow action of nitric acid; the slow and partial solution of iodine without further reaction; the want of action of chromate of potassium upon it; and the production of crystals when it is dissolved in an alcoholic solution of potassa. (See *Pharm. Journ.*, ix. 575.) Mr. Redwood states that a very small proportion of alcohol may be detected in the oil, by the effervescence, with disengagement of nitrous vapours, which ensues when the oil, thus contaminated, is mixed with an equal volume of nitric acid, of the sp. gr. 1·5. With pure oil no other effect is obvious than a slight change of colour. (*Ibid.*, xi. 486.) If sulphuric acid produces with the oil a bright-red, instead of a brownish-red colour, it indicates that the oil has probably been distilled with salt water, in which case it is apt, according to Mr. Ferris, to deposit a blood-red matter, occasionally complained of by druggists. (*Ibid.*, p. 565.)

Mr. Wm. A. Tilden has found that the introduction of a little fused chloride of calcium into purified oil of bitter almonds contributes to its preservation, probably by the absorption of the last traces of water contained in it. Of two specimens of the oil, which had been set aside for two years, one without addition, the other containing a fragment of the fused chloride, the former was found filled with crystals of benzoic acid, the latter was perfectly free from crystalline deposit and quite fluid. (*Pharm. Journ. and Trans.*, 2d ser., viii. 325, Dec. 1866.)

soap, in confectionery, and for culinary purposes, to which it is even better adapted than the proper oil of bitter almonds, because free from hydrocyanic acid. (*Pharm. Journ.*, xi. 421.) Van den Corput has found nitrobenzine a perfect cure for the itch. One or two frictions well made are sufficient to kill both the insect and its eggs. He mixes the nitrobenzine with twice its weight of glycerin, and applies it by means of a woollen rag impregnated with the mixture, having previously cleansed the body by vigorous friction with soft soap, followed by a bath. (*Ann. de Thérap.*, 1865, p. 156.)

In the twelfth edition of the *U. S. Dispensatory*, it is said that nitrobenzine is not destitute of activity, and should not, therefore, be incautiously used. Abundant evidence has since been obtained, proving it to possess highly poisonous properties. Not only has it been proved to be capable of destroying life in the lower animals, but it has also, in several instances, proved fatal in man; acting as a powerful narcotic poison, whether taken into the stomach, or inhaled in the state of vapour. In one case death took place from the swallowing, as was supposed, of about 15 drops of the poison; in a second, from an indefinite quantity taken into the stomach; in a third, from the breathing for several hours of the vapour of some nitrobenzole which had been spilled upon the clothes. In all the cases there was loss of consciousness, beginning with sensations as of intoxication, and increasing to profound coma, in which the patient died without vomiting, convulsion, or struggle of any kind: the whole duration of the case being about nine hours, four before the coming on of coma, and five from that point till death. After death there were appearances of general venous congestion, both internally and externally; the brain and its membranes were congested, with much bloody serosity in the ventricles; the cavities of the heart were full of blood: and nitrobenzole as well as anilin, into which it appeared to have been converted, were detected in the brain and stomach. Several instances are recorded in which serious consequences have followed the inhalation of the vapour escaping from soap scented with nitrobenzole. (Dr. Alfred S. Taylor, *Guy's Hospital Reports*, 3d ser., x. 192, A.D. 1864.) A case has been recorded by Dr. Limasset, in *l'Union Médicale*, in which an external application of nitrobenzine for the cure of itch, produced alarming symptoms of nervous and circulatory disorder, with severe vomiting, and exhalations having the bitter almond odour, from which, however, the patient recovered. (*Journ. de Pharm.*, Sept. 1874, p. 240.) —*Note to the thirteenth and fourteenth editions.*

Mr. J. M. Maisch has known nitrobenzole to be used for the adulteration of the oil of bitter almonds, and proposes the following mode of detecting it. Dissolve half a drachm of the suspected oil in two or three drachms of alcohol, add fifteen grains of pure fused caustic potassa, heat for a few minutes so as to dissolve the potassa and reduce the liquid to one-third, and then set aside to cool. If the oil be pure it will remain liquid, while, if nitrobenzole be present, there will, after cooling, be a crystalline deposit proportionate to the amount of adulteration. (*Am. Journ. of Pharm.*, Nov. 1857, p. 544.) R. Wagner proposes the sp. gr. of the two oils as a test; that of the oil of bitter almonds being from 1·04 to 1·044, while that of nitrobenzole is 1·18 to 1·201; and a mixture will have a higher sp. gr. than the pure oil. This would lead to the suspicion of the presence of nitrobenzole, which may then be separated by agitation with bisulphite of sodium. The almond oil will dissolve, while the nitrobenzole will float on the surface. (*Journ. de Pharm. et de Chim.*, Mai, 1868, p. 399.) And still another and more recent method is that proposed by M. E. Bourgoin, consisting in the action of bisulphide of sodium on the mixed liquids, and the separation, by means of ether, of the nitrobenzole from the compound which the oil of bitter almonds forms with the bisulphide. For the more minute particulars of the process, see *Annuaire de Thérap.*, 1873, p. 98. (*Note to the tenth, twelfth, thirteenth, and fourteenth editions.*)

The following are given, in the lately revised U.S. Pharmacopœia, as the distinctive characters of this oil. "Soluble in nitric acid at ordinary temperatures, without the evolution of nitrous acid fumes. When fifteen grains of potassa are added to a solution of fifteen minims of the oil in two fluidrachms of alcohol, and the mixture is heated until the potassa is dissolved, and the solution is reduced by evaporation to about one-third of its original bulk, the resulting liquid has a brownish-yellow colour, and deposits no crystals upon standing for an hour in a cool place." *U. S.*

Medical Properties and Uses. The unpurified volatile oil of bitter almonds, which is the product directed by the Pharmacopœia, operates upon the system in a manner closely analogous to that of hydrocyanic acid. A single drop is sufficient to destroy a bird, and four drops have caused the death of a dog of middle size. The case of a man is recorded, who died in ten minutes after taking two drachms of the oil. It might probably be substituted with advantage for medicinal hydrocyanic acid; as the acid contained in the oil is much less liable to decomposition, remaining for several years unaltered, if the oil is preserved in well-stopped bottles. According to Schrader, 100 parts of the oil contain sufficient acid for the production of 22·5 parts of Prussian blue; but the proportion is not constant, varying, according to Mr. Groves, from 8 to 12·5 per cent. From one-fourth of a drop to a drop may be given for a dose, to be cautiously increased till some effect upon the system is observed. It may be administered in emulsion with gum arabic, loaf sugar, and water. It has been employed externally, dissolved in water in the proportion of one drop to a fluidounce, in prurigo senilis and other cases of troublesome itching. To facilitate the solution in water, the oil may be previously dissolved in spirit. Oil of bitter almonds is said to conceal the tast of cod-liver oil and of castor oil. W.

Off. Prep. Aqua Amygdalæ Amaræ, *U. S.*

OLEUM AMYGDALÆ EXPRESSUM. *U.S.*

Expressed Oil of Almond.

Syn. Oleum Amygdalæ Dulcis. *Pharm.*, 1860. *U. S.*

The fixed oil obtained from the kernel of the fruit of Amygdalus communis (*De Candolle*). *U. S.*

Off. Syn. OLEUM AMYGDALÆ. *Almond Oil.* The oil expressed from bitter and sweet almonds. *Br.*

Huile d'amandes, *Fr.;* Mandelöl, *Germ.;* Olio di mandorle, *Ital.;* Aceyte de almendras, *Span.*

See AMYGDALA.

This oil is obtained equally pure from sweet and bitter almonds. In its preparation, the almonds, having been deprived of a reddish-brown powder adhering to their surface, by being rubbed together in a piece of coarse linen, are ground in a mill resembling a coffee-mill, or bruised in a stone mortar, and then pressed in canvas sacks between plates of iron slightly heated. The oil, which is at first turbid, is clarified by rest and filtration. Sometimes the almonds are steeped in very hot water, deprived of their cuticle, and dried in a stove, previously to expression. The oil is thus obtained free from colour, but in no other respect better, while it is more apt to become rancid on keeping. Bitter almonds treated in this way, impart a smell of hydrocyanic acid to the oil. M. Boullay obtained 54 per cent. of oil from sweet almonds, Vogel 28 per cent. from bitter almonds. Munch gives 55·4 per cent. as the yield of the former, and 52 per cent. as that of the latter. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 400.) Though sometimes expressed in this country from imported almonds, the oil is generally brought from Europe.

Oil of almonds is clear and colourless, or slightly tinged of a greenish-yellow, is nearly inodorous, and has a bland sweetish taste. It remains liquid at temperatures considerably below the freezing point of water. Its sp. gr. is from 0·917 to 0·92. From the statement of Braconnot, it appears to contain 76 per cent. of olein and 24 of margarin.

According to Dr. H. Hager, the oils expressed from the large sweet and the smaller bitter almonds differ considerably; as shown by the elaidin test; the former

oil congealing more rapidly—almost completely; the latter about twelve hours later, and the more imperfectly the smaller the bitter almond has been. Only about one-third of its bulk congeals, when from the small Oporto almonds.

Oil of almonds is said to be sometimes adulterated with poppy oil, or other drying oils of less value. This sophistication may be detected, as suggested by M. Wimmec, by taking advantage of the property of being converted into solid elaidic acid by the action of nitric acid, belonging to the olein of the non-drying, but not to that of the drying oils. By treating iron filings with nitric acid in a flask, nitrous acid is produced, which is to be conducted into water upon which the suspected oil is placed. If the almond oil contain even but a small quantity of poppy oil, or other drying oil, this will remain in the form of drops on the surface, while the genuine oil will be converted entirely into crystallized elaidin. (*Journ. de Pharm.*, Dec. 1862, p. 500.)

Colza oil, another not uncommon adulteration, may be detected, according to M. Schneider, by the action of nitrate of silver. Dissolve the oil in twice its volume of ether, add about 30 drops of a concentrated alcoholic solution of the nitrate, shake the mixture, and allow it to stand in the dark. If there be much colza oil, the lower part of the liquid will become first brown and then black; if but little, the brown colour will not appear for about 12 hours; but always the discoloration will be obvious on the evaporation of the ether. (*Pharm. Journ.*, March, 1862, p. 484.)

It is said that, in the south of France, the sweet almond oil is sometimes adulterated with a cheaper oil, called the *oil of apricots*. According to M. J. Nicklés, this adulteration may be detected by means of powdered hydrate of lime, which with the oil of apricots forms an emulsion that slowly assumes an unctuous consistence, while it has no such action on the almond oil, merely rendering it opaque for a time, and then gradually separating and leaving the oil clear. A mixture of the two oils emulsionizes with the lime, and on standing deposits the unctuous matter referred to. (See *Am. Journ. of Pharm.*, July, 1866, p. 289.)

Dr. Hager recommends the following mode of distinguishing the oils of the *peach and apricot seeds* from the almond oil. If equal volumes of the oil and of 25 per cent. nitric acid are shaken together in a test tube, an emulsion-like mixture is produced, which separates on standing. All true almond oils yield a white mixture, and the oils remain white for many hours after separation. The other oils mentioned turn yellowish at once, on being shaken with the acid, and the colour afterwards deepens, and in half an hour is of a rather deep-red yellow. (*Am. Journ. of Pharm.*, Sept. 1870, p. 408.)

Oil of almonds may be used for the same purposes with olive oil; and, when suspended in water by means of mucilage or the yelk of eggs and loaf sugar, forms a pleasant emulsion, useful in pulmonary affections attended with cough. From a fluidrachm to a fluidounce may be given at a dose.

Off. Prep. Unguentum Aquæ Rosæ, *U. S.;* Unguentum Cetacei, *Br.;* Unguentum Simplex, *Br.;* Unguentum Hydrargyri Oxidi Rubri, *Br.;* Unguentum Plumbi Subacetatis Compositum, *Br.* W.

OLEUM ANTHEMIDIS. *Br.*

Oil of Chamomile.

The oil distilled in Britain from chamomile flowers. *Br.*

For an account of the plant yielding this oil, see ANTHEMIS, *page* 130.

This oil has been introduced into the Materia Medica list of the British Pharmacopœia, under the name of *English Oil of Chamomile*, and with the direction that it shall be distilled in England. It is seldom prepared or used in this country. Baumé obtained thirteen drachms of the oil from eighty-two pounds of the flowers; according to Mr. Brande, the average product of 100 pounds is two pounds twelve ounces. It has the peculiar smell of chamomile, with a pungent somewhat aromatic taste. When recently distilled it is of a pale sky-blue or greenish-blue colour, which changes to yellow or brownish on exposure. The sp. gr. of the English oil is said

to be 0·9083. According to M. Gerhardt, oil of chamomile is a mixture of a carbohydrogen ($C_{20}H_{16}$) with an oxygenated oil ($C_{10}H_6O_2$). (*Chem. Gaz.*, vi. 483.) It has sometimes been employed in spasm of the stomach, and as an adjunct to purgative medicines. Its chief use, however, appears to be as an ingredient of the extract of chamomile of the British Pharmacopœia, to which it is added in order to supply the place of the oil driven off by the heat used in its preparation. This oil must not be confounded with the product of *Matricaria Chamomilla*, employed on the continent of Europe under the name of oil of chamomile. (See *Matricaria*.) The dose is from five to fifteen drops.

Off. Prep. Extractum Anthemidis, *Br.* W.

OLEUM BERGAMII. *U.S.*

Oil of Bergamot.

The volatile oil obtained from the rind of the fruit of Citrus Limetta (*De Candolle*). *U. S.*

Huile de bergamotte, *Fr.;* Bergamottöl, *Germ.;* Olio di bergamotta, *Ital.*

CITRUS. See AURANTII CORTEX.

Citrus Limetta. De Cand. *Prodrom.* i. 539. The bergamot tree has been generally ranked among the lemons; but is now considered as a variety of the Citrus Limetta of Risso, and is so placed by De Candolle. It has oblong-ovate dentate, acute, or obtuse leaves, somewhat paler on the under than the upper surface, and with footstalks more or less winged or margined. The flowers are white, and usually small; the fruit pyriform or roundish, terminated by an obtuse point, with concave receptacles of oil in the rind.

The pulp of the fruit is sourish, somewhat aromatic, and not disagreeable. The rind is shining, and of a pale-yellow colour, and abounds in a very grateful volatile oil. This may be obtained by expression or distillation. In the former case, it preserves the agreeable flavour of the rind, but is somewhat turbid; in the latter, it is limpid but less sweet. The mode of procuring it by expression is exactly that used for oil of lemons. (See *Oleum Limonis.*) It is brought from Italy, the south of France, and Portugal.

The oil of bergamot, often called *essence of bergamot*, has a sweet, very agreeable odour, a bitter aromatic pungent taste, and a pale greenish-yellow colour. Its sp. gr. varies from 0·870 to 0·888 (*Lewis, Zeller*); and its composition is essentially the same as that of oil of lemons. It is distinguished from the lemon and orange oils by readily dissolving in *liquor potassæ*, and forming with it a clear solution. (*Zeller.*) Though possessed of the excitant properties of the volatile oils in general, it is employed chiefly, if not exclusively, as a perfume. W.

OLEUM CAJUPUTI. *U.S., Br.*

Oil of Cajeput.

The volatile oil obtained from the leaves of Melaleuca Cajuputi (Roxburgh, *Trans. Lond. Medico-Bot. Soc.*). *U. S.* The oil distilled from the leaves of Melaleuca minor, *D. C.* Imported from Batavia and Singapore. *Br.*

Huile de cajéput, *Fr.;* Cajeputöl, *Germ.;* Olio di cajeput, *Ital.;* Kayuputieh, *Malay.*

MELALEUCA. *Sex. Syst.* Polyadelphia Icosandria.—*Nat. Ord.* Myrtaceæ.

Gen. Ch. Calyx five-parted, semi-superior. *Corolla* five petaled. *Stamens* about forty-five, very long, conjoined in five bodies. *Style* single. *Capsule* three-celled. *Seeds* numerous. *Roxburgh.*

It was long supposed that the oil of cajeput was derived from *Melaleuca leucadendron;* but from specimens of the plant affording it, sent from the Moluccas, and cultivated in the botanical garden of Calcutta, it appears to be a distinct species, which has received the name of *M. Cajuputi.* It corresponds with the *arbor alba minor* of Rumphius, and is a smaller plant than *M. leucadendron.* It is possible,

however, that the oil may be obtained from different species of Melaleuca; as M. Stickel, of Jena, succeeded in procuring from the leaves of *M. hypericifolia*, cultivated in the botanical garden of that place, a specimen of oil not distinguishable from the cajeput oil of commerce, except by a paler green colour. (*Annal. der Pharm.*, xix. 224.) Two other species of Melaleuca, *M. viridifolia* and *M. latifolia*, large trees growing abundantly in the island of New Caledonia, are said to yield a volatile oil very analogous to the oil of cajeput. The leaves of different species of Melaleuca have been used advantageously, in the form of bath, in chronic rheumatism. (*Annuaire de Thérap.*, A.D. 1861, p. 67.)

Melaleuca Cajuputi. Rumphius, *Herbar. Amboinense*, tom. ii. tab. 17; Roxburgh, *Trans. Lond. Med. Bot. Soc.*, A.D. 1829; *Journ. of the Phil. Col. of Pharm.*, vol. i. p. 193. — *Melaleuca minor.* De Candolle. This is a small tree, with an erect but crooked stem, and scattered branches, the slender twigs of which droop like those of the weeping willow. The bark is of a whitish ash colour, very thick, soft, spongy, and lamellated, throwing off its exterior layer from time to time in flakes. The leaves have short footstalks; are alternate, lanceolate, when young sericeous, when full grown smooth, deep-green, three and five-nerved, slightly falcate, entire, from three to five inches long, from one-half to three-quarters of an inch broad; and when bruised exhale a strong aromatic odour. The flowers are small, white, inodorous, sessile, and disposed in terminal and axillary downy spikes, with solitary, lanceolate, three-flowered bractes. The filaments are three or four times longer than the petals, and both are inserted in the rim of the calyx.

This species of Melaleuca is a native of the Moluccas, and other neighbouring islands. The oil is obtained from the leaves by distillation. It is prepared chiefly in Amboyna and Bouro, and is exported from the East Indies in glass bottles. The small proportion yielded by the leaves, and the extensive use made of it in India, render it costly.

Properties. Cajeput oil is very fluid, transparent, of a fine green colour, a lively and penetrating odour analogous to that of camphor and cardamom, and a warm pungent taste. It is very volatile and inflammable, burning without any residue. The sp. gr. varies from 0·914 to 0·9274. Its composition, according to Blanchet and Sell, is represented by the formula $C_{20}H_{16}+2HO$; and its boiling point is 347° F. Schmidtproposes the name of *cajeputene* for the carbohydrogen $C_{20}H_{16}$, of which it is a bihydrate. (*Trans. Royal Soc. Edin.*, xii. 360.) The oil is wholly soluble in alcohol. When it is distilled, a light colourless liquid first comes over, and afterwards a green and denser one. The green colour has been ascribed to a salt of copper, derived from the vessels in which the distillation is performed; and Guibourt obtained two grains and a half of oxide of copper from a pound of the commercial oil. But neither Brande nor Gœrtner could detect copper in specimens examined by them; and M. Lesson, who witnessed the process for preparing the oil at Bouro, attributes its colour to chlorophyll, or some analogous principle, and states that it is rendered colourless by rectification. Guibourt, moreover, obtained a green oil by distilling the leaves of a Melaleuca cultivated at Paris. A fair inference is that the oil of cajeput is naturally green; but that, as found in commerce, it sometimes contains copper, either accidentally present, or added with a view of imitating or maintaining the fine colour of the oil. The proportion of copper, however, is not so great as to forbid the internal use of the oil; and the metal may be separated by distillation with water, or agitation with a solution of ferrocyanide of potassium.*

The high price of cajeput oil has led to its occasional adulteration. Oil of rosemary, or that of turpentine, impregnated with camphor and coloured with the resin of milfoil, is said to be employed for the purpose. The best test, according to Zeller, is iodine, which, after a moderately energetic reaction, with little increase of temper-

* This statement as to the frequent occurrence of copper in the cajeput oil of commerce, though, at the same time, its presence is not essential, has been confirmed by recent experiments by Mr. Edward Histed, who of six specimens of the commercial oil, obtained from different sources, found copper in all. When redistilled, the oil became perfectly colourless, but, after a few days exposure to copper filings, reassumed its green colour. (*Pharm. Journ.*, April, 1872, p. 804.)—*Note to the fourteenth edition.*

ature, and but a slight development of orange vapours, occasions immediate inspissation into a loose coagulum, which soon becomes a dry, greenish-brown, brittle mass.

Medical Properties and Uses. This oil is highly stimulant, producing when swallowed a sense of heat, with an increased fulness and frequency of pulse, and exciting in some instances profuse perspiration. It is much esteemed by the Malays and other people of the East, who consider it a panacea. They are said to employ it with great success in epilepsy and palsy. (*Ainslie.*) The complaints to which it is best adapted are probably chronic rheumatism, and spasmodic affections of the stomach and bowels, unconnected with inflammation. It has been extolled as a remedy in spasmodic cholera, and has been used also as a diffusible stimulant in low fevers. It is said to have been used in some cases of cholera in the collapsed state with altogether unhoped-for success; being administered, in such cases, in the dose of from fifteen grains to a drachm in a single potion. (*Ann. de Thérap.*, 1867, p. 71; from the *Presse Médicale Belge.*) Diluted with an equal proportion of olive oil, it is applied externally to relieve gouty and rheumatic pains. Like most other highly stimulating essential oils, it relieves toothache, if introduced into the hollow of the carious tooth. M. Delvaux, who has made extensive use of this oil, has found it beneficial, internally given, in dyspepsia with flatulence, in the early stages and milder forms of cholera, in verminose affections in children, in chronic laryngitis and bronchitis, in chronic catarrh of the bladder, in chronic rheumatism of the joints with little or no swelling, and in painful chronic rheumatism of the muscles and fibro-muscular tissues, whether external or internal. Externally applied, M. Delvaux has derived great benefit from it in various cutaneous diseases, as pityriasis, psoriasis, and especially in that extremely obstinate affection of the face, acnea rosacea, which he has often succeeded in curing by the simple application of this oil, three times a day. (*Annuaire de Thérap.*, A.D. 1862, p. 38.) The dose is from one to five drops, given in emulsion, in the form of pill, or upon a lump of sugar.

Off. Prep. Linimentum Crotonis, *Br.;* Spiritus Cajuputi, *Br.* W.

OLEUM CAMPHORÆ. *U.S.*

Oil of Camphor.

The volatile oil obtained from Camphora officinarum (Nees, *Laurin.*). *U.S.*

As there are two camphors known in commerce, those, namely, of Camphora officinarum and of Dryobalanops Camphora, so there are two oils of camphor derived from those plants respectively. It is that of the Camphora officinarum which is recognised in our Pharmacopœia, being the one which most commonly reaches this country, and is almost exclusively found in the shops. As the Camphora officinarum has been already described under the head of Camphora, it is unnecessary to say anything more of it here. (See *Camphora*, page 204.) In the same place an account has been given of the mode of procuring the oil, as practised in the island of Formosa.

The commercial oil of camphor, as found in our markets, is a fluid of a light reddish-brown colour with a yellowish tint, having a strong odour precisely like that of camphor, a bitterish camphorous taste, and the specific gravity, according to Prof. Procter, of 0·940. As described by M. Lallemand, the oil of the Camphora officinarum is very fluid, scarcely coloured, and of a strong smell of camphor. It acts strongly on polarized light, and is dextrogyrate. Martius and Ricker give as its formula $C_{20}H_{16}O$. It begins to boil at 356° F., but the temperature gradually rises to 401°, when it remains stationary. The part which first comes over is the proper volatile oil; that which rises at the higher temperature condenses after distillation, and is true camphor. The former, when duly rectified, distils at 356°, and appears to be a carbohydrogen isomeric with pure oil of turpentine, forming a crystallizable compound with muriatic acid. (*Journ. de Pharm.*, Avril, 1860, p. 289.) Commercial oil of camphor is therefore a fluid carbohydrogen, holding camphor in solution.

The Dryobalanops oil of camphor is a different product, resembling the genuine oil in odour, yet having also something peculiar in addition, which enables it to be

readily distinguished when the two are examined together. An account of this oil is given at *page* 207, in a note treating of the Dryobalanops Camphora and its products. A volatile oil, received by M. Biot from Dr. Junghun, who is said to have collected it from the Dryobalanops Camphora in the island of Sumatra, was sent to M. Lallemand, who describes it as somewhat viscid, of a strong balsamic odour and reddish colour, and as separable by distillation into a volatile liquid and a non-volatile matter, which concretes on cooling into a resinous brittle mass, resembling colophony. The volatile liquid consists of two distinct oils, isomeric with each other and with pure oil of turpentine, but differing in their boiling point, and in various other respects. The original oil yielded nothing similar to camphor. It is obviously a very different product from that which has been generally ascribed to the Dryobalanops, and much more closely resembles the turpentines than the camphorous oils. If it really was obtained from the Dryobalanops Camphora, this must be a very different tree from what it has been described to be; and the probability is that there has been some mistake as to the origin of the oil described by M. Lallemand.

The oil of camphor has properties similar to those of camphor but more stimulant, and is especially applicable to affections of the stomach and bowels, in which an anodyne and stimulant impression is indicated, as flatulent colic and spasmodic cholera. It may also be used externally, as a rubefacient and anodyne liniment, diluted with soap liniment, or olive oil, in local rheumatism and neuralgic pains, bruises, sprains, &c. The dose is two or three drops. W.

OLEUM CINNAMOMI. *U.S., Br.*

Oil of Cinnamon.

Syn. Oil of Ceylon Cinnamon.

The volatile oil obtained from the bark of Cinnamomum Zeylanicum (Nees, *Laurin.*). *U.S.* The oil distilled from Cinnamon Bark. *Br.*

Huile de cannelle, *Fr.;* Zimmtöl, *Germ.;* Olio di cannella, *Ital.;* Aceyte de canéla, *Span.*

See CINNAMOMUM.

There are two oils of cinnamon in commerce; one procured from the Ceylon cinnamon, which, as having the finest flavour, is the only one recognised by the U. S. and Br. Pharmacopœias; the other from the Chinese cinnamon, and often distinguished by the name of *oil of cassia*, which it held in the late Edinburgh Pharmacopœia. There is, however, no essential difference in the two oils; and that of the Chinese cinnamon, as much the cheaper and more abundant of the two, will probably continue to be generally employed, notwithstanding the official preference for the Ceylon product.

Oil of cinnamon of Ceylon is prepared in that island from inferior kinds of cinnamon, of insufficient value to pay the export duty. The following account of the method of extraction is given by Marshall. The bark, having been coarsely powdered, is macerated for two days in sea-water, and then submitted to distillation. A light and a heavy oil come over with the water, the former of which separates in a few hours, and swims upon the surface, the latter falls to the bottom of the receiver, and continues to be deposited for ten or twelve days. In future distillations, the saturated cinnamon water is employed with sea-water to macerate the cinnamon. Eighty pounds of the freshly prepared bark yield about 2·5 ounces of the lighter oil, and 5·5 of the heavier. From the same quantity kept for several years in store, about half an ounce less of each oil is obtained. The two kinds are probably united in the oil of commerce.

Recently prepared oil of cinnamon is of a light-yellow colour, becoming deeper by age, and ultimately red. Pereira states that the London druggists redistil the red oil, and thus obtain two pale-yellow oils, one lighter and the other heavier than water, with a loss of about 10 per cent. in the process. The oil has the flavour of cinnamon, and when undiluted is excessively hot and pungent. It is said sometimes to have a peppery taste, ascribable to an admixture of the leaves with the bark in the preparation of the oil.

Chinese oil of cinnamon (*oil of cassia*) is imported from Canton and Singapore.

Like the former it is pale-yellow, becoming red with age. Its flavour is similar to that of the Ceylon oil, though inferior; and it commands a much less price. Zeller states that it is heavier, less liquid, and sooner rendered turbid by cold, and that in the Ceylon oil iodine dissolves rapidly, with a considerable increase of heat, and the production of a tough residue, like extract, while in oil of cassia the reaction is slow, quiet, and with little heat, and the residue is soft or liquid. The following remarks apply to both.

Oil of cinnamon has the sp. gr. of about 1·035. Alcohol completely dissolves it; and, as it does not rise in any considerable quantity at the boiling temperature of that liquid, it may be obtained by forming a tincture of cinnamon and distilling off the menstruum. When exposed to the air, it absorbs oxygen, and is slowly converted into a peculiar acid denominated *cinnamic* acid, two distinct resins, and water. *Cinnamic acid* is colourless, crystalline, sourish, volatilizable, slightly soluble in water, readily dissolved by alcohol, and convertible by nitric acid with heat into benzoic acid. It is sometimes seen in crystals in bottles of the oil which have been long kept. Like benzoic acid, it is said when swallowed to cause the elimination of hippuric acid by urine. (*Journ. de Pharm.*, 3e sér., iii. 64.) It may be obtained by distilling the balsam of Tolu. Of the two resins, one is soluble both in hot and cold alcohol; the other readily in the former, but sparingly in the latter. Oil of cinnamon is almost wholly converted by nitric acid, slowly added, into a crystalline mass, thought to be a compound of the oil and acid. From the researches of Dumas and Peligot, it appears that there exists in the oil a compound radical, named *cinnamyl* ($C_{18}H_7O_2$), which with one eq. of hydrogen forms pure oil of cinnamon, or hydruret of *cinnamyl*, and with one of oxygen anhydrous cinnamic acid. Crystallized cinnamic acid contains, in addition, one eq. of water. All the constituents of the ordinary oils of cinnamon are supposed to be derived from the pure oil or hydruret of cinnamyl by the absorption of oxygen. The oil has been produced artificially by Strecker from styrone, a derivative from styrax. (See *Styrax.*)

Oil of cinnamon is said to be frequently adulterated with oil of cloves, which, according to Ulex, cannot be detected by the smell or taste. Thus sophisticated, it is stated, on the same authority, to evolve a very acrid vapour when a drop is heated on a watch-glass, to swell up and evolve red vapours if treated with fuming nitric acid, to remain liquid with concentrated caustic potassa, and to assume an indigo-blue colour when protochloride of iron is added to its alcoholic solution; none of which events happen when the oil is pure. (*Archiv. der Pharm.*, Jan. 7, 1853.) It is said also to be frequently adulterated with alcohol and fixed oil, the mode of detecting which is given in *page* 611.

Medical Properties and Uses. This oil has the cordial and carminative properties of cinnamon, without its astringency; and is much employed as an adjuvant to other medicines, the taste of which it corrects or conceals, while it conciliates the stomach. As a powerful local stimulant, it is sometimes prescribed in gastrodynia, flatulent colic, and languor from gastric debility. The dose is one or two drops, and may be administered in the form of emulsion. Mitscherlich found six drachms to kill a moderate-sized dog in five hours, and two drachms in forty hours. Inflammation and corrosion of the gastro-intestinal mucous membrane were observed after death.

Off. Prep. Aqua Cinnamomi, *U. S.;* Spiritus Cinnamomi, *U. S.* W.

OLEUM LIMONIS. *U. S., Br.*

Oil of Lemon.

The volatile oil obtained from the rind of the fruit of Citrus Limonum (*De Candolle*). *U. S.* The oil expressed or distilled from fresh lemon-peel. Imported chiefly from Sicily. *Br.*

Huile de citron, *Fr.;* Citronenöl, *Germ.;* Olio di limone, *Ital.;* Aceyte de limon, *Span.*

See LIMON.

The exterior rind of the lemon abounds in a volatile oil, which, being contained in distinct cellules, may be separated by simple expression. The rind is first grated

from the fruit, and then submitted to pressure in a bag of fine cloth. The oil thus obtained is allowed to stand till it becomes clear, when it is decanted, and kept in stopped bottles. By a similar process, the oil called by the French *huile de cedrat* is procured from the citron. (See *Oleum Bergamii* and *Limonis.*) These oils may also be obtained by distillation; but thus procured, though clearer, and, in consequence of the absence of mucilage, less liable to change on keeping, they have less of the peculiar flavour of the fruit; and the mode by expression is generally preferred. Prof. Procter states that he learned, when in Naples, that a third method of separating the oil, in Calabria and Sicily, was to put the grated rind into hot water, and skim off the oil as it rises to the surface. (*Am. Journ. of Pharm.*, Jan. 1868, p. 27.) The oils are brought originally from Italy, Portugal, or the south of France.

The oil of lemons and oranges, as well as those of the other aurantiaceæ, will keep indefinitely upon admixture with a small proportion of alcohol, say one ounce to a pound of the oil. When wanted for use, a small quantity of water, the same as of alcohol, added to the mixture, will unite with the alcohol, and subside to the bottom, leaving the oil free of the alcohol for all practical purposes. (Carl Fruh, *Am. Journ. of Pharm.*, May, 1871, p. 201.)

Properties. Oil of lemons is a very volatile liquid, having the odour of the fruit, and a warm, pungent, aromatic taste. As commonly procured it is yellow, and has the sp. gr. 0·8517; but by distillation it is rendered colourless, and, if three-fifths only are distilled, its sp. gr. is reduced to 0·847, at 71° F. It is soluble in all proportions in anhydrous alcohol. In its ordinary state, it contains oxygen, but when purified by distillation *in vacuo*, at a low temperature, it consists exclusively of carbon and hydrogen, in the same proportion as in pure oil of turpentine, or camphene; its formula being $C_{20}H_{16}$. In this state it is capable of absorbing almost half its weight of muriatic acid gas, by which it is converted into a crystalline substance, and a yellow oily fuming liquid. The crystalline substance is analogous to artificial camphor, produced by the action of muriatic acid upon oil of turpentine, and is a compound of the oil and acid. The oil of lemons is said to consist of two isomeric oils.

It is often adulterated by the fixed oils and by alcohol. But in this country the most frequent sophistication is with oil of turpentine, which is difficult of detection from its similar composition and specific gravity. Perhaps the best test of the presence of this oil is the terebinthinate smell, produced when the adulterated oil is evaporated from heated paper. Oil of lemons, procured by expression, is apt to let fall a deposit, and to undergo chemical change. Mr. J. S. Cobb has found no method so effectual to obviate this result, and at the same time to retain unimpaired the flavour of the oil, as to shake it with a little boiling water, and allow the mixture to stand. A mucilaginous matter separates, and floats on the surface of the water, from which the purified oil may be decanted. (*Annals of Pharm.*, ii. 86.)

Medical Properties and Uses. Oil of lemons has the stimulant properties of the aromatics; but is chiefly used to impart flavour to other medicines. It has been commended as an application to the eye in certain cases of ophthalmia.

Off. Prep. Linimentum Potassii Iodidi cum Sapone, *Br.;* Spiritus Ammoniæ Aromaticus; Syrupus Limonis, *U. S.;* Syrupus Acidi Citrici, *U. S.* W.

OLEUM LINI. *U. S., Br.*

Flaxseed Oil.

The fixed oil obtained from the seed of Linum usitatissimum. *U. S.* The oil expressed without heat from linseed. *Br.*

Linseed oil; Huile de lin, *Fr.;* Leinöl, *Germ.;* Olio di lino, *Ital.;* Aceyte de linaza, *Span.*

See LINUM.

This oil is obtained by expression from the seeds of *Linum usitatissimum*, or common flax, which, according to M. Berjot, contain 34 per cent. (*Journ. de Pharm.*, Avril, 1863, p. 277.) In its preparation on a large scale, the seeds are usually roasted before being pressed, in order to destroy the gummy matter contained in their

coating. The oil is thus obtained more free from mucilage, but more highly coloured and acrid than when procured by cold expression. For medical use, therefore, it should be prepared without heat; and, as it is apt to become rancid quickly on exposure, should be used as soon after expression as possible. It may, however, be rendered sweet again by agitation with warm water, rest, and decantation. It is said to be obtained purer and in larger proportion by treating the crushed seeds with bisulphide of carbon, than by expression. (See *Am. Journ. of Pharm.*, xxvi. 265.) Flaxseed oil has a yellowish-brown colour,* a disagreeable odour, and a nauseous somewhat acrid taste; is of the sp. gr. 0·932; boils at 600° F.; does not congeal at zero; dissolves in forty parts of cold and five of boiling alcohol, and in one part and a half of ether; and has the property of drying or becoming solid on exposure to the air. The drying property resides in its fluid constituent, which, to distinguish it from the olein of the non-drying oils, is named *linolein*. Its acrimony is owing to the presence of a small proportion of an acrid oleoresin. From its drying property, it is useful in painting, and the formation of printers' ink.†

It is said that cod-liver oil has recently been used for the adulteration of that of flaxseed, especially where the latter is intended for preparing printers' ink. Mr. Aug. Morell detects the adulteration in the following method. Take 10 parts by weight of the suspected oil, mix it in a small cylindrical glass tube with 3 parts of crude nitric acid, agitate the mixture well, and allow it to rest. If cod-liver oil is present the oily layer at top assumes a dark brown to blackish-brown colour, while the acid at bottom varies from bright orange to orange or dark yellow. So little as 3 per cent. of cod-liver oil may thus be detected. If the flaxseed oil is pure it becomes during the agitation, first sea-green, and afterwards dirty greenish-yellow, the acid being bright yellow. (*Pharm. Journ.*, Nov. 1873, p. 384.)

Medical Properties and Uses. The oil is laxative in the dose of a fluidounce; but on account of its disagreeable taste is seldom given internally. It has, however, been highly recommended as a cure for piles, in the dose of two ounces of the fresh oil morning and evening. It is sometimes added to purgative enemata; but its most common application is externally to burns, usually in combination with lime-water.‡

Off. Prep. Ceratum Resinæ Compositum, *U. S.;* Linimentum Calcis, *U. S.*

B.

OLEUM MORRHUÆ. *U. S., Br.*

Cod-liver Oil.

The fixed oil obtained from the liver of Gadus Morrhua and of other species of Gadus. *U. S.* The oil extracted from the fresh liver of the cod, Gadus Morrhua (*Linn.*), by the application of a heat not exceeding 180°. *Br.*

* The following method of bleaching flaxseed oil, which is equally applicable to that of rapeseed and poppyseed, is recommended by C. Puscher. He mixes 100 kilogrammes of the oil with 2 kilogrammes of a mixture of equal weights of sulphuric acid, and alcohol of 96 per cent. The sulphuric acid mixes uniformly with the oil; the mixture soon assumes a green turbidness, which afterwards becomes black; and in 24 or 48 hours, the liquid becomes clear by the deposition of a black sediment. It is necessary to wash the oil with hot water, to separate the little remaining acid. Linseed oil in bulk shows merely a yellowish tint; the other oils mentioned become quite colourless. (*Am. Journ. of Pharm.*, March, 1873, p. 110; from *Chem. Central Blatt.*)—*Note to the fourteenth edition.*

† *Linoleum.* This name has been given to preparations of flaxseed oil, having certain physical properties, which adapt it to many of the purposes for which caoutchouc is used. It is made by incorporating, with a strong heat, the oil converted by the oxidation of the drying process into a semi-resinous substance with resinous gums and other bodies. (See *Am. Journ. of Pharm.*, July, 1866, p. 372.)

‡ *Oiled Paper.* A substitute for waxed cloth, for the dressings of wounds and ulcers, prepared in the following manner by M. Gauthier, of Geneva, with flaxseed oil, has been highly recommended. To facilitate its drying, 3 litres (about 6·4 pints) of the oil are boiled for an hour or two with 30 grains of acetate of lead, 30 grains of litharge, 15 grains of yellow wax, and 15 grains of turpentine. Thus prepared, the oil is spread upon silk-paper by means of a brush on both surfaces. On the top of the first sheet another is then placed so as to overlap it at one corner. The lower surface of the second sheet thus becomes impregnated with the oil, which now requires to be applied only to the upper. Any desired number of sheets may be thus successively superimposed. They are then separated, and suspended in a drying apartment, attached to a cord by means of hooks or pins. When dry, they should be sprinkled over with chalk to prevent adhesion, and packed away. (*Journ. de Pharm.*, Mai, 1860, p. 363.)—*Note to the twelfth edition.*

Oleum jecoris Aselli; Huile de morue, *Fr.;* Stockfischleberthran, *Germ.*

GADUS. *Class* Pisces. *Order* Jugulares. *Linn.* Malacopterygii Subbrachiati. *Family* Gadidæ. *Cuvier.*

Gen. Ch. Recognised by the ventrals attached under the throat, and attenuated to a point.

Gadus Morrhua. Linn. *Syst. Nat. ed. Gmelin*, i. p. 1162; Cuvier, *Règne Animale*, ii. 212; Bloch. *Ichthyologie*, pl. lxiv.—*Morrhua vulgaris.* Storer, *Synops. of Fishes of N. Am.*, p. 216. The *common cod* is between two and three feet long, with brown or yellowish spots on the back. The body is moderately elongated and somewhat compressed, and covered with soft rather small scales, of which the head is destitute. Of the fins, which are soft, there are three on the back, two anal, and a distinct caudal; and the fin under the throat is narrow and pointed. The jaws are furnished with pointed irregular teeth, in several ranks. The gills are large, with seven rays. This species of cod inhabits the Northern Atlantic, and is especially abundant on the banks of Newfoundland, where it finds food adapted to its wants.

Besides the common cod, several other species of Gadus, frequenting the seas of Northern Europe and America, contribute to furnish the cod-liver oil of commerce. Among these De Jongh mentions *Gadus callarias* or *dorsch* (*Morrhua Americana* of Storer), *G. molva* or *ling*, *G. carbonarius* or *coal fish*, and *G. pollachius* or *pollock*, as affording the oil on the coast of Norway;* while, from information obtained by Professor Procter, there is reason to believe that, on our own coast, in addition to the pollock above mentioned, it is obtained also from the *hake* (*G. merluccius*) and the *haddock* (*G. Æglifinus*). It is said that 24,000 gallons of the oil are obtained annually on our coast between Boston and Eastport, in Maine, in reference to the drug market. (See *Am. Journ. of Pharm.*, Nov. 1859, p. 500.)

Preparation. Fishermen have long been in the habit of collecting this oil, which is largely consumed in the arts, particularly in the preparation of leather. Upon the coasts of Newfoundland, Nova Scotia, and New England, the boats which fish near the shore, being small, soon obtain a load, and running in to land, deliver their cargoes to persons whose business it is to cleanse and salt the fish. The oil is prepared either in the huts of the fishermen, or more largely at establishments to which the livers are conveyed in quantities. These are put into a boiler with water, and heated until they are broken up into a pultaceous mass, which is thrown upon a strainer covering the top of a cask or tub. The liquid portion passes, and upon standing separates into two parts, the oil rising to the surface of the water. The oil is then drawn off, and, having been again strained, is prepared for the market. Another and improved method, which has come into use since the extensive employment of the oil as a medicine, is to heat the livers in a large tin vessel by means of steam externally applied. The pultaceous mass resulting is drained as before mentioned; the livers themselves containing, besides oil, a considerable portion of watery fluid, which passes off with it in the form of emulsion, and separates on standing. The oil thus procured is called *shore oil*, and is the purest kind. The crews of the larger boats, which fish upon the banks far from land, cleanse the fish on board, and, throwing the offal into the sea, put the livers into barrels or other receptacles, where they undergo a gradual decomposition, the oil rising to the surface, as it escapes from the disintegrating tissue. The oil which first rises, before putrefaction has very decidedly commenced, approaches in purity to the shore oil, but is somewhat darker and less sweet. This is sometimes drawn off, constituting the *straits oil* of the fishermen. The remaining mass, or the whole, if the portion which first rises be not separated, continues exposed for a variable length of time to the heat of the sun, undergoing putrefaction, until the boat, having completed her cargo, returns to port. The contents of the casks are then put into boilers, heated with water, and treated as already described. Before being finally put into barrels, the oil is heated to expel all its water. Thus prepared, it is denominated *banks oil*, and is of the darkest colour, and most

* For an account of the mode of fishing for cod and of preparing the oil practised in Norway, the reader is referred to an interesting article, by Mr. Robert Howden, in the *Pharm. Journ. and Trans.* (Jan. 1868, p. 312). A paper on the preparation of the oil in Denmark, by M. J. Léon Soubeiran, will be found in the *Journ. de Pharm. et de Chim.* (4e sér., iv. 324, A.D. 1866).

offensive to the taste and smell. Much of the oil prepared by the fishermen is collected by the wholesale dealers, who keep it in very large reservoirs of masonry in their cellars, where it becomes clarified by repose, and is pumped into barrels as wanted for sale. By the further exposure, however, which it thus undergoes, it acquires a still more offensive odour; while that which has been originally introduced into barrels, and thus kept secluded from the air, is better preserved. The above facts in relation to the collection of cod-liver oil have been mainly derived from a very interesting paper by Professor Procter, in the *Am. Journ. of Pharm.* (xxiii. 97). To the same journal (xxvi. 1) the reader is referred for an account, by Dr. E. H. Robinson, of Nova Scotia, of the method in which the oil is prepared by the fishermen of that Province.

The oil is sometimes procured by expression. Mr. Donovan recommends the following plan, which affords a very fine oil. The livers, perfectly sound and fresh, are to be placed in a clean iron pot over a slow fire, and stirred until they assume the condition of a pulp, care being taken that the mass be not heated beyond 192°. When this temperature is attained, the pot is to be removed from the fire, and its contents introduced into a canvas bag, through which water and oil will flow into a vessel beneath. After twenty-four hours, the oil is to be decanted and filtered through paper. In this state it is pale-yellow, with little odour, and a bland not disagreeable taste.

Properties. Three varieties of cod-liver oil are known in the market, the *white* or *pale-yellow*, the *brownish-yellow*, and the *dark-brown*, corresponding to the three commercial varieties already alluded to. These differ in no essential character, but simply from the mode of preparation; the pale being prepared from fresh sweet livers, the dark-brown from livers in a state of putrefaction, and the brownish-yellow from those in an intermediate state; and the three varieties run together by insensible shades. The colour of the pale is from the slightest tint of transparent yellow to a fine golden yellow, that of the light-brown very similar to the colour of Malaga wine, that of the dark-brown what its name implies, with opacity in mass, but transparency in thin layers. They are of the usual consistence of lamp-oil, and have a characteristic odour and taste, by which they may be distinguished from other oils. This smell and taste are familiar to most persons, being very similar to those of shoe-leather; at least as prepared in this country, where the curriers make great use of cod-liver oil. We regard these sensible properties as the most certain test of the genuineness of the oil. They are much less distinguishable in the pale than in the dark-brown varieties, but we have met with no specimen which did not possess them in some degree. In the purest they are scarcely repulsive, in the dark-brown they are very much so. When a decided smell of ordinary fish-oil is perceived, the medicine may always be suspected. It is quite distinct from that peculiar to the cod-liver oil. The taste of all the varieties is more or less acrid, and in the most impure is bitterish and somewhat empyreumatic. The sp. gr. at 72° F., as ascertained by Prof. Procter, varied from 0·915 to 0·9195; the first being that of the *hake* oil, the second that of the *haddock*, while the sp. gr. of the purest oil from the common cod was 0·917. De Jongh found the sp. gr. at 63° F., of the pale 0·923, of the light-brown 0·924, of the dark-brown 0·929. The oil from the cod does not congeal at 14° F., though that of G. carbonarius and that of the livers of different species of Raja, let fall at that temperature a solid fatty matter, supposed to be margarin. Alcohol dissolves from 2·5 to 6 per cent., water from 0·637 to 1·28 per cent. of different varieties; the pale yielding least to these solvents. (*Journ. de Pharm.*, Jan. 1854, p. 39.)

From an analysis of the oil by De Jongh, it appears to consist of a peculiar substance named gaduin; oleic and margaric acids with glycerin; butyric and acetic acids; various biliary principles, as fellinic, cholic, and bilifellinic acids, and bilifulvin; a peculiar substance soluble in alcohol; a peculiar substance insoluble in water, alcohol, or ether; iodine, chlorine, and traces of bromine; phosphoric and sulphuric acids; phosphorus, lime, magnesia, soda, and iron. These were found in all the varieties, though not in equal proportion in all; yet it is quite uncertain whether the difference had any relation to their degree of efficacy. *Gaduin* is obtained by saponifying the oil with soda, decomposing the soap by acetate of lead, and treating the resulting lead soap with ether, which dissolves the oleate of lead

and gaduin, leaving the margarate of lead behind. The ethereal solution, which is dark-brown, is decomposed by sulphuric acid, which liberates the brown oleic acid. This owes its colour to gaduin, to separate which soda is added in excess. The resulting oleate of sodium, which is insoluble in an excess of the alkali, is dissolved in alcohol; and the alcoholic solution is cooled below 32°, by which means the oleate of sodium is separated, the gaduin remaining in solution. This is precipitated from its solution by the addition of sulphuric acid. Gaduin is a dark-brown substance, brittle and pulverizable when dry, without odour or taste, quite insoluble in water, and in great measure soluble in ether and alcohol. It is insoluble in nitric and muriatic acids, but is dissolved by sulphuric acid, giving a blood-red colour to the solution, from which it is precipitated by water and the alkalies. It is soluble in alkaline solutions. Chlorine decolorizes it. Its formula is $C_{35}H_{23}O_9$. Gaduin itself is yellow, but becomes brown by exposure to the air. It has not been ascertained to be in any degree connected with the virtues of the oil. It is not improbable that the biliary principles associated with the oil are concerned in its peculiar influences; as it is by their presence mainly that this differs from other oils. It has been thought that gaduin itself is of biliary origin. Winckler has inferred from his researches that cod-liver oil is an organic whole, differing from all other fixed oils. Thus, it yields no glycerin upon saponification, but, in place of it, a peculiar body which he denominates oxide of propyl. The fatty acids generated are the oleic and margaric. Dr. Luck has found a peculiar fatty acid in turbid oil, which he names *gadic acid*, and the same is obtained from the clear oil by saponification. (*Neues Jahrbuch für Pharm.*, vi. 249.) By reaction with ammonia in distillation, the oil yields a peculiar volatile alkali, called *propylamia*, which has a strong pungent odour, recalling that of herring-pickle, of which the same alkali is an ingredient. No other officinal fatty oil yields a similar product. (See *Am. Journ. of Pharm.*, xxiv. 343.) Some have been disposed to ascribe the virtues of the oil to its iodine and bromine; but these are in too small proportion for much effect, and the oil has produced results which have never been obtained from iodine and bromine themselves. The presence of iodine cannot be detected by the usual tests. It is necessary to convert the oil into a soap, and to carbonize this before it will give evidence of iodine. The proportion never exceeds 0·05 per cent., or 1 part in 2000. The oil is capable of dissolving a larger proportion; and, if any specimen contain more, there is reason to suspect that it has been fraudulently added.

Tests of Purity. In consequence of the great demand for this oil, it has not unfrequently been adulterated with other fixed oils, and occasionally others have been fraudulently substituted for it. The importance, therefore, is obvious of ascertaining some mode of testing its purity and genuineness. There is reason to believe that all the oils from the livers of the Gadidæ have analogous properties. They have been indiscriminately used; and upon the results of their employment is based, in part, the present reputation of the medicine. They may, therefore, be considered as in fact one oil, so far as their medicinal use is concerned. Unfortunately chemistry has yet discovered no perfectly reliable test. The furthest it has yet gone is to point out certain reactions, which may be considered as evidences of the presence of biliary principles in the oil, thus indicating its hepatic origin. Among these probably the most characteristic is that of sulphuric acid, a drop of which, added to fresh cod-liver oil, on a porcelain plate, causes a centrifugal movement in the oil, and gives rise to a fine violet colour, soon passing into yellowish or brownish red. Sometimes, instead of assuming the violet hue, the colour immediately becomes a clear red, or dark brownish-red. This is said to be especially the case with those specimens of the oil which have been prepared by boiling the livers with water. Shark-liver oil responds in like manner to the test of sulphuric acid, but is said to have the sp. gr. 0·866, which is much lower than that of any variety of the genuine oil. Strong nitric acid causes instantly, when agitated with cod-liver oil, a pinkish or rose-red colour, which soon becomes brown; while no such effect is produced on other animal or vegetable oils. According to Winckler, the oil should afford the smell of herring-pickle when heated with potassa, lime, and chloride of ammonium. But the most reliable tests are the sensible properties of odour and taste. If there be none of the peculiar shoe-

leather smell and taste, or if a strong lamp-oil odour be perceptible, the oil may be suspected. Little of importance can be inferred from the colour. Some have been disposed to prefer the dark offensive oil; but our own experience accords with that of those who have found the pale or light-brown equally efficient; and, for facility of administration and acceptability to the stomach, the latter is greatly preferable.

It is important that the oil should be secluded from the air, which effects a gradual change, no doubt impairing its efficiency. Hence the vessels containing it should be full; and apothecaries ought to keep it in bottles well stopped, holding about the quantity generally wanted for use at one time.

Medical Properties and Uses. Cod-liver oil has been long popularly employed in northern Europe in rheumatic and strumous diseases. It was first brought to the notice of the profession generally by German practitioners, and had acquired great reputation on the continent before it was used to any extent in Great Britain. At Manchester, in England, it was employed by the medical profession in the treatment of chronic rheumatism and gout, as early as 1766; but it was not until the appearance of the treatise of Professor Bennett, of Edinburgh, in 1841, that it came into general notice in Great Britain and the United States. It is at present one of the most esteemed remedies in the catalogue of the Materia Medica. The diseases in which it has proved most efficient are chronic rheumatism and gout, and the various morbid affections connected with a scrofulous diathesis, such as external glandular scrofula, diseases of the joints and spine, carious ulcers, tabes mesenterica, rickets, and phthisis. It has been found useful also in chronic cutaneous eruptions, lupus, ulcers of the mouth, some varieties of palsy, chronic pectoral complaints not tuberculous, pertussis, obstinate constipation, intestinal worms, and incontinence of urine; and may be employed with the hope of good in all chronic cases in which the disease appears to consist mainly in impaired digestion, assimilation, and nutrition. In pulmonary consumption, in the experience of the author, it has far exceeded in efficacy any other remedy or combination of remedies that he has hitherto employed. It is necessary, however, to persevere for four or six weeks before looking for any decidedly favourable results, though the change does often begin earlier. In most cases remarkable temporary relief is afforded; in many, the disease is favourably modified, and its fatal termination postponed; and in some, cures appear to have been effected.

As to its mode of action, there has been much difference of opinion. Some consider it merely as a nutritive agent, having the advantage over other oleaginous substances, of a readier entrance into the system, and more easy assimilation. But we cannot agree with this opinion. Other oleaginous substances, certainly not less nutritious, have not been equally efficient, though taken in much larger quantities. If this be the true explanation, persons living chiefly on milk which abounds in oil, or on fat pork, ought to show a special exemption from scrofulous complaints. The probability appears to us to be that, in consequence of some peculiar principle or principles it contains, it exercises a stimulant and alterative influence on the processes of assimilation and nutrition; thereby causing the production of healthy tissue, instead of that abortive material which is deposited by the blood-vessels in scrofula and phthisis. With our views of the modus operandi of cod-liver oil, it would of course be contraindicated in all cases where there is existing plethora, or a strong tendency to it. The medicine has been accused of having occasionally produced serious congestion of the lungs.

This oil is recommended strongly, on the base of his own experience, by Dr. J. Prestwich, as a remedy in hooping-cough, which is not only greatly relieved by it, but is often so nearly cured, that for some time Dr. Prestwich has considered it as a specific in that disease. He begins with the remedy when the early inflammatory symptoms have disappeared, and the disease may be considered as having reached the nervous stage. (The *Lancet*, Dec. 2, 1871, p. 812.) In a case of *milky urine*, in a male, with at times considerable irritability of the urinary passages, in which various remedies had been used with little or no permanent benefit, cod-liver oil was prescribed, with the effect in a few days of a restoration of the urine to its healthy state; and, at the end of four years, without any return of the complaint. (The *Med. Record*, Dec. 1868, p. 440.)

The dose is a tablespoonful three or four times a day for adults, a teaspoonful repeated as frequently for children, which may be gradually increased as the stomach will permit, and continued for a long time. It may be taken alone or mixed with some vehicle calculated to conceal its taste, and obviate nausea. For this purpose recourse may be had to any of the aromatic waters, to the aromatic tinctures, as the tincture of orange-peel, diluted with water, or to a bitter infusion, as that of quassia. It may be given floating on the vehicle, or mixed with it by means of gum or the yelk of eggs, with sugar, in the form of an emulsion. Perhaps the best vehicle, when not contraindicated, is the froth of porter. Let a tablespoonful of porter be put into the bottom of a glass, upon the surface of this the oil, and over all some of the froth of the porter. A small piece of orange-peel may be chewed before and after taking the medicine. An emulsion with tragacanth and water with additions to modify the taste has been highly commended. Make a mucilage with 8 parts of tragacanth and 500 of cold water. For every 30 parts of this mucilage add 4 parts of alcohol flavoured with oil of bitter almonds; and then cod-liver oil in such proportion as may be deemed advisable, shaking the mixture thoroughly. (*New Remedies*, April, 1873, p. 344.) M. Duquesnel proposes to disguise the taste of the oil by the addition of tincture of *Eucalyptus globulus*, in the proportion of one or two per cent. It almost entirely disguises the taste of the oil, renders it more easy of digestion, and obviates the disposition to irritation. (*New Remedies*, Oct. 1873, p. 548.) Various other methods have been adopted to conceal or correct its taste, and favour its administration. Common salt has been recommended; but nothing, perhaps, so effectually destroys the taste as oil of bitter almonds, of which one part will answer for 200 parts of the oil; but a better plan is to shake strongly, in a flask, one measure of the oil with from one to two of cherry-laurel water, according to the degree of offensiveness, and to separate the liquids after they have been allowed to stand for twenty-four hours. The oil should be filtered if not quite clear. The medicine has sometimes also been given in capsules; but this must be a very tedious method. M. Dufourmantel prepares a jelly by dissolving half a drachm of ichthyocolla in as little hot water as possible, and then gradually mixing with it a fluidounce of the oil with four drops of the oil of anise, taking care not to exceed the heat of 75° F. (*Journ. de Pharm.*, Juin, 1864, p. 72.) M. Bouchut has proposed to give the oil in the form of bread. He incorporates the oil with wheat flour, and has this made into bread, which, he says, is in no degree disagreeable. (*New Remedies*, Oct. 1873, p. 522.) The oil is sometimes applied externally by friction, and in cases of ascarides or lumbricoides, is injected into the rectum. It has been recommended locally in chronic articular affections, paralysis, various chronic cutaneous eruptions, and in opacity of the cornea after the subsidence of inflammation. In the last-mentioned affection, one or two drops of the oil are applied by means of a pencil to the cornea, and diluted, if found too stimulating, with olive or almond oil. It is said, when long used internally, to occasion sometimes an exanthematous or eczematous eruption.*

* *Cod-liver Oil with Iodide of Iron.* A preparation of cod-liver oil, in which the oil was supposed to hold iodide of iron in solution, has been considerably used in Europe, under the impression that such a combination is more efficient in scrofulous states of the system than the pure oil. But M. Rabourdin, of Orléans, France, showed that the preparation, as found in the shops, often contains no iron; and his results were confirmed by M. Sinimberghi, a pharmaceutist of Rome, who states that the oil sold as containing iodide of iron was, in several specimens examined by him, not only destitute of iron, but was altered in colour, had a noxious taste and smell, was more or less thickened, and was in fact unfit for use. He proposes the following formula, which he says yields a limpid preparation, differing but little in colour, taste, and odour from the pure oil, does not change on keeping, and yet contains four grains of iodide of iron in a fluidounce. Taking 1000 parts of the pure oil, he separates 30 parts, and adds to this portion 12 parts of pure ether. Shaking the mixture, which is exposed to a slight increase of temperature, he sets it aside for the moment, and then rubs together in a porcelain mortar 6·5 parts of pure protosulphate of iron and 5·15 parts of perfectly pure iodide of potassium, and during the trituration adds 1 part of reduced iron to neutralize any iodine that may be set free, and a little pure glycerin to moisten the mixture. When the double decomposition has taken place, which is usually completed in two minutes, he gradually adds to the mixture one-third of etherized oil prepared as above, and one-third of the original cod-liver oil remaining, and, mixing these well together, fills with the mixture a glass bottle, which is kept well closed till the precipitate has subsided. The clear oil is then poured off, and the process is repeated a second and a third time by adding a second and third portion of the etherized oil and pure oil to the precipitate. The whole is now put into a

The *olein* of cod-liver oil has been recommended by Dr. Arthur Leared, when the oil itself disagrees with the stomach. He has found it to produce the same remedial effects, and to be much better borne. It may be given in the same dose. A *solution of quinia in the oil* has been proposed in cases where the two medicines are jointly indicated. It may be made by adding the freshly precipitated alkaloid to the oil, in the proportion of two grains to a fluidounce, and heating them together, by means of a water-bath, until the mixture becomes quite clear.

It has been thought that the efficacy of cod-liver oil is greatly enhanced by augmenting the proportion of certain active principles naturally contained in it; and a preparation of this kind, known as *Fougera's cod-liver oil*, each pint of which contains eight grains of iodine, one grain of bromine, and one of phosphorus, has been extensively used in this country, and is highly praised in some of our journals. (*Med. and Surg. Reporter*, May 2, 1868, p. 397.)* Iodine, the preparations of iron, the phosphates, and lime in various combinations, have also been associated with cod-liver oil, with the object of adding special nutritive influence to that of the oil; and a soap of cod-liver oil with lime is spoken of by Dr. Van den Court, of Brussels, in the highest terms as a remedy of great value in phthisis. (*New Remedies*, Oct. 1871, p. 85.) W.

OLEUM MYRISTICÆ. *U.S., Br.*

Oil of Nutmeg. Volatile Oil of Nutmeg.

The volatile oil obtained from the kernels of the fruit of Myristica fragrans (Houttuyn, *Nat. Hist.*). *U.S.* The oil distilled in Britain from nutmeg. *Br.*

See MYRISTICA.

bottle which it precisely fills, and, having been allowed to stand ten days, is filtered, and kept in well-stopped bottles. (*Pharm. Journ. and Trans.*, 2d ser., viii. 277.)

Ferruginous Cod-liver Oil. M. Ricker prepares this medicine as follows. Having saponified 100 parts of the oil with 70 parts of solution of soda of the sp. gr. 1·33, he adds to the soap 100 parts of a solution of common salt of 25 to 100. The mixture is placed upon a cloth and expressed. Of the residue 60 parts, dissolved in 500 of distilled water, are precipitated by a solution of 15 parts of sulphate of iron in 100 of water. The insoluble ferruginous precipitate which forms is washed upon a linen cloth and expressed. The process is completed by dissolving 30 parts of this soap in 500 of cod-liver oil, and filtering. The resulting oil is of a brown colour, and 30 parts contain 62 thousandths of one part of iron, equivalent to about three grains to a pint. (*Journ. de Pharm. et de Chim.*, 4e sér., v. 57, A.D. 1857.)

Extract of Cod Liver. Under the name of *Geoffroy's Dragées of Cod-liver Extract*, a medicine has been patented in England, and recently attracted some attention, consisting essentially of an extract obtained by evaporating the watery liquid which escapes from the cod liver when the oil is extracted. Mr. Squire obtained one pound of this watery fluid from twenty-eight pounds of the liver, and by its evaporation 12 per cent. of extract. Mr. John Barr, one of the patentees, states that livers properly treated yield much more watery liquid than here stated, and that the liquid gives 15 per cent. of extract. Now, if, as some suppose, the virtues of cod-liver oil depend upon principles extracted with it from the liver independently of the pure oil, there is every reason to believe that these principles exist to a certain extent in the watery fluid referred to, and consequently that the preparation under consideration may have important powers, and prove highly useful as a medicine. This, however, is a point to be determined only by experience; and all that can be said at present, is that the medicine is worthy of a trial. The following is given as the chemical constitution of the extract; in 100 parts 60·62 of fish-bile constituents, 2·545 of propylamin, 6·0 of acetic, lactic, and butyric acids, 2·09 of phosphorus and phosphoric acid, 0·2 of sulphur and sulphuric acid, 0·154 of iodine, 1·525 of chlorine with a trace of bromine, 1·17 of soda, 0·366 of magnesia, 0·510 of lime, 0·211 of potassa, 2·862 of ammonia, and 21·847 of water, including loss. Five grains of the extract are announced as equal in medicinal virtues to a tablespoonful of cod-liver oil. It is prepared for use in the form of pills, which consist of six parts of the extract, five of cacao butter, and one of sugar. (*Chem. News*, Dec. 1, 1865, p. 264, and Jan. 5, 1866, p. 10.)

Cleansing Cod-liver Oil Bottles. Prof. Procter has found benzine the best material for this purpose, with the addition of pearlash, lime, and boiling water. The practical pharmaceutist is referred for the details of the process to the *Am. Journ. of Pharm.*, Nov. 1868, p. 509. (*Notes to the thirteenth edition.*)

* *Dugong Oil.* An oil has been brought into notice, as a substitute for cod-liver oil, obtained from two species of *Halecore*, *H. Australis* (*Owen*) and *H. Dugong* (*Illig.*), cetaceous animals inhabiting the rivers and bays of Northern and Eastern Australia, and many of the East India islands. The flesh of these animals is said to be delicate and palatable, and valued for food. The oil is obtained by boiling the superficial fat. It is bland and sweet, and free from disagreeable taste and smell, so that it may be taken more freely than cod-liver oil, which it is thought to equal in virtues. It was introduced into use by Mr. W. Hobbs, a surgeon of Brisbane, on Moreton Bay. (*Chem. News*, Jan. 28, 1860, p. 87, and *Am. Journ. of Pharm.*, July, 1858, p. 335, and May, 1860, p. 230.)—*Note to the twelfth edition.*

This oil is obtained from powdered nutmegs by distillation with water. A better method, according to M. J. Cloez, who has carefully examined the subject of oil of nutmeg, is to exhaust the powder with bisulphuret of carbon or ether, distil off the solvent by means of a water-bath, and expose the butter-like residue to a current of steam, the vapour being conveyed into a refrigerated receiver where it condenses. (*Journ. de Pharm.*, Fév. 1864, p. 150.) Oil of nutmeg is colourless or of a pale-straw colour, limpid, lighter than water, soluble in alcohol and ether, with a pungent spicy taste, and a strong smell of nutmeg. The sp. gr. is stated differently at 0·920 and 0.948. It consists of two oils, which may be separated by agitation with water, one rising to the surface, the other sinking to the bottom. Upon standing it deposits a crystalline stearoptene, which is called by John *myristicin*. Prof. Flückiger examined this stearoptene, and found that, contrary to what had been said, it was not in any degree soluble in water. From its solution in alcohol he obtained it in extremely light crystalline scales, which, after repeated crystallization, had still the odour of nutmeg, were fusible at 54° C., and soluble in the ordinary menstrua of substances of the same class, and, as just said, insoluble in water. By glacial acetic acid it is first coloured red. (*Pharm. Journ.*, March, 1874, p. 714.) M. Cloez found that, when the oil was distilled at a temperature below 347° F., there came over 95 per cent. of a liquid, which, when treated with a little caustic potassa and subsequently distilled from a little sodium, in order to separate traces of a compound of oxygen, was a pure colourless carbohydrogen, remaining liquid at zero of F., of the sp. gr. 0·853 at 59° F., and corresponding in composition with pure oil of turpentine, having the formula $C_{20}H_{16}$. It differs, however, in yielding, when acted on by a current of muriatic acid gas, a liquid instead of solid compound with the acid. In this purified state the oil has an odour recalling that of nutmeg, but, when the oil is diluted, approaching to that of the oil of lemons. It absorbs oxygen slowly, losing its fluidity. Chlorine and bromine act on it vigorously, nitric acid violently with the disengagement of red vapours, and concentrated sulphuric acid dissolves and darkens it. (*Ibid.*, p. 150–2.) The oil may be used for the same purposes as nutmeg, in the dose of two or three drops; but is not often employed.

Off. Prep. Pilula Aloës Socotrinæ, *Br.;* Spiritus Ammoniæ Aromaticus; Spiritus Myristicæ, *Br.* W.

OLEUM OLIVÆ. *U.S., Br.*

Olive Oil.

The fixed oil obtained from the fruit of Olea Europæa. *U. S.* The oil expressed in the south of Europe from the ripe fruit of Olea europæa (*Linn.*). *Br.*

Huile d'olive, *Fr.;* Olivenöl, *Germ.;* Olio delle olive, *Ital.;* Aceyte de olivas, *Span.*

Olea. *Sex. Syst.* Diandria Monogynia.—*Nat. Ord.* Oleaceæ.

Gen. Ch. Corolla four-cleft, with subovate segments. *Drupe* one-seeded. *Willd.*

Olea Europæa. Willd. *Sp. Plant.* i. 44; Woodv. *Med. Bot.* p. 280, t. 98. This valuable tree is usually from fifteen to twenty feet in height, though sometimes much larger, especially in Greece and the Levant. It has a solid, erect, unequal stem, with numerous straight branches, covered with a grayish bark. The leaves, which stand opposite to each other on short footstalks, are evergreen, firm, lanceolate, entire, two or three inches in length, with the edges somewhat reverted, smooth and of a dull-green colour on their upper surface, whitish and almost silvery beneath. The flowers are small, whitish, and disposed in opposite axillary clusters, about half as long as the leaves, and accompanied with small, obtuse, hoary bractes. The fruit or olive is a smooth, oval drupe, greenish at first, but of a deep-violet colour when ripe, with a fleshy pericarp, and a very hard nut of a similar shape. Clusters of not less than thirty flowers yield only two or three ripe olives.

The olive tree, though believed by some to have been originally from the Levant, flourishes at present in all the countries bordering on the Mediterranean, and has been cultivated from time immemorial in Spain, the south of France, and Italy. It begins to bear fruit after the second year, is in full bearing at six years, and continues to flourish for a century. There are several varieties, distinguished by the form of

the leaves, and the shape, colour, and size of the fruit. The variety *longifolia* of Willdenow is said to be chiefly cultivated in Italy and the south of France, and the *latifolia* in Spain. The latter bears much larger fruit than the former; but the oil is less esteemed. The olive is largely cultivated in the north of Africa, especially in the vicinity of Tunis, and considerable quantities of the oil are exported from that city. (*Pharm. Journ.*, Sept. 1873, p. 204.) Attempts to cultivate it have been made in some of our Southern States, though not successfully in a commercial point of view; but in California the tree has found a congenial climate, and the extraction of the oil from the fruit, which is carried on to some extent, though rudely, at Santa Barbara, promises to become, with the culture of the olive tree, one of the leading industries of that part of the State. (*Am. Journ. of Pharm.*, Oct. 1872, p. 455.) The tree has been introduced into South Australia, and will probably become of commercial importance there. (*Phila. Med. Times*, Oct. 18, 1873, p. 47.)

The leaves and bark of the olive tree have an acrid and bitterish taste, and have been employed as substitutes for cinchona, though with no great success. Attention has been called, in France, to a hydro-alcoholic extract of the leaves, as having considerable febrifuge powers. In the quantity of from ten to twenty grains daily, in divided doses, it has been found useful in preventing the hectic paroxysms. In hot countries, a substance resembling the gum-resins exudes spontaneously from the bark. It was thought by the ancients to possess useful medicinal properties, but is not now employed. Analyzed by Pelletier, it was found to contain resin, a little benzoic acid, and a peculiar principle analogous to gum, which has been named *olivile*. But the fruit is by far the most useful product. In the unripe state it is hard and insupportably acrid; but, when macerated in water or an alkaline solution, and afterwards introduced into a solution of common salt, it loses these properties, and becomes a pleasant and highly esteemed article of diet. Mannite has been found in all parts of the tree while in vital activity, as in the green leaves and unripe fruit, but cannot be detected in the yellow fallen leaves, nor in the perfectly ripe fruit. (*Am. J. of Pharm.*, March, 1866, p. 179.) The pericarp, or fleshy part of the ripe olive, abounds in a fixed oil, which constitutes its greatest value, and for which the tree is chiefly cultivated in Southern Europe. In the unripe olive a peculiar green substance, together with mannite, has been found by M. S. de Lutz, both of which disappear as the fruit ripens, being probably converted into oil, which now takes their place. (*Journ. de Pharm.*, Juin and Déc. 1862.) The oil is obtained by first bruising the olives in a mill, and then submitting them to pressure. The product varies much, according to the state of the fruit, and the circumstances of the process. The best, called *virgin oil*, is obtained from the fruit picked before perfect maturity, and immediately pressed. It is distinguished by its greenish hue. The common oil used for culinary purposes, and in the manufacture of the finest soaps, is procured from very ripe olives, or from the pulp of those which have yielded the virgin oil. In the latter case the pulp is thrown into boiling water, and the oil removed as it rises. An inferior kind, employed in the arts, especially in the preparation of the coarser soaps, plasters, unguents, &c., is afforded by fruit which has been thrown into heaps, and allowed to ferment for several days, or by the *marc* left after the expression of the finer kinds of oil, broken up, allowed to ferment, and again introduced into the press. The remarks made under the head of Oleum Myristicæ (*page* 630), in relation to the extraction of that oil by means of bisulphuret of carbon, are applicable also to olive oil.

Olive oil is imported in glass bottles, or in flasks surrounded by a kind of network of grass, and usually called Florence flasks. The best comes from the south of France, where most care is exercised in the choice of the fruit.

Properties. The pure oil is an unctuous liquid, of a pale-yellow or greenish-yelllow colour, with scarcely any smell, and a bland, slightly sweetish taste. Its sp. gr. is 0·9153. It is soluble in twice its volume of ether, but is only partially soluble in alcohol, at least unless this liquid be in very large proportion. It begins to congeal at 38° F. At a freezing temperature a part of it becomes solid, and the remainder, retaining the liquid consistence, may be separated by pressure, or by the agency of cold alcohol, which dissolves it. The concrete portion has been found by MM. Pe-

louze and Boudet to be a definite compound of margarin and olein; the liquid portion is uncombined olein. According to Braconnot, the oil contains 72 per cent. of olein, and 28 of margarin. Olive oil is solidified by nitrous acid and nitrate of mercury, and converted into a peculiar fatty substance, called *elaïdin*. The olein of all oils which have not the drying property undergoes the same change, when acted on by nitrous acid; and the singular fact is stated by MM. Pelouze and Boudet, that the margarin of olive oil, combined as it is with olein, is converted by that acid into elaïdin, while the same principle, in a state of purity, is not affected by it. (*Journ. de Pharm.*, xxiv. 391.)*

Olive oil, when exposed to the air, is apt to become rancid, acquiring a disagreeable smell, a sharp taste, a thicker consistence, and a deeper colour; and the change is promoted by heat. It is frequently adulterated with the cheaper fixed oils, especially with that of poppies; but the adulteration may be easily detected by reducing the temperature to the freezing point. As other oils are less readily congealed than the olive oil, the degree of its purity will be indicated by the degree of concretion. Another mode has been indicated by M. Poutet, founded on the property possessed by supernitrate of mercury of solidifying the oil of olives, without a similar influence upon other oils. Six parts of mercury are dissolved at a low temperature in seven and a half parts of nitric acid of the sp. gr. 1·35; and this solution is mixed with the suspected oil in the proportion of one part to twelve, the mixture being occasionally shaken. If the oil is pure, it is converted after some hours into a yellow solid mass; if it contains a minute proportion, even so small as a twentieth, of poppy oil, the resulting mass is much less firm; and a tenth prevents a greater degree of consistence than oils usually acquire when they concrete by cold. M. Gobel has invented an instrument which he calls the elaïometer, by which the smallest quantity of poppy oil can be detected. (See *Am. Journ. of Pharm.*, xvi. 24.) According to M. Marchand, strong sulphuric acid produces with poppy oil a lemon-yellow colour, which rapidly becomes darker, and, after ten or fifteen minutes, is followed by tints of rose-colour and bright violet, which are never afforded with the same reagent by pure olive oil. (*Ibid.*, xxvi. 432.) The presence of colza oil may be detected by the test of nitrate of silver, as stated under the head of Oleum Amygdalæ Expressum (*page* 616). M. Diesel states that the pure oil is coloured green by common nitric acid; whereas, if mixed with rape oil, it is rendered of a yellowish-gray colour. (*Arch. der Pharm.*, xlvi. 287.) According to M. Behrens, whose statement is confirmed by MM. Guibourt and Reveil, the presence of oil of sesamum is known by the beautiful deep-green colour immediately produced, when the suspected oil is added, in equal weight, to a mixture of equal parts of sulphuric and nitric acids; which acids cause with the pure oil, at first, a bright-yellow colour. (*Journ. de Pharm.*, 3e sér., xxiv. 351.) Immense quantities of lard oil are said to be exported from this country to France, and employed in the adulteration of olive oil. The reaction with nitric acid would probably serve to detect this adulteration, which, however, in a pharmaceutical point of view, is of little inconvenience.†

* The following table gives the solubility of various alkaloids in olive oil as ascertained by Pettenkoffer. At the ordinary temperature, 100 parts of the oil dissolve of

Morphia	0·00	Quinia	4·20	Atropia	2·62
Narcotina	0·25	Strychnia	1·00	Veratria	1·78
Cinchonia	1·00	Brucia	1·78		

(*Journ. de Pharm.*, Juin, 1859, p. 486.)—*Note to the twelfth edition.*

† The following simple method of detecting any grain oil, especially that of cotton-seed, has been published by Dr. Ramon Codina Langlies, pharmaceutist at Barcelona. It is based, he says, on the reagents proposed by Hauchecorne. The process consists in the use of a reagent, composed of three parts of pure nitric acid at 40°, and one part of distilled water. In a test tube, or a small phial with a ground glass stopper, 3 grammes of the oil to be examined are mixed with 1 gramme of the reagent; and the mixture is heated on a water-bath. If the oil is pure, the mixture becomes clearer, and assumes a yellow colour, as the purified oil; if falsified by a grain oil, it becomes transparent like pure oil, but takes on a red colour. With 5 per cent. of the grain oil, the reddish colour is characteristic, with 10 per cent. it is decisive. The experiment does not require more than 15 or 20 minutes; the change of colour persists for three days. (*Journ. de Pharm.*, Janv. 1870, p. 57.)

For the changes effected in olive oil, when bleached by sunlight, see *Am. Journ. of Pharm.* (July, 1872, p. 300). These changes are such as to interfere materially with the action of the ordinary tests, as nitric acid, sulphuric acid, and caustic soda.

For a method of detecting the oil of arachis (ground-nut oil) in olive oil, based on the presence of arachnic acid in the former, by M. A. Renaud, see the *Journ. of Pharm.*, Janv. 1872, p. 48. (*Note to the fourteenth edition.*)

M. A. Lailler, a French pharmaceutist, has found in the joint action of chromic and nitric acids a test by which he believes that olive oil can be distinguished from most other oils. If a mixture of two parts of liquid chromic acid at the eighth, and one of nitric acid of 40°, in the quantity of 30 grains, be agitated in a glass tube with two drachms of olive oil, there will be no oxidation nor any disengagement of heat, but at the end of forty-eight hours, at most, a beginning of concretion, which in some days becomes complete, and is followed by the entire absorption of the reagent by the oil, and a blue coloration of the latter. Every specimen of olive oil which does not present these phenomena completely must be considered as falsified. (*Journ. de Pharm. et de Chim.*, 4e sér.. i. pp. 187–8.)

Medical Properties and Uses. Olive oil is nutritious and mildly laxative, and is occasionally given in cases of irritable intestines, when the patient objects to more disagreeable medicines. Taken into the stomach in large quantities, it serves to involve acrid and poisonous substances, and mitigate their action. It has also been recommended as a remedy for worms, and is a very common ingredient in laxative enemata. Externally applied, it is useful in relaxing the skin, and sheathing irritated surfaces from the action of the air; and is much employed as a vehicle or diluent of more active substances. In the countries bordering on the Mediterranean, it is thought, when smeared over the skin, to afford some protection against the plague; and applied warm, by means of friction over the surface, is said to be useful as a remedy in the early stages of that complaint. But the most extensive use of olive oil is in pharmacy, as a constituent of liniments, ointments, cerates, and plasters.

The dose as a laxative is from one to two fluidounces.

Off. Prep. Cataplasma Lini, *Br.;* Charta Epispastica, *Br.;* Ceratum Cetacei, *U. S.;* Cerat. Plumbi Subacetatis, *U. S.;* Cerat. Saponis, *U. S.;* Emplastrum Ammoniaci cum Hydrargyro; Empl. Cerati Saponis, *Br.;* Empl. Hydrargyri; Empl. Picis, *Br.;* Empl. Plumbi; Enema Magnesiæ Sulphatis, *Br.;* Linimentum Ammoniæ; Liniment. Calcis, *Br.;* Liniment. Camphoræ; Liniment. Chloroformi, *U. S.;* Liniment. Plumbi Subacetatis, *U. S.;* Unguentum Cantharidis, *Br.;* Unguent. Hydrargyri Compositum, *Br.;* Unguent. Hydrargyri Nitratis, *Br.;* Unguent. Veratriæ, *Br.* W.

OLEUM RICINI. *U. S., Br.*

Castor Oil.

The fixed oil obtained from the seed of Ricinus communis. *U. S.* The oil expressed from the seeds of Ricinus communis, *Linn.* Imported chiefly from Calcutta. *Br.*

Huile de ricin, *Fr.;* Ricinusöl, *Germ.;* Olio di ricino, *Ital.;* Aceyte de ricino, *Span.*

RICINUS. *Sex. Syst.* Monœcia Monadelphia.—*Nat. Ord.* Euphorbiaceæ.

Gen. Ch. MALE. *Calyx* five-parted. *Corolla* none. *Stamens* numerous. FEMALE. *Calyx* three-parted. *Corolla* none. *Styles* three, bifid. *Capsules* three-celled. *Seed* one. *Willd.*

Ricinus communis. Willd. *Sp. Plant.* iv. 564; Woodv. *Med. Bot.* p. 624, t. 221. The castor oil plant, or *palma Christi*, attains in the East Indies and Africa the character of a tree, and rises sometimes thirty or forty feet. In the temperate latitudes of North America and Europe it is annual; though M. Achille Richard saw, in the south of France, in the vicinity of Nice, on the sea-coast, a small wood consisting entirely of what he supposed to be this species of Ricinus.* The following description applies to the plant as cultivated in cool latitudes. The stem is of vigorous growth, erect, round, hollow, smooth, glaucous, somewhat purplish towards the top, branching, and from three to eight feet or more in height. The leaves are al-

* While at Montpellier, in France, in the spring of 1861, the author was assured by Dr. Martius, Professor of Botany in the University of that city, that the species seen by Richard, forming a grove in the south of France, was not, as believed by that botanist, the Ricinus communis, but the *Ricinus Africanus.* This Prof. Martius knew from personal observation; and he stated, moreover, that all the plants of the genus Ricinus growing wild on the borders of the Mediterranean were of this species, viz., the R. Africanus. (*Note to the twelfth edition.*)

ternate, peltate or supported upon footstalks inserted into their lower disk, palmate with seven or nine-pointed serrate lobes, smooth on both sides, and of a bluish-green colour. The flowers are monœcious, stand upon jointed peduncles, and form a pyramidal terminal raceme, of which the lower portion is occupied by the male flowers, the upper by the female. Both are destitute of corolla. In the male flowers the calyx is divided into five oval, concave, pointed, reflected, purplish segments; and encloses numerous stamens, united into fasciculi at their base. In the female the calyx has three or five narrow lanceolate segments; and the ovary, which is roundish and three-sided, supports three linear, reddish stigmas, forked at their apex. The fruit is a roundish glaucous capsule, with three projecting sides, covered with tough spines, and divided into three cells, each containing one seed, which is expelled by the bursting of the capsule.

This species of Ricinus is a native of the East Indies and Northern Africa, naturalized in the West Indies, and cultivated in various parts of the world, in few countries more largely than in the United States. New Jersey, Virginia, North Carolina, and the States upon the right bank of the Ohio, especially Illinois, are the sections in which it is most abundant. It has also been introduced into California, where the oil is largely prepared at Marysville from beans produced in the neighbourhood. (*Pharm. Journ.*, May, 1871, p. 927.) The flowers appear in July, and the seeds ripen successively in August and September. A decoction of the leaves is said to be employed effectively in the Cape Verde Islands, as a local application to the breast, for promoting the secretion of milk; and an infusion of the leaves has been given internally by Dr. Routh, with great supposed success, for producing the same effect in lying-in women with deficiency of milk. (*London Lancet*, Dec. 24, 1859.) The officinal part is the fixed oil extracted from the seeds.

1. The Seeds. These are about as large as a small bean, oval, compressed, obtuse at the extremities, very smooth and shining, and of a grayish or ash colour, marbled with reddish-brown spots and veins. At one end of the seed is a small yellowish tubercle, from which an obscure longitudinal ridge proceeds to the opposite extremity, dividing the side upon which it is situated into two flattish surfaces. In its general appearance the seed is thought to resemble the insect called the *tick*, the Latin name of which has been adopted as the generic title of the plant. Its variegated colour depends upon a very thin pellicle, closely investing a hard, brittle, blackish, tasteless, easily separable shell, within which is the kernel, highly oleaginous, of a white colour, and a sweetish taste, succeeded by a slight degree of acrimony. The seeds easily become rancid, and are then unfit for the extraction of the oil, which is acrid and irritating. In 100 parts Geiger found, exclusive of moisture, 23·82 parts of envelope, and 69·09 of kernel. These 69·09 parts contained 46·19 of fixed oil, 2·40 of gum, 20·00 of starch and lignin, and 0·50 of albumen. Mr. Henry Bower could find no starch, but separated from the seeds an albuminoid principle, which acted with amygdalin and water like emulsin, producing the odour of oil of bitter almonds, though in a less degree. (*Am. Journ. of Pharm.*, xxvi. 208.) It is highly probable that it is this principle which, acting as a ferment on the oily matter of the seeds, gives rise to changes in its nature which render them rancid. More recently, Mr. G. J. Scattergood found the odour of castor oil to be developed in the beans when bruised with water, and much more powerfully in those long kept than in the fresh. The water distilled from the seeds has a peculiar nauseous odour, quite distinct from that of the oil. (*Ibid.*, xxviii. 207.)*

* *Ricinia or Ricinine.* Professor Tuson has recently announced the discovery in the seeds of a peculiar alkaloid, which he proposes to name *ricinine*, but which should be called *ricinia*. To obtain it, the crushed seeds are exhausted by successive portions of boiling water; the decoction is filtered through wet muslin; the filtered liquid is evaporated to dryness over a water-bath; the extract thus obtained is exhausted by boiling alcohol; the alcoholic solution is allowed to cool, then filtered to separate a little resinous matter, and lastly concentrated and permitted to stand. In the course of some hours, a mass of nearly white crystals is deposited, which when recrystallized from alcohol, and decolorized by animal charcoal, are the alkaloid in a pure state. Ricinine crystallizes in rectangular prisms and tables, has a feebly bitter taste, somewhat resembling that of bitter almonds, is fusible and crystallizes on cooling, volatilizable unchanged, inflammable, soluble most readily in water and alcohol, and very slightly in ether or benzole. Heated with hydrate of potassa it evolves ammonia, and therefore contains nitrogen. It appears to combine with sulphuric, nitric, and

Taken internally the seeds are powerfully cathartic, and often emetic. Two or three are sufficient to purge, and seven or eight act with great violence. This property depends upon an acrid principle, which has by some been thought to exist exclusively in the integuments, by others in the embryo. But it is now satisfactorily ascertained that the integuments are inert; and Guibourt maintains that the principle alluded to pervades the whole kernel, in connection with the oil. This principle is considered by some as volatile, and is said to be dissipated by the heat of boiling water. This view is strengthened by the experiments of Mr. Scattergood above referred to; as the water distilled from the seeds proved decidedly purgative in the dose of half a fluid-ounce, and in twice the quantity both purged and vomited. The same experimenter found that the residue, after the seeds had been exhausted by ether and alcohol, was inert in the dose of 28 grains; and the ethereal extract proved a mild cathartic in the dose of from two to five fluidrachms. After expression of the oil, and treatment with pure alcohol, M. Calloud found the residue to be powerfully emetic in the quantity of 30 grains, taken in two doses. (*Journ. de Pharm.*, 3e sér., xiv. 190.)* M. Parola states that ether also is incapable of extracting the acrid emetic principle from the seeds. At a temperature much above 212° the oil itself becomes altered, and acquires acrid properties.†

2. The Oil. This may be extracted from the seeds in three ways; 1. by decoction, 2. by expression, and 3. by the agency of alcohol or other solvent.

The process by decoction, which has been practised in the East and West Indies, consists in bruising the seeds, previously deprived of their husk, and then boiling them in water. The oil, rising to the surface, is skimmed or strained off, and afterwards again boiled with a small quantity of water to dissipate the acrid principle. To increase the product it is said that the seeds are sometimes roasted. The oil is thus rendered brownish and acrid; and the same result takes place in the second boiling, if care is not taken to suspend the process soon after the water has been evaporated. Hence it happens that the West India oil has generally a brownish colour, an acrid taste, and irritating properties.

The oil is obtained in this country by expression. The following, as we have been informed, are the outlines of the process usually employed by those who prepare it on a large scale. The seeds, having been thoroughly cleansed from the dust and fragments of the capsules with which they are mixed, are conveyed into a shallow iron reservoir, where they are submitted to a gentle heat insufficient to scorch or decompose them, and not greater than can be readily borne by the hand. The object

muriatic acids. But a more accurate investigation is needed, before it can be admitted to be undoubtedly a distinct and pure alkaloid. A minute quantity is said to be obtained from castor oil by shaking it with water, evaporating the liquid, treating the residue with boiling benzole, and allowing the solution to evaporate spontaneously. Professor Tuson does not claim for the new alkaloid the possession of purgative properties. Two grains given to a rabbit produced no observable effect. (*Note to the twelfth edition.*)

* A case is reported in the *Archives Générales de Médicine* (Mars, 1869, p. 284), by Dr. Houzé de l'Aubnoit, Professor of the School of Medicine of Lille, in which a middle-aged woman of that city was fatally poisoned by the seeds of the castor oil plant. Wishing to take a dose of castor oil, she sent a child to a herbalist for the medicine, and received in return a package of these seeds, weighing from 30 to 50 grammes (more than a troyounce), with directions to bruise a portion of them in a mortar, to put them into milk or coffee, and to drink them. She complied with the directions, and took a fifth part of the contents of the package at a dose. She was very speedily seized with violent vomiting and purging, with bloody stools, which continued almost incessantly for five days, when she died. Examination showed signs of violent inflammation of the alimentary canal, especially of the small intestines, which were blackened for a large extent, and so much softened that they were ruptured on handling. (*Note to the fourteenth edition.*)

† Mr. Richard V. Tuson, Professor of Chemistry in the Royal Veterinary College, England, has obtained from the cake left after the expression of castor oil, a principle called by him *ricine*, which presented the following properties on examination. 1. Cautiously heated on a glass plate, it melted, and on cooling formed a whorl of acicular crystals. 2. Heated between two watch-glasses, it sublimed, apparently without decomposition. 3. Strongly heated on platinum foil, it melted, then took fire, and burned with a highly luminous flame, leaving no ash. 4. Heated with hydrate of potassa, it evolved ammonia, proving that it contains nitrogen. 5. Dissolved in muriatic acid, and mixed with solution of chloride of platinum, it yielded, on evaporation, well defined orange octohedra. 6. Again, cold saturated aqueous solutions of ricine and bichloride of mercury, mixed, and allowed to stand, deposit fasciculi of acicular crystals. Mr. Tuson expects to be able to prove that ricine is an alkaloid. (*Am. Journ. of Pharm.*, Feb. 1871, p. 72; from *Chem. News*, Nov. 11, 1870.)—*Note to the fourteenth edition.*

of this step is to render the oil sufficiently liquid for easy expression. The seeds are then introduced into a powerful screw press. A whitish oily liquid is thus obtained, which is transferred to clean iron boilers, supplied with a considerable quantity of water. The mixture is boiled for some time, and, the impurities being skimmed off as they rise to the surface, a clear oil is at length left upon the top of the water, the mucilage and starch having been dissolved by this liquid, and the albumen coagulated by the heat. The latter ingredient forms a whitish layer between the oil and the water. The clear oil is now carefully removed; and the process is completed by boiling with a minute proportion of water, and continuing the application of heat till aqueous vapour ceases to rise, and till a small portion of the liquid, taken out in a vial, continues perfectly transparent when it cools. The effect of this last operation is to clarify the oil, and to render it less irritating by driving off the acrid volatile matter. But much care is requisite not to push the heat too far; as the oil then acquires a brownish hue, and an acrid peppery taste. After the completion of the process, the oil is put into barrels, and sent into the market. There is reason, however, to believe that much of the American oil is prepared by merely allowing it to stand for some time after expression, and then drawing off the supernatant liquid. One bushel of good seeds yields five or six quarts, or about 25 per cent. of the best oil. If not carefully prepared, it is apt to deposit a sediment upon standing; and the apothecary may find it necessary to filter it through coarse paper before dispensing it. Perhaps this may be owing to the plan just alluded to of purifying the oil by rest and decantation. We have been told that the oil in barrels occasionally deposits in cold weather a copious whitish sediment, which it redissolves when the temperature rises. A large proportion of the drug consumed in the eastern section of the Union has been derived, by way of New Orleans, from Illinois and the neighbouring States, where it has been at times so abundant that it has been used for burning in lamps, and for lubricating machinery.* We were informed, however, that in the year 1857, from a failure of the crops, and the consequent high price of the oil, considerable quantities were brought from the East Indies; and, in a report made to the American Pharmaceutical Association, in the autumn of 1859, it is stated that, after the first of January of that year, 20,000 gallons of castor oil, and 50,000 bushels of castor beans had been imported from the same source, at the port of Boston.†

The process for obtaining castor oil by means of alcohol has been practised in France; but the product is said to become rancid more speedily than that procured in the ordinary mode. Such a preparation has been employed in Italy, and is asserted to be less disagreeable to the taste, and more effective, than the common oil obtained by expression. According to M. Parola, an ethero-alcoholic extract, and an ethereal or alcoholic tincture of the seeds, operate in much smaller doses than the oil, and with less disposition to irritate the bowels or to cause vomiting. (See *Am. Journ. of Med. Sci.*, N. S., xiii. 143.)

* For a particular account of the mode of cultivating the castor oil plant, and preparing the oil in the Western States, see a paper by Prof. Procter in the *Am. Journ. of Pharm.* (xxvii. 99). It is stated in this paper that, by the aid of an improved press, the product of oil has been so much increased, that 15 bushels of seeds will yield 40 gallons of oil. Most of the seeds produced in Illinois are now expressed in St. Louis. (*Note to the eleventh edition.*)

† *Italian Castor Oil.* The castor oil plant is cultivated throughout Italy, but especially in the neighbourhood of Verona, where the oil is prepared with great care, and is remarkably free from the peculiar odour and taste which render this medicine so repulsive to many palates. As it is highly desirable, for certain purposes, that the oil should be as free from these properties as possible, though as a mere purgative perhaps less powerful when deprived of them, it is a point worthy of investigation, why it is that the Italian oil is superior to most if not all other commercial varieties of the oil in these respects. The following facts in relation to the mode of preparing the oil practised at Verona, published by Mr. H. Groves, of Florence, acquire on this account a special value. One point of importance is that the seeds are used fresh, as the oil rapidly becomes rancid in them when kept. Another fact is that the seeds are entirely deprived of their coating before being submitted to pressure. This is effected by passing them between two revolving wooden rollers, with a winnowing machine beneath; and, to secure the complete absence of integument, they are afterwards assorted by the hand; all being rejected which are not perfectly decorticated. They are then put into hempen bags, which are arranged in layers, with a sheet of iron heated to 90° F. between them, so as to enable the oil to flow. Lastly, they are submitted to pressure in hydraulic presses. The oil which now flows is of the finest quality. An inferior kind is obtained by pressing the marc at a somewhat higher heat. (*Pharm. Journ. and Trans.*, Oct. 1866, p. 250.)—*Note to the thirteenth edition.*

Properties. Pure castor oil is a thick, viscid, colourless liquid, with little or no odour, and a mild though somewhat nauseous taste, followed by a slight sense of acrimony. As found in the shops it is often tinged with yellow, and has an unpleasant smell; and parcels are sometimes though rarely met with, of a brownish colour, and hot acrid taste. It does not readily congeal by cold. When exposed to the air it slowly thickens, without becoming opaque. It is heavier than most of the other fixed oils; its sp. gr. having been stated to be 0·969 at 55° F. It differs also from other fixed oils in being soluble in all proportions in cold absolute alcohol. Weaker alcohol, of the sp. gr. 0·8425, takes up about three-fifths of its weight. It has been supposed that adulterations with other fixed oils might thus be detected, as the latter are much less soluble in that fluid; but Pereira has shown that castor oil has the property of rendering a portion of other fixed oils soluble in alcohol; so that the test cannot be relied on. (*Pharm. Journ.*, ix. 498.) Such adulterations, however, are seldom practised in this country.* Castor oil is soluble also in ether. Its proximate composition is but imperfectly understood. When exposed to destructive distillation, it yields various gaseous products, volatile oleaginous liquids, and two peculiar substances called acrolein and œnanthole; and there is left behind a spongy elastic mass of remarkable properties. By nitrous acid the oil is solidified and converted into a fatty substance, which was named at first *palmin*, but afterwards *ricinelaïdin*, from its analogy with the product of a similar reaction on olive oil. This principle yields *palmic* or *ricinelaïdic acid* and glycerin on saponification. The oil appears to be a glyceride; and, when it is saponified, and the soap decomposed by an acid, an oily liquid is obtained, consisting chiefly of ricinoleic acid, and a small portion of a solid acid, which is supposed to be a mixture of stearic and palmitic acids. (Gregory's *Handbook*, 4th ed., p. 303.) Its constituents would, therefore, seem to be mainly ricinolein and a little stearin and palmitin. Ricinoleic acid is converted by caustic potassa into caprylic alcohol and sebacic acid, with disengagement of hydrogen; and the same products are obtained by the reaction of potassa with the oil itself. (See *Journ. de Pharm.*, Août, 1855, p. 113.) M. Lefort gives the formula $C_{56}H_{52}O_8$, as representing the ultimate composition of castor oil. (*Ibid.*, 3e sér., xxiii. 348.) Its purgative property is supposed by MM. Bussy and Lecanu to belong essentially to the oil, and not to any distinct principle which it may hold in solution. According to M. O. Popp, castor oil differs from all other fixed oils in turning the plane of polarized light to the right. (*Am. Journ. of Pharm.*, Aug. 1871, p. 354; from *Arch. de Pharm.*, 1871.) Various substances containing colouring principles which they yield to castor oil, produce beautiful fluorescence in that fluid when heated with it; such as logwood, turmeric, camwood, &c. (Charles Horner, *Pharm. Journ.*, Oct. 1874, p. 282.)

Castor oil which is acrid to the taste may sometimes be rendered mild by boiling it with a small proportion of water. If turbid, it should be clarified by filtration through coarse paper. On exposure to the air, it is apt to become rancid, and is then unfit for use.†

* *Cohesion figures as a means of testing liquids.* A new mode of testing liquids has been recently proposed by Mr. Charles Tomlinson, which is applicable to this oil, and may succeed when purely chemical methods fail. When one liquid is dropped on the surface of another, there are often curious figures produced, as the drop spreads out on the surface of the liquid upon which it falls, occasioned by the conflict between the cohesion of the drop and the forces which cause its diffusion. These the author calls *cohesion figures*. As a general rule, each liquid has its own characteristic figures, which are modified by the admixture of other liquids, and thus the means are afforded of testing not only the identity of any suspected liquid, but also its purity. To one not acquainted with the characteristic cohesion figures, it would be sufficient to try the experiment with a specimen known to be pure, and then to compare with the figure it forms, those formed by the specimen to be tested. The experiment should always be made under precisely similar circumstances. In reference to castor oil, it should be dropped from the end of a glass rod upon the surface of perfectly clear water, in a glass vessel scrupulously clean; as any imperfection in these respects might interpose a physical impediment to the success of the experiment. (*Chem. News*, Feb. 13, 1864, p. 79. See also *Am. Journ. of Pharm.*, July, 1864.)

Effect on light. Another test for castor oil is its influence on polarized light. The fixed oils generally have little or no power. Castor oil deviates the plane of polarization to the right, but loses this property if heated to 270° C. (*Journ. de Pharm.*, Nov. 1861, p. 339.)—*Note to the twelfth edition.*)

† The following method of purifying rancid castor oil is recommended by M. Pavesi. Mix 1000

Medical Properties and Uses. Good castor oil is a mild and speedy cathartic, usually operating with little griping or uneasiness, and evacuating the contents of the bowels without much increasing the alvine secretions. Hence, it is particularly applicable to constipation from collections of indurated feces, and to cases in which acrid substances have been swallowed, or acrid secretions have accumulated in the bowels. From its mildness it is also especially adapted to diseases attended with irritation or inflammation of the bowels; as colic, diarrhœa, dysentery, and enteritis. It is habitually resorted to in cases of pregnant and puerperal women, and is decidedly, as a general rule, the best and safest cathartic for children. Infants usually require a larger relative dose than adults, probably because they digest more of the oil.

The dose for an adult is about a fluidounce, for an infant from one to three or four fluidrachms. It is sometimes difficult of administration, not so much from any peculiarly disagreeable taste, as from the recollection of former nausea, or other uneasiness which it may have produced, and from its clamminess and adhesiveness to the mouth. In a few cases, the disgust which it excites is utterly unconquerable by any effort of resolution. It is desirable, therefore, to obviate this inconvenience, as far as possible, by the mode of exhibition. A common method is to give it floating in mint or cinnamon water; but that which we have found upon the whole the least offensive, is to mix it with a cup of hot sweetened coffee, by which it is rendered more fluid, and its taste considerably disguised. Some take it in wine, or spirituous liquors, or the froth of porter; but these are often contraindicated by their stimulant property. When the stomach is unusually delicate, the oil may be made into an emulsion with mucilage or the yelk of an egg, loaf sugar, and an aromatic water. Tragacanth has been recommended as producing a better emulsion than gum arabic. Laudanum may be added in cases of intestinal irritation. It has been proposed to give the oil in the air-bladders of fishes, which may be preserved in alcohol for the purpose.* Castor oil may also be beneficially used as an enema, in the quantity of two or three fluidounces, mixed with some mucilaginous liquid. It has been recommended as a local application to the breasts of nursing women, to promote the secretion of milk.

Though apt to become rancid by itself, it loses much of this susceptibility when mixed with lard; and some apothecaries are said to use it as a substitute for olive oil in unguents and cerates. But the slightly irritating properties of even the mildest castor oil render it unfit for those preparations which are intended to alleviate irritation.

Off. Prep. Collodium cum Cantharide, *U. S.;* Collodium Flexile; Linimentum Sinapis Compositum, *Br.;* Pilula Hydrargyri Subchloridi Composita, *Br.* W.

OLEUM ROSÆ. *U. S.*

Oil of Roses.

The volatile oil obtained from the petals of Rosa centifolia. *U. S.*

See ROSA CENTIFOLIA.

This is commonly called *attar, otto,* or *essence of roses.* It is prepared on a large scale in Turkey in Europe, especially in the Balkan mountains, in Egypt, Persia, Cashmere, India, and other countries of the East; but European and American commerce is at present supplied chiefly from the region constituting the southern slope of the Balkans. Kizanlik is said to be the district in which the oil is most largely produced; 500,000 metticals (about 3000 avoirdupois pounds) being at present the annual amount obtained. The roses are gathered in May, and are distilled with the green leaves of the calyx. They are put, to the amount of 30 or 60 lbs.,

parts of the oil with 25 parts of purified bone-black and 10 of magnesia; allow the mixture to stand for three days, with occasional agitation; then filter through paper or felt. (*Repert. de Pharm.*, Sept. 1857.)—*Note to the twelfth edition.*

* Oil of bitter almonds has been proposed as an effectual means of destroying the taste of castor oil. It is to be employed in the same method as in the case of cod-liver oil. (See *page* 628.) Another measure is to beat the oil well with the contents of an egg, adding a little salt, sugar, and a few drops of orange flower water. (*Note to the twelfth edition.*)

into a tinned copper boiler of the capacity of about 150 lbs. The heat is applied over an open fire, and a boiling temperature is continued for two hours, when the first part of the distilled fluid is returned to the boiler, and the process is continued to completion. The oil collects on the top of the water in the receiver, where it is removed from time to time as it accumulates. (*Pharm. Journ.*, June, 1872, p. 1051.) In the south of France it is prepared in small quantities by distilling the petals of the rose with water. The oil concretes and floats upon the surface of the water when it cools. The precise species of rose from which the oil is extracted is not in all instances certainly known; but it is said to be obtained from *R. damascena* in Northern India, *R. moschata* in Persia, and *R. centifolia* (*provincialis*) in the north of European Turkey. Dr. Hochstell of the Vienna University, who travelled in the region of the rose culture, and from whose paper the facts just mentioned were chiefly derived, states that the most important species cultivated in the valley of Kizanlik are *R. damascena*, *R. semperviva*, and *R. moschata*. It is furnished in very minute proportion; not more than three drachms having been obtained by Colonel Polier, in Hindostan, from 100 lbs. of the petals. It is usually imported in small bottles, and is very costly.*

Oil of roses is said to be prepared in Macedonia by crushing the petals in mills, expressing the fluid part, filtering it, and then exposing it to the sun in small glass vessels. The oil gradually collects on the surface of the liquid, and is removed. (*Pharm. Cent. Blatt*, 1847, p. 783.)

Landerer states that, at Damascus and other parts of Asia Minor, the oil is prepared by dry distillation. The buds being collected before sunrise are placed in a glass retort; and the distillation is effected by a salt-water bath, care being taken so to regulate the heat as not to scorch the petals. The water of the fresh roses and their oil come over together, and the latter floating on the top is separated in the usual mode.

Oil of roses is nearly colourless, or presents some shade of green, yellow, or red; but, according to Polier, the colour is no criterion of its value. It is concrete below 80°, and becomes liquid between 84° and 86°. Its odour is very powerful and diffusive. At 90° its sp. gr. is 0·832. Alcohol dissolves it, though not freely when cold. It consists of two oils, one liquid, the other concrete at ordinary temperatures. These may be separated by freezing the oil, and compressing it between folds of blotting paper, which absorbs the liquid oil, and leaves the concrete or stearoptene. The latter consists exclusively of carbon and hydrogen; the former, of these with oxygen. The odour resides exclusively in the liquid oil, the pure stearoptene being scentless.

Sandal-wood oil, other volatile oils, fixed oils, spermaceti, &c., are said to be added as adulterations. The volatile additions may be detected by not being concrete; the fixed, by the greasy stain they leave on paper when heated. Guibourt has offered certain tests by which he thinks the purity of the oil may be determined. (See *Am. Journ. of Pharm.*, xxi. 318.) It is said that the oil of one of the sweet-scented Pelargoniums, perhaps the *rose-geranium*, is much employed in Turkey for the purpose of adulteration; but this is probably a mistake. According to Mr. Hanbury, who appears to have thoroughly investigated the subject, two substances especially are used in Constantinople for adulterating the oil; one spermaceti, the other a volatile oil, produced by certain grasses in the East Indies belonging to the genus *Andropogon*, large quantities of which are exported from Bombay, partly directly to Europe, partly through the Arabian Gulf, whence it reaches Constantinople. The same oil is imported into London under the name of *Turkish essence of geranium*. (*Pharm. Journ.*, April, 1859, p. 506.)†

A test of the genuineness of oil of roses has been proposed by Hager, consisting in the action of strong sulphuric acid, which, added in the quantity of twenty drops to five drops of the oil, produces a reddish-brown mixture, which, if shaken when

* See a paper by Prof. J. L. Smith, on the preparation of the otto of rose in the Balkans, in the *Am. Journ. of Pharm.*, July, 1859, p. 324.

† For a paper by Dr. R. Bauer, of Constantinople, giving an account of oil of roses in all its relations, its production, properties, adulteration, &c., the reader is referred to the *Pharm. Journ. and Trans.* (Dec. 1867, p. 286).—*Note to the thirteenth edition.*

cold with three drachms of absolute alcohol, will, if the oil be pure, change into a tolerably clear yellowish-brown solution, remaining clear if heated to ebullition; whereas, if the oil be adulterated, the mixture will continue very cloudy, and sometimes a deposit will form. Professor Redwood, however, on trying the test, did not find it satisfactory. (*Pharm. Journ. and Trans.*, Feb. 1866, p. 424.)

Flückiger, who has carefully examined the stearoptene of the oil, states that its crystals present microscopic characters so distinctive that it is impossible to confound them with any of the substances fraudulently employed. They are truncate semi-sided prisms, the angles of which are unequal, and which must be attached to the rhomboidal system. This stearoptene, melted, and allowed to cool, crystallizes in a manner so complete, that the microscope can readily reveal the presence of foreign substances, such as spermaceti, fatty bodies, wax, and other analogous amorphous substances. (See *Journ. de Pharm. et de Chim.*, Juillet, 1869, p. 30.)

Oil of roses may be added, as a grateful perfume, to various spirituous preparations for internal use, and to cerates and ointments. W.

OLEUM SESAMI. *U.S. Secondary.*

Benne Oil.

The fixed oil of the seed of Sesamum Indicum, and of Sesamum orientale. *U.S.* See SESAMI FOLIUM.

OLEUM SUCCINI. *U.S.*

Oil of Amber.

The volatile oil obtained by the destructive distillation of Amber. *U.S.*

Amber. *Succinum.* This is a fossil resin, derived, probably, from extinct coniferæ, occurring generally in small detached masses, in alluvial deposits, in different parts of the world. It is found chiefly in Prussia, either on the sea-shore, where it is thrown up by the Baltic, or underneath the surface, in the alluvial formations along the coast. It is said that the whole annual product of the Baltic coast is at present about 200,000 pounds. (*Am. Journ. of Pharm.*, July, 1868, p. 369.) Large deposits occur in some lakes on the eastern coast of Courland, and an extensive bed of yellow amber was discovered in 1854, on sinking a well in the coal mines near Prague. The largest mass of amber, yet found, weighed thirteen pounds. Amber also occurs in considerable quantities near Catania, in Sicily. It is usually associated with lignite, and sometimes encloses insects and parts of vegetables. In the United States, it was found at Cape Sable, Maryland, by Dr. Troost. In this locality it is associated with lignite and iron pyrites. It has also been discovered in New Jersey. The amber, consumed in this country, is brought from the ports of the Baltic. A mine of it is said to have been discovered, and is now worked, near Rokwood in Australia.

It is a brittle solid, generally in small irregular masses, permanent in the air, having a homogeneous texture and vitreous fracture, and susceptible of a fine polish. It becomes negatively electric by friction. Its colour is generally brownish-yellow, either light or deep; but is occasionally reddish-brown or even deep-brown. It has no taste, and is inodorous when cold, but exhales a peculiar, aromatic smell when heated. It is usually translucent, though occasionally transparent or opaque. Its sp. gr. is about 1·07. Water and alcohol scarcely act on it. When heated in the open air, it softens, melts at 548°, swells, and at last inflames, leaving, after combustion, a small portion of ashes. Subjected to distillation in a retort furnished with a tubulated receiver, it yields, first, a yellow acid liquor; and afterwards a thin yellowish oil, with a yellow waxy substance, which is deposited in the neck of the retort, and the upper part of the receiver. This waxy substance, exhausted by cold ether of the part soluble in that menstruum, is reduced to a yellow micaceous matter,

identical with the *chrysen* of Laurent. A white crystalline substance, identical with the *idrialin* of Dumas, may be separated from the micaceous substance by boiling alcohol. Both chrysen and idrialin are carbohydrogens. (Pelletier and Walter, *Journ. de Pharm.*, v. 60.) As the distillation proceeds, a considerable quantity of combustible gas is given off, which must be allowed to escape. By continuing the heat, the oil gradually deepens in colour, until, towards the end of the distillation, it becomes black and of the consistence of pitch. The oil obtained is called *oil of amber*, and the acid liquor is a solution of impure *succinic acid*. Repeatedly distilled from nitric acid, amber yields an acid liquor, from which, after it has been neutralized with caustic potassa, ether separates pure camphor. (Doepping, *Journ. de Pharm.*, vi. 168.) Camphor is also obtained by distilling to dryness powdered amber with an extremely concentrated solution of caustic potassa. (G. Reich, *Ibid.*, xiii. 33.)

According to Berzelius, amber consists of 1. a volatile oil of an agreeable odour in small quantity; 2. a yellow resin, intimately united with a volatile oil, very soluble in alcohol, ether, and the alkalies, easily fusible, and resembling ordinary resins; 3. another resin, also combined with a volatile oil, soluble in ether and the alkalies, sparingly soluble in cold, but more soluble in boiling alcohol; 4. succinic acid; 5, a bituminous principle insoluble in alcohol, ether, and the alkalies, having some analogy to the lac resin of John, and constituting more than four-fifths of the amber. It also contains a strongly odorous, bright-yellow substance, which hardens by time, but preserves in part its odour. The ultimate constituents of amber are carbon 80·59, hydrogen 7·31, oxygen 6·73, ashes (silica, lime, and alumina) 3·27 = 97·90. A minute proportion of sulphur has also been found among its constituents. (*Journ. de Pharm.*, Mai, 1864, p. 404.)

Amber was held in high estimation by the ancients as a medicine; but at present is employed only in pharmacy and the arts. In pharmacy it is used to prepare oil of amber and succinic acid. In the arts it is made into ornaments, such as beads, and instruments of use, as mouth-pieces, and is employed in preparing varnishes. When put to the latter use it requires to be first subjected to roasting, whereby it is rendered soluble in a mixture of linseed oil and oil of turpentine. This solution forms *amber varnish.* B.

Oil of Amber. *Oleum Succini. Crude Oil of Amber.* In the U.S. Pharmacopœia of 1850, this is placed among the Preparations; in that of 1860, it was transferred to the Materia Medica list. The following are the former officinal directions for its preparation.

"Take of Amber, in powder, *any quantity.* Put the Amber, previously mixed with an equal weight of sand, into a glass retort, which is to be only half filled; then distil, by means of a sand-bath, with a gradually increasing heat, an acid liquor, an oil, and a concrete acid impregnated with oil. Separate the oil from the other matters, and keep it in well-stopped bottles." *U. S.*

The amber in this process undergoes decomposition, and affords, among other products, an empyreumatic oil, which floats in the receiver upon the surface of an acid liquor. The heat requisite for the complete decomposition of the amber cannot be supported by a glass retort; and, in order that all the oil which it is capable of yielding may be collected, the distillation should be performed in a tubulated iron or earthenware retort, which may be placed immediately upon the fire. The sand is added to prevent the amber from swelling too much. The oil may be separated from the acid liquor by means of the separating funnel. As first procured, it is a thick, very dark-coloured liquid, of a peculiar strong empyreumatic odour. In this state it is occasionally employed as a liniment; but for internal use it should be rectified. It is said that the scrapings of *copal* and the resin *dammar* are often substituted for amber, and yield an oil scarcely distinguishable from the genuine. (*Pereira.*)

Off. Prep. Oleum Succini Rectificatum, *U. S.* W.

OLEUM TEREBINTHINÆ. *U.S., Br.*

Oil of Turpentine.

The volatile oil distilled from the turpentine of Pinus palustris and of other species of Pinus, *U.S.* The oil distilled from the oleo-resin (turpentine) obtained from Pinus palustris (*Miller's Dict.*), Pinus Tæda (*Linn.*), and sometimes Pinus Pinaster (*Aiton.*) *Br.*

Huile volatile de térébenthine, *Fr.;* Terpenthinöl, *Ger;* Olio della tremer tina, *Ital.;* Aceyte de trementina, *Span.*

See TEREBINTHINA.

This oil is commonly called *spirits* or *spirit of turpentine.* It is prepared by distillation from our common turpentine, though equally afforded by other varieties. It may be distilled either with or without water; but in the latter case a much higher temperature is required, and the product is liable to be empyreumatic. To obtain it quite pure it should be redistilled from a solution of caustic potassa. The turpentine of *Pinus palustris* is said to yield about 17 per cent. of oil; while the common turpentine of Europe affords 24 per cent. Large quantities are distilled in North Carolina for exportation.

Pure oil of turpentine is perfectly limpid and colourless, of a strong, penetrating, peculiar odour, and a hot, pungent, bitterish taste. It is much lighter than water, having the sp. gr. 0·86 at 72° F.; is highly volatile and inflammable; boils at a temperature somewhat higher than 300°; is very slightly soluble in water, less soluble in alcohol than most other volatile oils, and readily soluble in ether. Boiling alcohol dissolves it with facility, but deposits most of the oil upon cooling. One hundred parts of alcohol of 0·84 dissolve 13·5 parts of the oil at 72°. As found in commerce, it always contains oxygen; but, when perfectly pure, it consists exclusively of carbon and hydrogen, and is thought to be isomeric with the radical of camphor. Hence it has been denominated camphene. (See *page* 207.) According to Blanchet and Sell, it consists of two distinct isomeric oils, which, by the absorption of oxygen, are converted into two distinct resins, corresponding to those found by Unverdorben in colophony. (*Journ. de Pharm.*, xx. 226.) But there is reason to believe that these oils are the results of chemical reaction; as, when isolated, they have boiling points higher than that of the original oil. Heated in close vessels to 482° F., oil of turpentine undergoes certain changes in properties, without any discoverable change of composition. (*Ibid.*, 3e sér., xxiv. 428.) It absorbs muriatic acid, forming with it two compounds, one a red dense liquid, the other a white crystalline substance resembling camphor, and hence called *artificial camphor.* The latter consists of the unaltered oil (camphene) combined with the acid, and is therefore muriate of camphene. In the former the oil appears to have undergone some molecular change, being converted into an oil isomeric with the oil of turpentine, but differing from it in its action on polarized light, and in forming a liquid compound with muriatic acid. Nitric acid converts oil of turpentine into resin, and by long boiling into *turpentinic acid.* Mixed with water and chloride of lime, and then distilled, the oil yields a liquid which M. Chautard found to be identical with chloroform. (*Ibid.*, 3e sér., xxi. 88.) On exposure to air and light, it deposits white acicular crystals, which are without taste or smell, insoluble in cold water, but soluble in ether and alcohol. (Boissenot, *Journ. de Chim. Méd.*, ii. 143.) White crystals of stearoptene, heavier than water and fusible at 20°, separate from the oil at the temperature of 18° below zero. These are probably a hydrate of the oil. The hydrate may be produced by exposing on a plate four volumes of the oil recently distilled, three of alcohol, and one of nitric acid. Crystals form at the end of a week or more. This happens though thé oil may be mixed with others, and may serve to detect adulterations with it of oils which do not have the same composition. (Berthelot, *Journ. de Pharm. et de Chim.*, xxviii. 451.) The name of *terpin* has been given to this crystalline hydrated oil of turpentine; and similar crystals, if not identically the same in character, have been taken from the interior of an old pine log, where they were probably formed from the oil remaining in the structure of the wood.

(John M. Blake, *Am. Journ. of Sciences and Arts*, A.D. 1867, xliii. 202.) Oil of turpentine may be made to yield cymene identical with that existing in the oil of cummin, and with that obtained by dehydrating camphor. (See *Cumin Seed*, in *Part III.*)

Exposed to the air the oil absorbs oxygen, becomes thicker and yellowish, and loses much of its activity, owing to the formation of resin. A small proportion of formic acid is said also to be generated. Hence the Edinburgh College directed the oil to be rectified by distilling it with about four measures of water. But the process is difficult in consequence of the great inflammability of the vapour, and its rapid formation, which causes the liquid to boil over. In this country it is scarcely necessary; as the recent oil can be obtained at an expense less than that which would be incurred by redistillation on a small scale. Another mode of purifying the oil is to agitate it with one-eighth of alcohol, which dissolves the resinous portion. About one-fifth of the alcohol is retained by the oil, but is readily separated by agitation with water.

The oil as obtained from different species of pine or fir, though having many common properties, and identical in composition, is somewhat different, especially in relation to its influence on polarized light. Thus, the oil used in this country, derived from Pinus palustris, produces deviation of the plane of polarization to the right, while the French oil, from Pinus maritima, has the contrary effect. M. Berthelot, after numerous experiments, has come to the conclusion, that the oils of turpentine of the formula $C_{20}H_{16}$, whether from the same or different trees, are mixtures of several isomeric carburets, constituting permanent varieties, which carry their distinctive characters with them into combination, as in their artificial camphors and hydrates, which have the same rotary power as their respective oils. (*Journ. de Pharm. et de Chim.*, xxv. 263.)

Berthelot has shown that oil of turpentine has, under certain conditions, the power, while undergoing oxidation itself, of causing the oxidation of other bodies, to which it imparts a portion of the oxygen absorbed from the air. All that is necessary to give this power to the oil is that, soon after distillation, it should be exposed to the air, as in a bottle half filled. Solar light assists, but is not essential to the change, which goes on even in the dark. The oil retains the property thus acquired indefinitely, but may be deprived of it by exposure to a boiling heat, or by agitation with certain other substances, as pyrogallate of potassium. No other chemical or physical change can be detected in the oil. (*Journ. de Pharm.*, Mai, 1860, p. 351.)

In this country, the oil of turpentine, though often more or less impure from the presence of resin, is probably not often adulterated. An instance, however, has been put on record, in which a sample of the oil, having a pale-green colour, was found to contain copper. This was easily separated by shaking the oil with a little saturated solution of prussiate of potassium, and allowing it to stand for two or three days to settle. (C. Lewis Diehl, *Am. Journ. of Pharm.*, Sept. 1867, p. 386.)

Medical Properties and Uses. Oil of turpentine is stimulant, diuretic, occasionally diaphoretic, anthelmintic, in large doses cathartic, and externally rubefacient. Swallowed in moderate quantities it produces a sense of warmth in the stomach, accelerates the circulation, and increases the heat of the skin, without especially affecting the functions of the brain. In small doses, frequently repeated, it stimulates the kidneys, augmenting the secretion of urine, and often producing, especially if long continued, painful irritation of the urinary passages, amounting sometimes to violent strangury. At the same time it imparts the odour of violets to the urine; and this effect is also produced by its external application, or even by breathing the air of an apartment impregnated with its vapours. In large doses it occasions slight vertigo, or a sense of fulness in the head, sometimes amounting to intoxication, attended frequently with nausea, and succeeded generally, though not always, by speedy and brisk catharsis. When this effect is experienced, the oil is carried out of the bowels, and, no time being allowed for absorption, is less apt to irritate the kidneys and bladder than in small and repeated doses. In some constitutions it produces, even when taken internally, an erythematic eruption on the skin. Persons who inhale its vapour are liable to strangury and even bloody urine. We have seen cases of hæmaturia in seamen from on board vessels loaded with turpentine. A case is on record in which

a woman was found dead, after having swallowed a large quantity of the oil, probably about six ounces. The muscles were in a state of rigid contraction; the membranes of the brain and spinal marrow were greatly congested, and the brain in a less degree: and the lungs and right cavities of the heart were gorged with blood. The inference is that death resulted from asphyxia, produced probably by a tetanic contraction of the muscles of respiration. (See *Am. Journ. of Med. Sci.*, Oct. 1858, p. 562.)

The oil is employed in numerous diseases. As a stimulant it sometimes proves serviceable in low forms of fever. We have found it extremely useful in the advanced stage of typhoid or enteric fever; and especially in cases in which the tongue has partially or completely thrown off its fur in flakes, and afterwards become dry, with a surface destitute of its ordinary papillary appearance, and often contracted and fissured. The remedy has, in our hands, proved almost uniformly successful under these circumstances. With small doses of the oil frequently repeated, the tongue becomes moist and again coated, the tympanitic state of the bowels disappears, and the patient goes on to recover as in a favourable case of fever. Its efficiency, however, in typhoid fever, is ascribable not so much to its stimulant properties, as to an alterative influence upon the ulcerated surface of the bowels characteristic of that disease. The medicine has been recommended as a counter-irritant in yellow and puerperal fevers; and may undoubtedly be given with advantage in the latter stages of these diseases, and in other instances of gastric and enteric inflammations, which require a resort to stimulation. In chronic rheumatism, particularly sciatica and lumbago, the oil has often been given with great benefit. It has also been much extolled as a remedy in neuralgia, in epilepsy and tetanus, in passive hemorrhages, particularly from the bowels, in disordered conditions of the alimentary canal attended with sallow countenance, foul tongue, tumid abdomen, sour or fetid eructations, and general depravation of health, in obstructions of the bowels, in chronic dysentery and diarrhœa, in obstinate gleets and leucorrhœa, in suppression of urine, and retention and incontinence of urine from debility, in chronic nephritic and calculous affections, and in various conditions of hooping cough. In certain cases of dysentery, whether acute or chronic, when the tongue is quite dry, and smooth as if from defect of the papillary structure, no remedy has proved so efficient in our hands as oil of turpentine. We have seen it also very beneficial in hæmoptysis. As a vermifuge it is highly esteemed, especially in cases of tænia. It appears to destroy or debilitate the worm, which, losing its hold upon the bowels, is then easily discharged. In cases of worms in the stomach it is very useful. The worms, in this instance, are destroyed, and then digested as any other dead animal matter. In dropsies with feeble action the oil may sometimes be advantageously given as a diuretic; and in amenorrhœa from torpor of the uterine vessels it is occasionally useful. As a local stimulant it may be given beneficially in some instances of flatulent colic, and gout in the stomach. It has seemed to act favorably as an antidote to the poisonous effect of phosphorus; and a case is recorded by Dr. Andaut, in the *Bulletin Gén. de Thérapeutique*, in which a workman, 63 years old, had swallowed, with a view to suicide, the phosphorus contained in 150 matches, but, having taken also half an ounce of oil of turpentine in order to increase the effect of the poison, escaped fatal consequences, without any other effect than temporary disorder of the alimentary canal. (*Am. J. of Pharm.*, March, 1869, p. 176.)

The dose for ordinary purposes is from five to thirty drops, repeated every hour or two, in acute, and three or four times a day in chronic diseases. In rheumatism it is recommended by some in the dose of a fluidrachm every four hours. As a remedy for the tape-worm it is given in the quantity of one or two fluidounces, and should be followed by castor oil if it do not operate in three or four hours. It has also proved successful in tænia in the dose of half a drachm, twice a day, continued for a considerable time. In ordinary cases of worms, the usual dose may be given. It may be administered on sugar, or in emulsion with gum arabic, loaf sugar, and cinnamon or mint-water. As to some its taste is very disagreeable, the form of capsules or pills has been recommended.*

* It has been objected to the form of capsule, that, in consequence of the breaking of its coating

In the form of enema, the oil has been employed in amenorrhœa, and to promote uterine contraction in child-birth, and is highly useful in cases of ascarides, obstinate constipation, and distension of the bowels from accumulation of air. No remedy is more effectual in tympanites than injections of oil of turpentine. From half a fluidounce to two fluidounces may be administered, suspended by the yelk of eggs in half a pint or a pint of water, or some mucilaginous fluid.

Externally applied, oil of turpentine irritates and speedily inflames the skin; and, in low forms of fever with coldness of the surface, is when heated one of the most efficacious rubefacients. It is also used as a liniment in rheumatic and paralytic affections, and various internal inflammations. It should generally, in mild cases, be diluted with olive oil; and in some constitutions, even in this state, produces such violent inflammation of the skin, with extensive eruptions, as to render its external use in any shape improper. Mixed with some mild oil, and introduced on cotton into the ear, it is sometimes beneficial in deafness arising from a deficient or unhealthy secretion of wax. Applied to recent burns, it is thought by some to be highly useful in allaying the burning pain and promoting a disposition to heal. For this purpose, however, it is usually mixed with resin cerate (*basilicon ointment*), so as to form a liniment capable of being spread upon linen rags. (See *Linimentum Terebinthinæ.*)* The oil has been recommended also in anthrax and erysipelas. M. Beullard has found it useful in eczema, applied directly to the affected part. It causes immediately severe pain and much swelling, and in a few minutes must be removed, and followed by cooling and demulcent measures. A modification of the disease is thus produced, which renders ordinary applications successful that had been previously useless. (*Ann. de Thérap.*, 1865, p. 138.) It is thought by Profs. Von Erlach and Lucke, of Berne, to be peculiarly efficacious in parasitic affections of the scalp, by destroying the parasites and preventing the development of the spores. (*Am. Journ. of Med. Sci.*, July, 1869, p. 248.) Applied freely to the abdomen it has proved useful in different abdominal inflammations, and used in the same manner, and by enema, it has been highly recommended in disorders following delivery. (E. Copeman, M.D., *Med. Times and Gaz.*, Aug. 1872, p. 194.)

Oil of turpentine has been recommended in the form of bath, in affections in which its constitutional impression is desired. For this purpose Dr. T. Smith, of Cheltenham, England, employs from five to ten fluidounces of the oil, with half a fluidounce of the oil of rosemary, and two pounds of carbonate of sodium in each bath. The breath becomes strongly impregnated with the terebinthinate odour. (*Braithwaite's Retrospect*, xxi. 355.) Applied in vapour, the oil is said to be a very speedy cure for the itch. The bed and night clothes are sprinkled with thirteen drachms of the oil, and the patient finds himself cured on awaking in the morning. (*Am. Journ. of Med. Sci.*, July, 1857, p. 232.) Baths of the vapour of turpentine are stated to be very beneficial in chronic rheumatism. They are said to be borne well, for twenty-five minutes, at a temperature from 140° to 160° F. (*Arch. Gén.*, 4e sér., xxviii. 80.) Inhalation of the vapour has been recommended by Skoda in gangrene of the lungs.

Off. Prep. Confectio Terebinthinæ, *Br.;* Enema Terebinthinæ, *Br.;* Linimentum Cantharidis, *U. S.;* Liniment. Terebinthinæ; Liniment. Terebinthinæ Aceticum, *Br.;* Unguentum Terebinthinæ, *Br.* W.

the oil may come undiluted in contact with the mucous membrane, and thus produce undue irritation. The form of pill, as usually prescribed, being somewhat difficult of execution, M. Lacambre gives the following process as not liable to that objection. Take of oil of turpentine 8 grammes, white wax 20 ditto, powdered sugar 9 ditto, oil of lemon 2 drops. Melt the wax in the oil of turpentine, pour into a mortar, allow to cool, then add the sugar, and form a mass to be divided into pills of 25 centigrammes (3 or 4 grs.) each. Roll them in powdered starch, and keep in a well-stopped bottle. (*Journ. de Pharm.*, Sept. 1873, p. 223.)—*Note to the fourteenth edition.*

* The following is the formula adopted by the Philadelphia College of Pharmacy for the preparation of the rubefacient liniment, so much sold under the name of *British Oil.* ℞. Olei Terebinth. f℥viij, Olei Lini f℥viij, Olei Succini f℥iv, Olei Juniperi f℥iv, Petrolei Barbadensis f℥iij, Petrolei Americani (Seneca oil) f℥j. Misce.

OLEUM THEOBROMÆ. *U. S., Br.*

Oil of Theobroma. Butter of Cacao. Cacao Butter.

The concrete oil of the kernels of the fruit of Theobroma Cacao. *U. S.* A concrete oil obtained by expression and heat from the ground seeds of Theobroma Cacao (*Linn.*). *Br.*

THEOBROMA. *Sex. Syst.* Polyadelphia Decandria.—*Nat. Ord.* Sterculiaceæ. *Lindley.*

Gen. Ch. Calyx sepaled. *Petals* 5, vaulted at the base, ligulate above. *Stamens* 15, connected into an urceolus at the base; sterile filaments 5, alternate with the petals; fertile ones short, united into 5 filaments, each opposite to a petal and bearing 2 anthers. *Style* 5-cleft at the apex. *Stigmas* simple. *Fruit* indehiscent, 5-celled. *Seeds* embedded in a buttery pulp.

Theobroma Cacao. Linn. *Sp. Pl.* 1100; Hayne, *Darstel. und Beschreib. &c.*, ix. 35. This is a handsome tree, from twelve to twenty feet in height, growing in Mexico, the West Indies, and South America, in some parts of which it is largely cultivated, particularly in Guayaquil and Venezuela. The fruit is an oblong-ovate capsule or berry, six or eight inches in length, with a thick, coriaceous, somewhat ligneous rind, enclosing a whitish pulp, in which numerous seeds are embedded. These are ovate, somewhat compressed, about as large as an almond, and consist of an exterior thin shell, and a brown oily kernel. Separated from the matter in which they are enveloped, they constitute the *cocoa*, *cacao*, or *chocolate nuts* of commerce. They have a slightly aromatic, bitterish, oily taste, and, when bruised or heated, an agreeable odour. Analyzed by Mitscherlich, they were found to contain, in 100 parts, from 45 to 49 of fixed oil (*cacao butter*), 14 to 18 of starch, 0·34 of glucose, 0·26 of cane sugar, 5·8 of cellulose, 3·5 to 5 of colouring matter, 13 to 18 of albuminoid matter, 1·2 to 1·5 of theobromin, 5·6 to 6·3 of water, with 3·5 ashes. The colouring matter is probably the result of chemical change, as the fresh seeds are white. Theobromin has been found also in the shells in the proportion of about 1 per cent. (See *Am. Journ. of Pharm.*, Nov. 1862, p. 509.) The shells of the nuts are sometimes employed in the state of infusion, as a substitute for tea or coffee. They impart to boiling water a taste analogous to that of chocolate, but weaker. The kernel is consumed in great quantities, in the shape of chocolate, or in some analogous form.

Theobromin (or more properly *theobromia*) was discovered by M. Woskresensky, who obtained it in the following method. The kernels are exhausted with water by means of the water-bath; the solution is strained through linen, precipitated by acetate of lead, and filtered; the filtered liquor is freed from lead by sulphuretted hydrogen, and evaporated; the brown residue is treated with boiling alcohol, and the liquid filtered while hot. Upon cooling, the theobromia is deposited in the form of a reddish-white powder, which is rendered colourless by repeated crystallization. Keller obtained it still purer by heating the powder between two watch-glasses, by which a brilliant white sublimate was obtained. (*Gmelin's Handbook.*) Theobromia is a nitrogenous crystallizable principle, capable of forming salts with the acids, very bitter, volatilizable without change, freely soluble in hot alcohol, sparingly so in hot water, and closely analogous to caffein. Its formula, according to Dr. F. Keller, is $C_{14}H_8N_4O_4$. It has been converted into caffein by Prof. Strecker. (See *Am. J. of Pharm.*, Sept. 1861, p. 406.) In the *Edinb. Med. Journal* (Oct. 1873), theobromia is said to be identical in effects on the system with caffein or thein. (*New Remedies*, Jany. 1874, p. 8.)

Chocolate is differently prepared in different countries. In Great Britain and the United States, it usually consists, when pure, exclusively of the cocoa or chocolate nuts, which are first roasted, then deprived of their shell, and lastly reduced, by grinding between heated stones, to a paste, which is moulded into oblong cakes. Not unfrequently rice flour or other farinaceous substance, with butter or lard, is added; but these must be considered as adulterations. On the continent of Europe,

sugar is generally incorporated with the paste, and spices, especially cinnamon, are often added. Vanilla is a favourite addition in South America, France, and Spain. Cocoa is often sold in the state of powder, which is sometimes mingled with other ingredients, such as ground rice, barley, flour, sugar, &c. Chocolate is prepared for use by reducing it to powder, and boiling it in milk, water, or a mixture of these fluids. In this state it is much employed as a drink at breakfast and tea, and serves as a substitute for coffee in dyspepsia. It is also a good article of diet for convalescents, and may sometimes be given advantageously as a mild nutritive drink in acute disease.

Oil of Theobroma. Cacao Butter. This is the fixed oil of the chocolate nut. It is extracted either by expression, decoction, or the action of a solvent. Soubeiran recommends that the seeds, previously ground, be mixed with one-tenth of their weight of water, and then pressed between hot plates of tinned iron. It is advisable that the heat should not exceed that of boiling water, and even a lower heat will answer. When the method of decoction is used, the cacao should be slightly roasted before boiling. As a solvent, bisulphide of carbon has been found to answer well, as recommended in the preparation of the expressed oil of nutmeg. (See *Oleum Myristicæ.*) Upon the whole, the method of expression is perhaps preferable. The presence of water in the ground seeds is said greatly to facilitate the process. The expressed oil, which is generally imported, comes in the shape of oblong cakes, like those of chocolate, weighing about half a pound each. It is whitish or yellowish, of the consistence of tallow, with an agreeable odour resembling that of chocolate, and a bland, pleasant taste. It was analyzed by Specht and Gössman, who found it to consist of stearin, palmitin, and olein. From its large proportion of stearin, it is one of the best fats for the preparation of stearic acid. (*Chem. Gaz.*, Aug. 15, 1854, p. 306.) It is said to be frequently adulterated with animal fats.

Butter of cacao is used as an ingredient in cosmetic ointments, and in pharmacy for coating pills, and preparing suppositories. For the last purpose it is well adapted by its consistence and blandness, and is now largely consumed. It was, indeed, on this account chiefly that it was introduced into the U. S. Pharmacopœia of 1860.* A good lip salve is said to be prepared by melting together 28 ounces of cacao butter, 4 ounces of yellow wax, and a drachm, each, of balsam of Peru and benzoic acid, straining, adding perfuming oils, as those of rose, bergamot, and bitter almonds, in sufficient quantity, and finally, when nearly cool, an ounce of glycerin. (F. Bringhurst, *Am. Journ. of Pharm.*, July, 1867, p. 348.)

Off. Prep. Suppositoria Acidi Carbolici, *U. S.;* Supposit. Acidi Tannici; Supposit. Aloës, *U. S.;* Supposit. Assafœtidæ, *U. S.;* Supposit. Belladonnæ, *U. S.;* Supposit. Hydrargyri, *Br.;* Supposit. Morphiæ; Supposit. Opii, *U. S.;* Supposit. Plumbi, *U. S.;* Supposit. Plumbi Composita, *Br.;* Supposit. Plumbi et Opii, *U. S.* W.

OLEUM THYMI. *U. S.*

Oil of Thyme.

The volatile oil obtained from Thymus vulgaris. *U. S.*

This was introduced into the U. S. Pharmacopœia of 1860, under the impression, that what is usually employed under the name of *oil of origanum*, and by that name was recognised in former editions of the Pharmacopœia, is really the product of the Thymus vulgaris, or common thyme. This fact was ascertained by Mr. Daniel Hanbury, during a journey in the south of France, where thyme grows wild in great abundance, and is largely collected for distillation. The oil is

* *Mafurra Tallow.* Under this name a fatty matter is known, obtained from the fruit of a tree growing in Mozambique, and the Isles of Madagascar and Bourbon, and bearing a close resemblance in qualities to cacao butter. The kernel of the fruit is described as of the size of the cacao bean, having the same characteristic odour when bruised, and a bitter taste. The fatty matter is extracted by boiling the kernels in water. It is of a firm solid consistence, less fusible than tallow, of a yellowish colour, and the odour of cacao butter. It agrees, moreover, with that substance in containing olein and palmitin, and yields palmitic acid largely when saponified. The tree which yields it will probably be found to bear a close botanical affinity to Theobroma. (See *Am. Journ. of Pharm.*, xxviii. 163.)

taken from France to England, and thence reaches this country under the name of oil of origanum, having, probably from its greater cheapness, been substituted for the genuine oil. The substitution is of the less importance, as, for all the purposes for which oil of origanum was used, that of thyme is not less useful, while it is at least quite as agreeable.

Thymus vulgaris is a very common plant, indigenous in the south of France, and cultivated in our gardens. It is a labiate plant, belonging to the Linnæan class and order Didynamia Gymnosperma, and characterized as a genus by its subcampanulate calyx, having its throat closed with hairs, and its corolla with the upper lip flat and emarginate, and a longer lower lip. It is a low under-shrub, procumbent at the base, with ovate-linear, revolute leaves, and flowers in a whorled spike. The herbaceous portion, which should be gathered when the plant is in flower, has a peculiar, strong, aromatic, agreeable odour, not lost by drying, and a pungent, aromatic, camphorous taste. Its active constituent is the volatile oil, which is obtained separate by distillation with water.

The oil, as prepared in the south of France, is, after one distillation, of a reddish-brown colour, and called the *red oil*, but when again distilled is colourless, and in this condition is distinguished as the *white oil*. It is the former that is exclusively found in our shops. According to Zeller, one pound of the fresh herb yields 45·7 grains of the oil, of the dried herb 38 grains. The oil, as found in our shops, is of a reddish-brown colour, and of an odour recalling that of thyme, but less agreeable. Its sp. gr. is stated at 0·905, but probably varies, as the oil is a complex body. Besides other ingredients, it contains a principle called *thymol*, which is concrete at ordinary temperatures, and comes over last in distillation, and which in the solid state is somewhat heavier than water.

Thymic Acid. Thymol. The thymol referred to in the above paragraph has recently attracted considerable attention, under the name of thymic acid, from its possession of antiseptic properties analogous to those of carbolic and cresylic acids and creasote, with which it is also analogous in composition. It may be obtained by submitting the oil to a prolonged refrigeration, under the influence of which it crystallizes; but in this solid state it is less convenient for use than as a liquid. It appears that there are two isomeric forms of thymic acid, one the crystalline product here referred to, the other a liquid, obtained by treating the oil of thyme with an aqueous solution of potassa or soda, which separates it from a principle called *thymene* with which it is mixed in the oil, and which is not affected by the alkalies. The thymate thus formed is decomposed by an acid, and the liberated thymic acid is purified by repeated washings, desiccation, and finally distillation. In this state it may be exposed to a very low temperature, without crystallizing, even though some crystals of the other variety be thrown in for a nucleus. In a concentrated state it has an acrid and caustic taste; but when very much diluted, the only taste perceptible is that of thyme, and a sense of coolness in the mouth like that caused by the oil of peppermint. In the crystalline state it melts at 111° F. and boils at 446° F. When once melted, it often has the peculiarity of remaining indefinitely in the liquid state. It is only very slightly soluble in water, but is very soluble in alcohol, and more freely in proportion to the concentration of the menstruum. It is dissolved by ether and the fixed oils, and has no rotary power as regards polarized light. The alkalies unite with it to form soluble salts. Like creasote it has the property of combining with animal tissues, and thus protecting them against putrefaction. Its composition is represented by the formula $C_{20}H_{14}O_2$; while *thymene*, with which it is associated in the oil, is a hydrocarbon, isomeric with the oil of turpentine, and having the composition $C_{20}H_{16}$. The disagreeable odour of carbolic or phenylic acid induced M. Bouilhon, a French pharmaceutist, to search among the analogous chemical products, in the hope of finding some one which might have the important practical properties of carbolic acid without disagreeable smell. This he believes that he has found in thymic acid. Dr. Paquet, clinical professor of surgery at Lille, has satisfied himself by numerous experiments that thymic acid has excellent antiseptic properties, which adapt it to all those purposes to which carbolic acid has been applied as a disinfectant. In a concentrated state it has, more-

over, caustic properties, which render it very useful for the cauterization of the dental nerves. Dissolved in water in the proportion of one to 1000, with the addition of a little alcohol, it is useful in the dressing of unhealthy wounds, and is peculiarly indicated in cases in which the tincture of iodine and other antiseptic remedies have proved unavailing. Combined in the proportion of 4 parts of the acid with 4 of tannin, 2 of anilin, and 100 of glycerin, it has been used with great success by Dr. Paquet, for the preservation of anatomical specimens. For the dressing of wounds, it may be used in the form of a lotion composed of 1 part of the acid, 4 of alcohol of 85°, and 995 of distilled water. In the form of ointment, it may be employed incorporated with lard in the proportion of from 2 to 20 drops to an ounce. If taken internally, it may either be formed into an emulsion, or dissolved in alcohol, or made into pills with 2 parts of the acid and 4 parts of medicinal soap, and any desirable excipient; the soap being necessary for the proper division of the acid. (*Journ. de Pharm. et de Chim.*, Août, 1868, p. 147.)

Thyme has the aromatic properties of sage, lavender, &c., and may be used for the same purposes; but it is more employed in cooking than in medicine. *T. serpillum*, or the wild thyme of Europe, is analogous in properties to the garden thyme. Both are occasionally used in baths, fomentations, and cataplasms, along with other aromatic herbs.

The oil is used almost exclusively as a local application. Introduced on lint or cotton into the cavity of a carious tooth, it will sometimes allay toothache. It is often used as a mild irritant in chronic rheumatism, sprains, bruises, &c., generally in connection with spirit and camphor. It is an ingredient, under the name of oil of origanum, in *opodeldoc*, the Linimentum Saponis Camphoratum of former editions of the U. S. Pharmacopœia, which was, we think unfortunately, discarded in that of 1860. W.

OLEUM TIGLII. *U.S.*

Croton Oil.

The fixed oil obtained from the seed of Croton Tiglium. *U.S.*

Off. Syn. OLEUM CROTONIS. The oil expressed from the seeds of Croton Tiglium (*Linn.*). *Br.*

Huile de Croton, *Fr.;* Crotonöl, *Germ.;* Nervalum unnay, *Tamool.*

CROTON. See CASCARILLA.

Croton Tiglium. Willd. *Sp. Plant.* iv. 543; Woodv. *Med. Bot.*, 3d ed., vol. v. p. 71. This species of Croton is a small tree or shrub, with a few spreading branches, bearing alternate petiolate leaves, which are ovate, acuminate, serrate, smooth, of a dark-green colour on the upper surface, paler beneath, and furnished with two glands at the base. The flowers are in erect terminal racemes, scarcely as long as the leaf; the lower being female, the upper male, with straw-coloured petals. The fruit is a smooth capsule, about the size of a filbert, with three cells, each containing a single seed.

The tree is a native of Hindostan, Ceylon, the Moluccas, and other parts of India. It is pervaded by an acrid purgative principle, probably analogous to that found in other plants belonging to the family of Euphorbiaceæ. Rumphius says that the root is employed in Amboyna, in the dose of a few grains, as a drastic purge in dropsy; and, according to the same author, the leaves are so acrid that, when chewed and swallowed, they excite inflammation in the lips, mouth, and throat, and along the whole course of the alimentary canal. The wood is said in small doses to be diaphoretic, in larger, purgative and emetic. But the seeds are the most active part. These have been long used in India as a powerful purgative, and were employed so early as 1630 in Europe, under the names of *grana Molucca* and *grana tiglia*. But in consequence of their violent effects they fell into neglect, and had ceased to be ranked among medicines, when, at a comparatively recent period, attention was again called to them by the writings of some English physicians in India. They are now imported for their oil, which is the only product of the plant considered officinal.

These seeds are rather larger than a grain of coffee, oblong, rounded at the extremities, with two faces, the external considerably more convex than the internal,

separated from each other by longitudinal ridges, and each divided by a similar longitudinal ridge, so that the whole seed presents an irregular quadrangular figure. Sometimes, as in the coffee grain, their internal surface is flat with a longitudinal groove, owing to the presence of only two seeds in the capsule, the groove being produced by the central column or axis. The shell is covered with a soft, yellowish-brown epidermis, beneath which the surface is black and smooth; and, as the epidermis is often partially removed by friction during their carriage, the seeds as they come to us are frequently mottled, and sometimes nearly black. The kernel or nucleus is yellowish-brown, and abounds in oil. In India the seeds are prepared for use by submitting them to slight torrefaction, by which the shell is rendered more easily separable. In the dose of one or two grains the kernel purges with great activity.

The oil is obtained by expression from the seeds, previously deprived of the shell. It may also be separated by decoction in water, or by the action of ether, or bisulphide of carbon, which dissolves the oil, and leaves it behind when evaporated.* Guibourt recommends, after the first expression, to digest the residue with alcohol at a temperature of 120° to 140 F., and then submit it to a new expression. The alcohol is to be separated by distillation from the oil, which is then to be mixed with the first product. According to Dr. Nimmo, the seeds consist of 64 per cent. of kernel, and 36 of envelope. From the seeds imported into England, about 22 per cent. of oil is obtained by simple expression. Guibourt, by his process, obtained 52 per cent. from the kernels, equivalent to about 35 from the seeds. Croton seeds yielded to Brandes upon analysis, independently of the shell, traces of a volatile oil, fixed oil, a peculiar fatty acid called *crotonic acid*, an alkaloid which he called *crotonin*, resin, stearin, wax, extractive, sugar, starch, gum, albumen, gluten, lignin, and salts. The crotonin has been subsequently found to be nothing more than a magnesian soap with an alkaline reaction. The *crotonic acid*, which is separated along with the oil on expression, has been thought to be the active principle of the seeds, but is now said to be inert. It may be obtained by treating the oil with solution of potassa, decomposing the resulting soap by tartaric acid, filtering and distilling the solution, neutralizing the product with baryta-water, evaporating to dryness, decomposing the salts of baryta with strong phosphoric acid, and again distilling. (*Christison's Dispensatory.*) The acid solidifies at 23° F., is highly volatile, has a very acrid taste, and is very irritating to the nostrils.†

Properties. Croton oil, as found in the shops, varies from a pale-yellow to a dark reddish-brown. That imported from India is usually pale, that expressed in Europe dark, like the deepest coloured sherry. Its consistence is rather viscid, and is increased by time. Its smell is faint, but peculiar, its taste hot and acrid, leaving in the mouth a disagreeable sensation which continues for many hours. The oil is wholly soluble in ether and oil of turpentine. Its relations to pure alcohol differ somewhat with the variety of the oil. That obtained by expression in England is wholly and readily soluble, forming a solution which is permanent at ordinary temperatures; while the India or pale oil forms an opaque mixture, which becomes clear and uniform upon being heated, but separates on standing into two portions, one

* *Extraction by Ether.* Having washed and dried the seeds, grind them in a coffee-mill, and form a soft paste with ether. Introduce this into a narrow percolation tube, and gradually pour ether upon it until exhausted. Evaporate the ether by means of a water-bath, and filter the remaining oil through paper. (*Journ. de Pharm.*, Août, 1862, p. 116.)

Extraction with bisulphide of carbon. The seeds, well bruised, are introduced into a bottle with three times their weight of bisulphide of carbon well rectified; the mixture is allowed to stand, with frequent agitation, for 24 hours; the whole is then poured upon a cloth and rapidly expressed. The residue is similarly treated with twice its weight of the bisulphide, and expressed, after standing as before. The products of the two macerations are mixed, then filtered in a covered funnel, and finally submitted to distillation, by means of a water-bath, in a glass retort, at the temperature of 160° or 170° F. The bisulphide should be recovered by condensing its vapour in a refrigerated receiver. The oil is to be poured into a capsule, to show that it contains none of the bisulphide, and then introduced into a bottle. (*Journ. de Pharm.*, 3e sér., xxxi. 28.)—*Note to the twelfth edition.*

† Prof. Tuson believes that he has found in croton seeds a peculiar alkaloid, analogous to cascarillin. He extracts it by the same process as that already described, by which he obtained ricine from the castor-bean. (See *note*, p. 635.) But further experiments are required for satisfactory results. (See *Am. Journ. of Pharm.*, Sept. 1864, p. 418.)

consisting of alcohol somewhat diminished in bulk, the other of the oil correspondingly increased in bulk by retaining a portion of the alcohol. It is possible that the difference in colour, and in their relations to alcohol, between the India and English oils, may be owing to a change in the kernels from being kept.

Some croton oil examined by M. Dublanc, of Paris, when agitated with ten times its weight of alcohol, was separated into two parts, one of which, amounting to 6 per cent., was dissolved by the alcohol, the other remained undissolved, but retained 50 per cent. of alcohol. The latter, upon being repeatedly treated with alcohol, lost all its acrimony; while the portion dissolved was extremely acrid. From these observations it would appear that the acrid and probably active principle of the oil is dissolved by alcohol; while a bland fixed oil, which constitutes the chief part of it, is not taken up by that liquid.*

It is thought that croton oil is often adulterated with other fixed oils. In the Br. Pharmacopœia of 1864, it was given as a test of the purity of the oil expressed from the imported seeds, that when agitated with an equal volume of alcohol and gently heated, it forms a clear solution, from which about three-fourths of the oil separate on cooling; but the statement is asserted to be untrue of the English expressed oil, though correct of the imported. The test was intended to detect the presence of castor oil, which would be dissolved by the alcohol, and thus occasion a diminution of the bulk. It has been omitted in the present Pharmacopœia.†

We were told by the late Dr. M. Burrough, who was for some time in India, that much of the oil there prepared, under the name of croton oil, is derived from the seeds of a plant different from the Croton Tiglium. From a parcel of these seeds presented to him by Dr. Burrough, Dr. R. E. Griffith produced a plant which proved to be Jatropha Curcas, the seeds of which are known by the name of *Barbadoes nuts.* (See *Tapioca.*) This oil, though weaker than the genuine, was said by Dr. Burrough to be an efficient cathartic in the dose of three or four drops. Dr. Hamilton

* Some experiments have recently been made by Thomas Schlippe on the composition of croton oil, with very interesting results. The crotonic acid referred to in the text is only one out of a number of fatty acids contained in the oil, and is neither the acrid nor the purgative principle. Besides the proper fatty part, there are probably other ingredients upon which the medicinal activity of the oil depends. Of these Schlippe has separated the acrid, but not as yet the purgative principle. The former he calls *crotonol.*

The fatty part of the oil, when saponified, yielded *stearic, palmitic, myristic,* and *lauric acids;* and of the oleic acid series, besides some not well defined, *crotonic* and *angelic acids;* all of which exist as glycerides, that is, as compounds of the acids respectively with glycerin, in the recent oil.

Crotonol, or the acrid principle, which exists in the expressed oil in the proportion of 4 per cent., may be separated in the following manner. Agitate the oil with sufficient alcoholic solution of soda to form a milky fluid; heat this gently for some hours, and then add water or solution of chloride of sodium, so as to cause the oil to rise and form a stratum on the surface; separate this fatty oil by passing the liquid through a moist filter; to the filtrate add dilute muriatic acid, which will separate and cause to rise to the surface another oily matter; dissolve this in cold alcohol, and treat it with freshly prepared hydrated oxide of lead. When the acid reaction has quite ceased, add freely a weak watery solution of soda, by which the fluid is rendered milky, and afterwards divides into a watery liquid and a clear oil which sinks to the bottom. To obtain this result, it is often necessary to add chloride of calcium freely to the alcoholic solution. Separate the oil, wash it with water on a moist filter, and dissolve it in ether. Agitate the ethereal solution with water in a cylindrical glass vessel, and, having drawn off the clear ethereal solution, allow the ether to evaporate in a capsule *in vacuo.* The crotonol remains as a tenacious mass, colourless or of a slightly wine colour, and of a weak and peculiar odour. Schlippe ascribes to a decomposition of the crotonol the odour, like that of the decoction of seneka, which is often possessed by croton oil. (*Liebig's Annalen,* cv. 1.)—*Note to the twelfth edition.*

Somewhat different results from those of Schlippe have been announced by A. Geuther. The volatile acids, according to him, are mainly the acetic, butyric, and valerianic acids, probably some œnanthilic acid, and, of the oleic series, perhaps pyroterebinic and higher acids. A liquid acid $C_8H_6O_4$ (Schlippe's crotonic acid), does not occur in croton oil. Nor is its solid acid identical with the angelic, though agreeing with it in composition, $C_{10}H_8O_4$. The tiglinic acid constitutes more than one-third of the volatile acids of croton oil. It melts at 64° C., and boils at 201·1° C., while angelic acid melts at 45°, and boils at 190° C. (*Am. Journ. of Pharm.,* July, 1870, p. 318; from *Zeitschr. f. Chemie,* 1870, i. 26, 28.)—*Note to the fourteenth edition.*

† Mr. Maisch proposes to detect croton oil in any mixture by the following plan, based upon Schlippe's results in reference to crotonol. The suspected oil is agitated with an alcoholic solution of soda or potassa, and the solution having been separated, is then saturated with hydrochloric or sulphuric acid. If croton oil be present, its acrid principle, crotonol, will rise to the surface in the form of an oil, which, when applied to the skin, will produce in three or four hours not only inflammation, but also the peculiar eruptive affection excited by croton oil. (*Am. Journ. of Pharm.,* July, 1860, p. 307.)—*Note to the twelfth edition.*

states that croton seeds are afforded by *Croton pavana*, growing in Ava and the eastern parts of Bengal; and it is probable that a portion of the croton oil of commerce is obtained from these seeds. (*Trans. Lin. Soc.*, xiv. 257.) These facts may explain some of the discrepancies in reference to the effects of alcohol above mentioned.

Medical Properties and Uses. Croton oil is a powerful hydragogue purgative, acting for the most part, when given in moderate doses, with ease to the patient, but in large doses apt to excite vomiting and severe griping pains, and capable, if immoderately taken, of producing fatal effects. It acts with great rapidity, frequently evacuating the bowels in less than an hour, and generally exciting a rumbling sensation in half that period. It possesses also great advantage in the minuteness of the dose, on account of which it may frequently be given when we should fail with more bulky medicines; as in mania, coma, and the cases of children. A drop placed on the tongue of a comatose patient will generally operate. Though long used in India, and known more than a century ago to the Dutch physicians, it did not attract general notice till about 1820, when it was introduced into England by Mr. Conwell. It is chiefly employed in cases of obstinate constipation, in which it often produces the happiest effects after the failure of other medicines; but it may also be advantageously used in almost all cases in which powerful and speedy purging is demanded. Dropsy, apoplexy, mania, and visceral obstructions are among the complaints in which it has been particularly recommended. It has recently been employed with great asserted benefit in neuralgia, epilepsy, and spasm of the glottis, and has been supposed to have powers in these affections independent of its purgative property. The seeds are said to have been used with great success in India in amenorrhœa. Applied externally, the oil produces inflammation of the skin, attended with pustular eruption, and has been used in this way in rheumatism, gout, neuralgia, glandular and other indolent swellings, and in laryngeal and pulmonary diseases. It should be diluted with three parts of olive oil, soap liniment, oil of turpentine, or other convenient vehicle, and applied as a liniment twice or oftener in twenty-four hours. Sometimes the insusceptibility of the skin is such as to require its application undiluted. The oil may also be applied externally, in the form of a plaster, made by incorporating one part of it with four parts of lead plaster, melted by a very gentle heat. Sometimes it appears to produce inflammation in parts distant from those to which it was directly applied. It has been said that four drops, used externally by friction around the umbilicus, will produce a purgative effect, but this is denied by Dr. Barlai, of Tuscany, who states that it is only when the oil is applied to the skin divested of the cuticle that it will operate upon the bowels. Nævus has been cured by the introduction of croton oil into the little tumour by means of needles. (*M. & S. Reporter*, Feb. 7, 1874, p. 128.)

The dose for an adult is one or two drops, and is most conveniently administered in the form of pill. A safe and convenient plan is to make two drops into four pills with crumb of bread, and to give one every hour till they operate. The oil may also be given in emulsion. The form of tincture may be advantageously resorted to when a minute quantity of the medicine is required; as it affords the means of readily dividing the dose.

Off. Prep. Linimentum Crotonis, *Br.* W.

OPIUM. *U. S., Br.*

Opium.

The concrete juice obtained from the unripe capsules of Papaver somniferum, by incision and spontaneous evaporation. *U. S.* The juice, inspissated by spontaneous evaporation, obtained by incision from the unripe capsules of the poppy, Papaver somniferum (*Linn.*), grown in Asia Minor. *Br.*

"Opium, when dried at 212° until it ceases to lose weight, should yield at least ten per cent. of morphia by the officinal process." *U. S.*

Opium, *Fr.;* Opium, Mohnsaft, *Germ.;* Oppio, *Ital.;* Opio, *Span.;* Affioni, *Turk.;* Ufyoon, *Arab.;* Sheerikhaskash, *Persian;* Ufeem, *Hindoo.*

PAPAVER. *Sex. Syst.* Polyandria Monogynia. — *Nat. Ord.* Papaveraceæ.
Gen. Ch. Corolla four-petaled. *Calyx* two-leaved. *Capsule* one-celled, opening by pores under the persistent stigma. *Willd.*

Opium is at present generally believed to be derived exclusively from the *Papaver somniferum;* though every species of poppy is capable of yielding it to a greater or less extent, and some authors have indicated the *Papaver orientale* as its real source. The British and French Pharmacopœias unite with our own in recognising only the first-mentioned species.

Papaver somniferum. Willd. *Sp. Plant*, ii. 1147; Woodv. *Med. Bot.* p. 376, t. 138. There are several varieties of this species, of which the two most prominent are distinguished by the titles of the white and black poppy, derived from the colour of their seeds. It is the former which is usually described as the proper opium plant. The *white poppy* is annual, with a roundish, smooth, erect, glaucous, often branching stem, usually rising two or three feet in height, but sometimes five or even six feet in favourable situations. The leaves are large, variously lobed and toothed, and alternately disposed on the stem, which they closely embrace. The flowers are terminal, very large, and of a white or silver-gray colour. In India they appear in February, in Europe and the United States not earlier than June, July, or August. The calyx is smooth and composed of two leaves which fall when the petals expand. These are usually four in number; but there is a variety in which the flower is double. The germen, which is smooth and globular, supports a radiated stigma, and is surrounded by numerous short and slender filaments, with erect, oblong, compressed anthers. The capsule is smooth and glaucous, rounded, from two to four inches in diameter, somewhat flattened at the top and bottom, and crowned with the persistent stigma, the diverging segments of which are arranged in a circle upon the summit. It contains numerous minute white seeds, which, when perfectly ripe, escape through small openings beneath the stigma. In the *black poppy*, the flower, though sometimes white, is usually violet-coloured or red, the capsule somewhat smaller and more globular, and the seeds of a brown or blackish colour.

All parts of the poppy contain a white, opaque, narcotic juice; but the leaves, analyzed by M. Blondeau, yielded none of the active principles by which opium is characterized. (*Journ. de Pharm.*, vii. 214.) It is in the capsule that the juice most abounds, and the virtues of the plant chiefly reside. Hence this part is sometimes employed medicinally. (See *Papaver.*) The seeds are destitute of narcotic properties, and are even used as food. The Romans employed them in the preparation of various dainties. They abound with a bland oil, which may be extracted by expression. According to M. Berjot, the seeds yield from 46 to 50 per cent. (*Journ. de Pharm.*, Avril, 1863, p. 277.) This is an article of much importance on the continent of Europe, particularly in France and Germany. In the former of these countries, the value of the oil annually produced is said to be 25 or 30 millions of francs. (Roux, *Ibid.*, Sept. 1859, p. 202.) The oil is employed for culinary and pharmaceutic purposes, in painting and the manufacture of soap, and in other ways as a substitute for olive oil. The poppy does not appear to elaborate the milky fluid in which its narcotic properties reside before a certain period of its growth; for we are told that, in Persia, the young plants which are pulled up to prevent too thick a crop are used as potherbs; and the μηκων of the Greeks, which is believed to be identical with the Papaver somniferum, is said by Hippocrates to be nutritive.

Though generally believed to be a native of Asia, this species of poppy grows wild in the south of Europe, and even in England, whither its seeds are supposed to have been brought at a very early period. It was cultivated by the ancient Greeks, and is mentioned by Homer as a garden plant. It is at present cultivated very extensively in India, Persia, Egypt, and Asiatic Turkey, for opium; and in several parts of Europe, especially in the northern departments of France, and in the south of Germany, mainly for the seeds; though in both countries, good opium is at the same time produced. It is said that, in some parts of China, especially in the province of Szy-tschuan, notwithstanding that the drug is so abundantly imported from India, great quantities of it are produced for the supply of the masses of the people; the Bengal opium being used only by the rich. (*Neues Repertorium*, xii. 80, A. D.

1863; from *Blakiston's Five Months on the Yang-tze.*) In this country it was until recently found only in our gardens as an ornamental flower. But of late attempts have been made to cultivate it, on a somewhat large scale, with results not altogether discouraging; and the fact is worthy of observation, as having a favourable bearing on enterprises of this kind in our Northern States, that, though an idea has prevailed that a warm climate is favourable to the development of the narcotic principles in the poppy, yet the contrary would seem to be the case; and the poppy cultivated in the colder regions is really the most productive in morphia. This opinion has the support of Guibourt (*Journ. de Pharm.*, Sept. 1867, p. 222); and would seem to be established by the facts, that the opium of Anatolia is richer in morphia than that of the much hotter regions of Bengal and Upper Egypt; and that, while the best Smyrna opium seldom yields more than 12 per cent. of the alkaloid, that produced in the north of France yields from 20 to 24 per cent. (M. Bussy, *Ibid.*, p. 221.)* Efforts are now being made to introduce the opium culture into *Australia*,

* *Opium Culture in the United States.* Experiments have been occasionally made in this country, on a small scale, to determine what probability there might be that the poppy could be advantageously cultivated. One of these was made nearly forty years ago by the author, who, in preparing a small medico-botanical garden for the illustration of his lectures in the University of Pennsylvania, devoted a bed to the P. somniferum, with the view of collecting the juice. The plant grew luxuriantly, and, at the proper season, upon the incision of the capsules, yielded the milky juice quite as freely as had been anticipated; but the smallness of the product compared with the time and labour expended in obtaining it, convinced him that, with the price of labour in the United States, it would be futile to attempt the production of opium as a profitable agricultural operation.

At the meeting of the American Pharmaceutical Association in 1865, specimens of opium were presented, produced in Campbell Co., Virginia, by Mr. P. Robertson. The juice was collected in the usual way from several different species; and the specimens of the drug presented had the characteristic appearance of opium. The peculiar odour, however, was comparatively feeble. Being submitted for examination to Mr. I. J. Graham, they were found by him to contain both morphia and narcotina, but only 4 per cent. of the former, so that they could not enter into competition in the market with the imported drug. (*Am. Journ. of Pharm.*, Jan. 1867, p. 50.)

A much better product has been obtained from the white poppy, by Dr. H. Black, of Bolivar, Tenn., who has for several years given some attention to its culture. A specimen of this opium, examined by Mr. E. S. Wayne, of Cincinnati, was shown to contain 10·2 per cent. of morphia, and might well vie with the best Smyrna opium. But the author has not learned that the opium was, in this instance, cultivated with a view to pecuniary profit. (*Ibid.*, Jan. 1868, p. 77.)

Specimens of a product, intended to represent opium, have been offered to pharmaceutists in New York and Philadelphia, with a view to ascertain their real value. It was produced in Addison Co., Vermont, by Mr. W. C. Wilson, who gave the following account of his proceeding to Prof. Procter. He had a considerable extent of ground sown with seeds of the opium poppy, which grew vigorously; and about the middle of August the collection of the juice from the capsule was begun, and continued till the first of September. At this time the plants were cut down, bruised with a little alcohol for preservation, and subjected to pressure. The liquid thus obtained was evaporated, and the extract was mixed with the juice from the capsule, so as to form a soft, nearly homogeneous mass, of a pilular consistence. Some of the drug was shown to the author by Prof. Procter. It presented very much the appearance of Egyptian opium though somewhat darker, and had very decidedly the characteristic smell of genuine opium. Mr. Wilson obtained 640 pounds of this substance from 6·25 acres of land, or about 100 pounds to the acre, and received from eight to ten dollars for each pound, or about one thousand dollars an acre. Examined by Prof. Procter, the opium was found to contain in its commercial state 6·25 per cent. of morphia, and, when dried, 7·44 per cent. This sample is therefore equal to inferior specimens of Smyrna opium, though below the standard for officinal use. But it differs from genuine opium in being much more largely soluble in water. Considering that a large proportion of it consisted of an inspissated expressed juice, derived from the whole plant, which contains, according to all preceding analyses, but a very minute proportion of morphia, the portion of it derived by incision from the capsules must be very rich in morphia; thus, as far as credit can be attached to this account, confirming the opinion elsewhere stated, that the poppy produces a much larger proportionate yield of morphia when cultivated in cold regions than in hot.* We are informed by Prof. Procter, in the article containing the foregoing account of Vermont opium, that various experiments are now going on in Mississippi and other parts of the South and West; but, if the opinion just referred to as to the influence of climate be correct, these experiments are not made under the most favourable circumstances. It will be seen that the product of the poppy in Virginia and Tennessee, as stated in preceding paragraphs, compared with that from Vermont, affords still further confirmation of the opinion. The inference from all this is, that there seems to be a fair

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* After the above statements had been printed, we had an opportunity of seeing an additional communication of Prof. Procter in the forthcoming number of the *American Journal of Pharmacy* for January, 1869 (p. 23). From this it appears that other specimens of the Vermont opium had come into the possession of Prof. Procter, who, upon a careful analysis of them, found them very different from and much inferior to that first examined; yielding, instead of 6·25 per cent. of morphia stated in the text, one of them 0·90, or less than one per cent.; the second, 0·40 per cent.; and a third, none whatever; so that, in the present state of our knowledge on this subject, the Vermont opium must be considered altogether unreliable. (*Note to the thirteenth edition.*)

and, in the province of Victoria, with such success as to lead to the hope that this drug may become a valuable object of export. (*Pharm. Journ.*, Oct. 1870, p. 272, also Jan. 1871, p. 543.)

The process for procuring opium from the poppy, as practised by the modern inhabitants of India and Persia, according to the reports of Kerr and Kœmpfer, is very nearly the same with that described by Dioscorides as employed in his own times, about eighteen hundred years since; and the accounts of Bélon, Olivier, Texier, and more recently M. Bourlier, as to the modes of collection in Asia Minor, are not materially different. As the capsules abound most in the narcotic juice, it is from these that the opium is procured. According to Texier, a few days after the fall of the flower, men and women proceed to the fields, and make horizontal incisions into the capsule, taking care not to penetrate its cavity. A white juice exudes, and appears in the form of tears upon the edges of the incisions. The field is left in this state for twenty-four hours, after which the juice is scraped off by means of large blunt knives. A portion of the epidermis of the capsule is also removed, and constitutes about one-twelfth of the whole product. Each poppy-head affords opium but once. Thus collected, the opium is in a state of an adhesive and granular jelly. It is placed in smaller vessels, where it is beaten, and at the same time moistened with saliva. When of a proper consistence, it is wrapped in leaves, and sent into the market. (*Journ. de Pharm.*, xxi. 196.) Considerable quantities of good opium have been obtained in England by scarifying the capsules of the poppy. Similar success has been met with in France; and the drug obtained by incisions, in the latter country, has been found equal if not superior to that imported from the East.*

chance for the profitable cultivation of the poppy in the more Northern States. (See *Am. Journ. of Pharm.*, Nov. 1868, p. 513.)—*Note to the thirteenth edition.*

In a paper by Prof. Maisch in the *Am. Journ. of Pharm.* (March, 1874, p. 105), is a statement that he had received from Mr. J. H. Flint, of Marysville, California, a handsome specimen, with the following account of its origin. It had been produced on the Sacramento River, about 15 miles from Marysville; but, though the recently collected drug was found to contain 7¾ per cent. of morphia, equivalent to about 10 per cent. in perfectly dried opium, yet the expense of cultivation and collection would exceed the commercial returns, and therefore forbade its introduction as an article of agriculture. The specimen was "more homogeneous in its texture than Smyrna opium, of a good, strong narcotic odour, and unexceptional in its physical properties," and, containing the legitimate amount of morphia, might readily be admitted into commerce in the United States; and, though of itself it might not repay the cost of production, yet, as suggested by Prof. Maisch, it might very probably do so if connected with the poppy seeds, which yield a valuable fluid oil, and, after the expression of the oil, serve as a food for cattle, rendering the cultivation of the poppy profitable in France and Germany for the seed alone. (*Note to the fourteenth edition.*)

* So early as the year 1796, a premium was awarded by the Society for the Encouragement of Arts, to Mr. Ball, for a specimen of British opium; and in 1823, Messrs. Cowley and Stains collected 196 pounds, which sold for nearly seven dollars a pound, from little more than twelve acres of land. This product, however, was by no means equal to that obtained in Scotland by Mr. John Young. From one acre of ground, planted with poppies and potatoes, he procured fifty-six pounds of opium, valued at 450 dollars, while the whole expense was more than repaid by the potatoes, and the oil expressed from the seeds. For papers on the subject of the cultivation of the poppy in England, see *Edin. Phil. Journ.* (i. 258). and the *Quart. Journ. of Science* (iv. 69).

M. Aubergier has cultivated opium in France, with encouraging results. Instead of allowing the juice after the incision to inspissate on the capsule, he collected it immediately, and dried it by artificial heat. One workman collected in a day 300 grammes (9·64 troyounces) of juice, which yielded one-quarter of its weight of opium. The product differed in strength very greatly, according to the variety of poppy used; the yield of morphia having varied from 3 to 17·8 per cent. He gives the preference to the *purple poppy.* (*Ann. de Thérap.*, A.D. 1852, p. 29.) See also the same work (A.D. 1853, p. 1) for an elaborate report on M. Aubergier's memoir, by a committee consisting of MM. Rayer, Orfila, and others. Attempts have been made to introduce the cultivation of opium into Algiers; and specimens of the drug produced in that country have yielded from 7 to 11 per cent. of morphia. (*Journ. de Pharm.*, Oct. 1854, p. 293.) From various communications in the journals, it appears that the collection of opium in France was on the increase; and an important fact is said to have been proved beyond doubt, that the production of the seed for oil, and of opium, may be carried on together, without injury. (*Note to former editions.*)

M. Odeph, of Luxeuil, with a view of facilitating the collection of the juice, has invented an instrument for making the incisions, which not only shortens the process, but enables wholly inexperienced persons to operate, as the instrument itself regulates the depth of the incisions, so as to avoid perforating the wall of the capsule, thereby impeding the growth of the plant, and consequently the maturing of the seeds. (*Ann. de Thérap.*, 1866, p. 2.) Very recently M. Lallier, in a memoir presented to the Academy of Sciences, states that the production of opium has not of late been extending in France, in consequence of the uncertainty of the weather; rains often coming

Another method of extracting the virtues of the capsules is to select such as have ceased to yield their juice by exudation, to beat them with a small proportion of water, and inspissate the liquid thus obtained by artificial heat. The ancient Greeks were acquainted with both processes, as appears from the writings of Dioscorides. The term *οπιον*, derived from *οπος*, juice, they applied to the substance procured by incisions, which answers precisely to the modern opium. The inspissated expressed juice they called *μηκωνιον*, from *μηκων*, the name of the plant. Tournefort states that it is the latter preparation which is exported from Turkey as opium; the former being much more valuable, and therefore retained in the country for the use of the great and wealthy. This error has been copied by many writers on materia medica; and, till within a comparatively few years, opium was generally believed to be an extract obtained by evaporating either the expressed juice, or a decoction of the capsules.*

Commercial History. Commerce is supplied with opium chiefly from Hindostan, Persia, Egypt, and Asiatic Turkey. Immense quantities are produced in the Indian provinces of Bahar and Benares, and in the more interior province of Malwa. The opium of Hindostan is distributed extensively through continental and insular India, where it is habitually employed in the place of spirituous liquors. Great quantities are also sent to China, into which it finds an easy entrance, notwithstanding prohibitory laws.† Much was formerly imported by the East India Company into England, through which a small proportion reached our own country; but it was so far inferior to that from Turkey, that it was at length excluded from the market, and none is now brought directly from the East. The great demand for it in the Indian Archipelago, and in China, and its consequent high price, have probably contributed even more than its reputed inferiority to this result. Indeed, Ainslie explicitly states that India opium is inferior to none; and it is probable that the specimens, from which the description formerly current among authors was drawn up, were the refuse of the Eastern market. We know that the drug was formerly very much and variously adulterated by the natives. Among the impurities mentioned by authors are the extract of the poppy procured by decoction, the powdered leaves and stems of the plant made into a paste with mucilage, oil of sesamum, catechu, and even cow-dung. But a more careful official inspection has resulted in a great improvement of the India opium. Of that produced in Persia, very little is brought to this country; and it is scarcely known in our market as a distinct variety. Much was formerly produced in Upper Egypt, especially in the district of ancient Thebes, which was

on at the moment when the incisions are made, so as to wash away the juice, and thus destroy the harvest. To obviate this, M. Lallier proposes that the plants should, at the proper season, be pulled up and carried under cover, where, by immersing their roots in water, they will yield not only as much as in the usual mode, but even more, while the seeds ripen as well, and yield as much oil as when the plant ripens in the soil. (*Journ. de Pharm. et de Chim.*, Oct. 1867, p. 274.)—*Note to the thirteenth edition.*

In Armenia, where opium is largely produced, four varieties of seeds are used, the white, yellow, black, and sky-blue. The flower produced by the white seeds is white, that by the yellow is red, that by the black is black, and that by the sky-blue is deep-purple. The white and sky-blue seeds yield large, somewhat oblong capsules, like citrons in shape; the yellow, and black, small and round capsules. For an extent of ground forty paces square, forty drachms of seeds are required. Each head yields about a grain of opium. The operators not accustomed to the work, are apt to become intoxicated or stupefied during the period of harvest. (Gaultier de Claubry, *Journ. de Pharm.*, 3e sér., xiii. 105.)

A very interesting paper, by Mr. S. H. Maltass, on the cultivation and collection of opium in Turkey, and its preparation for the market, affording minute information on these points, is contained in the *Pharm. Journ. and Trans.* for March, 1854 (p. 395).

* For the most recent details in relation to the opium culture in Anatolia or Asia Minor, the reader is referred to an article by M. E. R. Heffter, of Smyrna, in the *Am. Journ. of Pharm.* (July, 1868, p. 362), originally published as a pamphlet in that city, in April, 1868. Any one disposed to engage in the business of cultivating opium in the United States would do well to consult this paper. (*Note to the thirteenth edition.*)

† The immense demand for opium in China, where it is generally used as an article of luxury, as alcoholic drinks are consumed in the Western world, is greater than can be supplied by all the surplus product of India, and has led to the extensive cultivation of the drug in certain provinces of China, and especially in Eastern Mongolia and Northern Manchuria, and in the south-western province of Yunnan. The opium, however, produced in China, is, on the whole, greatly inferior, and is said to be used chiefly for mixing with the imported drug in the proportion of seven to three. (*Pharm. Journ.*, Nov. 1869, p. 304.)—*Note to the fourteenth edition.*

supposed to yield it in greatest perfection. Hence it was long known by the name of *Opium Thebaicum*, and laudanum is still frequently directed in prescriptions as *Tinctura Thebaica*. Its cultivation has been again introduced into Egypt; and considerable quantities are exported.

Turkey opium is produced in Anatolia, and shipped chiefly from the port of Smyrna. It is brought to the United States, either directly from the Levant, or indirectly through different European ports. From the treasury returns for the years from 1827 to 1845 inclusive, according to a table prepared by Dr. J. B. Biddle, and published in the *American Journal of Pharmacy* for April, 1847, it appears that the average value of the annual importations for the period referred to was from Turkey 128,137 dollars, from England 13,744, from France 4,470, and from all other places 6,607 dollars. Of this amount so much was exported as to leave, for the average annual consumption of the country, the value of 66,809 dollars. In the year ending June 30, 1862, the value of the opium import is stated, in the N. Y. *Journal of Commerce*, to have increased to 932,887 dollars. Of this amount, however, 281,796 dollars' worth was imported into California, to supply the wants of the Chinese population of that region; and the medical necessities of our vast armies were responsible for much of the increase. (*Am. J. of Pharm.*, Sept. 1865, p. 393.) Turkey opium usually comes to us in masses of irregular size and shape, generally more or less flattened, covered with leaves, or the remains of leaves, and with the reddish capsules of some species of *Rumex*, which are said to be absent in the inferior kinds, and may, therefore, be considered as affording some indication of the purity of the drug. We may account for this circumstance upon the very probable supposition, that these capsules are removed during the operation which the masses undergo in the hands of the merchants after leaving those of the cultivators. We are told by the French writers that extensive frauds are practised at Marseilles in this branch of commerce. The opium taken thither from the Levant is first softened, and then adulterated with various matters which are incorporated in its substance. To use a strong expression of Guibourt, they make the opium over again at Marseilles. Our traders to the Mediterranean would do well to bear this assertion in mind. According to Dr. A. T. Thomson, one-fourth part of Turkey opium generally consists of impurities. Sand, ashes, the seeds of different plants, extracts of the poppy, *Lactuca virosa*, *Glycyrrhiza glabra*, and *Chelidonium glaucum*, gum arabic, tragacanth, salep, aloes, even small stones, and minute pieces of lead and iron, are mentioned among the substances employed in the sophistication of the drug. Mr. Landerer, of Athens, was informed by a person who had been engaged in the extraction of opium, that grapes, freed from their seeds and crushed, were almost universally mixed with the poppy juice, and that another adulteration consisted of the epidermis of the capsules and stem of the plant, pounded in a mortar with the white of eggs. (See *Am. Journ. of Pharm.*, xv. 238.) According to Mr. Wilkins, who witnessed the collection of opium, the inspissated juice of the grape, thickened with flour, is often used for the same purpose. (*Pharm. Journ.*, xiv. 400.) In England a sophisticated opium was some years since prepared, which, though so near resembling good Turkey opium in appearance that by the eye alone it was difficult to detect the fraud, was yet wholly destitute of the active principle of the drug. Portions of it were sent into the markets both of France and this country. A sample of a similar drug, perhaps the same, was examined by Prof. Aikin, Examiner of drugs for the port of Baltimore, and found to contain but 1·10 per cent. of morphia. (See *Am. Journ. of Pharm.*, July, 1859, p. 374.) It was probably the genuine drug, deprived of its morphia by some process which did not materially disturb the visible arrangements of its particles.* (*Ibid.*, x. 261.)

* The great importance of opium renders it desirable that all its commercial varieties should be accurately described, and their relative value so far as possible ascertained. The following statement has been drawn up from the most recent published accounts of the drug, and from the personal observations of the author.

The varieties of this drug may be arranged, according to the countries in which they are produced, under the heads of *Turkey*, *Egyptian*, *India*, and *Persia opium*.

I. TURKEY OPIUM. This title belongs to the opium produced in the Turkish province of Anatolia, and exported from Smyrna and Constantinople. According to some authorities, there is no

Opium is regarded as inferior when it has a blackish colour; a weak or empyreumatic smell; a sweet or slightly nauseous and bitter taste; a soft, viscid, or greasy

essential difference between the parcels of the drug brought from these two ports. Others maintain that they are distinct varieties, differing in their interior structure, and probably also in the precise place of their production, and the mode of their collection. The truth probably is, that most of the opium shipped at Constantinople is produced in the more northern parts of the opium districts of Anatolia; while that from Smyrna is collected in the provinces more convenient to the latter city; and, though it is possible that an identical drug may often be brought from the two ports, yet there are grounds for arranging it under different varieties, as derived from these different sources. There can be little doubt also that a portion of opium which is taken to Constantinople is produced in Macedonia in Europe, which must, therefore, be added to the opium-producing regions. (*Neues Repert.*, xvi. 751, A.D. 1867.)

1. *Smyrna Opium.* This is the variety which is, beyond all comparison, most abundant in our markets; and it is from this that the ordinary descriptions of opium are drawn up. It comes to us in masses of various size, usually from half a pound or somewhat less to a pound in weight, sometimes, though rarely, as much as two or even three pounds, originally, perhaps, of a globular form, but variously indented, and rendered quite irregular in shape by the pressure to which they have been subjected, while yet soft, in the cases which contain them. Sometimes they are even pressed out into flat cakes. As brought into market, the lumps are usually hard on the outside, but still soft within. They are covered externally with the remains of leaves, and with the reddish capsules of a species of Rumex, which have no doubt been applied in order to prevent the surfaces from adhering. Notwithstanding, however, this coating, the masses sometimes stick together, and two or more become consolidated into one. In this way the fact may be accounted for, that the seeds of the Rumex are occasionally found in the interior of the masses. In the finer parcels of Smyrna opium, the colour internally is light-brown; in the inferior it is darker. A peculiar character of this variety is that, when a lump of it is cut into and then carefully torn, numerous minute shining tears are observable, particularly under a microscope, bearing some resemblance to small seeds, but readily distinguishable by pressure between the fingers. They are undoubtedly formed from the drops of juice which escape from the incisions in the capsules, and which, according to Bélon, are allowed to concrete before they are removed. From the account of the same author it appears that, after the juice has been collected, it is not subjected to the process of kneading or beating, as in the case of other varieties of the opium; so that the tears preserve their original shape in the mass. It is probably owing to the peculiar mode of collecting Smyrna opium, that minute pieces of the skin of the poppy capsules are found intermingled in the mass; these being separated in the process of removing the adhering tears. In the best specimens of Smyrna opium, these fragments of the capsules are the only impurities. This variety of the drug is of very different qualities; the finest kinds yielding, according to Merck, as much as 13 per cent. of pure morphia, while from some very bad parcels he could not procure more than 3 or 4 per cent. In these inferior specimens the colour is darker, the smell is often musty, and there is very generally more or less mouldiness both upon the surface, and in the interior of the masses, indicating perhaps too much moisture in the opium originally, or its subsequent exposure to an injurious degree of dampness. Good Smyrna opium ought to yield 10 or 11 per cent. of morphia. Dr. Christison, however, states that he has not been able to procure more than 9 per cent. from the finest Smyrna opium.*

2. *Constantinople Opium.* Most of the Constantinople opium is in lumps from half a pound to two and a half pounds in weight, and scarcely distinguishable in exterior appearance from those of the former variety, being equally irregular in shape, and in like manner covered with the capsules of the Rumex. According to Merck, however, it often differs strikingly from the Smyrna opium in its interior constitution, being wholly destitute of the tears which characterize that variety. This would indicate some difference in the mode of collecting and preparing the juice. In the case of the Constantinople opium, it is probably removed from the capsules before concretion. Merck says that he has not discovered, in this variety, those minute portions of the poppy capsules which are usually present in Smyrna opium. The average quality of the Constantinople opium, as above described, is about equal to that of the drug from Smyrna; but it appears to be occasionally purer; as Merck obtained from one specimen as much as 15 per cent. of pure morphia. Dr. R. Bauer, of Constantinople, who has for many years had the opportunity of becoming familiar with the different varieties of opium which reach that city, denies that at present any of the varieties produced near Smyrna contain tears, except the single one from Magnesia. (*Neues Repert.*, xvi. 751, A.D. 1867.)

In an account by M. Bourlier, of the culture of the poppy and collection of opium in Bithynia, a province of Asia Minor, near Constantinople, it is stated that the lumps, when formed out of the concrete juice, are enveloped in poppy leaves; and no mention is made of the use of the Rumex capsules to prevent adhesion. It is the opium here collected, which, according to M. Bourlier, is known throughout the Levant and in Europe as Constantinople opium. On the same authority it is stated that the yelk of eggs is sometimes largely used for adulterating opium; a fraud which

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*According to Landerer, little of the opium is produced in the immediate neighbourhood of Smyrna; the greater portion being brought to that port, on the backs of camels, from a distance of from ten to eighteen days' journey. (*Journ. de Pharm.*, 3e sér., xxiii. 33.) The same writer states that the opium is chiefly prepared at Kara Chissar, near Magnesia. The incisions are generally made before sunrise. The juice is partly caught in mussel-shells, and dried in the sun. This is considered the best. Every evening the juice which has dried upon the capsules is scraped off, with a portion of the epidermis. The poppy is then cut down, and stripped of its leaves, which are boiled in water; and the liquor is evaporated to the consistence of an extract. With this the inspissated juice is incorporated, and the mixture is then formed into cakes, wrapped in poppy leaves, and placed on shelves to dry. (See *Am. Journ. of Pharm.*, xxiii. 251.) It is very evident, from the interior structure of the *best Smyrna opium*, that it has not been prepared in the way described by Landerer; though his account is probably true in reference to inferior varieties of the drug. (*Note to the tenth edition.*)

consistence; a dull fracture; or an irregular, heterogeneous texture, from the intermixture of foreign substances. It should not impart a deep-brown colour to the

may be detected by the large proportion of fatty matter which the adulterated drug yields to ether, and by the impossibility of drying it so as to fit it for pulverization. (*Annuaire de Thérap.*, A.D. 1859, p. 4.)

Guibourt describes another variety of Constantinople opium of much inferior character. "It comes," he observes, "in small flattened cakes, sufficiently regular and of a lenticular shape, from two to two and a half inches in diameter, and always covered with a poppy leaf, the midrib of which divides the surface into two equal parts. It has an odour similar to that of the preceding variety, but feebler, and it blackens and dries in the air. It is more mucilaginous than Smyrna opium, and contains only half as much morphia." These characters are obviously those of Egyptian opium; and, though the parcels which came under the notice of Guibourt may have been imported directly from Constantinople, it is highly probable that they were originally from Alexandria. Mr. Stettner, of Trieste, though well acquainted with the opium commerce of that port, admits no such Constantinople opium as that described by Guibourt. (*Annal. der Pharm.*, xxiv. 65.) According, however, to Dr. Bauer, the opium collected in the districts nearest Constantinople is mostly in small pieces, often of only 2 or 3 ounces, which are always invested with poppy leaves, or more rarely with grape leaves, generally smooth, and without Rumex capsules; and this description corresponds with Guibourt's. (*Neues Repert.*, xvi. 754, A.D. 1867.)

A number of varieties of opium produced in European and Asiatic Turkey, circulate more or less in Austria and other parts of Germany, which have been described by Dr. C. Finckh in *Buchner's Repertory* (vol. xvi. p. 749), and of which we propose to give a brief account here.

Opium of Ghévé or Gévé is gathered from a poppy with red flowers, and comes in the form of small rounded cakes, weighing 2 or 3 ounces, enveloped in the leaves of the poppy, with a smooth and shining surface, which seems to be divided into two halves by the median nerve of the leaf. The interior is in layers of light and deep coloured opium; and its yield of morphia is from 12 to 15 per cent.

Opium of Amasia differs from the preceding only in this, that there are two enveloping poppy leaves, placed crosswise, and with their lower surface outward, so as to give a rugose appearance to the cakes. In the interior the mass is homogeneous, but in its qualities very analogous to the *Gévé* opium.

Opium of Mallatia is in small loaves, round or somewhat oval, from 4 to 5 ozs. in weight, made with the greatest care, and enveloped in poppy leaves, with a rugose surface, and the median line corresponding to the middle of the loaves. The borders of these, frequently deprived of the leaf, are very delicate. The substance of the loaf is homogeneous, but generally poor in morphia.

Opium of Magnesia is in irregular cakes or loaves, from 1 to 4 ozs. in weight. They are covered first with a layer of Rumex seeds, and afterwards with poppy and vine leaves, and owe their irregular form to the envelopes, for originally they are rounded. The interior is composed of agglutinated tears, and is of excellent quality.

Opium of Salonica or of *Kutchina*, has a strong analogy in all respects with that of Gévé, for which it is often substituted.

The following represent the varieties in which Smyrna opium appears in the market.

The *Opium of Balukhissar*, which is the chief source of the Smyrna opiums, is in cakes of from 4 to 12 ozs., irregular, though originally globular-ovoid. They are covered with Rumex seeds, and present, besides, on their surface poppy leaves irregularly applied. The mass is formed of tears lighter or deeper coloured, and is so rich in morphia as to cause this variety to be always sought for in the market.

The *Opium of Cataya* is generally in lumps half as large as the preceding, which it approaches closely in its characters, and in its yield of the alkaloid.

The *Opium of Taushan* or Taushanly is in irregular lumps, twice as long as broad, and weighing from 3 to 5 ounces. The mass consists of tears, and is carelessly enveloped with the poppy leaf and a few Rumex seeds. This variety is rich in morphia.

The *Opium of Angora or Engiri* is readily known by its under surface being covered only with one leaf of the poppy. The masses, being almost spherical, appear to have been originally in balls. Their weight is from 6 to 8 ounces, the interior homogeneous, and the quality inferior.

The *Opium of Kara Hissar* is in balls, flattened beneath, of the weight of 6 or 8 ozs., and covered with poppy leaves and Rumex seed. Though carefully prepared, this variety, from its deficiency in morphia, is of inferior quality.

The *Opium of Cigusti* is in irregular loaves, 6 or 8 ozs. in weight, enveloped in poppy leaves and Rumex seed. Though rarely falsified, it often contains fragments of the poppy capsules, and forms a mass sometimes of distinct tears, sometimes not. Occasionally rich, it is almost always mixed with the various forms of Smyrna opium.

Dr. Finckh has noticed the following adulterations; opium of Macedonia, with clay; of Angora, with wax; of Amasia, with gum; of Tauschan, with liquorice; of Balukhissar, with melted pitch. He has even found an opium evidently made almost entirely of clay and cow dung. The opiums of Macedonia are most frequently adulterated. (*Journ. de Pharm.*, Nov. 1869, p. 377.)—*Note to the fourteenth edition.*

II. EGYPTIAN OPIUM. This is in flat roundish cakes, of various dimensions, sometimes as much as six inches in diameter, and a pound in weight, usually, however, much smaller, and sometimes not weighing more than half an ounce. These cakes are either wrapped in a poppy leaf, so placed that the midrib divides the surface into two equal parts, or exhibit vestiges of such a covering. Occasionally the brown colour of the opium is seen through the leaf, and the surface appears as if uncovered, while the leaf is still present. This variety of opium is always destitute of the Rumex capsules, and differs from the Smyrna opium also in being brittle instead of tenacious, and equally hard in the centre as at the surface of the mass. Its fracture is conchoidal and of a waxy

saliva, nor leave a dark uniform trace when drawn over paper, nor form with water a thick viscid solution.

lustre, and small fragments of it are translucent. Its colour is usually redder than that of Smyrna opium, though sometimes dark. Some of the pieces, on exposure to the air, become damp and sticky on the surface, indicating the fraudulent addition of a deliquescent substance. The odour is similar to that of Smyrna opium, but weaker. It is an inferior variety; as the best of it, examined by Merck, yielded only 6 or 7 per cent. of morphia; and a specimen of it was found by Mr. J. Evans, of Philadelphia, to contain not more than 3·55 per cent. Egyptian opium, therefore, should never be dispensed by the apothecary, or employed in the preparation of his tinctures; as the prescription of the physician is based upon the strength of good Smyrna opium, which is about twice that of the Egyptian.

M. Gastinel, residing in Cairo, under the stimulus apparently of the works of Aubergier, is making efforts for improving the production of opium in Egypt, by which it is hoped that the reputation which the product of this region formerly possessed may be restored. (*Ann. de Thérap.*, 1866, p. 3.) That the deficiency of morphia in Egyptian opium is not ascribable to the climate, would seem to be proved by the fact, reported to the Paris Society of Pharmacy, by M. Gastinel, director of the garden of acclimation at Cairo, that he has produced opium in a garden of his own, containing 12 per cent. of morphia. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 415, A.D. 1866.)

III. INDIA OPIUM. Little if any of this opium reaches our market. There appear to be two chief varieties of it; one produced in Bahar and Benares, in the Bengal Presidency, and called *Bengal opium*, the other in the interior provinces, and designated by the name of *Malwa opium*.

1. *Bengal Opium.* For a minute account of the cultivation and preparation of this variety of opium, the reader is referred to elaborate papers by Dr. Eatwell, of Calcutta, contained in the eleventh and twelfth volumes of the *London Pharmaceutical Journal and Transactions*, an abstract of which will be found in the *Am. Journ. of Pharm.* (xxiv. 118), and in the last edition of Pereira's *Materia Medica* (vol. ii. p. 1009, Am. ed.). Bengal opium is identical with the variety sometimes called *Patna opium*. It is in round balls, weighing three pounds and a half, invested by a coating half an inch thick, composed of agglutinated leaves and poppy-petals. The interior of the mass is of a brownish-black colour, of the consistence of a stiff paste, and possessed in a high degree of the characteristic odour and taste of opium. The proportion of active matter in this opium varies somewhat with the season and in the different specimens. From a table given by Dr. Eatwell, it appears that the percentage of morphia varies from 2·17 to 3·67, and that of narcotina from 3·85 to 5·70. Prof. Procter found a specimen of Patna opium to yield about 5 per cent. of morphia. (*Am. Journ. of Pharm.*, xxi. 194.) It is, therefore, much inferior to the best Smyrna opium in its yield of morphia, while it is richer in narcotina. Yet Christison states that all the India opium which he has seen is exempt from the mixture of leaves, seeds, and fragments of poppy capsules so abundant in Smyrna opium. Its inferior character is possibly, in some degree, owing to the circumstance, that the juice, after collection, is kept for some time before it is made up, and consequently undergoes fermentation. Prof. Carson, of the University of Pennsylvania, in describing a specimen of this variety in the *Am. Journ. of Pharm.* for July, 1849 (p. 194), speaks of acicular crystals, which he had noticed by the aid of the microscope; and he informs me (Sept. 1864), that on recently examining a specimen of the same opium, now perfectly dry, he found similar crystals. No such crystals, he states, are to be found in Smyrna opium.

The India opium examined by Dr. A. T. Thomson was apparently of inferior character. As described by that author, it was in round masses, covered with the petals of the poppy in successive layers, to the thickness of nearly one-fourth of an inch. It had a strong empyreumatic smell, with little of the peculiar heavy odour of Turkey opium. Its taste was more bitter and equally nauseous, but less acrid. Its colour was blacker, and its texture, though as tenacious, was less plastic. It was more friable, and, when triturated with water, was wholly suspended or dissolved, leaving none of that plastic residue which is afforded by the other variety. It yielded to Dr. Thomson more narcotina than Turkey opium, but only about one-third the quantity of morphia. All these are the characters of an extract of the poppy heads, rather than of their inspissated juice. The absence of the plastic principle analogous to caoutchouc is strong evidence in favour of this view of its nature; for it is obvious that water would not extract this principle from the capsules, while it is hardly probable that the juice is destitute of it. Besides, the strength indicated by Dr. Thomson is very nearly the same with that of the extract of the capsules prepared in France. Bengal opium is at present superior to that here described, though still inferior to the Smyrna opium.

There is a variety of Bengal or Patna opium, called *garden Patna opium*, which was described in the fifth edition of this work, on the authority of Dr. Christison, as Malwa opium. Dr. Christison has subsequently ascertained its true origin. It is prepared in Bahar with peculiar care, from juice which has not been suffered to undergo fermentation. It is in cakes three or four inches square, and about half an inch thick, which are packed in cases with a layer of mica between them. These cakes are without covering, hard, dry, and brittle, of a uniform shining fracture, and not unlike an extract in appearance. The colour is sometimes almost black, and sometimes of a light-brown, not unlike that of Egyptian opium. Dr. Christison states that it is much superior to the globular Bengal opium, and that some specimens are little inferior to Turkey opium in the proportion of morphia.

2. *Malwa Opium.* This is in flat, roundish cakes, five or six inches in diameter, and from four to eight ounces in weight. They are commonly quite hard, dry and brittle, of a light-brown colour, a shining fracture, a compact homogeneous texture, and free from mechanical impurities. The quality is superior to that of common Bengal opium. (*Christison's Dispensatory.*) A specimen of Malwa opium, described by Dr. Carson (*Am. Journ. of Pharm.*, xxi. 195), broke with a rough fracture, which was of a blackish-brown colour, here and there showing irregular oily spots. Prof. Procter obtained from it 9¼ per cent. of morphia.

In consequence of the recent discovery that the poppy growing in the Himalayas yields

Properties. Good opium has a peculiar, strong, narcotic odour, and a bitter, somewhat acrid taste. When long chewed it excites much irritation in the lips and tongue, and may even blister the mouth of those unaccustomed to its use. Its colour is reddish-brown or deep-fawn; its texture compact; its sp. gr. 1·336. When drawn over paper it usually leaves an interrupted trace of a light-brown colour. It is often soft in the interior of the mass, and in this state is tenacious; but when exposed to the air it gradually hardens, and ultimately becomes brittle, breaking with a shining fracture, and affording, when pulverized, a yellowish-brown powder, which becomes adhesive upon a slight elevation of temperature. It readily inflames upon the application of a lighted taper. It yields its virtues to water, alcohol, and diluted acids,

opium having a much larger proportion of morphia than that produced in the lowlands, the cultivation of the plant is about to be greatly extended in the mountainous regions. (*Journ. de Pharm.*, Février, 1874, p. 158.)

An essay on the antiquity of the opium culture in India, the cultivation of the drug in that region, its collection, commerce, qualities, adulterations, &c., by M. Créteur, contained in the *Annuaire de Thérapeutique* for 1868 (p. 1), gives the most recent information on these points from personal observation. The author states that a specimen of good India opium yielded him about 10 per cent. of morphia, and expresses his conviction that this variety of opium will again enter into the commerce of Europe.

In the "Report on the Progress and Condition" of India, for 1871–2, it is stated that the cultivation of opium in India is increasing; there being at the time of the report 500,000 acres in Bengal and 608 in Bombay, planted with the poppy. During the same years, the exports of opium amounted to 893,364 chests, valued at £13,365,288. (*Pharm. Journ.*, Dec. 1873, p. 498.)

IV. PERSIA OPIUM. A variety of opium under this name has sometimes existed in the markets of London, and has even found its way to this country, though it is very rare. Recently it is said to have reached Europe in considerable quantities, and has received especial attention in France. It is in different forms. The most common is in cylindrical pieces, about three and a half inches long, and half an inch thick, wrapped in glossy paper, and tied with a cotton thread, and each weighing about half an ounce. It is of a uniform consistence, but exhibits, nevertheless, under the microscope, small agglutinated tears, much less than those of Smyrna opium. It has the liver-brown colour of Egyptian opium, a virose musty odour, and a very bitter taste, and, like Egyptian opium, softens in a moist atmosphere. According to Dr. Reveil, it contained 15 per cent. of glucose. The first specimens were brought to England from Trebizond on the Black Sea; but their precise origin was not known. Three other forms of Persia opium have been described by Dr. Reveil, as they were offered to his notice in Paris. *One* was in spherical cakes, without envelope or Rumex capsules. In physical characters, it closely resembled the cylindrical variety, though softer and more hygrometric. It had a strongly virose odour, and a bitter slightly sweetish taste. The *second* was in irregular masses, liver-coloured, of a virose smell and bitter taste, brittle, smooth and shining, compact, and very hygrometric. The *third* was in the form of flat cakes, covered with an unknown leaf with some Rumex capsules, of a reddish-brown colour, tasting and smelling like the preceding, compact, and smooth. Of these the first and third contained, each, 31·6 per cent. of glucose; the second 13·9 per cent.

All these varieties were remarkable by the absence of obvious impurities, such as are insoluble in water and alcohol. From 75·2 to 84·2 per cent. was soluble in water, from 71·6 to 81·6 in alcohol at 85°. The *cylindrical* variety yielded 8·15 per cent. of morphia; the *spherical* 6·4 per cent.; the *irregular* 7·1 per cent.; and the *flat and coated* 5·10 per cent. The presence of glucose in such large proportions may be explained by the asserted fact that honey is sometimes mixed with opium at the time of its collection. Though the proportion of morphia is considerable in these varieties, yet, in consequence of their large proportion of soluble matter, they yield comparatively feeble extracts. (*Journ. de Pharm.*, Août, 1860, p. 101.) Since M. Reveil's investigation, two samples of Persia opium have been examined by M. Séput of Paris, one of which yielded 9·33 and the other 9·37 per cent. of morphia. (*Ibid.*, Mars, 1861, p. 163.) From the report of a trial in New York, published in the *Journal of Commerce*, it appears that a parcel of Persia opium, imported into that city from London in 1835, was in small round balls, and contained only 3 per cent. of morphia.

New variety of so-called Persia Opium. M. Charles gives an account of a variety of opium which has for some time appeared in the commerce of Paris, and is said to have come from Persia. It is in conical cakes, weighing about a pound, partially covered with the remains of poppy leaves, but without Rumex seeds. Its odour is unlike that of Smyrna opium, but rather resembles that of green coffee, and, when the drug is heated, that of chocolate. In its ordinary state it is soft like common opium, but when well dried is easily powdered, though slightly deliquescent. It mixes readily with cold water, with little malaxation. It yielded on analysis 8·40 per cent. of morphia and 3·60 of narcotin; a smaller proportion of the former than is recognised as officinal. M. Charles suspected that honey and glucose had been added as adulterations, and had some ground for his belief. At all events, should it be offered for sale here, it should be rejected. (*Pharm. Journ.*, May, 1873, p. 883; from *Bull. de Tran. de la Soc. de Pharm. de Bordeaux*, March, 1873.)—*Note to the fourteenth edition.*

Relative strength of the varieties of opium. It is highly important that the real value of these commercial varieties should be known; as otherwise there can be no certainty in relation to the strength of the preparations which may be made from them. In the preparation of laudanum and the other tinctures into which opium enters, it is understood that the drug employed should have the average quality of good Smyrna opium. The inferior kinds should be used only for the extraction of morphia. M. Guibourt has published a series of investigations into the richness in morphia of different varieties of opium, giving the percentage yielded in the soft, the hard, and

but not to ether. To all these menstrua it imparts a deep-brown colour. Alcohol dissolves about four-fifths of it. Pelletier states that the proportion taken up by water varies in all specimens. He never found the quantity of extract prepared with cold water to exceed 12 parts out of 16. (*Journ. de Pharm.*, Nov. 1832.)

Much attention has been devoted to the chemical constitution of opium. It was by their researches into the nature of this substance that chemists were led to the discovery of those vegetable alkaloids, which, as the active principles of the plants in which they are found, have attracted so much notice, and been applied so advantageously to the treatment of disease. To Sertürner, an apothecary at Eimbeck, in Hanover, belongs the credit of having opened this new and most important field of experiment. In the year 1803, M. Derosne made known the existence of a crystallizable substance which he had discovered in opium, and which he erroneously believed to be the active principle. In the following year, Seguin discovered another crystallizable body, which experience has proved to be the true narcotic principle of opium; but he did not fully investigate its nature, and no immediate practical advantage accrued from his excellent analysis. About the same time Sertürner was engaged in a similar investigation, the results of which, very analogous to those obtained by Seguin, were published in a German journal, without, however, attracting general attention. In this state the subject remained till 1817, when Sertürner announced the existence of a saline compound in opium, consisting of a peculiar alkaline principle united with a peculiar acid, and clearly demonstrated the precise nature of a substance, which, though before discovered both by Seguin and himself, had been hitherto but vaguely known. To the alkaloid, in which he correctly conceived the narcotic powers of opium to reside, he gave the name of *morphium*, which has been subsequently changed to *morphia*, in order to render it conformable with the titles of the other alkalies. The acid he called *meconic*, a term derived from the Greek name of the poppy. The correctness of the statements of Sertürner was confirmed by Robiquet, who also satisfactorily demonstrated that the substance obtained by Derosne, and called by him the *salt of opium*, was a principle altogether distinct from morphia, though supposed to possess considerable influence over the system. In the belief of its narcotic powers, Robiquet denominated it *narcotin*, a title which it still retains. Several other peculiar principles have since been discovered; though it is difficult to resist the impression, that some of them may be the result of the processes to which opium is submitted for their extraction. According to the views of its constitution admitted when this was written, opium contains, 1. morphia; 2. narcotin or narcotina; 3. codeia; 4. paramorphia; 5. papaverina; 6. opiania; 7. narcein or narceia; 8. *pseudomorphia;* 9. meconin; 10. porphyroxin; 11. meconic and sulphuric acids; 12. a peculiar acid not yet fully investigated, perhaps the thebolactic acid recently discovered by the Messrs. Smith, of Edinburgh; 13. extractive matter; 14. gum; 15. bassorin; 16. glucose; 17. a peculiar resinous body insoluble in ether and containing nitrogen; 18. fixed oil; 19. a substance resembling caoutchouc; 20. an odorous volatile principle; together with lignin, and a small proportion of acetic acid, sulphate of lime, sulphate of potassium, alumina, and iron. In relation to their

the dried states. The following table contains an abstract of his results. It is obvious that he operated only on fair specimens of the several varieties.

		Soft.	Hard.	Dried.
Anatolia (Smyrna) opium	lowest	9·60 per c.	10·82 per c.	11·70 per c.
do. do. do.	highest	18·24	19·77	21·46
do. do. do.	mean	12·40	13·57	14·78
Constantinople do.	lowest	10·90	13·32	14·40
do. do.	highest	14·00	15·72	17·00
Egyptian do.	lowest		5·19	5·81
do. do.	highest		11·45	12·21
Persian do.			10·52	11·37
Indian (Patna) do.	lowest		5·09	5·27
do. do. do.	highest		6·93	7·72
French do.	lowest		14·21	14·83
do. do.	highest		21·10	22·88
do. do.	mean		16·77	17·69

(*Journ. de Pharm.*, Janv., Fév., et Mars, 1862.)—*Note to the twelfth edition.*

optical properties, all the organic bases of opium produce deviation of the plane of polarization to the left. (Bouchardat and Boudet, *Journ. de Pharm.*, 3e sér., xxiii. 294.)*

Since the publication of the foregoing statement of the composition of opium, further investigation has led to the discovery, and more or less full description, of several other organic bases; viz., metamorphia, found by Wittstein, cryptopia, discovered in the laboratory of the Messrs. Smith, of Edinburgh; and at least four new ones announced by Hesse, lanthopia, meconidia, codamia, and laudania, making altogether, with those longer known, at least fifteen alkaloids in the opium; while there are several derivatives, the most important of which is apomorphia, to be hereafter considered under morphia, from which it is derived.

Of the principles above mentioned *morphia* is by far the most important. It is generally admitted to exist in opium united with meconic acid in the state of meconate, and to a certain extent also as a sulphate. Of morphia and its preparations we shall treat under another head. (See *Morphia.*)

Narcotina or *narcotin* receives one or the other of these names, according as it is considered alkaline or neuter. It exists in opium, chiefly at least, in the free state, and is left behind in considerable quantity when the drug is macerated with water. It is white, tasteless, and inodorous; and crystallizes in silky flexible needles, usually larger than the crystals of morphia, fusible at 240° and volatilizable at 310° (*W. A. Guy*),† insoluble in cold water, soluble in 400 parts of boiling water, in 100 parts of cold and 24 of boiling alcohol which deposits it upon cooling, and very soluble in ether. The fixed and volatile oils, and the diluted acids, also dissolve it; and it has recently been found to be soluble in the volatile oil of turpentine, which, aided by heat, will extract it from opium, and yield it in crystals by evaporation. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 156.) As it exerts no alkaline reaction

* Glucose, mentioned in the text as one of the ingredients of opium, has but recently been proved to exist normally in the drug. M. Lakens, of Toulouse, has found it in a tincture of poppy capsules, and in all the commercial varieties of opium, in proportions varying from 3 to 14·5 per cent. This fact is of some importance in reference to the use of grape-juice in the adulteration of opium, showing that the presence of glucose, even in considerable quantity, must not be considered as a proof of sophistication. (*Journ. de Pharm.*, Oct. 1854, p. 265.)

Besides the components of opium above enumerated, notice has been given by Dr. G. C. Wittstein of the discovery of another alkaloid, which, from its near alliance to morphia, he proposes to name *metamorphia*. We shall give a brief notice of it here, until its claims shall have been established by further investigation. If we count the pseudomorphia of Pelletier, it is the ninth alkaloid which has been extracted from opium.

Metamorphia. This was obtained by Wittstein from a substance separated from the dregs of laudanum, in an attempt to prepare morphia from them by Mohr's method with lime. By crystallization fine white silky needles were obtained, which consisted of the hydrochlorate of a new alkaloid. This was separated by exactly saturating with sulphate of silver, and macerating the precipitate with carbonate of barium. The alkaloid was extracted by alcohol, and, after evaporation, was obtained in hard flat prisms, arranged in a stellate form. The crystals were fused by heat, but at the same time decomposed. They were dissolved by about 6000 parts of cold and by 70 of boiling water, by 9 parts of boiling and 330 of cold alcohol, of 90 per cent. The alcoholic solution had a sharp, bitter taste, and a feeble alkaline reaction. The alkaloid was insoluble in ether, but rapidly soluble in solution of potassa, somewhat less so in ammonia, and soluble also in the alkaline carbonates, especially with the aid of heat. Nitric acid instantly coloured the crystals orange-red, and formed a yellow solution. A concentrated solution of iodic acid gradually produced a yellow colour with its aqueous solution, and a purple colour in starch paper suspended above it. The aqueous solution is not disturbed by sesquichloride of iron, is rendered grayish-black by nitrate of silver, and causes gradually a yellow turbidness in solution of terchloride of gold, which results in a brownish precipitate. It was not subjected to elementary analysis. From its origin in the dregs of laudanum, it appears to us most probable that it was the result of chemical change in morphia. (*Chemisches Central Blatt*, No. 61, p. 966; see also *Am. Journ. of Pharm.*, Jan. 1861, p. 24.) Dr. Fronmüller found Wittstein's metamorphia to be soporific in doses of half a grain. (*Ibid.*, Sept. 1861, p. 408.)—*Note to the twelfth edition.*

Proportionate quantity of the more important constituents of Opium. The following are given as the relative quantities of the ingredients mentioned, obtained by the Messrs. Smith, of Edinburgh, from 100 parts of fine opium: 10 parts of morphia, 6 of narcotina, 0·15 of thebaina, 1 of papaverina, 0·3 of codeia, 0·02 of narceia, 0·01 of meconin, 4 of meconic acid, and 1·25 of thebolactic acid. (*Pharm. Journ. and Trans.*, Oct. 1865, p. 183.)—*Note to the thirteenth edition.*

† The results here given, on the authority of Mr. Wm. A. Guy, as regards the fusing and subliming points of the alkaloids, were obtained through a very careful application of heat, in a special manner, and are recorded in the *Pharm. Journ. and Trans.*, Feb. 1868, p. 374. It should be noticed, however, that, in the process of sublimation, the alkaloids undergo a partial decomposition, leaving a more or less copious carbonaceous residue, by which, as he observes, the alkaloids and glucosides are distinguished from most other bodies. (*Note to the thirteenth edition.*)

upon vegetable colours, and does not prevent the acids from reddening litmus paper, there would appear to be some reason for denying it the rank of an alkali. But it unites with some of the acids forming definite compounds, which may be procured in a separate state; and Robiquet obtained the sulphate and muriate of narcotina well crystallized. (*Journ. de Pharm.*, xvii. 639, and xix. 59.) Hence many chemists, among whom is Berzelius, consider it alkaline; and, perhaps, this view of it is the most convenient. It must be admitted, however, to have a very feeble neutralizing power. With acetic acid it does not appear to form a permanent combination; for, though dissolved by cold acetic acid, it is separated by heating the solution. Narcotina consists of carbon, hydrogen, nitrogen, and oxygen; and its formula, as given by Hinterberger, is $C_{44}H_{23}NO_{14}$. According to Messrs. Matthiessen and Foster, it contains the elements of cotarnin and meconin. It may be distinguished from morphia by its insipidity, solubility in ether, and insolubility in alkaline solutions, by not affecting vegetable colours, by assuming a yellowish instead of a blood-red colour under the action of strong nitric acid, by not decomposing iodic acid, and by not producing a blue colour with the salts of iron. It is, however, reddened by a mixture of nitric and sulphuric acids. Hence, if to a mixture of it with strong sulphuric acid a small piece of nitre is added, a deep blood-red colour is produced; while morphia, under the same circumstances, yields a brownish or olive-green colour. It gives a greasy stain to paper when heated upon it over a candle. Heated with an excess of sulphuric acid and deutoxide of manganese, it is converted into an acid called *opianic acid*, and into a substance of feeble alkaline properties, which has received the name of *cotarnin* (*cotarnia*). (*Journ. de Pharm.*, 3e sér., vi. 99.) Meconin is said also to be among the results of its decomposition by oxidizing agents. When distilled with potassa, it yields a colourless volatile liquid having alkaline properties, with the strong smell of herring-pickle together with that of ammonia. This is a peculiar alkaloid, and has received the name of *propylamin*. (Wertheim, *Pharm. Cent. Blatt*, June 1, 1850, p. 421, and Dec. 17, 1851, p. 918.)* Water extracts narcotina partially from opium, in consequence of the acid which the latter contains, either free or combined with the narcotina. It is usually obtained mixed with morphia in the processes for procuring that principle; and may be separated by the action of ether, which dissolves it without affecting the morphia, and yields it upon evaporation. It may also be obtained by digesting opium in ether, and slowly evaporating the ethereal solution, which deposits crystals of narcotina. It is said that the same result may be obtained by using the oil of turpentine as the menstruum, first heating it with opium, and then evaporating the solution. Another mode of procuring it is to treat opium, exhausted by previous maceration in water, with dilute acetic acid, filter the solution, precipitate by an alkali, wash the precipitate with water, and purify it by solution in boiling alcohol, from which it crystallizes as the liquid cools. Should it still be impure, the solution in alcohol and crystallization may be repeated.

The proportion of this principle found in opium varies extremely in the different varieties, and in different specimens of the same variety. Thus in Smyrna opium it has been found, according to different observers, in quantities varying from 1·30 to 9·36 per cent.

Though narcotina itself is tasteless, its salts are very bitter, even more so than those of morphia. (*Berzelius.*) Their solution reddens litmus, and yields precipi-

* There would seem, from the observations of Wertheim and Hinterberger, to be four homologous modifications of narcotina, having a fixed relation to each other in composition, the number of eqs. of nitrogen and oxygen being the same in all, while those of carbon and hydrogen increase by 2 eqs. in regular progression. Thus 1. *normal narcotina* (Hinterberger) has the formula $NC_{42}H_{21}O_{14}$; 2. *methylic narcotina* (Wertheim) $NC_{44}H_{23}O_{14}$; 3. *ethylic narcotina* (Wertheim) $NC_{46}H_{25}O_{14}$; and 4. *propylic narcotina* (Wertheim) $NC_{48}H_{27}O_{14}$. Another interesting point is that each of these yields a peculiar volatile alkaloid by distillation with potassa; and the several products bear to each other the same chemical relation as exists between the fixed alkaloids from which they are derived. They are *ammonia* from the first, *methylamin* from the second, *ethylamin* from the third, and *propylamin* from the fourth. The last of these volatile alkaloids has been referred to in the text as having the smell of herring-pickle. It has been produced also by distilling ergot with potassa. Methylamin was procured by Wertheim. The other products are, we believe, thus far hypothetical. (*Pharm. Cent. Blatt*, Dec. 17, 1851, p. 918, and *Journ. de Pharm.*, 3e sér., xxiii. 154.) —*Note to the tenth edition.*

tates with the alkalies and infusion of galls. It has already been stated that Robiquet obtained the sulphate and muriate crystallized.

Different opinions have been advanced relative to the action of narcotina on the system. Derosne believed it to be the active principle of opium; though upon experimenting with it, he obtained effects but little stronger than those produced by an equal dose of opium itself. Others found it possessed in different degrees of narcotic properties; and the results of various experiments which led to the conclusion may be seen in former editions of this work. But a more thorough investigation has led to the conclusion that it cannot be ranked among narcotic medicines. It is now pretty well established that narcotina is identical with aconella, an alkaloid recently extracted by the Messrs. Smith of Edinburgh from aconite. (See *page* 79.) The effects of a narcotic character which have been attributed to it, have probably arisen from the employment of a preparation not entirely freed from other principles contained in the opium. Indeed, so little has it of this character, that the name of *anarcotina* has been proposed for it, expressive of its total want of narcotic power. Dr. O'Shaughnessy, Professor of Chemistry in the Medical College of Calcutta, recommends narcotina very highly in intermittent fever, and believes that he has discovered in it even stronger antiperiodic properties than those of quinia. In the cases reported by him, it was employed in combination with muriatic acid. Given in this form, though powerfully febrifuge, it was found not to produce narcotic effects, not to constipate the bowels, and never to occasion the distressing headache and restlessness which sometimes follow the use of quinia. It proved, moreover, powerfully sudorific. It was given in doses of three grains, three times a day. Dr. O'Shaughnessy was induced to recommend its employment to his medical friends in India, from a knowledge that it had proved effectual in mild agues, in the hands of Dr. Roots and Mr. Jetson in England.*

Codeia was discovered in 1832 by Robiquet in the muriate of morphia prepared according to the process of Gregory. It exists in opium combined like morphia with meconic acid, and is extracted along with that alkali in the preparation of the muriate. (See *Morphia.*) When the solution of the mixed muriates of morphia and codeia is treated with ammonia, the former alkaloid is precipitated, and the codeia, remaining in solution, may be obtained by evaporation and crystallization. It may be purified by treating the crystals with hot ether, which dissolves them, and yields the codeia in colourless crystals by spontaneous evaporation. This alkaline product melts at 300° without decomposition. Guy gives 220° as its point both of fusion and volatilization. (*Pharm. Journ. and Trans.*, Feb. 1868, p. 374.) It is soluble in water, which takes up 1·26 per cent. at 60°, 3·7 at 110°, and 5·9 at 212°. When added in excess to boiling water, the undissolved portion melts and sinks to the bottom, having the appearance of an oil. It is soluble also in alcohol and ether, but insoluble in alkaline solutions. Hence, it may be separated from morphia by a solution of potassa or soda, which dissolves the morphia, and leaves the codeia. It has an alkaline reaction on test paper, and combines with acids to form salts, some of which are crystallizable, particularly the nitrate. Its capacity of saturation is almost identical with that of morphia. According to Robiquet, 1 part of muriatic acid is saturated by 7·837 of codeia, and by 7·88 of morphia. It is distinguishable, however, from the latter principle by the different form of its crystals, which are octohedral, by its solubility in boiling ether, greater solubility in water, and insolubility in alkaline solutions, and by not assuming a red colour with nitric acid, nor a blue one with the salts of sesquioxide of iron. (*Journ. de Pharm.*, xix. 91.) Tincture of galls precipitates from its solutions a tannate of codeia. Crystallized from a watery solution, it contains about 6 per cent. of water, which is driven off at 212°. The crystals obtained from a solution in ether contain no water. Like most of the other organic alkalies, it consists of carbon, hydrogen, nitrogen, and oxygen; its received formula being $C_{35}H_{20}NO_5$, and its combining number consequently 284. According

* The different effects, obtained by different experimenters from narcotina, are readily explicable, should the statements as to the existence of a powerful alkaloid (opiania), which may have been mixed with the narcotina, and of several different modifications of narcotina itself (*page* 664), prove to be correct. (*Note to the tenth edition.*)

to Dr. Anderson, however, the formula of the anhydrous alkaloid is $C_{36}H_{21}NO_6$, with the addition of two eqs. of water in the hydrate. (*Month. Journ. of Med. Sci.*, May, 1850, p. 492.) Dr. Gregory tried the effects of *nitrate of codeia* upon himself and several of his pupils, and found that, in a dose of three grains or less, it produced no obvious effect, but, in the quantity of from four to six grains, accelerated the pulse, occasioned a sense of heat in the head and face, and gave rise to an agreeable excitement of the spirits like that resulting from intoxicating drinks, which was attended with a sense of itching upon the skin, and, after lasting for several hours, was followed by an unpleasant depression, with nausea and sometimes vomiting. No tendency to sleep was observed, except in the state of depression. In two or three cases the medicine produced a slight purgative effect; but in others it appeared to exercise no peculiar influence on the bowels. Mr. A. F. Haselden considers a grain of codeia as equivalent to half a grain of morphia; and states that two grains cause nausea. On the same authority, the hydrochlorate is more powerful than the pure alkaloid; two grains of it inducing vertigo, nausea, and vomiting. He has found facial and ischiatic neuralgia to yield to it, when all other means had failed. (*Pharm. Journ. and Trans.*, Sept. 1866, p. 156.) M. Barbier, of Amiens, administered codeia *uncombined* in numerous cases, and observed that, in the dose of one or two grains, it acted on the nervous system, and appeared to be directed especially to the great sympathetic; as it relieved painful affections having their origin apparently in disorders of that nerve, while it exerted no influence over pains of the back and extremities supplied by nerves from the spinal marrow. He did not find it to affect the circulation, disturb digestion, or produce constipation. In sufficient quantity, it induced sleep without giving rise, like opium, to signs of cerebral congestion. Dr. Mirandi, of Havana, employed it with advantage in several bad cases of dyspepsia. Dr. Aran, of Paris, considers it one of the most efficient means in our possession for relieving pain, and obtaining calm sleep, inferior to morphia only that it must be given in larger doses, and having the advantage over it that it does not occasion disturbed sleep, disorder of the stomach, constipation, or sweating with cutaneous eruptions. (*Am. Journ. of Med. Sci.*, Jan. 1, 1863, p. 184.) Dr. Garrod, of London, however, has had a different experience, having found it, in large doses, neither anodyne nor soporific. (*Med. Times and Gaz.*, March, 1864, p. 333.) On the whole, there can be little doubt that codeia has a decided action on the animal economy, and is among the principles upon which opium depends for its peculiar powers. It may be given in syrup, in a dose of from half a grain to two grains or more, and M. Aran has found it efficient in the dose of one-third of a grain. Mr. Haselden recommends a syrup containing two grains to the fluidounce, as the most convenient proportion for a division of the dose.

Paramorphia (*thebaina*) is the name given by Pelletier to a principle, discovered by him in the precipitate thrown down from an infusion of opium, treated with milk of lime. The precipitate being washed with water till the liquid came away colourless, and then treated with alcohol, instead of affording morphia to this solvent, as was anticipated, yielded a new alkaline principle, which was obtained separate by evaporating the alcohol, acting on the residue with ether, allowing the ethereal solution to evaporate spontaneously, and then purifying the resulting crystalline mass by dissolving it in an acid, precipitating by ammonia, and recrystallizing by means of alcohol or ether. Pelletier named it paramorphia, from its close analogy in composition with morphia, from which, however, it is quite distinct in properties. It is white, crystallizable in needles, of an acrid and styptic rather than bitter taste, fusible at about 300° (fusible at 210°, volatilizable at 320°, *Guy*), scarcely soluble in water, very soluble in alcohol and ether when cold, and still more so when heated, and capable of combining with the acids, with which it forms salts not crystallizable from their aqueous solution. Alkalies precipitate it from its acid solutions, and, unless in very concentrated solution, do not dissolve it when added in excess. It is not, like morphia, reddened by nitric acid, nor does it become blue with solutions of the salts of sesquioxide of iron. From codeia it differs in never being in large crystals, in not forming crystallizable salts, in being always precipitated from its acid solutions by ammonia, and in not melting in oily drops. From narcotina, which it

most resembles, it may be distinguished by its shorter crystals, which want the pearly appearance of those of narcotina, by its different taste, by its much greater solubility in cold alcohol, of which 10 parts will dissolve 1 of this principle, while narcotina requires 100 parts, and by the action of nitric acid, which converts it into a resin-like matter before dissolving it, while the same acid instantly dissolves narcotina. It consists of carbon, hydrogen, nitrogen, and oxygen; its formula being, according to Dr. Anderson, $C_{38}H_{21}NO_6$. (See *Journ. de Pharm.*, 3e sér., xxiv. 233.) The name of *thebain* was proposed for it by M. Couërbe, who was disposed to give the credit of its discovery to M. Thiboumery, the director of Pelletier's laboratory. Magendie considered it closely analogous, in its effects on the system, to strychnia and brucia, producing tetanic spasms in the dose of a grain.

Papaverina (*papaverin*). The discovery of this alkaloid was announced by Dr. G. Merck. It is crystallizable in needles, fusible at 210° and volatilizable at 310° (*Guy*), insoluble in water, very sparingly soluble in cold alcohol or ether, more soluble in these liquids boiling hot, and deposited by them on cooling. With acids it forms salts, most of which are very sparingly dissolved by water. The muriate crystallizes with extraordinary facility. The alkaloid is readily dissolved by moderately concentrated muriatic acid, from which, on the addition of more acid, the muriate separates, assuming the form of an oily layer at the bottom of the vessel, which is readily converted on standing into a mass of acicular crystals. These crystals are very sparingly soluble in cold water. The muriate yields with bichloride of platinum a yellow precipitate which is insoluble in boiling water or alcohol. Papaverina is prepared by precipitating the aqueous infusion of opium with soda, exhausting the precipitate with alcohol, evaporating the tincture to dryness, treating the residue with a dilute acid, filtering, precipitating by ammonia, dissolving the precipitate in muriatic acid, mixing acetate of sodium with the solution, and treating with boiling ether the resulting precipitate. The ethereal solution deposits the papaverina on cooling. A characteristic property of this alkaloid is that its crystals, when moistened with concentrated sulphuric acid, acquire a dark-blue colour. Its formula is $C_{40}H_{21}NO_8$. (*Chem. Gaz.*, March 15, 1850; from *Liebig's Annalen.*) Papaverina has been further investigated by Dr. Thomas Anderson, who confirms the statements of Merck. (*Chem. Gaz.*, Jan. 15, 1855, p. 21.)

Opiania (*opianin*). This was found by Dr. Hinterberger in some supposed narcotina, which had been obtained by Engler, an apothecary of Vienna, from a parcel of Egyptian opium which he was working for morphia. An infusion of the opium was precipitated by ammonia, and the precipitate, having been washed first with water and then with cold alcohol, was dissolved in hot alcohol, and decolorized by animal charcoal. A crystalline mass was thus obtained, consisting apparently of morphia and narcotina. By repeated solutions in hot alcohol and crystallization, the former was separated, remaining in the alcohol, while the supposed narcotina was obtained in crystals. These, upon being examined by Dr. Hinterberger, proved to be a new alkaloid, to which he gave the name of *opianin*. It is in long, colourless, transparent needles, belonging to the prismatic system. When precipitated by ammonia from the solution of the muriate, it is in the form of a soft white powder. It is without smell, and in alcoholic solution has a strong and durable bitter taste. At the temperature of 212° F. it remains unchanged. It is insoluble in water, and requires for solution a large quantity of boiling alcohol, from which it is entirely thrown down, upon cooling, in the state of crystals. In alcoholic solution it has a strong alkaline reaction; and from this solution both opiania itself and its salts are thrown down by alkalies. Concentrated sulphuric acid dissolves without changing it; nitric acid renders it yellow, and, if added to its sulphuric acid solution, blood-red, but after a short time changing to light-yellow. Its formula, according to Hinterberger, is $C_{66}H_{36}N_2O_{21}$. From experiments, it has been inferred to be powerfully narcotic, and to resemble morphia in its action. About one-tenth of a grain of one of these alkaloids was given to a cat, and the same quantity of the other to another cat, with very similar effects. These were decidedly narcotic, and continued for a considerable time, but had ceased at the expiration of 24 hours, without fatal effects. (*Chem. Gaz.*, Dec. 1, 1852, p. 444.)

Narceia (*narcein*), discovered by Pelletier in 1832, is white, in silky acicular crystals, inodorous, of a slightly bitter taste, fusible at 197° F. (170°, and volatilizable at 420°, *Guy*), soluble in 375 parts of cold and 220 of boiling water, soluble also in alcohol, and insoluble in ether. It forms a bluish compound with iodine, the colour of which is destroyed by heat and the alkalies. Besides, according to Stein, the blue colour is not produced when there is too much of the iodine present, which then causes a brown colour with narcein; the blue colour appearing, under such circumstances, only when the excess of iodine is saturated by ammonia. (*Journ. de Pharm.*, Janv. 1872, p. 59.) It is rendered blue by the action of mineral acids so far diluted as not to decompose it; but does not, like morphia, become blue by the action of the salts of iron, nor red by that of nitric acid. It is dissolved by the acids, but was thought not to neutralize them, and, though at first considered alkaline by Pelletier, was afterwards ranked with indifferent bodies. At present, however, its alkaloid character is admitted, as it unites with sulphuric acid to form a crystallizable sulphate. (*Journ. de Pharm.*, Avril, 1864, p. 367.) It resembles, moreover, the organic alkalies in its constitution, consisting of carbon, hydrogen, nitrogen, and oxygen. Its formula, according to Dr. Anderson, is $C_{46}H_{29}NO_{18}$. Dr. Dragendorff has announced that solution of narceia gives a crystalline precipitate with the double iodide of zinc and potassium. This reaction may be employed with iodine as a test of narceia. If a solution of this salt, with a little iodized water, be added to solutions of narceia, and the mixture then agitated with ether to remove the iodine in excess, a solution containing a very small quantity of narceia will distinctly assume a blue colour. The other alkaloids of opium are destitute of this property. (*Journ. de Pharm.*, Avril, 1870, p. 346.) Pelletier obtained it in the course of his analysis of opium. Having formed an aqueous extract of opium, he treated it with distilled water, precipitated the morphia by ammonia, concentrated the solution, filtered it, threw down the meconic acid by baryta-water, separated the excess of baryta by carbonate of ammonium, drove off the excess of the ammoniacal salt by heat, evaporated the liquor to the consistence of syrup, set it aside till a pulpy matter formed containing crystals, separated and expressed this pulpy matter, then treated it with alcohol, and concentrated the alcoholic solution. This, on cooling, deposited crystals of narceia, which were easily purified by repeated solution and crystallization. Meconin, which often crystallizes with it, may be separated by the agency of ether. Experiments have been performed with narceia, which go to prove that it closely resembles morphia in its influence on the system, though somewhat weaker: and that, while capable of producing sleep, relieving pain and irritation, alleviating cough, and checking diarrhœa, it is not followed by the unpleasant sensations about the head and other disagreeable symptoms which often attend the action of morphia, is less disposed to constipate, and less stimulant to the circulation. In cases in which morphia disagrees with the patient, or is otherwise contraindicated, narceia may be resorted to for most of the purposes for which the other alkaloid is employed. It may be administered in pill or syrup. From one-third to three-quarters of a grain may be given for a dose, the smaller to relieve cough, the larger to remove pain or produce sleep.*

* Much attention has recently been attracted to narceia, in consequence of the valuable properties ascribed to it by M. Claude Bernard, as the result of his experimental researches into the physiological properties of the several opium alkaloids respectively. According to M. Bernard, narceia, in its operation on the lower animals, is decidedly soporific, in this respect resembling morphia and codeia, being more energetic than either, though without the deep torpor produced by the former. Bernard, however, was not the first to experiment with narceia. Not long after its discovery, Magendie injected 10 centigrammes (about 1·5 grains) of it, several times into the jugular vein of dogs, without observing any special action. (*Ann. de Thérap.*, 1865, p. 25.) So early as 1852, M. Lecomte demonstrated its soporific effect, having repeated Magendie's experiment, with very different results. Ten centigrammes dissolved in ten grammes of distilled water were injected into the jugular vein of a large dog. The animal was put into a calm sleep with snoring, yet retained sensibility so far as to feel the presence of insects upon the skin; and it was noticed that, while the anterior limbs had lost neither sensibility nor mobility, the posterior had obviously suffered some diminution of these properties, showing that the medicine, in its action on the spinal marrow, more especially affected the lumbar region. (*Ibid.*, p. 27.) Some years later, similar experiments were performed by MM. Debout and Béhier, confirmatory of the results obtained by M. Lecomte and M. Bernard. But they were extended also to the human subject, both in health and disease, and always with similar results.

Pseudomorphia was discovered by Pelletier more than thirty years since; but, as it exists in small quantities, and was thought to be only an occasional ingredient in opium, little attention has been paid to it. An interesting fact, however, in relation to it, and one of some toxicological importance, is that it possesses two properties con-

M. Debout tried on himself a syrup of narceia, each tablespoonful of which contained a centigramme (0·15 gr.), taking a tablespoonful at first twice a day, gradually increased to seven a day, and continued with the latter quantity for ten days. The soporific effect was experienced when the evening dose amounted to 3 centigrammes (nearly half a grain); and the sleep was afterwards deeper in proportion to the increase of the dose. The sleep was always calm, never attended with painful dreams, and was interrupted momentarily by the least noise; nor was it followed in the morning by that heaviness of the head often noticed as the result of morphia. The only inconvenience experienced was a rather obstinate constipation during the continuance of the experiment. Nor was the action pronounced upon the secretory function; although, from a dose of 7 centigrammes (about a grain), some hebetude of the bladder was experienced, which might be ascribed to the influence upon the lower spinal marrow, as observed by M. Lecomte. No itching of the surface, no trouble of sight or hearing, were noticed; the narcotic influence of the medicine being limited to its soporific action. It was, however, found to exercise the same calming influence over bronchial irritation, as in the relief of cough. No effect on the respiration or pulse was noticed. The general conclusions drawn from these experiments were as follows. The calming and soporific effects of narceia are superior to those of codeia, and almost equal those of morphia, over which it has the advantage that it operates without causing cerebral congestion, and consequently that the sleep produced by it is lighter, and never attended with painful dreams. Narceia, moreover, is less apt than morphia to disturb the digestive organs; causing nausea and vomiting less frequently, and constipation less intense. The greatest inconvenience from it is that, when it exceeds the quantity of 5 centigrammes (about three-quarters of a grain), it is liable to bring on difficulty of discharging the urine, from a partially paralyzing action on the bladder.

Besides these physiological investigations, narceia has been submitted also to therapeutic trials, with results corresponding with its ascertained influence on the functions. M. Béhier has found it to quiet cough, diminish expectoration in consumptive patients, check diarrhœa, relieve pain, cause sleep, quiet restlessness, and to produce all these effects whether given internally or by subcutaneous injection. Sometimes, however, it caused vomiting, and sometimes suspended the emission of urine, without modifying the desire to micturate. (*Ibid.*, pp. 23–47.)

M. Liné, formerly resident physician of one of the French hospitals, after a series of observations in a ward of the hospital, gives the following conclusions, which are in close conformity with those of his predecessors. Narceia exceeds all the opium alkaloids in soporific power; neither morphia nor codeia, as a general rule, producing either so protracted or so profound a sleep. While thus energetic as a soporific, it gives rise only in a very slight degree to those secondary effects of opium which so often interfere with its administration, such as excessive perspiration, headache, a sense of heaviness in the head, nausea, vomiting, &c. It does not constipate like opium, and, according to M. Liné, even induces diarrhœa in large doses; a point, however, in which his experience differs from that of M. Debout. It relieves pain, and very generally acts with a more or less paralyzing effect on the urinary excretory function. (*Druggists' Circular*, June, 1866; from *Gazette des Hôpitaux*.)

To the foregoing testimony must be added that of Dr. Eulenburg. According to this practitioner, narceia, while acting as a narcotic, causes at first a diminished frequency and volume of the pulse, followed after some time by acceleration. The pulse rarely increases during its use more than 12 or 15 beats in a minute. Upon the cutaneous nerves it acts like other narcotics. The repetition of internal doses often produces one or two stools, and sometimes even a diarrhœa, conformably with the observation of M. Liné. It appears, however, to retard the occurrence of the menses. Subcutaneously administered, it produces none of the muscular action which follows the injection of morphia. For the relief of irritation, and as a soporific, it is preferable to every other medicine. It is, indeed, indicated, independently of simple idiopathic neuralgia, in all cases where pain is the prominent symptom, such as affections of the joints, phlegmon, painful ocular diseases, orchitis, cystitis, cyrrhosis of the liver, wounds, and after painful operations. In all these cases, employed internally or externally, in the doses recommended by Dr. Eulenburg, it quickly relieves the pain, and often produces a sleep of four, five, or even nine hours; a sleep sweet, tranquil, uninterrupted, and with a peaceful awakening; always without disordered action or poisonous effect. In many cases of disease morphia can scarcely be used in consequence of its various unpleasant effects, primary or secondary; and to these narceia is admirably adapted, as it produces the good effects, so far as relates to the relief of pain and irritation and the production of sleep, without the noxious and disagreeable. The dose employed by Dr. Eulenburg for producing sleep and relieving pain is from $\frac{1}{6}$ to $\frac{1}{2}$ a grain internally, and from $\frac{1}{8}$ to $\frac{1}{4}$ by the hypodermic method. In sick headache, $\frac{1}{6}$ of a grain, followed shortly afterwards by one-ninth of a grain, taken at the beginning, produces a sleep which continues several hours, and from which the patient awakes in full health. (*Ann. de Thérap.*, 1867, pp. 6–9.)

Of the numerous communications upon the effects and uses of narceia, the author has met, with but a single exception, with none which was not commendatory; and in all there is so close an agreement as to the peculiar effects of the medicine, that there is scarcely room for doubt on the subject. The exception referred to is that presented in the report of Dr. Da Costa as to the effects of the medicine in the wards of the Pennsylvania Hospital. (See *Reports of the Penn. Hospital*, 1868, p. 177.) The effects in this instance were such as failed altogether to support the highly flattering statements heretofore made on the subject of narceia; and if the medicine employed by Dr. Da Costa was really narceia, tolerably pure, his experience must throw a strong doubt upon the favourable statements made by others. Only further observation and experience can determine the question. (*Note to the thirteenth edition.*)

sidered characteristic of morphia, those namely of being reddened by nitric acid, and of striking a blue colour with the salts of iron, and yet is without any poisonous influence upon the animal economy. (*Journ. de Pharm.*, xxi. 575.) Hesse has recently investigated the subject, with the following results. He found that it accompanies morphia procured by Gregory's method, and may be separated from that alkaloid by adding ammonia in excess to an alcoholic solution containing both. The morphia is precipitated, and pseudomorphia, remaining in solution, may be obtained by evaporating the mother-liquid. It is tasteless, insoluble in water, alcohol, ether, chloroform, and dilute sulphuric acid, but easily soluble in solution of potassa, soda, and lime, and in alcoholic solution of ammonia, though sparingly in a watery solution of the last-mentioned alkali. It does not neutralize muriatic acid, dissolves in concentrated sulphuric acid with the production of an olive-green colour, in concentrated nitric acid with an intense orange-red, and in solution of sesquichloride of iron with a blue colour. At 248° F. it loses two eqs. of water of crystallization, and at higher temperatures is decomposed without melting. Its composition is represented by the formula $C_{24}H_{19}NO_8$. It forms sparingly soluble salts with sulphuric, nitric, oxalic, and tartaric acids, and a crystalline deposit, very slightly soluble in muriatic acid, with solution of corrosive sublimate. (*Chem. News*, April 12, 1867, p. 188.)

Cryptopia. The discovery of this alkaloid was announced by Messrs. T. & H. Smith, of Edinburgh, in a communication to the *Pharmaceutical Journal and Transactions* for April, 1867 (p. 595). The Messrs. Smith obtained it from the weak alcoholic washings of crude morphia after precipitation, by first neutralizing the liquid with dilute sulphuric acid, and then, after recovering the alcohol by distillation, and washing out the still copiously with hot water, by precipitating the mixed liquor of the still and the washings by milk of lime in large excess. The liquid is then filtered off, and the pitch-like precipitate, having been thoroughly washed, is boiled with alcohol in large quantity, the solution filtered, and the alcohol distilled off. The pitchy substance which remains in the retort, and which consists mainly of thebaina, is separated from the supernatant watery liquid, and heated to ebullition with enough alcohol to dissolve it. The solution, having been set aside, will be found in a day to have set into a mass of crystals, which consist of crystallized thebaina. This mass is now strongly pressed in a cloth, and the residuary cake powdered and dissolved in dilute muriatic acid; care being taken that the acid be not in excess. The filtered liquid is evaporated and crystallized, and the process of evaporation and crystallization repeated, so as to separate all the muriate of thebaina. If now the mother-waters be set aside, the muriate of cryptopia will in the course of some weeks crystallize out of them, but mixed with crystallized muriate of thebaina: and the separation of the two is extremely difficult. But as the crystals of the two alkaloids are very different, those of thebaina being hard and strong, those of cryptopia soft and generally tufted, by careful management, and by repeating the crystallization many times, so as to get rid of most of the thebaina, the muriate of cryptopia may be seen forming on the surface of the harder salt in the solution. The mother-liquors being now poured off, and allowed to evaporate spontaneously, the whole at length sets into a soft mass, which, being pressed in a cloth, is found to consist of almost pure muriate of cryptopia. But the practical reader who wishes to carry the process into effect is referred to the paper of the Messrs. Smith for details, without which he might not be able to succeed in his essays. To obtain the pure alkaloid, it is to be precipitated from the solution of the muriate by ammonia, then washed, dried, and finally washed with ether or alcohol, which readily dissolves thebaina, but has little effect on cryptopia. It may be got in a crystallized state by boiling it with a large quantity of alcohol, which, on cooling, will slowly deposit the alkaloid in crystals. The quantity of cryptopia obtained from opium is extremely small; and it must, I think, strike the reader of this process as highly probable, that it is rather a product formed out of thebaina than a proper educt of the drug.

Cryptopia is without colour or smell; and its salts, though at first bitter to the taste, afterward cause a sense of coolness in the mouth, like that produced by peppermint. It melts at about 400° F., and, heated to redness, is decomposed, blackening and giving forth watery vapours, but without properly subliming. According

to Guy, it melts and sublimes at the same temperature of 350°. It is insoluble in water, quite insoluble in ether, and very sparingly soluble in alcohol, requiring 1265 parts of that liquid when cold to dissolve it. Chloroform dissolves it almost as freely as narcotina. Oil of turpentine and benzole do not appear to dissolve it. It has very strong alkaline powers, and forms crystallizable salts with the acids, which are distinguishable from all the other salts of the opium alkaloids by a strong tendency to gelatinize. If the muriate be dissolved in about 30 parts of hot water, and set aside, instead of crystallizing, it forms a jelly closely resembling that of pure gelatin. From all the constituents of opium, except the stronger alkaloids, morphia, codeia, and thebaina, it is distinguished by its strong alkaline properties, as it neutralizes the strongest acids. From morphia it is distinguished by its very sparing solubility in alcohol, and from codeia and thebaina by its total insolubility in ether. It differs also in the effect of strong sulphuric acid, which produces a blue colour with the minutest quantity of cryptopia, a blood-red with thebaina, and none with morphia or codeia. The tendency of its salts to gelatinize is another distinguishing property of cryptopia. The formula of the alkaloid, admitting the eq. of C to be 12 and of O 16, is $C_{23}H_{25}NO_5$. (*Pharm. Journ. and Trans.*, April, 1867, p. 595, and June, 1867, p. 716.)

The alkaloids recently announced by M. Hesse, require some notice individually; but, from deficiency of space, this must be very brief; and, for the same reason, we introduce in a note the account of Hesse, as to the method of procuring them, in an abridged form.*

Lanthopia (*Lanthopine*) differs from pseudomorphia only in not becoming blue with perchloride of iron, and in giving, when entirely pure, with the sulphuric and nitric acids, solutions which remain colourless. Its acid oxalate and tartrate are crystallizable.

Laudania (*Laudanine*) ($C_{40}H_{25}NO_8$) as first prepared, is mixed with cryptopia, from which it is separated by dissolving it in acetic acid, and adding a slight excess of dilute solution of soda, by which the cryptopia is entirely precipitated. The liquid being filtered, and treated with chloride of ammonium, lets fall the laudania, which soon assumes the crystalline form. The acetate, with the addition of iodide

* M. O. Hesse obtained most of the newly discovered alkaloids announced by him from the black mother-liquors, left behind in the process for procuring muriate of morphia, first employed by Dr. Gregory, and adopted by the British Pharmacopœia. This liquor, diluted with an equal volume of water, was precipitated by an excess of ammonia; the clear liquid was exhausted with ether, and this treated as described in *Ann. Chem. Pharm.*, clxxx. p. 47. (*Pharm. Journ.*, Janv. 1872, p. 549.) The method in which these alkaloids were first separated from opium by Hesse, was as follows. A watery infusion is prepared, and precipitated by caustic soda or lime-water in excess. In the liquid, a substance is retained, which may be extracted by ether, and one of the characteristics of which is that it yields with sulphuric acid a purple colour. This appears to be the porphyroxin of Merck, described at *page* 673 among the constituents of opium. This Hesse found to be a mixture of several alkaloids, which he separated in the following manner. The liquid above referred to as containing the colouring matter, is well shaken with ether; this, being separated, is acidulated with acetic acid, and the impure acetates are obtained by evaporating off the ether. The residue is mixed gradually with a dilute alkaline solution, and agitated so as to cause the resin which separates to form a mass. After twenty-four hours, the precipitate is separated; the liquid containing the alkaloids is mixed with muriatic acid in slight excess, and the alkaloids then precipitated with ammonia. The whole is now shaken with chloroform, acetic acid is added in slight excess, the chloroform is evaporated, and the residue neutralized with ammonia. The precipitate produced is reddish-coloured, and though at first resinoid, soon crystallizes. This, which consists of impure lanthopia, is separated by filtration, and the filtered liquid, after twenty-four hours, is mixed with caustic soda, in quantity but very little more than necessary to decompose the ammonia salts in solution. It is then shaken repeatedly with ether to separate codeia, which renders it turbid. This alkaloid is separated more readily by ether than the other alkaloids present, meconidia, codamia, laudania, and another which the author designated by the letter *x*. Ether does not extract the last mentioned bases from the solution containing fixed alkali, until after chloride of ammonium has been mixed with it. When the ethereal solution is allowed to evaporate very slowly, *laudania* first crystallizes; the other three bases remaining as an almost amorphous mass when the ether has all escaped. But if, before the ether has entirely evaporated, the liquid be mixed with solution of bicarbonate of sodium, crystals of *codamia* are deposited as the ether further evaporates. If the mother-liquor, from which the two alkaloids have been separated, is now treated with acetic acid and chloride of sodium, muriate of *meconidia* is precipitated, the base *x* remaining in solution. The latter is quite separated from meconidia by repeatedly dissolving the muriate in water, shaking it with bicarbonate of sodium and ether, and then evaporating off the ether. (*Pharm. Journ.*, Sept. 1870, p. 205.)—*Note to the fourteenth edition.*

of potassium, gives rise to the hydriodate of laudania, from which ammonia separates the base perfectly pure.

This alkaloid is dissolved at 18° C. by 647 parts of ether. Sulphuric acid gives with it characteristic reactions. When pure, at common temperatures, it assumes a pale-rose colour, and at 150° C. a reddish violet. When mixed with oxide of iron, it exhibits the same changes, but with much greater intensity. Laudania is an energetic base, and with potassa forms a crystallizable compound. Its salts, with the exception of the neutral sulphate, oxalate, and tartrate, are crystallizable.

Codamia (*Codamine*), which has the formula $C_{38}H_{23}NO_5$, in composition closely resembles laudania, but is readily distinguished from it by the effect of chloride of iron and nitric acid, both of which colour it deep-green. It crystallizes anhydrous. It can be purified by taking advantage of the feeble solubility of its iodohydrate. Having decomposed this salt by ammonia, dissolve the precipitate in ether, wash the ethereal solution with solution of bicarbonate of sodium; then filter on animal charcoal (animal black). By evaporation the liquid abandons the alkaloid in beautiful colourless crystals. Codamia crystallizes also from benzine; but, thus obtained, it melts at 126° C., while that procured through ether melts at about 120° C. The acid iodohydrate, tartrate, and oxalate are crystallizable.

Protopia (*Protopine*) is a new alkaloid which Hesse separated from cryptopia. Both are precipitated as insoluble muriates by muriatic acid in excess; but, if the precipitate be dissolved by an excess of oxalic acid, the binoxalate of cryptopia will crystallize, and protopia remain in the mother-waters. The liquid is separated, precipitated by ammonia, and agitated with ether; and the ethereal solution is taken up by muriatic acid. The muriate of protopia being dense and granular, while that of cryptopia is very light, the two are separated by levigation; eighty grammes of crude crytopia furnishing one and a half of protopia.

Separated from the muriate by ammonia, protopia constitutes a crystalline powder, insoluble in water, soluble in alcohol, and in hot benzine and acetone, more soluble in chloroform, insoluble in the alkalies generally, but slightly soluble in ammonia. It melts at 202° C., undergoing decomposition, and crystallizes anhydrous. Its formula is $C_{40}H_{19}NO_{10}$. Perchloride of iron does not colour it; nitric acid colours it yellow; sulphuric acid dissolves it, colouring it first yellow, then red, and lastly violet. The alcoholic solution has an alkaline reaction. The salts are neuter and crystallizable.

Laudanosia (*Laudanosine*) exists in the mother-waters of thebaina, with cryptopia and protopia. The thebaina having been precipitated by tartaric acid, the mother-water is neutralized by ammonia, and bicarbonate of sodium is added. After eight days of rest, a blackish mass separates. The limpid liquid with an excess of ammonia, yields a copious precipitate, which, agitated with heated benzine, gives to that liquid a mixture of several alkaloids. The benzine solution, upon cooling to 40° C., deposits the cryptopia and protopia. On agitation anew with heated bicarbonate of sodium, and subsequent complete refrigeration, the laudanosia crystallizes. It is entirely purified by ether, which dissolves it abundantly; and by transformation into iodohydrate, is but slightly soluble in water. It is itself insoluble in water and the alkalies, soluble in alcohol, acetone, and chloroform. It melts at 89° C., and is decomposed at 110° C. Chloride of iron does not colour it. Sulphuric acid colours it rose in the cold, and violet when heated. Nitric acid transforms it into a nitrous base. It crystallizes anhydrous. Its formula is $C_{42}H_{27}NO_8$. It forms crystallizable salts, which are "sufficiently" soluble and bitter.

Hydrocotarnia (*Hydrocotarnine*) is retained in solution, by the benzine, from which the laudanosia has been deposited on cooling. Muriatic acid gas being made to pass into this solution, the muriate of hydrocotarnia crystallizes. This alkaloid seems to result from a transformation of narcotina. If the latter be made to boil some time with baryta-water, a portion of it is decomposed, giving rise to a crystallizable matter, soluble in ether, which appears to be identical with hydrocotarnia $C_{24}H_{15}NO_6$. This alkaloid is very soluble in alcohol, acetone, chloroform, benzine, and ether. It melts at 50° C., and loses, at a somewhat greater heat, the molecule of water with which it crystallizes. Sulphuric acid dissolves it, changing it yellow

in the cold, and crimson-red when heated. Nitric acid colours it yellow; perchloride of iron does not affect its colour.

According to Hesse, opium contains at least fifteen alkaloids. They may be divided into four groups, in relation to the modification they undergo when heated with pure concentrated sulphuric acid. The changes of colour produced show that there are four products of decomposition, if not identical, at least nearly so. Of the four groups, two may be subdivided, each into two minor groups. They are as follows:

I. *Group of Morphia.* *a.* Group of morphia, properly called; morphia, codeia, and pseudomorphia. *b.* Group of laudania; laudania, codamia, and laudanosia. Of these, group *a* yields a deep dirty green; group *b*, a dirty reddish-violet.

II. *Group of Thebaina.* Thebaina, cryptopia, protopia; a dirty green, passing to violet.

III. *Group of Papaverina.* *a.* Group of papaverina properly called, comprehends actually only papaverina itself. *b.* Group of narceia; narceia, lanthopia. *a.* a deep violet; *b.* a brownish-black, or deep brown.

IV. *Group of Narcotina.* Narcotina, hydrocotarnia, a dirty reddish-violet.

Meconidia is here omitted, because its reaction with heated sulphuric acid is unknown.* (*Journ. de Pharm.*, Août, 1872, p. 151; from *Annalen der Chemie und Pharmacie*, t. cli. p. 87, Janv. 1869.)

Meconin, the existence of which was announced in 1832 by M. Couërbe, is identical with a substance discovered several years previously by M. Dublanc, jun., but of which no account was published. It is perfectly white, in the form of acicular crystals, soluble in about 265 parts of cold and 18 of boiling water, very soluble in ether, alcohol, and the essential oils, fusible at 195°, volatilizable without change (fusible at 120°, sublimable at 180°, *Guy*), and possessed of a degree of acrimony which favours the supposition that it may not be without action upon the system. It is neither acid nor alkaline, and contains no nitrogen. Meconin is obtained by precipitating the aqueous infusion of opium with ammonia, washing the precipitate with water until the latter nearly ceases to acquire colour, mixing the watery fluids, evaporating them to the consistence of molasses, setting them aside for two or three weeks, during which a mass of granular crystals is formed, then decanting the liquid, expressing the mass, and drying it with a gentle heat. The meconin may be separated from the mass by treating it with boiling alcohol of 36° Baumé, evaporating so as to obtain crystals, dissolving these in boiling water with animal charcoal, filtering the liquid while hot, and subjecting the crystals formed upon the cooling of the solution to the action of ether, which dissolves the meconin, and yields it in a state of purity by spontaneous evaporation. (*Journ. de Pharm.*, Dec. 1832.)

Porphyroxin may be obtained, according to Merck, by treating powdered opium, previously exhausted by boiling ether, and then made into a pulp by means of water,

* The following table by Hesse gives a brief abstract of the characteristic properties of most of the new alkaloids, discovered by himself, and of codeia and cryptopia, which, though previously discovered, he examined along with the others.

	DISSOLVED IN PURE SULPHURIC ACID.		IN ACID WITH OXIDE OF IRON.	
	At 20° C.	At 150° C.	At 20° C.	At 150° C.
Codeia	Colourless	Dirty green	Blue	Dirty green.
Codamia	Colourless	Dirty red-violet	Intense green-blue	Deep violet.
Laudania	Very faint rose-red	Deep red-violet	Brown-red, similar to solution of nitrate of cobalt	At first green then deep violet.
Laudanosia	Faint rose-red, somewhat stronger than laudania	Deep red-violet	Brown-red, similar to solution of nitrate of cobalt	At first green, then deep violet.
Cryptopia	At first yellow, then violet, and finally deep violet	Dirty green	Deep violet	Dirty green.
Protopia	At first yellow, then red, and finally bluish-red	Dirty greenish-brown.	Deep violet	Dirty greenish-brown.

(*Pharm. Journ.*, Jany. 1872, p. 549).—*Note to the fourteenth edition.*

with carbonate of potassium, agitating it with ether, evaporating the ethereal solution, dissolving the residue in dilute muriatic acid, and precipitating with ammonia. Paramorphia and porphyroxin are thus obtained together. These are to be dissolved in ether, which, by spontaneous evaporation, deposits the former in crystals, and the latter in the form of resin. The porphyroxin is separated by the cautious use of alcohol, and obtained by the evaporation of the alcoholic solution. It is neuter, crystallizable in shining needles, insoluble in water, soluble in alcohol and ether, and characterized by the property of assuming a purple-red or rose colour, when heated in dilute muriatic acid. (*Journ. de Pharm.*, 3e sér., xiv. 188.) Since its discovery by Merck, it has been fully investigated by Hesse, and ascertained, instead of a proximate principle, to be in fact a very complex substance, consisting of several alkaloids associated together, of which an account, derived from Hesse, is given in the preceding pages.

Meconic acid is in white crystalline scales, of a sour taste followed by bitterness, fusible and volatilizable by heat, soluble in four parts of boiling water, soluble also in cold water and alcohol, with the property of reddening vegetable blues, and forming salts. Its compounds with the earths and heavy metallic oxides are generally insoluble in water. Its characteristic properties are, that it produces a blood-red colour with the salts of sesquioxide of iron, a green precipitate with a weak solution of ammoniated sulphate of copper, and white precipitates soluble in nitric acid, with acetate of lead, nitrate of silver, and chloride of barium. It is obtained by macerating opium in water, filtering the infusion, and adding a solution of chloride of calcium. Meconate and sulphate of calcium are precipitated. The precipitate, having been washed with hot water and with alcohol, is treated with dilute muriatic acid at 180°. The meconate of calcium is taken up, and, upon the cooling of the liquid, bimeconate of calcium is deposited. This is dissolved in warm concentrated muriatic acid, which deposits pure meconic acid when it cools. It may be freed from colouring matter by neutralizing it with potassa, decomposing the crystallized meconate thus obtained by muriatic acid, and again crystallizing. Meconic acid has little or no action on the system, and is not used separately in medicine; but its natural relation to morphia requires that it should be understood.

Thebolactic acid, which was discovered by the Messrs. T. and H. Smith, of Edinburgh, appears to be a constant ingredient in opium. These chemists were led to search for it by the consideration that the quantity of meconic acid present is insufficient to saturate the whole of the morphia and other bases, which must, therefore, be neutralized by some other acid. They obtained it from the impure mother-liquid of morphia, after all the alkaloids had been thrown down by the addition of an alkali, by concentrating the liquors to a thick consistence, adding alcohol largely, filtering, precipitating all basic matter by sulphuric acid, filtering again, carefully neutralizing by milk of lime, distilling to recover the alcohol, and finally evaporating the residuary contents of the still to a syrupy consistence. After standing for about a week, the syrupy liquid will be seen to have set into a crystalline mass of thebolactate of calcium. This, being purified by repeated solution and crystallization, and by animal charcoal, is decomposed by adding the equivalent quantity of sulphuric acid, and separating the liberated thebolactic acid by means of alcohol. Stenhouse has shown that the new acid has the composition of lactic acid; but, according to Dr. Anderson, it is only isomeric and not identical with that acid. Its name implies the admission of its close relation to lactic acid, of which it may be regarded as a variety. The ready crystallization of its salt with lime is a characteristic property. (*Pharm. Journ.*, July, 1865, p. 50.)

Incompatibles. All the substances which produce precipitates with opium do not necessarily affect its medical virtues; but the *alkalies*, and all vegetable infusions containing *tannic* and *gallic acids*, are strictly incompatible; the former separating and precipitating the active principle, the latter forming with it an insoluble compound.

The proportion of morphia which any particular specimen of opium will furnish, may be considered as the best test of its value, except that of actual trial upon the system. Good opium should yield from 10 to 12 per cent. of the impure morphia precipitated from the infusion by ammonia with alcohol, according to the process of

the U. S. Pharmacopœia. (See *Morphia.*) The U. S. Pharmacopœia directs that opium, dried, at a heat of 212° F., until it ceases to lose weight, shall yield at least 10 per cent. of the pure alkaloid by the officinal process. The Br. Pharmacopœia requires at least from 6 to 8 per cent.

M. Guilliermond gives the following mode of estimating the strength of opium, as tested by the amount of morphia to be obtained from it. Take 15 parts of opium, cut it in pieces, rub it up with 60 parts of alcohol of 71°, drain the mixture on linen and express, treat the residue with 40 parts of alcohol also of 71°, unite the tinctures in a vessel with a large mouth into which 4 parts of solution of ammonia (22° Cartier) have been introduced, and allow the mixture to stand 12 hours. The crystals which form are to be put upon linen, washed repeatedly with water to separate the meconate of ammonium, and then introduced into a small vessel of water. The crystals of narcotina, being very light, continue suspended in the water, and may be decanted along with it, while those of morphia, remaining at the bottom, may be collected and weighed. Good opium, treated in this way, will yield for the fifteen parts employed from 1·25 to 1·75 parts of the crystals of morphia. (*Journ. de Pharm.*, xvi. 18.)*

* As the morphia obtained in the above process is not quite free from narcotina, M. De Vrij proposes the following modification. The mixture of morphia and narcotina, precipitated from the alcoholic solution by ammonia, after being washed, is to be heated with a slight excess of sulphate of copper dissolved in pure water. The narcotina has no action on the sulphate of copper, which is decomposed by the morphia, producing sulphate of morphia and tribasic sulphate of copper. The latter and the narcotina remain undissolved, and a solution is obtained containing sulphate of morphia with a little sulphate of copper. This, having been filtered, is treated first with sulphuretted hydrogen which precipitates the copper, and afterwards with ammonia which throws down the morphia. (*Pharm. Journ.*, x. 77.)

M. Fordos' method of estimating the proportion of morphia. Practical difficulties having been experienced in the application of M. Guilliermond's method, though much better than any plan previously proposed, the Belgic Academy of Medicine made the offer of a prize, which seems to have elicited the following process, considered by M. Fordos as the easiest of execution, and most accurate in its results. Macerate in 60 cubic centimetres of water 15 grammes of opium, cut into fine slices, agitating occasionally. After 24 hours, or sooner if there is any urgency, pour the mixture into a mortar, and divide the opium thoroughly by the pestle. Then pour the whole on a small filter, and, after the liquid has passed, wash the filter with 15 cubic centimetres of water with which the mortar and pestle have been thoroughly cleansed. Repeat the washing a second and a third time, using each time 10 cubic centimetres of water. The opium is thus sufficiently exhausted. One-third of the mixed liquids is taken in order to determine the quantity of ammonia necessary to precipitate the morphia. To this add the ammonia drop by drop till the liquor offers a slight ammoniacal odour, and then immediately cease. Note the quantity of ammonia consumed. Operate then on the residuary two-thirds of the liquid, representing 10 grammes of opium, with the view of ascertaining the proportion of morphia. Add an equal volume of alcohol of 85°, and twice the quantity of ammonia consumed in the previous operation. A slight excess of ammonia is requisite to separate all the morphia. Agitate the liquor, and allow it to stand in a bottle well stopped. Narcotina is soon deposited in fine needles but slightly coloured, and morphia in prisms larger and somewhat more coloured. After two or three days shake the bottle, and then allow it to rest for some hours, in order to give time for the deposition of the whole of the morphia. Collect the crystals on a small filter, and wash them with 15 or 20 cubic centimetres of weak alcohol, of only 40 or 50 to the 100. This washing removes the adhering mother-water, and frees the crystals from the colouring matter. There remain crystals of morphia little coloured, and white crystals of narcotina. Allow them to dry on the same funnel. Then pour on the filter from 10 to 15 cubic centimetres of pure sulphuric ether; and afterwards, at two or three times, from 10 to 15 cubic centimetres of chloroform. The crystals of narcotina are instantly dissolved in the chloroform, and carried off with it; and the morphia remains untouched. Lastly wash the filter with 15 cubic centimetres of ether, to remove the last traces of chloroform and narcotina. Dry the filter, and weigh the crystals of morphia, which may be very easily detached. To verify the result, ascertain that the crystals are entirely soluble in a solution of caustic potassa. The weight will represent the quantity of morphia in 10 grammes of the opium. We have been particular in presenting each step of the process precisely, as much depends upon a proper manipulation. The French weights and measures have been given for the sake of accuracy; but the operator may easily translate them into the equivalent weights and measures in use with us by consulting the table in the Appendix; or he can use any other convenient weight and measure, taking care to observe the same proportions. (*Journ. de Pharm.*, 3e sér., xxxii. 101.)

In the *Am. Journ. of Pharm.*, for Sept. 1863 (p. 385), is an interesting and valuable article on the assay of opium by Prof. F. F. Mayer, to which, for want of space, we must content ourselves with referring the reader. It is highly important that the apothecary should be able to determine the strength of his opium, and never to use any in his officinal operations, excepting for the preparation of morphia or its salts, which does not come up at least to the percentage required by our officinal standard. Sometimes it may happen that the opium is much stronger in morphia than that in ordinary use, and the consequence may be that an unexpected violence of operation may result. Hence it has been proposed in France to adopt some standard, and by mixing parcels of

Tests of Opium. It is sometimes highly important to be able to ascertain the presence or absence of opium in any suspected mixture. As meconic acid and morphia have been found only in the products of the poppy, if either or both of them be shown to exist in any substance, very strong evidence will be afforded of the presence of opium. The test should, therefore, be applied in reference to the detection of these two principles. If an aqueous infusion of the substance examined yields a red colour with the tincture of chloride of iron, there is presumptive evidence of the presence of meconic acid. Greater certainty may be obtained by the following process Add in excess to the filtered liquor a solution of acetate of lead. If opium be present, there will be a precipitate of meconate of lead, and the acetates of morphia and lead will remain in solution. The precipitate is then to be suspended in water, and decomposed, either by adding a little dilute sulphuric acid, which forms sulphate of lead and leaves the meconic acid in solution, or by passing through it a stream of sulphuretted hydrogen, removing by filtration the precipitated sulphuret of lead, and heating the clear liquor so as to drive off the sulphuretted hydrogen. With the clear liquor thus obtained, if it contain meconic acid, the tincture of chloride of iron will produce a striking red colour, ammoniated sulphate of copper a green precipitate, and acetate of lead, nitrate of silver, and chloride of barium, white precipitates soluble in nitric acid. Sulphocyanide of potassium, which, according to Dr. Wright, is an invariable constituent of saliva (*Simon's Chemistry*, ii. 6), produces a red colour with the salts of sesquioxide of iron, resembling that produced by meconic acid ; but, according to Mr. Everitt, this colour is entirely and at once destroyed by a solution of corrosive sublimate, which has no effect on the red colour of the meconate of iron. (See *Am. Journ. of Pharm.*, xii. 88.) On the contrary, chloride of gold reddens a solution of hydrosulphocyanic acid or a sulphocyanide, but not of meconic acid. Pereira says the acetates also redden the salts of sesquioxide of iron, but do not afford the results just mentioned with acetate of lead and chloride of barium. To test the presence of morphia, the liquid from which the meconate of lead has been precipitated,

different strengths in proper proportion to get an opium which shall always be the same. In a paper on opium in the *Am. Journ. of Pharm.* (March, 1860, p. 115), Dr. Squibb has treated on this subject, and proposes a preparation which, whatever may be the strength of the opium used, shall always have a fixed value. Could such a preparation, based on sound principles, and of sufficiently easy execution, receive the sanction of our national code, it would certainly be of great practical importance. (*Notes to the twelfth edition.*)

M. A. Guilliermond, the son, believes that by giving more precision to his father's method identical results may be obtained; and with this view he gives the following modification. Take 15 grammes of opium, and rub it well in a mortar with 110 grammes of alcohol at 70 per cent. (120 cubic centimetres). After half an hour of trituration, when the disintegration is complete, ascertain the weight of the mixture, which ought to be 125 grammes, and, if not, add enough alcohol to make it so; then shake thoroughly, that the tincture may be uniformly saturated; filter into a little bottle with a large mouth 80 cubic centimetres, which should represent exactly two-thirds of the opium used, or 10 grammes; cause 2 grammes of liquid ammonia (22° B.), by means of a small glass tube drawn to a point at the lower end, to reach without disturbing the liquid at the bottom of the vessel; withdraw the tube by degrees, without agitating the liquid; cork the bottle so as to prevent evaporation. At the end of 36 hours the morphia will have separated in gravelly crystals, more or less rusty-coloured, but well formed. If it be accompanied with narcotine, this will crystallize in white shining needles, which in most cases can be separated by washing with water. The precipitate, washed with boiling water will represent, in decimal relation, the proportion of morphia to the opium. By proceeding on this plan, results will be obtained identical among themselves; but it is very certain that the morphia deposited does not exactly represent that contained in the opium, since the alcohol retains a portion: but it expresses the proportion relatively and sufficiently. (*Journ. de Pharm. et de Chim.*, Août, 1867, p. 102.)

M. Roussille proposes to modify Guilliermond's process, so as to shorten it without impairing its efficiency. The 15 grammes of opium are treated with 25 grammes of boiling water to complete disintegration; 60 grammes of boiling alcohol of 40° are added; the mixture is digested for an nour, and strained through linen; and the residue is again treated with 10 grammes of water and 60 grammes of alcohol, as before. The residue is now treated with 50 grammes of boiling absolute alcohol. All the liquids, mixed together and cooled, are carefully filtered, evaporated to one-third, and again filtered after cooling. Then the morphia is precipitated with 10 grammes of solution of ammonia (22° B. of the Fr. Codex); and the liquid is evaporated over sulphuric acid. At the end of three days the crystals are collected, and washed with ether and with water. The same results are given as by Guilliermond's process, which occupies more than five days, while this requires only three. (*Chem. News*, Oct. 5, 1866.)

Another modification is proposed by M. Fleury, in which oxalate of ammonium is added to the water with which the opium is first treated, in order to get rid of the meconate of calcium, the presence of which embarrasses the process. For details the reader is referred to the *Journ. de Pharm et de Chim.* (Août, 1867, p. 99).—*Notes to the thirteenth edition.*

and which may be supposed to contain the acetates of morphia and lead, must be freed from the lead by a stream of sulphuretted hydrogen, and then from the sulphuretted hydrogen by heat; after which the following reagents may be applied:—viz. 1. nitric acid, which colours the morphia red; 2. iodic acid, which is decomposed by the morphia with the extrication of iodine, which colours the liquid reddish-brown, and, if starch is present, unites with it to form a blue compound; 3. solution of ammonia, which, if carefully added, so as not to be in excess, throws down a precipitate of morphia soluble in a great excess of that alkali or of potassa; and 4. tannic acid, which precipitates tannate of morphia. If the precipitate thrown down by ammonia afford a deep-red colour becoming yellow with nitric acid, and a blue colour with sesquichloride of iron, the proofs may be considered as complete.*

Though opium is little injured by time if well kept, yet it does undergo spontaneous change, and M. Guibourt found less morphia in a specimen which had been in his possession nearly twenty years than it had yielded in its recent state. There was also more colouring matter. (*Ann. de Thérap.*, A.D. 1863, p. 5.)

Among the adulterations of opium, starch has been detected in a specimen examined by Mr. J. T. King. The drug was unduly brittle, and evidences of starch were afforded both by the microscope and by iodine. From the size and form of the granules, Mr. King inferred that the starch was that of the bean. (*Am. Journ. of Pharm.*, Jan. 1869, p. 1.) The probability is that powdered beans were the substance used.

Medical Properties and Uses. Opium is a stimulant narcotic. Taken by a healthy person in a moderate dose, it increases the force, fulness, and frequency of the pulse, augments the temperature of the skin, invigorates the muscular system, quickens the senses, animates the spirits, and gives new energy to the intellectual faculties. Its operation, while thus extending to all parts of the system, is directed with peculiar force to the brain, the functions of which it excites sometimes even to intoxication or delirium. In a short time this excitation subsides; a calmness of the corporeal actions, and a delightful placidity of mind succeed; and the individual, insensible to painful impressions, forgetting all sources of care and anxiety, submits himself to a current of undefined and unconnected, but pleasing fancies; and is conscious of no other feeling than that of a quiet and vague enjoyment. At the end of half an hour or an hour from the administration of the narcotic, all consciousness is lost in sleep. The soporific effect, after having continued for eight or ten hours, goes off, and is generally succeeded by more or less nausea, headache, tremors, and other symptoms of diminished or irregular nervous action, which soon yield to the recuperative energies of the system; and, unless the dose is frequently repeated, and the powers of nature worn out by over-excitement, no injurious consequences ultimately result. Such is the obvious operation of opium when moderately taken; but other effects, very important in a remedial point of view, are also experienced. All the secretions, with the exception of that from the skin, are in general either suspended or diminished; the peristaltic motion of the bowels is lessened; pain and inordinate muscular contraction, if present, are allayed; and general nervous irritation is composed, if not entirely relieved.

In doses insufficient to produce the full soporific effect, the stimulant influence upon the mental functions continues longer, and the subsequent calming effect is sustained for hours; sleep being not unfrequently prevented, or rendered so light and dreamy that, upon awaking, the patient will scarcely admit that he has slept at all. From large doses the period of excitement and exhilaration is shorter, the soporific

* Merck has proposed a test of opium, founded on the property, which characterizes porphyroxin, of assuming a red colour when heated in dilute muriatic acid. The suspected liquid is first to be carefully evaporated, a few drops of solution of potassa are to be added, and the mixture agitated with ether. The ethereal solution being filtered off, a slip of unsized paper is to be dipped into it and dried; and the moistening and drying should be repeated several times. The paper thus prepared is to be moistened with dilute muriatic acid, and then exposed to the vapour of boiling water. If it become reddened, opium may be inferred to exist in the liquid tested. Heusler states that this test is not applicable to the aqueous solution or extract of opium, because porphyroxin is insoluble in water; but Mr. Robertson, of Rotterdam, has found it to succeed with the watery extract, and infers that the porphyroxin is so combined in opium as to render it in some measure soluble. (*Journ. de Pharm.*, 3e sér., xxii. 190.)—*Note to the tenth edition.*

and anodyne effects are more intense and of longer duration, and the succeeding symptoms of debility are more obvious and alarming.

From quantities sufficient to destroy life, after a brief excitement, the pulse is reduced in frequency though not in force, muscular strength is diminished, and feelings of languor and drowsiness supervene, which soon eventuate in a deep apoplectic sleep. A stertorous respiration; a dark suffusion of the countenance; a full, slow, and labouring pulse; an almost total insensibility to external impressions; and, when a moment of consciousness is obtained by violent agitation or irritating applications, a confused state of intellect, and an irresistible disposition to sink back into comatose sleep, are symptoms which, for the first few hours, attend the operation of the poison. Though not signs of an elevated condition of the bodily powers, neither do they imply a state of pure, unmixed debility. The pulse is, indeed, slow; but it is often so full and strong as even to suggest the use of the lancet. In the space, however, of a few hours, varying according to the quantity of the narcotic taken, and the powers of the patient's constitution, a condition of genuine debility ensues; and this condition will be hastened in point of time, though it will be more under the control of remedies, if the opium be evacuated from the stomach. Called to an individual labouring under the influence of a fatal dose of opium, at a period from six to eight hours after it has been swallowed, the practitioner will generally find him with a cool, clammy skin; cold extremities; a pallid countenance; a feeble, thread-like, scarcely perceptible pulse; a slow, interrupted, almost gasping respiration; and a torpor little short of absolute, death-like insensibility. Death soon follows, unless relief is afforded.

No appearances are revealed by the dissection of those who have died of the immediate effects of opium, which can be considered as affording satisfactory evidence of its mode of operation. The redness occasionally observed in the mucous membrane of the stomach is not constantly present, and is ascribable as much to the irritating effect of remedies prescribed, or to the spirituous vehicle of the opiate, as to the action of the poison itself. Such at least is the inference drawn by Nysten from his experiments and observations; and Orfila states that the stomachs of dogs which he had killed by opium, internally administered, did not present the slightest vestige of inflammation. The force of the medicine is directed to the cerebral and nervous functions; and death is produced by a suspension of respiration, arising from the want of due influence from the brain. The section of the par vagum, on both sides, has not been found to prevent or retard the death of animals to which large doses of opium have been given, nor even materially to modify its narcotic effects. (*Nysten, quoted by Orfila.*) It would seem, therefore, that the active principle is conveyed into the circulation, and operates upon the brain, and probably upon the nervous system at large, by immediate contact. It is an error to attribute the anodyne, sedative, and soporific effects of the medicine to the previous excitement. They are, as much as this very excitement, the direct results of its action upon the brain. It is in the state of exhaustion and collapse which ensue after the peculiar influence of the opium has ceased, that we are to look for an illustration of that principle of the system, by which any great exaltation of its functions above the natural standard is followed by a corresponding depression. We may be permitted to advance the conjecture, that the excitement which almost immediately supervenes upon the internal use of opium, may be in some degree produced by means of nervous communication; while the succeeding narcotic effects are attributable to its absorption and entrance into the circulation; and the ultimate prostration of all the powers of the system is a necessary consequence of the previous agitation of the various organs.

On some individuals opium produces peculiar effects, totally differing from the ordinary results of its operation. In very small quantities it occasionally gives rise to excessive sickness and vomiting, and even spasm of the stomach; in other cases it produces restlessness, headache, and delirium; and we have known it, even in large doses, to occasion obstinate wakefulness. The headache, want of appetite, tremors, &c., which usually follow, in a slight degree, its narcotic operation, are uniformly experienced by some individuals to such an extent as to render the use of the medicine very inconvenient. It is possible that some of these disagreeable effects may arise not from the meconate of morphia contained in the opium, but from some other

of its ingredients; and those which do result from the meconate may not be produced by other salts of morphia. It has, indeed, been found that the operation of opium may often be favourably modified by changing the state of combination in which its active principle naturally exists. Dissolved in vinegar or lemon juice, it had been known to act in some instances more pleasantly and effectually than in substance or tincture, long before physicians had learned to explain the fact by referring it to the production of an acetate or citrate of morphia. When upon the subject of morphia, we shall take occasion to treat of the medical properties of this principle in its various combinations.

An occasional effect of opium, which has not yet been alluded to, is a disagreeable itching or sense of pricking in the skin, sometimes attended with a species of miliary eruption. We have found the effect to result equally from all the officinal preparations of this narcotic.

The general operation of opium may be obtained by injecting it into the rectum, or applying it to the surface of the body, especially upon a part denuded of the cuticle. It has appeared to us, when thus applied, to produce less general excitement, in proportion to its other effects, than when administered by the mouth; but we do not make the statement with entire confidence. It is said that, when introduced into the cellular membrane, it acts with great energy; and, when thrown into the cavity of the peritoneum, speedily produces convulsions and death. Injected into the cavity of the heart, it impairs or altogether destroys the powers of that organ.

The local effects of opium are similar in character to those which follow its general operation. An increased action of the part is first observable; then a diminution of its sensibility and contractility; and the latter effect is more speedy, more intense, and of longer continuance, the larger the quantity applied.

In all parts of the world, opium is habitually employed by many with a view to its exhilarating and anodyne influence. This is particularly the case among the Mahomedans and Hindoos, who find in this narcotic the most pleasing substitute for alcoholic drinks, which are interdicted by their religion. In India, Persia, and Turkey, it is consumed in immense quantities; and many nations of the East smoke opium as those of the West smoke tobacco. This is not the place to speak of the fearful effects of such a practice upon both the intellectual and bodily faculties.

The use of opium as a medicine can be clearly traced back to Diagoras, who was nearly contemporary with Hippocrates; and it was probably employed before his time. It is at present more frequently prescribed than perhaps any other article of the materia medica. Its extensive applicability to the cure of disease will be rendered evident by a view of the indications which it is calculated to fulfil. 1. It is excitant in its primary action. In low or typhoid complaints, requiring a supporting treatment, it exalts the action of the arterial and nervous systems, and, in moderate doses frequently repeated, may be employed with advantage in conjunction or alternation with other stimulants. 2. It relieves pain more speedily and effectually than any other known medicine taken into the stomach. If possessed of no other property than this, it would be entitled to high consideration. Not to mention cancer, and other incurable affections, in which the alleviation afforded by opium is of incalculable value, we have numerous instances of painful diseases which are not only temporarily relieved, but entirely cured by the remedy; and there is scarcely a complaint in the catalogue of human ailments, in the treatment of which it is not occasionally demanded for the relief of suffering, which, if allowed to continue, might aggravate the disorder, and protract if not prevent a cure. 3. Another very important indication, which, beyond any other narcotic, it is capable of fulfilling, is the production of sleep. For this purpose it is given in a great variety of diseases; whenever, in fact, morbid vigilance exists, not dependent on acute inflammation of the brain. Among the complaints in which it proves most serviceable in this way is delirium tremens, or the mania of drunkards. Opium produces sleep in two ways; first, by its direct operation on the brain, secondly, by allaying that morbid nervous irritation upon which wakefulness often depends. In the latter case it may frequently be advantageously combined with camphor, or Hoffman's anodyne. 4. Opium is powerfully antispasmodic. No medicine is so efficient in relaxing spasm, and in controlling those

irregular muscular movements which depend on unhealthy nervous action. Hence its great importance as a remedy in tetanus; colic; spasm of the stomach attending gout, dyspepsia, and cholera; spasm of the ureters in nephritis, and of the biliary ducts during the passage of calculi; and in various convulsive affections. 5. Probably dependent upon a similar influence over the nervous system, is the property which it possesses of allaying general and local irritations, whether exhibited in the nerves or blood-vessels, provided the action do not amount to positive inflammation; and even in this case it is often prescribed with advantage. Hence its use in composing restlessness, quieting cough, and relieving nausea, tenesmus, and strangury. 6. In suppressing morbid discharges, it answers another indication which fits it for the treatment of a long list of diseases. This effect it is, perhaps, enabled to produce by diminishing the nervous energy upon which secretion and muscular motion depend. Upon this principle it is useful in diarrhœa, when the complaint consists merely in increased secretion into the bowels, without high action or organic derangement; in consumption, chronic catarrh, humoral asthma, and other cases of morbidly increased expectoration; in diabetes; and in certain forms of hemorrhage, particularly that from the uterus, in combination with other remedies. 7. It remains to mention one other indication; that, namely, of producing perspiration, in fulfilling which, opium, conjoined with small doses of emetic medicines, is pre-eminent. No diaphoretic is so powerful or so extensively used as a combination of opium and ipecacuanha. We shall speak more fully of this application of the remedy under the head of *Pulvis Ipecacuanhæ Compositus.* It is here sufficient to say, that its beneficial effects are especially experienced in rheumatism, the bowel affections, and certain pectoral diseases.*

From this great diversity of properties, and the frequent occurrence of those morbid conditions in which opium affords relief, it is often prescribed in the same disease to meet several indications. Thus, in idiopathic fevers, we frequently meet with morbid vigilance and great nervous irritation, combined with a low condition of the system. In typhous pneumonia, there is the same depression of the vital powers, combined often with severe neuralgic pains, and much nervous irritation. In diarrhœa, besides the indications presented by the spasmodic pain and increased discharge, there is a strong call for the diaphoretic operation of the opium. It is unnecessary to multiply instances. There is hardly a complaint which does not occasionally present a complication of symptoms demanding the use of this remedy.

But a medicine possessed of such extensive powers may do much injury, if improperly directed; and conditions of the system frequently occur, in which, though some one of the symptoms calls for its use, others, on the contrary, are incompatible with it. Thus, opium is contraindicated by a high state of inflammatory excitement, which should be reduced before we can with propriety venture upon its employment; and, when there is doubt as to the sufficiency of the reduction, the opium should be given in combination with tartarized antimony or ipecacuanha, which modify its stimulant

* The extraordinary diversity of powers possessed by opium is certainly ascribable in part to the large number of its alkaloids, all of which produce some effect on the system, and between some of which there is a striking difference in effect. Our knowledge, however, of the precise mode of operation of these alkaloids, with the exception of two or three of them, was until recently very deficient, and is still far from satisfactory. M. Claude Bernard has, within a few years, by numerous experiments on the inferior animals, dispelled this ignorance in some degree; but his results must be received with much hesitation, as regards the physiological action on man; and should not be relied on by the practitioner until confirmed by the observation of the physiological experimentalist, and the practical therapeutist. This has been done to a considerable extent in relation to morphia, codeia, narcotina, and very recently to narceia. But in relation to the latter three of these, much remains to be done; and as to the other alkaloids, almost all. The following are the conclusions of M. Bernard, in relation to the six opium alkaloids examined by him. There are three principal properties in these alkaloids: 1. the soporific action; 2. the excitant or convulsive action: and 3. the poisonous action. The six alkaloids may be thus arranged in relation to these actions. In reference to the soporific power, narceia stands first, next morphia, and last codeia. The three others are destitute of the soporific property. In reference to the convulsive power, all have more or less of it; the order in which they stand in this respect being: 1. thebaina; 2. papaverina; 3. narcotina; 4. codeia; 5. morphia; 6. narceia. In the poisonous relation, we have 1. thebaina; 2. codeia; 3. papaverina; 4. narceia; 5. morphia; and 6. narcotina. (*Arch. Gén.*, 6e sér., iv. 462.) For further particulars the reader is referred to the journal just mentioned, and to the author's work on Therapeutics and Pharmacology (3d ed., i. 766.)—*Note to the thirteenth edition.*

operation, and give it a more decided tendency to the skin. It is also contraindicated by inflammation of the brain, or strong determination of blood to the head, by deficient secretion from inflamed mucous membranes, as in the early stages of bronchitis, and generally by constipation. When, however, the constipation depends upon intestinal spasm, as in colic, it is sometimes relieved by the antispasmodic action of the opium; and the binding effects of the medicine may be counteracted by laxatives.

Opium may be administered in substance or tincture. In the former state it is given in the shape of a pill, which, as a general rule, should be formed out of powdered opium, as it is thus more readily dissolved in the liquors of the stomach, and therefore operates more speedily and effectually than when made, as it sometimes is, immediately from the plastic mass. There is no medicine of which the dose is more variable, according to the habits of the patient, the nature of the complaint, or the purpose to be effected. While in catarrh and diarrhœa we often prescribe not more than one-fourth or one-third of a grain, in tetanus it has been administered, without abating the violence of the symptoms, in the enormous quantity of two drachms in twenty-four hours; and in a case of cancer of the uterus, under the care of the late Drs. Monges and La Roche, of this city, the quantity is stated to have been gradually increased till the amount taken during one day, either in the shape of tincture or in substance, was equivalent to more than three ounces. The medium dose, in ordinary cases of disease, to produce the anodyne and soporific effects of the medicine, is one grain.

Experience has shown that the action of opium is sometimes favourably modified by employing those constituents only which are soluble in water. Hence the watery extract is sometimes advantageously substituted for the drug itself, and an infusion for the tincture.* (See *Extractum Opii.*)

Opium may often be administered with great advantage by the rectum. In this way it operates most advantageously in obstinate vomiting, painful nephritic and uterine affections, strangury from blisters, and dysenteric tenesmus. It may be employed as a suppository, or in the form of enema made with laudanum and a small quantity of viscid liquid, as flaxseed tea, mucilage of gum arabic, or starch prepared with hot water. The quantity, as a general rule, may be three times that administered by the mouth; but the relative susceptibility of the stomach and rectum in different persons is not always the same; and the effects produced by the narcotic, given by injection, are sometimes much greater than was anticipated. The practitioner, moreover, should take into consideration the previous habits of the patient. In an individual long accustomed to take opium internally, and whose stomach will receive large doses with impunity, it is possible that the rectum may not have lost, in a proportionate degree, its absorbing power or susceptibility; and that serious consequences might result by adhering, in such a case, to the general rule as to the relative quantity to be given in the way of enema or suppository.

In some one of its liquid preparations, opium is often used locally as an addition to collyria in ophthalmia, to injections in gonorrhœa, and to lotions and cataplasms in various complaints of the skin, and external pains, as those of gout and rheumatism. It is also employed in substance, in the form of a plaster or cataplasm made from the powder. But its external use requires some caution, especially when the skin is deprived of the cuticle. Death is said to have resulted from a cataplasm, containing a large quantity of laudanum, applied to the epigastrium. (*Ann. de Thérap.*, 1843, p. 5.)

When opium has been taken in an overdose, the only effectual mode of relief is immediately to evacuate the stomach, either by the stomach-pump, or, when this is

* A good extemporaneous infusion of opium cannot well be prepared. Hence, to obtain the effects of this preparation, it is best to dissolve the extract in water. Mr. Eugene Dupuy, of New York, first prepares an infusion, and then adds alcohol enough to preserve it; so that the preparation may be kept ready made by the apothecary, to be used as a substitute for laudanum. He takes ten drachms of opium, reduces it to a thin pulp with water, allows the mixture to stand 48 hours, then percolates with water so as to obtain twelve fluidounces of infusion, to which four fluidounces of alcohol of 95 per cent. are added. The preparation is intended to be of about the same strength as laudanum. Consequently the dose should be from twelve to fifteen minims, or about as many drops. (*Am. Journ. of Pharm.*, xxiii. 211.)

not attainable, by the more active emetics, such as tartarized antimony, sulphate of zinc, or sulphate of copper, conjoined with ipecacuanha. Emetics are preferable to the stomach-pump, when opium has been swallowed in substance; as the capacity of the tube is insufficient to permit the passage of the masses in which the poison is sometimes taken. The operation of the emetic should be promoted by a very free use of warm drinks, by irritating the fauces with a feather, by keeping the patient in motion, and, if the insusceptibility to the action of the remedy is very great, by dashing cold water upon the head and shoulders, thus counteracting, for a moment, the narcotic influence of the opium upon the brain, and enabling this organ to receive and transmit the necessary impressions. Advantage will sometimes accrue from a moderate loss of blood, which tends to diminish the cerebral congestion, and thus not only awaken susceptibility to the impression of the emetic, but obviate also the danger of hemorrhagic effusion; but the bleeding should not be carried far, in consequence of danger from the subsequent debility. For the same purpose of favouring the emetic action, it has been recommended to pass a current of electricity through the brain.* After the evacuation of the poison, the chief indication is to obviate the debility which generally supervenes, and which, when the quantity of the narcotic has been large, or it has remained long in the stomach, is sometimes alarming and even fatal. For this purpose the carbonate of ammonium, or the aromatic spirit of ammonia, with wine-whey, may be employed internally, and sinapisms and stimulant frictions applied to the surface. The practitioner should not despair, even if called at the last moment. The stomach tube may be applied at any period; and it is possible that, even without evacuation of the stomach, a little aid may enable the system to resist the prostrating influence of the poison, if not taken in an overwhelming dose. The electro-magnetic battery was employed with great advantage in a case of prostration of this kind by Dr. Page, of Valparaiso; and the practice has been imitated in Europe and this country. Strong coffee, under these circumstances, has been found useful, and is obviously suggested in all cases by its powerful influence in producing wakefulness. Caffein has been employed as a substitute for coffee; but, as this principle is not the only active one in coffee, it should not be relied on until further tested by experience. Should other measures fail, resort may be had to artificial respiration, by which the functions of the lungs and heart may be sustained till the brain has struggled through its conflict with the narcotic, and is enabled to resume its healthful action. Brodie has demonstrated that death from many of the narcotics results from a suspension of the cerebral influence necessary to sustain the respiratory function, and that the heart ceases to act in consequence of the cessation of respiration. If this can be restored artificially before the contractions of the heart have entirely ceased, the circulation may continue, and life be supported for a time without aid from the brain, which now receives a supply of arterial blood, and is thus better enabled to rise above the repressing action of the opium. As this narcotic does not produce structural derangement, but operates chiefly on the nervous power, a favourable result is more likely to be experienced than in poisoning from some other articles of the same class. Several cases are on record, in which patients, apparently in the very last stage, were saved by a resort to artificial respiration.

Off. Prep. Acetum Opii, *U. S.;* Confectio Opii; Emplastrum Opii, *Br.;* Extractum Opii; Morphia, *U. S.;* Morphiæ Hydrochloras, *Br.;* Pilulæ Opii, *U. S.;* Pil. Plumbi cum Opio, *Br.;* Pil. Saponis Composita; Pulvis Cretæ Aromaticus cum Opio, *Br.;* Pulvis Ipecacuanhæ Compositus; Pulvis Kino Compositus, *Br.;* Pulvis Opii Comp.,

* From numerous observations recently recorded, there can be no doubt that a certain antagonism exists between opium on the one hand and belladonna and stramonium on the other, so that these poisons are to a certain extent reciprocally antidotal. For what is known on this subject, the reader is referred to a very interesting article by Dr. Wm. F. Norris, in the *American Journal of Medical Sciences* (Oct. 1862, p. 395). In numerous instances, the administration of belladonna freely, in cases of opium poisoning, so far from adding to the narcotic effect, appears to have superseded the influence of the opium by substituting its own; while the opium in the system has rendered innoxious, quantities of belladonna which might otherwise have produced poisonous effects. Nevertheless, our experience on the subject is not yet sufficient to justify us in abandoning the old treatment of evacuating the stomach, and afterwards supporting the system, which has proved efficacious in so many instances. (*Note to the twelfth edition.*)

Br.; Suppositoria Plumbi Composita, *Br.;* Tinctura Camphoræ Composita, *Br.;* Tinctura Opii; Tinct. Opii Acetata, *U. S.;* Tict. Opii Ammoniata, *Br.;* Tinct. Opii Camphorata, *U. S.;* Tinct. Opii Deodorata, *U. S.;* Trochisci Glycyrrhizæ et Opii, *U. S.;* Unguentum Gallæ cum Opio, *Br.;* Vinum Opii, *U. S.* W.

ORIGANUM. *U. S.*

Origanum. Common Marjoram.

The herb of Origanum vulgare. *U. S.*

This plant was officinal in the former U. S. and Ed. Pharmacopœias, but, as the volatile oil which was ascribed to it, and for which it was chiefly valued, had proved to be really the oil of thyme, it was omitted both in the late U. S. and the Br. Pharmacopœias, though, in consideration of its aromatic properties, it might well have been introduced into the Secondary Catalogue of the former. It has, we think, with great propriety, been restored in the recent revision of our National Code to its original position in the Materia Medica, and of course is replaced in its old position in this work.

ORIGANUM. *Sex. Syst.* Didynamia Gymnospermia. — *Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Strobile four-cornered, spiked, collecting the calyxes. *Corolla* with the upper lip erect and flat, the lower three-parted, with the segments equal. *Willd.*

Two species of Origanum have been used in medicine, *O. Majorana*, or sweet marjoram, and *O. vulgare*, or common marjoram. The former grows wild in Portugal and Andalusia, and is cultivated as a garden herb in other parts of Europe, and in the United States. Some authors, however, consider *O. Majoranoides*, which is a native of Barbary, and closely allied to *O. Majorana*, as the type of the sweet marjoram of our gardens. *Sweet Marjoram* has a pleasant odour, and a warm, aromatic, bitterish taste, which it imparts to water and alcohol. By distillation with water it yields a volatile oil, which was directed by the Edinburgh College among their preparations. It is tonic and gently excitant, but is used more as a condiment in cookery than as a medicine. In domestic practice, its infusion is much employed by the vulgar to hasten the tardy eruption in measles and other exanthematous diseases.

Origanum vulgare. Willd. *Sp. Plant.* iii. 135; Woodv. *Med. Bot.* p. 344, t. 123. This is a perennial herb, with erect, purplish, downy, four-sided, trichotomous stems, about eighteen inches high, and opposite, ovate, entire, somewhat hairy leaves, of a deep yellowish-green colour. The flowers are of a pinkish-purple or rose colour, disposed in roundish, panicled spikes, and accompanied with ovate reddish bractes, longer than the calyx. This is tubular and five-toothed, with nearly equal segments. The corolla is funnel-shaped, with the upper lip erect, bifid, and obtuse, the lower trifid, blunt, and spreading. The anthers are double, the stigma bifid and reflexed. The plant is a native of Europe and America. In this country it grows along the roadsides, and in dry stony fields and woods, from Pennsylvania to Virginia, and is in flower from June to October; but it is not very abundant, and is seldom collected for use. It has a peculiar, agreeable, aromatic odour, and a warm, pungent taste. These properties it owes to a volatile oil, which was formerly employed, but has been superseded, in great measure, if not altogether, by the oil of thyme. It may be separated by distillation with water. Origanum is gently tonic and excitant, and has been used in the form of infusion as a diaphoretic and emmenagogue, and externally as a fomentation; but it is at present little employed.

Off. Prep. Oleum Origani. *U. S.* W.

OS. *U. S.*

Bone.

OS USTUM. *Br.*

Bone Ash.

The residue of Bones, which have been burned to a white ash in contact with air. *Br.*

Os, *Fr.;* Knochen, *Germ.;* Ossa, *Ital.;* Huesos, *Span.*

Bones are employed in several pharmaceutical processes, and those derived from domestic quadrupeds, especially the ox, are the kind intended.

Properties, &c. Bones are solid, white, and of a lamellated texture, and constitute the skeleton of the superior orders of animals, of which they are the hardest and densest parts. They consist of a cellular gelatinous tissue, the cavities of which are filled with certain earthy salts. When subjected to destructive distillation, in *close* vessels, they are decomposed without alteration of shape, lose about three-sevenths of their weight, become brittle, and are converted into a black substance, containing the earthy salts of the bone, and constituting the species of animal charcoal called *bone-black.* (See *Carbo Animalis.*) The portions which distil over consist of the usual ammoniacal products derived from animal matter. (See *Ammonii Chloridum.*) Before the distillation is performed, the bones are boiled with water, to separate the fat, which amounts to 5 or 6 per cent.; but gelatin is at the same time extracted, with the effect of rendering the bones less fitted to furnish a good bone-black. In view of this fact, M. Deiss, of Paris, has proposed to extract the fat by bisulphide of carbon, which gives a product of 10 or 12 per cent., without injuring the bones for subsequent conversion into bone-black. (*Am. Journ. of Pharm.*, July, 1856, p. 356.) When calcined in *open* vessels, bones lose more of their weight in consequence of the combustion of the animal matter, and are converted into a white friable substance, consisting of the incombustible part, and commonly called *bone-earth*, or *bone-ash;* and a similar residue is obtained by calcining horn. (See *Cornu Ustum.*) Treated with boiling water, a small portion of the gelatinous matter is dissolved; but, when acted on by water in a *Papin's digester*, the whole of it is taken up, and the earthy salts, deprived of their cement, crumble into powder, and become diffused through the solution. When subjected to dilute muriatic acid, the earthy salts are dissolved, and the bone softens without losing its shape, and becomes semitransparent and flexible. The portion remaining unattacked by the acid is the gelatinous tissue, which may be converted into gelatin by long boiling. This is nutritious, and has been prepared so as to form a wholesome aliment by M. d'Arcet. His process for obtaining it consists in digesting bones in weak muriatic acid for seven or eight days, occasionally renewing the acid, plunging them for a few moments in boiling water, and then subjecting them to a strong current of cold water. The pure animal matter, thus procured, is made into cakes, called *portable soup* (*tablettes de bouillon*), by dissolving it in water, concentrating the solution until it gelatinizes, and drying the jelly obtained.

Composition. The bones of different animals, and of the same animal at different ages, vary somewhat in composition. Dry ox-bones, according to Berzelius, consist of bone-gelatin (cartilage of bone) 33·3, bone-phosphate of calcium with a little fluoride of calcium 57·35, carbonate of calcium 3·85, phosphate of magnesium 2·05, and soda with a very little chloride of sodium 3·45 = 100. Human bones differ somewhat in the proportions of their constituents, and in containing traces of iron and manganese. According to Dr. W. Heintz, however, bones exhausted by water, so as to remove the colouring matter of blood, contain not a trace of iron. Marchand found 1 per cent. of fluoride of calcium in human bone. *Bone-phosphate of calcium* consists, according to Mitscherlich, of one eq. of acid and three of lime. This analysis makes it the tribasic subphosphate, and the same composition has been assigned to it by Dr. Heintz.

Uses. Bones are applied to numerous uses. Burnt to whiteness, they furnish bone-phosphate of calcium, from which phosphorus and all its compounds are either directly or indirectly obtained. Subjected to destructive distillation in close vessels, they yield *impure carbonate of ammonium* with empyreumatic oil, and a carbonaceous residue, called *bone-black.* Calcined, pulverized, and washed, they form the material of which *cupels* are made. As bone-dust, they form an excellent manure. Deprived of their earthy salts by weak acids, they furnish a nutritious article of diet. By proper treatment with water they yield several varieties of gelatin, not only the coarser sorts, called size and glue, but also the finer kinds, which are employed, under the name of isinglass, in making animal jellies, and for the clarifying of wines. The hoof bones of the ox, boiled with water, furnish a peculiar oil, called neats-foot oil. (See *Oleum Bubulum.*)

Off. Prep. Calcii Phosphas Præcipitata, *U. S.;* Sodii Phosphas, *U. S.*

Off. Prep. of Bone Ash. Calcis Phosphas, *Br.;* Sodæ Phosphas, *Br.* B.

OVUM. *U. S.*

Egg.

The egg of Phasianus Gallus. *U. S.*

Off. Syn. OVI VITELLUS. *Yolk of Egg.* The yolk of the egg of Gallus Banckiva, *var.* Domesticus (*Temminck*). *Br.*

Œuf, *Fr.;* Ei, *Germ.;* Ovo, *Ital.;* Huevo, *Span.*

The common dunghill fowl is supposed to have come originally from India, where it is found in a wild state. It is now almost everywhere domesticated.

The egg, which is the only officinal product, consists of 1. an exterior covering called the shell; 2. a white, semi-opaque membrane, lining the internal surface of the shell; 3. the white; and 4. the yelk.

1. The shell—*testa ovi* or *putamen ovi*—consists, according to Vauquelin, chiefly of carbonate of calcium, with animal matter, and a minute proportion of phosphate of calcium, carbonate of magnesium, oxide of iron, and sulphur. When exposed to a high degree of heat in the open air, the carbonic acid is driven off, the animal matter consumed, and the lime is left nearly pure.

2. The membrane lining the shell appears to be of an albuminous nature.

3. The white—*albumen ovi*—is a glairy viscid liquid, contained in very delicate membranes, without odour or taste, readily soluble in water, coagulable by the stronger acids, by alcohol, and by a heat of 160° F. Exposed in thin layers to a current of air, it becomes solid, retaining its transparency and solubility in water. By coagulation it is rendered sapid, white, opaque, and insoluble. At a temperature of 212°, one part of it renders one thousand parts of water in which it has been dissolved opaque. It contains, according to Dr. Bostock, in 100 parts, 85 of water, 12 of pure albumen, 2·7 of mucus or uncoagulable matter, and 0·3 of saline substances, including soda with traces of sulphur. The white of egg is precipitated by chloride of tin, chloride of gold, subacetate of lead, sulphate of copper, corrosive sublimate, and tannin. When kept in the fluid state it soon putrefies; but, if carefully dried without coagulation, it may be long preserved unaltered, and may be applied in solution to the same purposes as in its original condition.

4. The yelk—*vitellus ovi*—is inodorous, of a bland oily taste, and forms an opaque emulsion when agitated with water. By heat it is coagulated into a granular solid, which yields a fixed oil by expression. M. Gobley found 100 parts of it to contain 51·486 of water, 15·760 of an albuminoid principle denominated *vitellin*, 21·304 of margarin and olein, 0·438 of cholesterin, 7·226 of oleic and margaric acids, 1·200 of phosphoglyceric acid, 0·034 of chloride of ammonium, 0·277 of chlorides of sodium and potassium and sulphate of potassium, 1·022 of phosphates of calcium and magnesium, 0·400 of animal extract (*extraite de viande*), and 0·553 of colouring matter, traces of iron and of lactic acid, &c. (*Journ. de Pharm.*, 3e sér., xii. 12.) Chevreul states that there are two colouring principles, one reddish containing iron, the other yellow, and similar to the colouring matter of bile. The former is more difficultly soluble in ether than the latter. (*Neues Repertor.*, 1867, xvi. 697.) According to MM. Valenciennes and Frémy, there are both albumen and vitellin in the yelk, the former being dissolved by cold water, the latter precipitated. They consider vitellin as closely analogous to fibrin, from which, however, it differs in not decomposing the peroxide of hydrogen. (*Chem. Gaz.*, Nov. 1, 1855, p. 410.) It is said that the yelk may be kept for a considerable time, without observable change, by adding to it 5 per cent. of sulphate of sodium, in powder or concentrated solution. Granules have been found, with the aid of the microscope, in the yellow of the egg, which are rendered blue by iodine, and have all the other properties of the starch granules. (*Journ. de Pharm.*, Oct. 1868, p. 261.)

To preserve eggs in their entire state, M. Bournouf recommends the following method, which he has found to answer well; affirming that he has eaten eggs which had been kept for two years; and he even thinks that the vitality of the germ may be preserved, in the same manner, for a considerable time. The plan consists simply in covering over each egg completely, by the end of the finger, with an ointment

consisting of one part of beeswax dissolved in two parts of heated olive oil. The oil is absorbed by the shell, and each of its pores becomes filled with the wax, so as entirely to exclude the air. (*Am. Journ. of Pharm.*, Jan. 1866, p. 88.) M. H. Violette, of Louisiana, has found eggs to keep perfectly sound, for six months, by merely covering them well with olive oil by means of the finger. (*Journ. de Pharm.*, Sept. 1867, p. 175.) Another method has been discovered by Mr. Charles Lamont, and patented, which consists in beating the eggs emptied into a long covered trough, by means of a revolving shaft furnished with a series of metallic disks, and then drying the mass by a current of heated air, and scraping off the concreted egg in thin scales or granules. It is said that the egg retains its flavour and fitness for cooking unimpaired. (*Chem. News*, Dec. 27, 1867, p. 323.)

M. Gayon informs us that, though it has been said that by a mixture of different parts of the eggs together, the white with the yellow, for an example, immediate putrefaction is provoked, yet the author denies that the fact is general as stated. He has himself proved the truth of his statement by introducing a mixture of the white and yellow into vessels, which, by using Pasteur's precautions, he has kept free from germs. Treated in this way, though with free contact of pure air, at a temperature from 20° to 36° C., the mixture has kept sound for months. When eggs contain bacteria, or the germs of the mould, these develop rapidly, and cause putrefaction or mouldiness, or both, according as one or the other of these organisms is present; and, if introduced into one of the bottles containing the preserved eggs, these will undergo the same changes in a few days. (*Journ. de Pharm.*, Oct. 1873, p. 292.)

Medical Properties and Uses. Eggs are applied to various purposes in medicine and pharmacy. The shells, powdered and levigated, may be used beneficially as an antacid in diarrhœa. In common with oyster-shells, they possess the advantage of uniting intimately animal matter with carbonate of calcium, the particles of which are thus more thoroughly isolated, and prove more acceptable to the stomach than chalk, in the finest state of division to which the latter can be brought by mechanical means. The dose and mode of preparation are the same as those of oyster-shell. (See *Testa.*)

The *white* of the egg is used chiefly for the clarification of liquids, which it effects by involving, during its coagulation, the undissolved particles, and rising with them to the surface, or subsiding. It is highly recommended as an antidote for corrosive sublimate and sulphate of copper, with which it forms insoluble and comparatively inert compounds. It is sometimes also used for the suspension of insoluble substances in water, but is inferior for this purpose to the yelk, and even to mucilage of gum arabic. Agitated briskly with a lump of alum it coagulates, at the same time dissolving a portion of the alum, and thus forming an astringent poultice, which may be advantageously applied between folds of gauze over the eye, in some states of ophthalmia.

The *yelk* in its raw state is thought to be laxative, and is a popular remedy in jaundice. If beneficial in this complaint, it is probably in consequence of affording a mild nutritious diet, acceptable to the stomach and easily digested. In dyspepsia it is, from this cause, highly useful. The late Dr. Jos. Parrish, of Philadelphia, found great advantage in that complaint from the habitual use of the yelk of egg, beat up with water and a little ginger. In pharmacy, the yelk is highly useful as an intermedium between water and insoluble substances, such as the balsams, turpentine, oils, &c. It is a mistake to employ the white, instead of the yelk of eggs, in preparing emulsions.*

Off. Prep. Mistura Chloroformi, *U. S.;* Mistura Spiritus Vini Gallici, *Br.* W.

* *How to know when an egg is fresh.* An egg remains fresh a day or two in summer, from one to six days in winter. The age of eggs may be told by immersion in salt water of a certain strength. Dissolve 4 ounces of table salt in 40 ounces of water, and, when the solution is perfect, introduce the egg. If only one day old, the egg will sink and touch the bottom of the vessel; if two days old, it will sink, but not to the bottom; if three, it will float near the top; if five or more, it will appear at the surface, and project more or less above it, according to the age. (*Ed. Med. Journ.*, Dec. 1873, p. 672.)—*Note to the fourteenth edition.*

PANAX. *U. S. Secondary.*

Ginseng.

The root of Panax quinquefolium. *U. S.*

Ginseng, *Fr., Germ., Span.;* Ginsen, *Ital.*

Panax. *Sex. Syst.* Pentandria Digynia. (Polygamia Dicœcia, *Linn.*) — *Nat. Ord.* Araliaceæ.

Gen. Ch. Flowers polygamous. *Umbel* simple. *Calyx* five-toothed. *Corolla* of five petals. *Berry* inferior, subcordate, two, sometimes three-seeded. *Calyx* in the male flower entire. *Nuttall.*

Panax quinquefolium. Willd. *Sp. Plant.* iv. 1124; Woodv. *Med. Bot.* p. 149, t. 58; Bigelow, *Am. Med. Bot.* ii. 82. The ginseng has a perennial root, which sends up annually a smooth round stem, about a foot high, and divided at the summit into three leafstalks, each of which supports a compound leaf, consisting of five, or more rarely of three or seven petiolate, oblong-obovate, acuminate, serrate leaflets. The flowers are small, greenish, and disposed in a simple umbel, supported by a peduncle which rises from the top of the stem in the centre of the petioles. The fruit is a kidney-shaped, scarlet berry, crowned with the styles and calyx, with two and sometimes three seeds.

The plant is indigenous, growing in the hilly regions of the Northern, Middle, and Western States, and preferring the shelter of thick, shady woods. The root is the part employed. This is collected in considerable quantities in Ohio and Western Virginia, and brought to Philadelphia and other cities on the seaboard for the purpose of exportation to China, where it is highly valued. Great quantities have recently been collected in Minnesota west of the Mississippi. Some suppose the ginseng plant of Chinese Tartary to be the same as ours; others believe it to be the *Panax Schinseng* of Nees Von Esenbeck; while by others, again, though acknowledged to be a Panax, it is thought to be a different species from either of those mentioned. While supplied with this drug exclusively from their own country, which furnished the root only in small quantities, the Chinese entertained the most extravagant notions of its virtues, considering it as a remedy for all diseases, and as possessing almost miraculous powers in preserving health, invigorating the system, and prolonging life. It is said to have been worth its weight in gold at Pekin; and the first shipment from North America to Canton yielded enormous profits. The subsequent abundance of supply has much diminished its value; but it is still in great repute.

The root is fleshy, somewhat spindle-shaped, from one to three inches long, about as thick as the little finger, and terminated by several slender fibres. Frequently there are two portions, sometimes three or more, connected at their upper extremity, and bearing a supposed, though very remote resemblance to the human figure, from which circumstance it is said that the Chinese name *ginseng* originated. When dried, the root is yellowish-white and wrinkled externally, and within consists usually of a hard central portion, surrounded by a soft whitish bark. It has a feeble odour, and a sweet, slightly aromatic taste, somewhat analogous to that of liquorice root. It has not been accurately analyzed, but is said to be rich in gum and starch, and contains albumen. Mr. S. S. Garrigues, of Philadelphia, obtained from it a peculiar substance, which he proposes to call *panaquilon*. To prepare it he heats a cold infusion so as to separate the albumen, filters, concentrates to a syrupy consistence, precipitates by a concentrated solution of sulphate of sodium, washes the precipitate thoroughly with the saline solution, and then treats it with alcohol, which dissolves the principle in question, and yields it on evaporation. To purify it, he dissolves it in water, treats the solution with animal charcoal, again evaporates, and dissolves the residue in absolute alcohol, which is finally distilled off. Panaquilon is an amorphous yellow powder, soluble in water and alcohol, but not in ether, of a sweet bitterish taste, and has the characteristic property, that, when treated with strong acids, it is converted into a white substance, insoluble in water, with the escape of carbonic

acid and water. Mr. Garrigues proposes for this white substance the name of *panacon*. (*Am. Journ. of Pharm.*, xxvi. 511.) The root is sometimes submitted, before being dried, to a process of clarification, which renders it translucent and horny, and enhances its value as an article of export. The extraordinary medical virtues formerly ascribed to ginseng had no other existence than in the imagination of the Chinese. It is little more than a demulcent, and in this country is not employed as a medicine. Some persons, however, are in the habit of chewing it, having acquired a relish for its taste; and it is chiefly to supply the wants of these that it is kept in the shops. W.

PAPAVER. *U.S.*

Poppy. Poppy Capsules.

The nearly ripe capsules of Papaver somniferum. *U.S.*

Off. Syn. PAPAVERIS CAPSULÆ. *Poppy Capsules.* The nearly ripe dried capsules of the white poppy, Papaver somniferum, *Linn.* Cultivated in Britain. *Br*

Capsules des pavots, *Fr.;* Kapseln des weissen Mohns, *Germ.;* Capidel papavero, *Ital.;* Cabezas de amapola, *Span.*

Papaver somniferum. See OPIUM.

In England the poppy is cultivated chiefly for its capsules, which are gathered as they ripen, and taken to market enclosed in bags. The Br. Pharmacopœia directs them to be collected before they are quite ripe, as they then contain more of the active milky juice; but, cut at this period, they are apt to lose their juice through the wounded surface, unless carefully kept inverted upon their crown while drying; and, even when thus treated, they are, according to the observations of Buchner, less active than the capsules collected after perfect maturity, while they contain more of useless saccharine and mucilaginous matter. (*Buchner's Repert.*, 3 R., viii. 289 and 326.) M. Meurein states, as the result of his experiments, that the richest are those collected just before the maturity of the seeds, when the capsules have passed from their glaucous-green to a yellowish-green colour. (*Journ. de Pharm.*, 3e sér., xxiii. 341.) They are occasionally imported; but as no effect is produced by them which cannot be as well obtained from opium, or some one of its preparations, they are little employed.

Dried *poppy capsules* vary in size from the dimensions of a small egg to those of the fist. They differ also in shape according to the variety of the poppy from which they are procured. On the continent two sub-varieties of the white poppy are recognised, the *long*, and the *round* or *depressed*. Of these, according to Aubergier, the long are richest in morphia, and his conclusions are confirmed by Meurein, who also found the largest capsules most efficient. Those commonly kept in our shops are spheroidal, flattened below, and surmounted by a crown-like expansion—the persistent stigma—which is marked by numerous diverging rays that rise somewhat above its upper surface, and appear to be prolongations of partial septa, or partitions, proceeding along the interior circumference of the capsule from the top to the bottom. In the recent state, the seeds, which are very numerous, adhere to these septa; but in the dried capsule they are loose in its cavity. The capsules of the black poppy are smaller and more globular than those of the white, and contain dark instead of light-coloured seeds. There appears to be no essential difference in their properties. Both kinds, when fresh, are glaucous, but when dried, as found in the shops, are of a dirty-white or purplish-brown colour, of a consistence somewhat like that of paper, inodorous, and with little taste, unless long chewed, when they are decidedly bitter. They contain principles similar to those of opium, which they yield to water by decoction, and have been employed in France for obtaining morphia.

On the continent of Europe, the poppy is cultivated largely for its seeds, which are valued for the large amount of an excellent fixed oil which they yield by expression. The proportion of oil obtained is about 50 per cent. It is of a pale-golden colour, liquid at 42° F., easily dried, inodorous, and of a pleasant flavour. It is bleached by exposure in thin layers to the sun. (*Pharm. Journ.*, March, 1874, p. 731.)

Medical Properties and Uses. Dried poppy-heads, though analogous to opium in medical properties, are exceedingly feeble. They are nevertheless asserted, in the

form of decoction, to have proved fatal in a child. The case, reported by Dr. F. L Winckler, was that of a babe, in the stomach of which he found a little morphia, but no meconic acid. (*Neues Repertor.*, 1867, xvi. 38.) They are sometimes employed in decoction, as an external emollient and anodyne application; and, in emulsion, syrup, or extract, are often used internally, in Europe, to calm irritation, promote rest, and produce generally the narcotic effects of opium.

Off. Prep. Decoctum Papaveris, *Br.;* Extractum Papaveris, *Br.;* Syrupus Papaveris, *Br.* W.

PAREIRA. *U. S.*

Pareira Brava.

The root of Cissampelos Pareira. *U. S.*

Off. Syn. PAREIRÆ RADIX. *Pareira Root.* The dried root of Cissampelos Pareira (*Linn.*), Brazil, *Br.*

CISSAMPELOS. *Sex. Syst.* Diœcia Monadelphia.—*Nat. Ord.* Menispermaceæ.

Gen. Ch. MALE. *Calyx* four-leaved. *Corolla* none. *Nectary* rotate. *Stamens* four, with connate filaments. FEMALE. *Calyx* one-leafed, ligulate roundish. *Corolla* none. *Styles* three. *Berry* one-seeded.

Cissampelos Pareira. Willd. *Sp. Plant.* iv. 861; Woodv. *Med. Bot.*, 3d ed., p. 167, t. 65. This is a climbing plant, with numerous slender, shrubby stems, and roundish, entire leaves, indented at the top, covered with soft hair upon their under surface, and supported upon downy footstalks, inserted into the back of the leaf. The flowers are very small, and disposed in racemes, of which those in the female plant are longer than the leaves. The plant is a native of the West Indies and South America, and is supposed to be the source of the root brought from Brazil, under the name of *pareira brava.* According to Auguste St. Hilaire, however, true pareira is obtained from another species of the same genus, growing in Brazil, and denominated *C. glaberrima;* while by Aublet it is referred to a species of *Abuta*, of the same natural family.*

The root comes in pieces from the thickness of the finger to that of the arm, from a few inches to two or more feet in length, sometimes as much as 8 inches or more in thickness, cylindrical, occasionally contorted or forked, and covered with a thin, firmly adhering, grayish-brown, or very dark-coloured bark. The outer surface is marked with longitudinal and annular wrinkles, and sometimes, in the larger pieces, with knotty excrescences. The interior is ligneous, yellowish, very porous, marked by irregular concentric circles, inodorous, and of a sweetish, nauseous, bitter taste. See the root well figured in the *Pharmaceutical Journal* (Aug. 1873, p. 102). The root imparts its virtues readily to water. M. Feneulle found in it a soft resin, a yellow bitter principle, a brown substance, an azotized substance, fecula, acidulous malate of calcium, nitrate of poiassium, and various other salts. He considers the yellow bitter substance as the active principle. It is soluble in water and alcohol, and precipitated from its solution by tincture of galls. Wiggers announced, in 1838, the existence in pareira brava of an organic alkali, for which he proposed the name of *cissampelina.* He procured it by boiling the root with water acidulated with sulphuric acid, precipitating by carbonate of potassium, dissolving the precipitate again in water acidulated with sulphuric acid, treating the solution with animal charcoal, precipitating anew with carbonate of potassium, drying and pulverizing the precipitate, treating it repeatedly with ether, and evaporating the ethereal solution. The alkaloid thus obtained may be rendered entirely pure by dissolving it in dilute acetic acid, precipitating with carbonate of potassium, and washing and drying the precipitate. (*Annal. der Pharm.*, xxvii. 29.) It is probably the chief ingredient of the bitter

* *Pareira Bark.* Though the root is the officinal part, the bark is probably possessed of similar virtues. A specimen which we had the opportunity of seeing at the international Exhibition at London in 1862, was in flat pieces, from two to four inches broad, about a line thick, extremely fibrous, so tough that it could be bent without breaking, of a very light dirty-yellowish colour, and covered with a light-coloured epidermis.

substance obtained by Feneulle. Peretti of Rome, and Pelletier afterwards, separated from the root an alkaloid, characterized by assuming a beautiful purple colour by contact with strong nitric acid. (*Journ. de Pharm.*, xxvi. 162.) In Christison's Dispensatory it is stated to be uncrystallizable, insoluble in water, soluble in ether, alcohol, and the acids, and of an intensely bitter and sweetish taste. Flückiger has found an alkaloid in the root, and, having thoroughly determined its origin, investigated its properties, and fixed its composition at $C_{18}H_{21}NO_3$, although acknowledging its identity with the *cissampelina* of Wiggers, considers himself authorized to supersede Wiggers' name, and to call it *pellosine* (*pellosina*). For an account of its mode of preparation and properties, the reader is referred to the *Pharmaceutical Journ.* (Oct. 1869, p. 193).

An impurity, found by Mr. John Moss, in considerable quantity, in a bale of pareira imported into London, was in pieces, paler, lighter in weight, and much less compact in texture than the genuine root; and consisting evidently of portions of the stem, as the greater number of pieces were covered with a bark, of a colour variegated by whitish patches of microscopic lichens, and occasional tufts of green moss. A comparison of the specimen with the stem of the proper pareira plant, in the museum of the Pharmaceutical Society, left no doubt of the identity of the two specimens; so that the stem of the plant is, sometimes at least, mixed with the root in commercial parcels. (*Pharm. Journ.*, May, 1874, p. 911.) From a paper by Dr. E. R. Squibb, it appears that, until recently, the drug imported into this country, under the name of Pareira, consisted really of the stems instead of the root. The stem is much weaker than the root, and should therefore always be rejected. Its sweetish and afterwards bitter taste is very feeble, and it yields much less extract than the root to any menstruum. (*Pharm. Journ.*, March, 1872, p. 107.)

Medical Properties and Uses. Pareira brava is said to be tonic, aperient, and diuretic. It was introduced into European practice so long ago as 1688, and at one time enjoyed considerable reputation as a lithontriptic. It has been recommended in calculous affections, chronic inflammation and ulceration of the kidneys and bladder, leucorrhœa, dropsy, rheumatism, and jaundice. The purpose for which it is at present chiefly employed is for the relief of chronic diseases of the urinary passages. Sir Benjamin Brodie found it very useful in chronic inflammation of the bladder, in allaying irritability of that organ, and correcting the disposition to profuse mucous secretion; and it has subsequently come into general use in the same affections. Advantage may often be derived from combining it, in this complaint, with one of the narcotics, as opium or hyoscyamus. In Brazil it is used in the cure of the bites of poisonous serpents; a vinous infusion of the root being taken internally, while the bruised leaves of the plant are applied to the wound. The dose of pareira brava in substance is from thirty grains to a drachm. The infusion, however, is more convenient. (See *Infusum Pareiræ.*) A tincture, made by macerating one part of the root in five parts of alcohol, has been given in the dose of a fluidrachm. The aqueous extract may be given in the dose of from ten to thirty grains. There is now an officinal fluid extract, of which the dose is from half a fluidrachm to a fluidrachm.

Off. Prep. Decoctum Pareiræ, *Br.;* Extractum Pareiræ, *Br.;* Extractum Pareiræ Fluidum, *U. S.;* Extractum Pareiræ Liquidum, *Br.;* Infusum Pareiræ, *U. S.*

W.

PEPO. *U. S.*

Pumpkin Seeds.

The seeds of Cucurbita Pepo. *U. S.*

This is one of the officinals recently introduced into the U. S. Pharmacopœia. The *Cucurbita Pepo*, or *common pumpkin*, is a plant too well known to need description. The seeds are the part used. These are oval, extended into a blunt point at one end, flattish, but somewhat swollen in the middle, with a distinct groove on both sides near the edge from one end to the other, when of full size about 9 lines long by 5 or 6 in breadth where broadest, of a light brownish-white colour, and a slightly sweetish, somewhat aromatic smell and taste. They consist of a firm brittle coating, and a

white oily kernel; and contain a fixed oil, an aromatic principle, chlorophyll, sugar, gum, and an acid, soluble in water and alcohol, for which the name of *citrullic acid* has been proposed. Deprived of their coating, and exhausted by ether, they yield 30 per cent. of fixed oil. (*Annuaire de Thérap.*, A.D. 1862, p. 176.)

Medical Properties. The seeds of the pumpkin have, within a few years, obtained in this country considerable reputation in the treatment of *tapeworm.* This employment of them, however, is not new. In the *Dictionary of Materia Medica* by Mérat and De Lens (ii. 493), it is stated that Dr. Hoarau had reported that, in the Isle of France, the seeds of a small variety of pumpkin were used against the tapeworm, and with never-failing success. In the year 1820, M. Mongeny, a physician of Cuba, published the results of his experience with the flesh of the pumpkin in the same disease. He had discovered the remedy by accident, and found it uniformly successful. He gave to the patient, in the morning, fasting, about three ounces of the fresh pumpkin in the form of a paste, and followed it at the end of an hour by about two ounces of honey, which latter was twice repeated at intervals of an hour. MM. Brunet and Lamothe, of Bordeaux, verified the statements of M. Mongeny, as to the efficacy of the remedy in tænia, employing a paste made from the seeds, in the dose of about an ounce and a half, with as much sugar. (*Ann. de Thérap.*, 1853, p. 301.)

In the *Boston Med. and Surg. Journ.* (October 8, 1851, page 201), is a communication from Mr. Richard Soule, recommending the seeds in very strong terms as a remedy in tænia; and his letter is preceded by some editorial observations, in which reference is made to the previous successful employment of the remedy by Dr. J. S. Jones, of Boston. Since that time various other notices of the efficacy of the seeds have appeared in the journals, and a very striking case was related to ourselves, on the best authority, in which they had proved immediately and completely successful, after the vain employment of all other known remedies, through a course of several years. Mr. Soule gives the preference to the seeds from the West Indies. The dose of the seeds is about two ounces; which are to be taken in the morning, fasting, and followed in an hour or two by a fluidounce of castor oil. The mode of administration is various. Sometimes the seeds, deprived of their outer covering, are beaten into a paste with sugar, and thus taken. In other instances, they are formed into an emulsion, by rubbing them up thoroughly with water and a little sugar.* W.

PETROSELINUM. *U.S. Secondary.*

Parsley.

The root of Petroselinum sativum (Lindley, *Flor. Med.*). *U.S.*

Persil, *Fr.;* Petersilie, *Germ.;* Prezzemolo, *Ital.:* Perexil, *Span.*

PETROSELINUM. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Apiaceæ or Umbelliferæ.

* The following emulsion, combining the virtues of the pumpkin seeds and male fern, has been recommended in tapeworm. Take of *pumpkin seeds* 600 grains, *sugar* 100 grains, ethereal extract of male fern 60 grains, water five fluidounces. Bruise the seeds in a marble mortar with the sugar, add half a fluidounce of water, and, when a homogeneous paste has been obtained, add the extract of fern, and gradually mix in the rest of the water. The emulsion should be taken without straining, early in the morning, in four doses, at intervals of fifteen minutes; the bottle being well shaken.

Oil of Pumpkin Seed. At the suggestion of the late Dr. H. S. Patterson, of Philadelphia, the expressed oil of the seeds was used in a case of tapeworm by Mr. John C. Lyons, and with success. After fasting for 24 hours, the patient took, in the morning, f℥ss of the oil, which was followed in two hours by f℥ss more, and in two hours after the second dose by f℥i of castor oil, which brought away the worm. The oil may be obtained also by the agency of a menstruum. It is probable that, separated by ether, it would be even more effective than when expressed. A portion of it was extracted from the crushed seeds by means of bisulphide of carbon. The product was 33⅓ per cent. of a thick red oil, with little smell, but of a somewhat rank taste. Its sp. gr. at 60° F. was 0·928. (G. A. Gross, *Am. Journ. of Pharm.*, July, 1865, p. 253.)—*Notes to the twelfth and thirteenth editions.*

A Fluid Extract of Pumpkin Seed, prepared in the following manner by Mr. Charles Hand, has given great satisfaction in Camden, N. J., where it was made. Take of the seed sixteen troyounces, alcohol of the sp. gr. ·835, a sufficiency. Bruise the seed with an equal bulk of washed sand until thoroughly comminuted, transfer to a conical percolator, pour in the alcohol till three pints have passed; reserve the first twelve ounces of the percolate, reduce the remainder to four fluidounces by distillation; and, lastly, mix with the reserved liquor, and filter. (*Am. Journ. of Pharm.*, May, 1869, p. 195.)—*Note to the fourteenth edition.*

Gen. Ch. Umbels compound. Involucres, partial of many, general of few bractes. *Calyx* obsolete. *Fruit* ovate, contracted at the sides. Ridges five, narrow, equal, the lateral on the edge. Vittæ one to each furrow. *Albumen* plano-convex. *Lindley.*

Petroselinum sativum. Hoffman, *Umb.* i. t. 1, f. 2; Lindley, *Flor. Med.* p. 35.—*Apium Petroselinum.* Willd. *Sp. Plant.* i. 1475; Woodv. *Med. Bot.* p. 118, t. 45. Parsley has a biennial root, with an annual, round, furrowed, jointed, erect, branching stem, about two feet in height. The radical leaves are compound, pinnated in ternaries, with the leaflets smooth, divided into three lobes, and notched at the margin. In the cauline leaves, the segments of the leaflets are linear and entire. The flowers are small, pale-yellow, and disposed in terminal compound umbels, with a one or two-leaved general involucre, and partial ones composed of six or eight leaflets. The petals are five, roundish, and inflexed at their apex. The seeds (half fruits) are small, ovate, flat on one side, convex on the other, dark-green, and marked with five longitudinal ridges. They have a strong terebinthinate odour, and a warm aromatic taste.

The plant is a native of Sardinia, and other parts of Southern Europe, and is cultivated everywhere in gardens. All parts of it contain a volatile oil, to which it owes its odour and mainly its taste, as well as its use in seasoning. M. H. Braconnot obtained from the herb a peculiar gelatinous substance, resembling pectic acid in appearance, which he named *apiin.* It differs from pectin in being more soluble in alcohol than cold water, in not being precipitated by alcohol from its watery solution, and in being separated by acids from its alkaline solutions unaltered, whereas pectin is under these circumstances converted into pectic acid. (*Journ. de Pharm.*, 3e sér., xix. 448.) It is procured by boiling the herb in water, straining the liquor, and allowing it to cool. The apiin then forms a gelatinous mass, which requires only to be washed with cold water. (*Philos. Mag.*, xxiv. 155.) Though the root is the part directed by the Pharmacopœia, the fruit is at least equally efficient. Examined by MM. Joret and Homolle, the seeds were found to contain a volatile oil, a crystallizable fatty matter, pectin which they believe to be the apiin of Braconnot, chlorophyll, tannin, a colouring matter, extractive, lignin, various salts, and, in addition to these, a peculiar substance to which they gave the name of *apiol.* This is a yellowish oily liquid, not volatile, heavier than water, of a peculiar and tenacious odour distinct from that of the plant, and an acrid pungent taste. It is inflammable, insoluble in water hot or cold, very soluble in alcohol, and dissolved in all proportions by ether and chloroform. It is analogous to the fixed oils, but is not chemically modified by the alkalies. It contains no nitrogen. To obtain it MM. Joret and Homolle exhausted the seeds with alcohol, treated the tincture with purified animal charcoal, distilled off three-fourths of the alcohol, treated the residue with ether or chloroform, evaporated the solution thus formed, mixed the residuary liquid with an eighth of its weight of litharge, allowed the mixture to rest twenty-four hours, and then filtered through a light layer of charcoal. Apiol is supposed by its discoverers to be the antiperiodic principle of parsley.

The root is spindle-shaped, about as thick as the finger, externally white, and marked with close annular wrinkles, internally fleshy and white, with a yellowish central portion. It has a pleasant smell, and a sweetish, slightly aromatic taste; but loses these properties by long boiling, and by time. It should be employed in the recent state.

Medical Properties and Uses. Parsley *root* is said to be aperient and diuretic, and is occasionally used in nephritic and dropsical affections, in connection with more active medicines. It was highly recommended by the late Professor Chapman, of the University of Pennsylvania. The usual form of administration is that of strong infusion. A decoction of the leaves, applied warm to the eye by means of a compress, has been employed with benefit by Dr. Neucourt in recent ophthalmia. (*Am. Journ. of Med. Sci.*, July, 1865, p. 257.) The *juice* of the fresh herb has been employed as a substitute for quinia in intermittents; and the *seeds*, as well as their supposed active principle, have been given with great asserted success in the same complaint. According to MM. Joret and Homolle, *apiol* acts on the system very much like quinia, producing, in the dose of about 15 grains, a slight cerebral exci-

tation without unpleasant effects of any kind, and, in double or quadruple the quantity, giving rise to a species of intoxication, with giddiness, morbid sights and sounds, frontal headache, and all the characteristic effects of a large dose of sulphate of quinia. They found it to cure intermittents, in temperate latitudes, in the proportion of 86 per cent. of the cases; and, though it proved less effectual in tropical regions, they seem to have shown that, in the absence of Peruvian bark or its preparations, it might be usefully resorted to as a substitute.* W.

PHOSPHORUS. *U.S., Br.*

Phosphorus.

"A translucent, nearly colourless solid, resembling wax, without taste, but having a peculiar smell. Its specific gravity is 1·8. It is extremely inflammable, and should be kept under water, and protected from the light. When exposed to the air it emits white fumes, which are luminous in the dark." *U.S.* "A non-metallic element obtained from bones." *Br.*

Phosphore, *Fr.;* Phosphor, *Germ.;* Fosforo, *Ital., Span.*

This non-metallic element was discovered in 1669 by Brandt, an alchemist of Hamburg, who obtained it from putrid urine by a process which remained a secret until 1737. As thus procured, it was exceedingly scarce and costly. In 1769, the Swedish chemist Gahn discovered it in bones, and shortly afterwards published a process by which it might be extracted from them.

Preparation. Powdered calcined bones (bone-phosphate of calcium) are digested for twenty-four hours with two-thirds of their weight of sulphuric acid previously diluted with twelve times its weight of water. The sulphuric acid separates the greater part of the lime from the phosphoric acid, and precipitates as sulphate of calcium; while a superphosphate of calcium remains in solution. The liquid is then strained through a linen cloth to separate the sulphate of calcium, and afterwards submitted to evaporation, which causes a fresh precipitation of sulphate, to be separated by a new straining. The strained solution is evaporated to a syrupy consistence, and then thoroughly mixed with half its weight of powdered charcoal, so as to form a mass, which is dried by being heated to dull redness. The mass when cool is quickly transferred to a coated earthenware retort, furnished with an adapter of copper, bent downwards at right angles, so as to enter a bottle with a large neck containing water, which should rise about two lines above the orifice of the adapter. The bottle is closed round the adapter with a cork, which is traversed by a small glass tube, to give exit to the gaseous products. The retort is heated in a furnace, furnished with a dome, in the most gradual manner, so as to occupy about four hours in bringing it to a red heat. Afterwards the heat is pushed vigorously, so long as any phosphorus drops into the water; and this takes place generally for from twenty-four to thirty hours. During this part of the process, the excess of acid in the superphosphate is decomposed; its oxygen combining with the charcoal, and the liberated phosphorus distilling over. The calcined bones of the sheep are preferred; as they contain the largest proportion of phosphate of calcium, and are most readily acted on by the acid.

M. Cari-Montrand proposes to obtain phosphorus by passing dry muriatic acid gas over a mixture of equal parts of bone-phosphate of calcium and finely powdered charcoal, contained in a porcelain tube, to which a glass tube is attached, dipping under water. Phosphorus and water distil over, carbonic oxide is evolved, and chloride of calcium is left. The following equation explains the reaction: $3CaO,PO_5$ and 5C and 3HCl = P and 3HO and 5CO and 3CaCl.

*Since the announcement of the antiperiodic properties of apiol, it has been found to possess other virtues also. By MM. Joret and Baillot and other practitioners it has been employed, with much success, as an emmenagogue in amenorrhœa and dysmenorrhœa, in the dose of about four grains morning and evening; being taken in the former affection in anticipation of the menstrual period, in the latter during its continuance. It is said also to have proved useful in the night-sweats of phthisis. From its unpleasant taste, it is most conveniently exhibited in capsules of gelatin. (*Journ. de Pharm.*, Juin, 1861, p. 456.)

The following improved process for obtaining phosphorus on a large scale is given by Hugo Fleck, of Germany. Clean, broken bones, deprived of fat, are digested in dilute muriatic acid, which gives rise to the formation of chloride of calcium, and acid phosphate of calcium ($CaO,2HO+PO_5$). The bone cartilage, remaining undissolved by the acid, is used for preparing gelatin. The solution is evaporated in pans until its sp. gr. is about 1·4, and then run off to cool, when the acid phosphate crystallizes. This salt, having been separated from the mother-liquor by being pressed between cloths and dried, appears as a white gritty powder with a pearly lustre. The dry salt, warmed, and mixed with a fourth of its weight of charcoal, is distilled from clay cylinders, like gas retorts. Every five cylinders open into one receiver, shaped like a muffle, and contained in a channel through which water flows. The residual bone-phosphate of calcium, in the cylinders, is incinerated upon iron plates to burn away the charcoal, and is thus saved to prepare fresh acid phosphate. By this process 100 lbs. of fresh bones yield from 6 to 7 lbs. of phosphorus, and from 10 to 20 of gelatin; while the process usually pursued gives only 4 or 5 lbs. of phosphorus. (*Pharm. Journ.*, Sept. 1856, p. 175.)

Properties. Phosphorus is a semitransparent solid, without taste, but possessing an alliaceous smell. When perfectly pure it is colourless; but as usually prepared it is yellowish or reddish-yellow. It is flexible, and when cut exhibits a waxy lustre. It is said by M. Bœttger to be easily pulverizable by agitation with a solution of urea. (*Journ. de Pharm.*, Juin, 1863, p. 488.) It is insoluble in water, but dissolves sparingly in ether, anhydrous alcohol, and the oils,* and abundantly in bisulphide of carbon† and chloroform. Its sp. gr. is 1·84, and its equivalent number 32 (31·02 Schroetter). Its pulverization may be readily effected by melting it in hot water, and agitating until it is thoroughly cooled; and the powder is obtained finer in saline solutions than in pure water. (Blondlot, *Journ. de Pharm. et de Chim.*, 4e sér., i. 72, A.D. 1865.) It takes fire at 100°, melts at 108°, and boils at 550°, air being excluded. During its combustion it combines with the oxygen of the air, and forms dry phosphoric acid. On account of its great inflammability, it must be kept under water. When exposed to the air it undergoes a slow combustion, emitting white vapours, which are luminous in the dark. It sometimes contains arsenic, and, therefore, when used in forming medicinal preparations, should be tested for that metal.‡ It also occasionally contains antimony and sulphur. The latter impurity renders it brittle.

When phosphorus is kept in ordinary water it becomes covered with a whitish layer, of the nature of which there are different opinions, being considered by some a hydrate of phosphorus, by others as an allotropic condition of that element, and by others again as partially crystallized; but all these opinions have been disproved by M. Ernest Baudrimont, who seems to have demonstrated that *white phosphorus* is entirely identical with that principle in its ordinary state, and results from a kind of erosion of the surface, owing to partial oxidation by the free oxygen held in solution by the water. The change never takes place in water entirely deprived of air; and the water when it has taken place holds phosphorous acid in solution. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 17, A.D. 1866.)

Prof. Schroetter, of Vienna, discovered an allotropic form of phosphorus, which he called *red* or *amorphous phosphorus*. It is formed when ordinary phosphorus

* The degree of solubility of phosphorus in the different fixed oils in ordinary use, it is often desirable to be acquainted with, in reference to its exhibition as medicine. The following list is taken from the *Journal de Pharmacie* (Févr. 1869, p. 94), where it is given on the authority of M. C. Merc. The oils of sweet almonds, of olives, of sesamum, and of ground-nuts will retain, at common temperatures, $\frac{1}{80}$ of their weight of phosphorus. It may even descend to $\frac{1}{75}$ for almond and ground-nut oils; but it is not prudent, in practice, to keep too near the limits of saturation. The oils of colza and flaxseed, brown cod-liver oil, and neats' foot oil, retain $\frac{1}{70}$ of their weight, even after eight days' exposure in a cellar. Castor oil is far removed from these figures, 105 parts of it being required to dissolve one of phosphorus. The author has observed no sensible difference in the dissolving power of overheated and not overheated oils. (*Journ. de Pharm.*, Févr. 1869, p. 95.)—*Note to the fourteenth edition.*

† According to M. A. Vogel, sulphide of carbon is capable of dissolving eighteen times its weight of phosphorus without losing its fluidity. (*Ibid.*, p. 237.)

‡ Dr. C. J. Rademaker obtained out of 100 parts of phosphorus, about one part of arsenic. (*Am. J. of Pharm.*, Nov. 1870.)—*Note to the fourteenth edition.*

is kept long at a temperature between 419° and 482° F., in atmospheres which have no action on it, or in closed glass tubes. Red phosphorus is much more indifferent than the ordinary substance, and is denser, its sp. gr. being 2·11. It is much less easily acted on by the air than ordinary phosphorus, and is insoluble in bisulphide of carbon, alcohol, and ether, in which ordinary phosphorus is soluble. Solidified from the fused state, it is brittle, and breaks with a conchoidal fracture. Its hardness is considerable. Obtained by distillation in a non-acting gas, it is mixed with ordinary phosphorus, from which it may be freed by bisulphide of carbon, which dissolves the ordinary variety, and leaves the allotropic as a deep-red amorphous powder. It may also be purified by shaking it with a solution of chloride of calcium, of a density intermediate between that of red and ordinary phosphorus, and with a little bisulphide of carbon. The red variety will sink to the bottom, and the ordinary float on top of the solution, dissolved in the bisulphide. (*E. Nicklès.*) Red phosphorus is not poisonous. This has been proved beyond a doubt by the experiments of MM. Reynal and Lassaigne, and of MM. L. Orfila and Rigaut. It is applicable to the manufacture of lucifer matches, and forms a much safer material than ordinary phosphorus. It does not take fire by friction at common temperatures, and, therefore, may be transported with the greatest safety. It has been said to be unchangeable in the air; but this is not exactly true, as proved by an observation of Mr. T. B. Groves, who, having set aside some red phosphorus in a bottle that was not air-tight, observed for a year or more no visible change, but found at length that it had become decidedly altered, and ascertained that oxidation had taken place, with the result of forming a large quantity of phosphoric and phosphorous acids, in the proportion of 5 eqs. of the former to 2 of the latter. (*Pharm. J. and Trans.*, June, 1865, p. 621.)

Besides the white and red forms of phosphorus, there is another, called the *black*, first noticed by Thenard, and recently investigated by M. Blondlot, who finds that it is pure phosphorus, and its production owing to some modification in the mode of cooling, when it has been in the liquid state. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 407, A.D. 1865.)

Still another modification of phosphorus has recently been made known by M. Hittorf, who obtained it by heating red phosphorus and lead together in a close vessel. The lead on melting dissolved the phosphorus, and on cooling deposited it in the state of crystals, resembling the crystals of arsenic. In this form, phosphorus is a conductor of electricity; and its sp. gr. at 62° F. is 2·34. M. Hittorf distinguishes it by the name of *metallic phosphorus*, and ranks it in the same category with red phosphorus, the latter differing simply in being amorphous. (*Chem. News*, March 23, 1866, p. 133.) M. Blondlot has succeeded in crystallizing common phosphorus by means of sublimation, operating in an atmosphere of nitrogen. (*Journ. de Pharm. et de Chim.*, 4e sér., iv. 321.)*

Phosphorus forms with oxygen hypophosphorous, phosphorous, and phosphoric acids. Of the last-mentioned acid there are three varieties, distinguished by containing, severally, one, two, or three eqs. of water. The only officinal compounds containing phosphorus are glacial and diluted phosphoric acids, phosphate and pyrophosphate of iron, and the phosphates of ammonium, calcium, and sodium.

Medical Properties. Phosphorus, exhibited in small doses, acts as a powerful general stimulant; in large doses, as a violent irritant poison. There is little if any doubt that, when not oxidized in the stomach, it is absorbed into the system, prob-

* *Liquid Phosphorus.* A claim has been advanced, by Prof. E. J. Houston, to the discovery of another allotropic form of phosphorus characterized by being in the liquid state. Pure phosphorus was boiled repeatedly in strong solution of hydrate of potassa, water being occasionally added to supply that lost by evaporation, and care taken cautiously to stir the liquid during the process. After five or ten minutes, the melted phosphorus is washed by a stream of pure water replacing the alkaline solution, and removing all the hypophosphites as well as liquid and gaseous hydrides of phosphorus that might have been formed. The liquid phosphorus is now in what is believed to be a hitherto unnoticed allotropic modification. Its peculiarity is that of retaining the liquid form indefinitely at temperatures very considerably below the melting point of ordinary phosphorus. A small portion in a test tube solidified at 38° F. Another peculiarity is that it is not oxidized on exposure to the air, and consequently does not shine in the dark. (*Am. Journ. of Pharm.*, March, 1874, p. 112; from the *Journ. of the Franklin Institute.*)—*Note to the fourteenth edition.*

ably dissolved in oleaginous matter, and operates through the blood. Its action is directed particularly to the kidneys and genital organs, producing diuresis, and excitation of the venereal appetite. From its peculiar physiological action, it is considered applicable to diseases attended with prostration of the vital powers. It has been recommended in impotency, typhoid and typhus fevers, dropsy, phthisis, marasmus, chlorosis, paralysis, locomotor ataxia, amaurosis, cataract, mania, melancholia, facial neuralgia, &c. In certain obstinate cutaneous diseases, particularly eczema and psoriasis, it has been used with advantage. (*Med. Times and Gaz.*, Jan. 1868, p. 619.) Those who work in phosphorus, as the manufacturers of lucifer matches, are liable to necrosis of the jaw-bones, the consequence of periostitis. The affection is probably produced by the inhalation of air contaminated with phosphorus vapour, which has a local action on the teeth, gums, and jaws, and a general deteriorating effect on the blood. Dr. James R. Wood has recorded, in the *N. Y. Journ. of Med.* for May, 1856, an interesting case of a girl of sixteen, in which the entire lower jaw was removed for necrosis caused by phosphorus.

The usual form for exhibiting phosphorus is in oily solution. The *Oleum Phosphoratum* of the Prussian Pharmacopœia is made as follows. Take of phosphorus *twelve grains;* almond oil, recently prepared, *an ounce.* Melt the phosphorus in the oil by the heat of warm water, and agitate until it appears to be dissolved. The ounce of oil takes up about four grains of phosphorus; and the dose of the solution is from five to ten drops, mixed with some mucilaginous liquid. An aromatic flavour may be given by the addition of a few drops of oil of bergamot. In an article in the *Archives Générales* (Mai, 1868, p. 609), it is maintained that the purest almond oil of the shops always contains water and organic matters dissolved or suspended, which react on the phosphorus, and so far modify its condition as to render the dose uncertain. To obviate this inconvenience, it is recommended to heat the oil, in the open air, for half an hour, at a temperature of about 300° F. at first, gradually increased to 350°. The water and organic impurities are thus driven off; and the oil, having been filtered, and allowed to cool, is introduced into bottles with ground glass stoppers, and kept for use. Dr. R. M. Glover has proposed to give phosphorus, dissolved in chloroform or cod-liver oil. He makes the chloroform solution, which is non-inflammable, by dissolving one part of phosphorus in four of chloroform. Of this solution he gives four or five minims, twice a day, with a drachm of ether, in a wineglassful of port wine, in typhoid fever. The solution in cod-liver oil is effected by adding the phosphorus, in chips, to the oil contained in a bottle, in the proportion of half a grain to the ounce. The bottle is then immersed in hot water, and the solution effected by shaking. This mode of giving phosphorus was used by Dr. Glover in strumous cases. (See *Braithwaite's Retrospect*, Am. ed., xxvii. 246.) Phosphorus has been given with success in intermittents, dissolved in oil of turpentine. (*Trans. of the Med. Soc. of Pennsylvania*, iv. 119.) M. Tavignot gives pills made from an oleaginous solution of phosphorus. One and a half grains are dissolved, by means of a water-bath, in two drachms of almond oil; the solution is made into a pill mass by mixing it with two drachms of almond oil soap and a sufficient quantity of an inert powder; and the mass is divided into 100 pills. From two to four of the pills may be taken daily. (*Journ. de Pharm.*, Août, 1863, p. 137.) Dr. Crawcour shakes phosphorus cut fine in a bottle with boiling absolute alcohol until cold. The alcohol dissolves about two grains to the fluidounce, and from 30 to 60 drops of the solution may be given with a wineglassful or two of water. (*Med. Times and Gaz.*, Feb. 1859, p. 222.) Great caution is necessary in the exhibition of phosphorus, and its effects should be closely watched. It ought never to be given in substance.

Phosphuret of zinc has been suggested as a substitute for phosphorus itself, having similar effects on the system, and being much more convenient of administration. It may be prepared by bringing the vapour of phosphorus into contact with zinc heated to ebullition, in a current of dry hydrogen. It is of a gray colour, a crystalline texture, and metallic lustre, unchangeable in the air, and easily affected by acids, which attack it in the stomach, evolving phosphoretted hydrogen, through which it operates. It may be given in pills made with liquorice powder and syrup

of gum arabic, in the dose of about one-thirtieth of a grain. (*Journ. de Pharm. et de Chim.*, Mai, 1868, p. 371.)

Toxical Properties and Tests. Phosphorus, taken in a poisonous dose, produces violent inflammation of the stomach and bowels, with intense pain, obstinate vomitings, tremblings, and, finally, convulsions on the approach of death. If swallowed in sticks on a full stomach, the poisonous symptoms are some hours in manifesting themselves. When taken in substance, two or three grains of tartar emetic should be given to dislodge it. If swallowed in the state of solution, copious draughts of cold water, containing magnesia in suspension, should be administered, in order to prevent the combustion of the phosphorus, and to neutralize any acid which may have been formed. A case is related by Dr. Landerer, in which a child who had swallowed nearly a teaspoonful of phosphorus paste,* prepared for killing rats, was saved by the free administration of magnesia, rubbed up with sugared water. Cases of supposed poisoning by phosphorus matches have been recorded. Messrs. Antonielli and Borsarelli have shown, by numerous experiments on animals, that fatty matter increases the poisonous activity of phosphorus, and that the best antidote is calcined magnesia given largely with water. (*Lancet*, Feb. 5, 1859, p. 136.) Duflos has proposed, as an antidote, a mixture of one part of magnesia and eight of chlorine water. From experiments on rabbits, A. Bechert inferred that this mixture would prove useful; but similar experiments, made by Schrader, L. Hofmann, and Schuchardt, were without effect. Carbon, particularly in the form of animal charcoal, has been recommended as an antidote, under the impression that it absorbs the poison, and thus obviates its effects. Prof. Bamberger, of Wurtzburg, believes that phosphorus poisons through its own direct action, and not by any chemical change; and recommends as an antidote, after full vomiting, solution of sulphate of copper, which instantly coats the pieces of phosphorus, remaining attached to the stomach, with a black layer of phosphuret of copper, and afterwards with one of red oxide; and the measure is said to have been employed with success. (*New Remedies*, July, 1872, p. 54.) Dr. Dybkowsky maintains that it is not by oxidation that phosphorus acts poisonously; but by being converted into phosphuretted hydrogen, which is the real poisonous agent. (*Boston Med. and S. Journ.*, July 10, 1873, p. 33.) Oil of turpentine has been recommended as an antidote to phosphorus; but by some experimenters its efficacy is confined to the impure French oil, while others deny it altogether. It is said that the vapour from oil of turpentine acts as an antidote to that of phosphorus, when the two are inhaled together. (*Arch. Gén.*, Juillet, 1868, p. 103.)† From experiments on dogs poisoned by phosphorus, MM. L. Orfila and Rigaut have shown that putrefaction is remarkably retarded. In a case of chronic poisoning from the copious inhalation of phosphorus vapour, the principal results were a gradual decay of the sexual function and paralysis, terminating in death at the end of three years. Partial or general paralysis is a not uncommon result. (*Lancet*, July 7, 1866, p. 23.) One of the most remarkable post-mortem appearances, in cases of phosphorus poisoning, is fatty degeneration of the liver; and the same pathological condition has been found in the heart. (*Guy's Hosp. Reports*, xiii. 242, A.D. 1868.)

E. Mitscherlich gives the following as a delicate test of phosphorus. The suspected substance is distilled with sulphuric acid and water from a flask, by means

* This paste is made as follows. Triturate six parts of phosphorus and one part of sulphur with six parts of water, until they liquefy. Then mix in two parts of flour of mustard, eight parts of sugar, and twelve parts of rye flour, with the aid of ten additional parts of water, and stir the whole so as to form a soft paste, which must be kept in pots closely stopped. (See *Am. Journ. of Pharm.*, Sept. 1855, p. 473.)

† The internal administration of oil of turpentine is said to have proved remedial in phosphorus poisoning; and the chemical reaction between the two principles, on which the result probably depends, appears to have been discovered by Köhler and Schimpf. If three-quarters of an ounce of phosphorus be gradually added to two pounds of ordinary oil of turpentine containing oxygen, heated to 40° C., a white crystalline solid is obtained on cooling. It has acid properties, and the author has given it the name of *turpentine phosphorous acid*. It is separated from excess of phosphorus by crystallization from alcohol. It is relatively harmless, and is probably formed when the two substances meet in the body, and is carried off by the kidneys, being, under such circumstances, found in the urine. (*Pharm. Journ.*, March, 1873, p. 703.)—*Note to the fourteenth edition.*

of a tube bent twice at right angles, into a vertical cooling tube, passing through the bottom of a wide glass cylinder filled with water, which is constantly kept cold by passing cold water in at the bottom, while the warm water escapes at the top. Under the cooling tube is placed a vessel to receive the distillate. If phosphorus is present, its vapour, mixed with steam, distils over, and gives rise to a distinct luminous appearance, visible in the dark, at the point where it enters the cold part of the cooling tube. The presence of alcohol and ether prevents the occurrence of the luminous appearance until they have distilled over. Oil of turpentine has the same effect permanently, but is not likely to be present in medico-legal cases. (*Am. Journ. of Med. Sci.*, July, 1856, p. 280; from the *Lancet.*) This test acts equally well in the presence of fatty matters, as has been shown by M. Vrij. L. Hofmann gives the following method of detecting phosphorus in the viscera in cases of poisoning. The viscera, mixed with water and a little sulphuric acid, are distilled until two drachms of liquid are obtained; to which a few drops of sulphide of ammonium (hydrosulphate of ammonia) are to be added, and the liquid is to be evaporated to dryness in a porcelain dish. If phosphorus be present, in the minutest quantity, a drop of solution of perchloride of iron will produce a deep violet and brownish, though evanescent colour, through its reaction. (*Chem. News*, Feb. 3, 1865, p. 53.)

The use of phosphorus as a disinfectant has been suggested by its extraordinary power of ozonizing the oxygen of the air, whereby noxious effluvia may be destroyed. A stick of it should be placed in an infected apartment, and so arranged that one half shall be immersed in water, the other half projecting.

Off. Prep. Acidum Phosphoricum Dilutum. B.

PHYSOSTIGMA. *U.S.*

Calabar Bean.

The seed of Physostigma venenosum (*Balfour*). *U.S.*

Off. Syn. PHYSOSTIGMATIS FABA, *Calabar Bean.* The seed of Physostigma venenosum (Balfour, *Trans. Royal Soc. Edinb.*, vol. xxii. p. 305), Western Africa. *Br.*

PHYSOSTIGMA. *Nat. Ord.* Leguminosæ. *Sub. Ord.* Papilionaceæ. *Tribe* Euphasiolæ.

Gen. Ch. Inflorescence axillary; on pendulous multifloral racemes; rachis of each raceme zigzag. *Calyx* campanulate, four-cleft at apex, the upper division notched, its segments ciliated. *Corolla* papilionaceous, curved in a crescentic manner. *Stamens* 10, diadelphous. *Pistil* more than one. *Stigma* blunt, covered by a ventricular hood, extending along the upper part of the convexity of the style. *Legume* dark-brown and straight, elliptico-oblong, with an apicular curved point, and outer and inner integuments easily separable. *Seeds* two or three, separated by a woolly substance. *Balfour.*

Physostigma venenosum. Balfour, *Transactions of the Royal Society of Edinburgh*, xxii. 305; *Ed. Med. Journ.*, July, 1863, p. 34. This is a climbing plant, with a ligneous stem, mounting on trees and shrubs, and frequenting especially the banks of streams, into which it often drops its fruit when ripe; and it is said that the people of Calabar derive their supply principally from the borders of the streams down which the fruits are carried. The root is spreading, with numerous fibrils, often having attached to them small succulent tubers. The flowers are in axillary, multiflorous, pendulous racemes. The corolla is papilionaceous, of a pale pink colour, with a purplish tinge. The legume when ripe is about seven inches long, and contains two or three seeds. It ripens at all seasons, but is most abundant during the rainy season from June to September. The seeds are the part used. The plant is the only known species.

It has been long known that certain poisonous substances were used as an ordeal, to determine the guilt or innocence of accused individuals, among the Negroes of Western Africa. One of these, called the ordeal bean of Calabar, from the region

where it is used, was brought to the notice of the scientific public by Dr. Daniell, in a paper read before the Ethnological Society of Edinburgh in 1846. Considerable attention was attracted to the subject; and specimens of the bean were obtained by Dr. Christison from the Gold Coast. These were planted in the Botanical Garden at Edinburgh, and produced a plant, which proved to be a perennial creeper, belonging to the natural family *Leguminosæ;* but at the date of the publication of the 11th edition of this work, early in 1858, the precise botanical position of the plant had not been determined. In the year 1859, specimens of the plant were sent from Calabar, which came under the observation of Dr. Balfour, of Edinburgh, who was thus enabled to ascertain its botanical character. He communicated the results of his examination to the Royal Society of Edinburgh; and his paper is published, with a particular description of the plant, in its *Transactions* (vol. xxii. p. 305). Having found that the plant belonged to a yet undescribed genus, he established a new one with the title of *Physostigma*, suggested by a peculiar inflation of the stigma; and designated the species as *venenosum*, from the notorious qualities of the fruit. In the *Edinburgh Medical Journal* (July, 1863, p. 36) is an essay by Dr. Thos. R. Fraser, containing a summary of what was known on the subject of the bean up to that date, with a particular description of the bean, and an account of experiments made with it on animals.

Properties. The seed is about the size of a large horse-bean, being somewhat more than an inch in length by three-fourths of an inch in breadth, with a very firm, hard, brittle, shining integument of a brownish-red, pale-chocolate, or ash-gray colour. The shape is irregularly kidney-form, with a longer convex and a shorter concave edge, two flat sides, and a furrow running longitudinally along its convex margin, and ending in an aperture near one of the extremities of the seed. Within the shell is a kernel consisting of two cotyledons, weighing on an average about 46 grains, hard, white, and pulverizable, of a taste like that of the ordinary edible leguminous seeds, without bitterness, acrimony, or aromatic flavour. The bean yields its virtues to alcohol, and imperfectly to water. The shell constitutes, according to Dr. Edwards, 30 per cent., the kernel 70 per cent. of the bean. Jobst and Hesse were thought to have succeeded in isolating the active principle, which they found exclusively in the cotyledons. They obtained it by exhausting an alcoholic extract of the seeds with water, adding magnesia to neutralization, which is indicated by the liquid becoming brown, then concentrating, and treating with ether. The ethereal solution was shaken with a little weak sulphuric acid. The liquid separated into two layers; the upper, ethereal, containing no alkaloid, and the lower, a solution of the sulphate in water. The latter was separated, treated with magnesia, and afterwards with ether, which yielded the alkaloid on evaporation. The substance thus obtained they proposed to name *physostigmin*. It was brown, amorphous, soluble in ammonia, soda, ether, benzole, and alcohol, and less so in cold water. Its watery solution had an alkaline reaction, and formed salts with the acids. Iodide of potassium precipitated it of a dark-brown colour. Melted with potassa it yielded alkaline vapours. (*Journ. de Pharm.*, Mars, 1864, p. 277.)

But the physostigmin thus obtained proved to be a complex body, containing the active principle associated with other substances. The pure alkaloid has been subsequently isolated by MM. Amédée Vée and Manuel Leven. They procured it by adding to a carefully prepared extract, made by exhausting the powdered seeds with cold alcohol of 95 per cent., a strong solution of tartaric acid, diluting the mixture with water, filtering, adding powdered bicarbonate of potassium in excess, again filtering, and shaking with ether, which yields the alkaloid impure on evaporation. To purify it, the residue was deprived of moisture by putting it under a bell-glass over strong sulphuric acid, was then treated with ether, and the ethereal solution allowed to evaporate spontaneously. Repeated solution in ether and crystallization were still necessary to free it from a red colouring matter, which adhered to it very tenaciously. The pure alkaloid is colourless, crystallizable in thin rhomboidal plates, slightly bitter, soluble in ether, alcohol, and chloroform, and but slightly so in water, to which, however, it gives a decided alkaline reaction. It is readily dissolved by the acids, and is precipitated by the substances which generally precipitate the alkaloids.

It is fusible, and at a high heat gives out white vapours, and burns without residue. Its salts are generally soluble. Its solution acts quickly on the pupil, and a drop of a solution containing only 1 part in 1000, placed within the eyelids, causes great and lasting contraction. The discoverers of this principle named it eserin (*eserina*), from the native name of the plant; but we prefer the first name of physostigmin (*physostigmia*). Of this alkaloid 1·5 milligrammes (·023 gr.), injected under the skin of a guinea-pig, produced palsy of the hind legs in five minutes, and death in half an hour, with dilatation of the pupil at the time of death. It is said to be capable of destroying life by absorption from the conjunctiva. A peculiarity of the alkaloid is that an aqueous solution of it, or one of its salts, exposed to the air in the presence of potassa, soda, or lime, becomes red, owing to the absorption of oxygen. The colouring matter is taken up by chloroform. The colour is not permanent, but gradually changes to yellow, green, or blue. This test will detect less than the 100-thousandth part of the alkaloid. The same property is possessed by the alcoholic extract of the bean.*

Effects on the System. The bean is the only part known to possess medicinal properties. The shell is not without influence on the animal system, as shown by experiments upon rabbits made by Dr. Fraser, who found it to purge, increase the flow of urine, and produce temporary paralysis of the extremities, but without loss of consciousness; and, though a quantity of extract equivalent to a drachm of the shell was given, it did not cause death. The kernel, however, is by far the most active part, as a rabbit was killed by five and a half grains of it. The most prominent effects of this part of the bean were obviously on the spinal marrow, and, as believed by Dr. Fraser, of a depressing character. They were paralysis, loss of reflex action, contraction of the pupil, occasionally evacuation of the bowels, with retention of consciousness until all power of expression ceased. Immediately after death the pupils dilated. No changes of structure were discoverable which could explain the phenomena. The brain and spinal marrow were apparently normal, and the heart full of blood. Similar effects were produced by topical application. The function of the part was suspended. The cardiac action and the vermicular movements of the bowels ceased by contact with the poison; and a little of it applied to the eye, produced contraction of the pupil of that eye, but not of both. The general conclusions of Dr. Fraser were, that the kernel has a depressing action on the spinal cord, causing death by paralysis, in some instances of the respiratory muscles, in others of the heart. One of the most interesting results of his experiments appears to be, that the integument of the seed, though possessing in a slight degree the powers of the kernel over the nervous system, differs from it in being actively cathartic.

In reference to the effects of the medicine upon the human system, much yet remains to be learned. It was known that the beans used by the natives as an ordeal, when given in a certain quantity, generally proved fatal, and the individual only escaped when they provoked vomiting, which was rare. A draught containing 19 seeds pounded and infused in water killed a man in an hour. It would be a subject of interesting inquiry, whether the integuments might not, in certain quantities, act energetically as an emetic as well as cathartic; and whether the escape of the accused

* A *sulphate of physostigmia or eserina*, being called for by oculists, in reference to its effects on the pupil, it becomes desirable to have a formula for its ready preparation. The following is offered by M. A. Petit. A hydro-alcoholic extract of the bean is dissolved in four parts of distilled water, and the solution filtered. To the solution is then added one gramme of bicarbonate of potassium for every 20 grammes of extract, and the mixture is shaken with ether in excess. The ether, which takes up nearly all the alkaloid, is, after a few minutes' repose, separated. A little distilled water is then added, and afterward sulphuric acid drop by drop: the liquid being shaken after each drop, and tested with litmus paper till exactly neutral. After standing, the aqueous solution is separated from the ether, which now contains none of the alkaloid. This ether is then employed as before, and the operation repeated three or four times, so as completely to exhaust the original solution, and the liquid obtained each time is added to the last watery solution. This contains the sulphate of physostigmia nearly pure. To purify this, it should be passed through the same process as the original solution of the extract. The resulting solution may be evaporated to crystallization if desired; but usually the evaporation is carried only so far as to get rid of all the ether present. If enough water be added to the solution to make as many grammes as there were drops of sulphuric acid employed (SO_3HO), each gramme will represent one centigramme (·1543 gr.) of the alkaloid. Of a collyrium made of one part of this to nine of water, a drop or two will be sufficient to act promptly on the pupil. (*New Rem.*, April, 1872, p. 380).—*Note to the fourteenth edition.*

person, in some instances, might not be owing to the accidental or contrived exhibition of a larger than ordinary proportion of this part of the seeds. Dr. Christison took about 12 grains of the kernel, which in 15 minutes produced giddiness and a feeling of torpidity, followed by great weakness and faintness, paleness of the surface, extreme weakness and irregularity of the pulse, and indisposition or inability to make voluntary muscular effort. There was no pain or other uneasiness, except the feeling of prostration and some nausea, and the intellect was normal. In two hours after the poison was swallowed, drowsiness occurred, but no stupor. Dr. Fraser experienced from smaller doses effects of a similar character, with temporary dimness of vision. The heart appears to be somewhat variously affected, sometimes acting irregularly or tumultuously, and sometimes less frequently. A peculiar epigastric sensation is generally experienced as the first symptom, about five minutes after the taking of the medicine, gradually increasing, and becoming at length almost painful. This continues at intervals for a considerable time, is after a little while attended with some dyspnœa; and then dizziness and feebleness of the extremities are experienced.

From the opposite effects of physostigma and atropia it might be reasonably inferred that there is an antagonism between them in their effects on the system; and this seems to have been proved by the experiments of Dr. Fraser, of Edinburgh, who succeeded in preventing the poisonous effects of atropia on animals by the administration of physostigma. (*Am. J. of Med. Sci.*, Oct. 1872, p. 500.)

On the whole, it would appear that the calabar bean is a direct sedative to the spinal marrow, thus producing muscular debility or relaxation, and when largely given, causing even palsy; and in poisonous doses acting by paralyzing the heart and respiratory muscles. It produces no loss of consciousness or stupor, and thus differs from the cerebral sedatives. Besides its action as a spinal sedative, it is more or less irritant to the alimentary canal, often vomiting or purging, and thereby saving life when taken in poisonous quantities. Seventy cases of children are related, who ate more or less of some beans on their arrival from Africa at the wharves of Liverpool, in all of whom vomiting was brought on either by the poison itself, or by emetics administered, except in a single case; and that case was the only one that proved fatal. The nausea and vomiting came on in about 30 minutes; the nervous symptoms, as trembling, dizziness, and loss of muscular power in less than an hour. In the fatal case four kernels had been eaten. Ordinarily in cases of death from calabar bean there are no positive post-mortem phenomena; the brain and spinal marrow being free from congestion. The remedies in cases of poisoning are emetics, as sulphate of zinc and ipecacuanha; and stimulants to support the vital actions.

The most interesting effect of the calabar bean, so far as its practical application is concerned, is that of contracting the pupil; an effect resulting either from its internal or local use. It is most conveniently obtained by introducing a drop of watery solution of the alcoholic extract into the eye. Only the eye operated on is in this case affected. It is highly probable that the effect is produced by a debilitating or paralyzing influence on the spinal centres, whereby the action of the expanding fibres is suspended, and the contractile influence from the cerebral centres is left unimpeded. Another effect on the eye, more recently noticed, is the contraction of the ciliary muscle, which regulates the accommodating power of the organ. Credit is especially due to Dr. T. A. Robertson, of Edinburgh, for calling attention to this influence of the calabar bean. (*Ed. Med. Journ.*, March, 1863, p. 815.) By this influence on the accommodation of the eye, distant objects become indistinct, are apparently magnified, and seem nearer; and Dr. Robertson noticed that this effect was produced sooner and ceased sooner than that upon the pupil. The eye in its normal state thus becomes near-sighted under the influence of the bean. In both these respects there is a strong contrast between the actions of the calabar bean and belladonna; one being exactly antagonistic of the other; as belladonna produces dilatation of the pupil, probably by relaxing the contractile power from the cerebral centres, and at the same time relaxes the ciliary muscles. It does not follow that the operation of the bean is positively stimulant any more upon the ciliary muscles than upon the contractile muscles of the iris. It may in both cases be considered as diminishing or paralyzing a power which in the normal state balances the stimu-

lant influence of the brain. The practical application of these properties of the calabar bean is obvious; and it is now considerably used, whenever the indication is presented either for producing contraction of the pupil, or increasing the power of accommodation of the eye to distances.

Therapeutic Use. In regard to the general therapeutic application of the calabar bean little has been decidedly determined. From its extraordinary sedative influence on the spine it would seem to be indicated in all cases of abnormal excitement or irritation of the spinal marrow, especially in tetanus and the poisonous effects of strychnia. Even in the earlier stages of paralysis induced by active congestion or irritation of the spinal marrow, its depressing influence on the cord is obviously called for. Facts have not yet been sufficiently accumulated to justify a positive statement as to its therapeutic virtues. Yet reports are favourable as to its powers in tetanus. Dr. Fraser reports eleven cases in which the calabar bean was used; and of these only two ended fatally. (*Am. Journ. of Med. Sci.*, Oct. 1868, p. 563.)

The bean may be used in the form of tincture or alcoholic extract. The dose of the kernel would be two or three grains, to begin with, and increased if necessary. But it is seldom used in this way. A strong tincture may be made by percolation with alcohol, of which five minims shall represent three grains of the bean, and a tincture of this strength is recommended by Dr. Fraser. The same writer obtained about 4 per cent. of extract by exhausting the kernel with alcohol. The dose, therefore, of alcoholic extract should not exceed one twenty-fourth of that of the kernel, or one-eighth of a grain. In tetanus, Dr. Fraser recommends the alcoholic extract, either in pill or dissolved in diluted alcohol, in the proportion of 32 grains to the fluidounce. He advises that the treatment should be commenced by subcutaneous injection with one-third of a grain, repeated every two hours, until the system is decidedly affected, and then to administer the remedy in three times the dose by the mouth. (*Am. Journ. of Med. Sci.*, Oct. 1868, p. 563.) An alcoholic extract is officinal, of which the dose is from one-sixteenth to one-fourth of a grain.

For application to the eye Dr. Robertson employed an alcoholic extract mixed with water so as to make liquid preparations of different strengths, one minim representing half a grain, two grains, or four grains. He found these to begin to affect the power of accommodation in 10 minutes, and to produce the full effect in 20 or 30 minutes. They were also wholly unirritating to the eye. They did not, however, keep well, and he afterwards abandoned them for preparations made by suspending the extract in simple syrup. But it would seem best to keep the extract perfectly dry, and mix it with a little water when wanted. This extract dissolves freely in glycerin; and a solution of two and a half grains in 100 minims of that liquid perfectly pure has been found to answer in practice. (*Pharm. Journ.*, July, 1863, p. 26.) Another method of application is to impregnate paper by immersing it three or four times in a concentrated tincture of the bean, allowing it to dry after each immersion, and placing within the lower lid a piece of the paper thus prepared, about one-eighth of an inch square.

Off. Prep. Extractum Physostigmatis. W.

PHYTOLACCÆ BACCA. *U. S. Secondary.*

Poke Berry.

The fruit of Phytolacca decandra. *U. S.*

PHYTOLACCÆ RADIX. *U. S. Secondary.*

Poke Root.

The root of Phytolacca decandra. *U. S.*

PHYTOLACCA. *Sex. Syst.* Decandria Decagynia. — *Nat. Ord.* Phytolaccaceæ.

Gen. Ch. Calyx none. *Petals* five, calycine. *Berry* superior, ten-celled, ten-seeded. *Willd.*

Phytolacca decandra. Willd. *Sp. Plant.* ii. 822; Bigelow, *Am. Med. Bot.* i. 39; Barton, *Med. Bot.* ii. 213. This is an indigenous plant, with a large perennial root, often five or six inches in diameter, divided into two or three principal branches, soft, fleshy, fibrous, whitish within, and covered with a brownish cuticle. The stems, which are annual, frequently grow to the height of six or eight feet, and divide into numerous spreading branches. They are round, very smooth, green when young, but purple after the berries have ripened. The leaves are scattered, ovate-oblong, entire, pointed, smooth, ribbed beneath, and on short footstalks. The flowers are numerous, small, and in long racemes, which are sometimes erect, sometimes drooping. The corolla consists of five ovate, concave, whitish petals, folding inwards. The germ is green. There are ten stamens, and the same number of pistils. The raceme of flowers becomes a cluster of dark purple, almost black, shining berries, flattened above and below, and divided into ten cells, each containing one seed.

The poke is abundant in all parts of the United States, flourishing along fences, by the borders of woods, and especially in newly cleared and uncultivated fields. The muck thrown up from the ditches of swamps is peculiarly favourable to it; and a bed of muck may almost always be recognized by the luxuriant growth of poke with which it covers itself. It also grows spontaneously in the north of Africa and the south of Europe, where, however, it is supposed to have been introduced from America. Its flowers begin to appear in July, and the fruit ripens in autumn. The magnitude of the poke-weed, its large rich leaves, and its beautiful clusters of purple berries, often mingled upon the same branch with the green unripe fruit, and the flowers still in bloom, render it one of the most striking of our native plants. The young shoots are much used as food early in the spring, boiled in the manner of spinage. The ashes of the stems and leaves contain a very large proportion of potassa, yielding, according to Braconnot, not less than 4·2 per cent. of the pure caustic alkali. In the plant the potassa is neutralized by an acid closely resembling the malic, though differing from it in some respects. The leaves, berries, and root are used, but the two latter only are mentioned in the Pharmacopœia. The root is most active. It should be dug up late in November, cut into thin transverse slices, and dried with a moderate heat. As its virtues are diminished by keeping, a new supply should be procured every year. The berries should be collected when perfectly ripe, and the leaves about the middle of summer, when the footstalks begin to redden.

The *berries* contain a succulent pulp, and yield upon pressure a large quantity of fine purplish-red juice. They have a sweetish, nauseous, slightly acrid taste, with little odour. The colouring principle is evanescent, and cannot be applied to useful purposes in dyeing, from the difficulty of fixing it. Alkalies render it yellow; but the original colour is restored by acids. The juice contains saccharine matter, and, after fermenting, yields alcohol by distillation.

The *dried root* is of a light yellowish-brown colour externally, very much wrinkled, and, when in transverse slices, exhibits on the cut surface numerous concentric rings, formed by the projecting ends of fibres, between which the intervening matter has shrunk in drying. The structure internally in the older roots is firm and almost ligneous; the colour yellowish-white, alternating with darker circular layers. There is no smell. The taste is slightly sweetish, and at first mild, but followed by a sense of acrimony. The active matter is imparted to boiling water and alcohol. From the analysis of Mr. Edward Donnelly, the root appears to contain tannic acid, starch, gum, sugar, resin, fixed oil, and lignin, besides various inorganic substances. (*Am. Journ. of Pharm.*, xv. 169.)

Medical Properties and Uses. Poke is emetic, purgative, and somewhat narcotic. As an emetic it is very slow in its operation, frequently not beginning to vomit in less than one or two hours after it has been taken, and then continuing to act for a long time upon both the stomach and bowels. The vomiting produced by it is said not to be attended with much pain or spasm; but narcotic effects have been observed by some physicians, such as drowsiness, vertigo, and dimness of vision. In overdoses it produces excessive vomiting and purging, attended with great prostration of strength, and sometimes with convulsions. A case is recorded in the *Stethoscope* for March, 1852 (ii. 134), by Dr. Geo. F. Terrill, of Hanover Co., Va., in

which death was produced in a woman by eating a double handful of the berries. Free purgation followed upon the first day, after which coma set in, with great prostration, though death did not occur until after the sixth day. Dr. A. W. Griggs, of West Point, Georgia, has reported the case of a child, six years old, who, after having swallowed two or three fluidrachms of a tincture of the root, was seized in less than an hour with tonic spasm of the muscles; the extremities being stiff, the hands clenched, the feet extended and toes flexed, and the trunk in a condition of opisthotonos. Under the application of cups to the head and spine, cold to the scalp, and a sinapism over the spine, the spasms were relieved, and recovery took place. (*N. Orleans Med. and Surg. Journ.*, A.D. 1866, xix. 255; from *Atlanta Med. and Surg. Journ.*, July, 1866.) If there was no other cause to which these symptoms could be ascribed, poke root must be considered as having before unsuspected powers; for, though considered narcotic, we have seen no proof from any other source that it is a spinal irritant. Poke root has been proposed as a substitute for ipecacuanha; but the slowness and long continuance of its action, and its tendency to purge, wholly unfit it for the purpose. In small doses it acts as an alterative, and has been highly recommended in the treatment of chronic rheumatism. Dr. C. S. Fenner, of Memphis, Tennessee, has found it highly useful, as an internal remedy, in granular conjunctivitis, especially in preventing the relapses to which the affection is so liable. A case has been recorded by Dr. Alexander, of Tennessee, in which an obstinate and painful tumour on the face, having some of the characters of cancer, disappeared in the course of three months under the use for that time of a fluid extract of phytolacca, given for the cure of chronic rheumatism, which also was greatly relieved by the remedy. Dilute carbolic acid with glycerin was used as a local measure. (*M. and S. Reporter*, May 14, 1870, p. 422.) Dr. Biggers, of La Grande, Oregon, states in a communication to the *Amer. Journ. of Med. Sci.*, that he has found the fluid extract of phytolacca an excellent remedy in inflamed and painful mammæ, having frequently employed the remedy, and invariably with success. (*New Remedies*, July, 1873, p. 403.) The dose of the powdered root, as an emetic, is from ten to thirty grains; as an alterative, from one to five grains. A saturated tincture of the berries may be given in rheumatic cases, in the dose of a fluidrachm, three times a day. Dr. Fenner uses a saturated decoction, of which he gives a wineglassful every two or three hours. A strong infusion of the leaves or root has been recommended in piles. An ointment, prepared by mixing a drachm of the powdered root or leaves with an ounce of lard, has been used with advantage in psora, tinea capitis, and some other forms of cutaneous disease. Dr. H. G. Carey, of Dayton, Ohio, has cured three cases of sycosis, and one of favus, by the local use of a decoction of the root. (*Va. Med. Journ.*, Aug. 1856, p. 144.) It occasions at first a sense of heat and smarting in the part to which it is applied. An extract made by evaporating the expressed juice of the recent leaves has been used for the same purposes, and acquired at one time considerable repute as a remedy in cancer. W.

PIMENTA. *U.S., Br.*

Pimento. Allspice.

The unripe berries of Eugenia Pimenta (*De Candolle*). *U.S.* The dried unripe berries of the Allspice tree, Eugenia Pimenta (*D. C.*), West Indies. *Br.*

Allspice, Jamaica pepper; Piment, Poivre de la Jamaique, *Fr.;* Nelkenpfeffer, *Germ.;* Pimenti, *Ital.;* Pimienta de la Jamaica, *Span.*

Myrtus. *Sex. Syst.* Icosandria Monogynia.—*Nat. Ord.* Myrtaceæ.

Gen. Ch. Calyx five-cleft, superior. *Petals* five. *Berry* two to five-celled, many-seeded. *Willd.*

Myrtus Pimenta. Willd. *Sp. Plant.* ii. 973; Woodv. *Med. Bot.* p. 541, t. 194.—*Eugenia Pimenta.* De Cand. *Prodrom.* iii. 285; Lindley, *Flor. Med.* p. 76. This is a beautiful tree, about thirty feet high, with a straight trunk, much branched above, and covered with a very smooth gray bark. Its dense and ever-verdant foliage gives it at all times a refreshing appearance. The leaves, which are petiolate, vary in shape and size; but are usually about four inches long, elliptical, entire,

blunt or obtusely pointed, veined, and of a deep shining green colour. The flowers are small, without show, and disposed in panicles upon trichotomous stalks, which usually terminate the branches. The fruit is a spherical berry, crowned with the persistent calyx, and when ripe is smooth, shining, and of a black or dark-purple colour. The tree exhales an aromatic fragrance, especially during the summer months, when in flower.

It is a native of the West Indies, Mexico, and South America, and is abundant in Jamaica, whence its fruit received the name of *Jamaica pepper*. The berries are the officinal part. They are gathered after having attained their full size, but while yet green, and are carefully dried in the sun. When sufficiently dry, they are put into bags and casks for exportation.

Properties. The berries, as they reach us, are of different sizes, usually about as large as a small pea, round, wrinkled, umbilicate at the summit, of a brownish colour, and when broken present two cells, each containing a black hemispherical seed. They have a fragrant odour, thought to resemble that of a mixture of cinnamon, cloves, and nutmeg. Hence the name of *allspice*, by which they are best known in this country. Their taste is warm, aromatic, pungent, and slightly astringent. They impart their flavour to water, and all their virtues to alcohol. The infusion is of a brown colour, and reddens litmus paper. They yield a volatile oil by distillation. (See *Oleum Pimentæ*.) Bonastre obtained from them a volatile oil, a green fixed oil, a fatty substance in yellowish flakes, tannin, gum, resin, uncrystallizable sugar, colouring matter, malic and gallic acids, saline matters, moisture, and lignin. The green oil has the burning aromatic taste of pimento, and is supposed to be the acrid principle. Upon this, therefore, together with the volatile oil, the medical properties of the berries depend; and, as these two principles exist most largely in the shell or cortical portion, this part is most efficient. According to Bonastre, the shell contains 10 per cent. of the volatile, and 8 of the fixed oil, the seeds only 5 per cent. of the former, and 2·5 of the latter. Berzelius considers the green fixed oil of Bonastre as a mixture of volatile oil, resin, fixed oil, and perhaps a little chlorophyll.

Medical Properties and Uses. Pimento is a warm aromatic stimulant, used in medicine chiefly as an adjuvant to tonics and purgatives, the taste of which it serves to cover; while it increases their warmth, and renders them more acceptable to the stomach. It is particularly useful in cases attended with much flatulence. It is, however, much more largely employed as a condiment than as a medicine. The dose is from ten to forty grains. A tincture of pimento has been recommended as a local application in chilblains.

Off. Prep. Aqua Pimentæ, *Br.;* Oleum Pimentæ; Syrupus Rhamni, *Br.* W.

PIPER. *U.S.*

Black Pepper.

The unripe berries of Piper nigrum. *U.S.*

Off. Syn. PIPER NIGRUM. *Black Pepper.* The dried unripe berries of Piper nigrum, *Linn.* Imported from the East Indies. *Br.*

Poivre, *Fr.;* Schwarzer Pfeffer, *Germ.;* Gemeine peper, *Dutch;* Pepe nero, *Ital.;* Pimienta negra, *Span.;* Fifil uswud, *Arab.;* Lada, *Malay;* Maricha, *Javan.;* Sahan, *Palembang.*

PIPER. See CUBEBA.

Piper nigrum. Willd. *Sp. Plant.* i. 159; Woodv. *Med. Bot.* p. 721, t. 246; Carson, *Illust. of Med. Bot.* ii. 38, pl. 83. The pepper vine is a perennial plant, with a round, smooth, woody, articulated stem, swelling near the joints, branched, and from eight to twelve feet or more in length. The leaves are entire, broad-ovate, acuminate, seven-nerved, coriaceous, very smooth, of a dark-green colour, and attached by strong sheath-like footstalks to the joints of the branches. The flowers are small, whitish, sessile, covering thickly a cylindrical spadix, and succeeded by globular berries, which are red when ripe.

The plant grows wild in Cochin-China and various parts of India. It is cultivated on the coast of Malabar, in the peninsula of Malacca, in Siam, Sumatra, Java, Borneo, the Philippines, and many other places in the East. The best pepper is

said to be produced in Malabar; but Europe and America derive their chief supplies from Sumatra and Java. It appears to have been introduced into the West Indies; as a specimen of black pepper was seen by the author, at the International Exhibition in London, in 1862, among the products of Trinidad. The plant is propagated by cuttings, and is supported by props, or trees planted for the purpose, upon which it is trained. In three or four years from the period of planting, it begins to bear fruit. The berries are gathered before they are all perfectly ripe, and, upon being dried, become black and wrinkled.

White pepper is the ripe berry, deprived of its skin by maceration in water and subsequent friction, and afterwards dried in the sun. It has less of the peculiar virtues of the spice than the black pepper, and is seldom employed.

Properties. The dried berries are about as large as a small pea, externally blackish and wrinkled, internally whitish, of an aromatic smell, and a hot, pungent, almost fiery taste. They yield their virtues partially to water, entirely to alcohol and ether. Pelletier found them to contain a peculiar crystalline matter called piperin, an acrid concrete oil or soft resin of a green colour, a balsamic volatile oil, a coloured gummy substance, an extractive matter like that found in leguminous plants capable of being precipitated by infusion of galls, starch, a portion of bassorin, tartaric and malic acids, lignin, and various salts. *Piperin* was discovered by Professor Œrsted, of Copenhagen, who considered it an organic alkali, and the active principle of pepper. Pelletier, however, utterly denied its alkaline nature and medical activity, and ascribed all the effects, supposed to have been obtained from it, to a portion of the acrid concrete oil with which it is mixed when not very carefully prepared. When perfectly pure, piperin is in colourless transparent crystals, according to Pelletier without taste, fusible at 212°, capable of being sublimed under favorable circumstances in perfect crystals (Waddington, *Pharm. J. and Trans.*, March, 1868, p. 415), insoluble in cold water, slightly soluble in boiling water which deposits it upon cooling, soluble in alcohol, ether, and acetic acid, decomposed by the concentrated mineral acids, with the sulphuric becoming of a blood-red colour, with the nitric, first of a greenish-yellow, then orange, and ultimately red. Christison, however, states, in his Dispensatory, that the whitest crystals he had been able to obtain were still acrid, and emitted an irritating vapour when thrown on heated iron. As ordinarily procured the crystals are yellow. Piperin consists of carbon, hydrogen, nitrogen, and oxygen; and its formula, according to Wertheim, is $C_{70}H_{37}N_2O_{10}$.* It is obtained by treating pepper with alcohol, evaporating the tincture to the consistence of an extract, submitting the extract to the action of an alkaline solution by which the oleaginous matter is converted into soap, washing the undissolved portion with cold water, separating the liquid by filtration, treating the matter left on the filter with alcohol, and allowing the solution thus obtained to evaporate spontaneously, or by a gentle heat. Crystals of piperin are deposited, and may be purified by alternate solution in alcohol or ether, and crystallization. The taste and medicinal activity of pepper probably depend mainly on the concrete oil or resin, and on the volatile oil. The concrete oil is of a deep-green colour, very acrid, and soluble in alcohol and ether. The volatile oil is limpid, colourless, becoming yellow by age, of a strong odour, and of a taste less acrid than that of pepper itself. It consists of ten eqs. of carbon

* An interesting chemical investigation into the nature of piperin has been made by Wertheim, the result of which is that it probably consists of a volatile alkaline principle ($C_{12}H_7\dot{N}$), combined with an electro-negative compound ($C_{58}H_{30}NO_{10}$), which, however, is thus far hypothetical. The former is obtained by distilling piperin mixed with soda and hydrate of lime, at a temperature between 300° and 320°. It is considered by Wertheim as identical with *picolin*, previously obtained by Dr. Anderson from the reaction of nitric acid on piperin, and described by him in a paper presented at the meeting of the British Association, at Edinburgh, in 1850. (*Chem. Gaz.*, Aug. 1849, p. 309; from *Liebig's Annalen.*) M. Cahours has since repeated the experiments of Wertheim, and obtained the same alkaline principle, which he names *piperidin*, and of which he gives the formula $C_{10}H_{11}N$, since changed by Wertheim to $C_{12}H_{13}N$. According to M. Cahours, it is a colourless liquid, having a mixed odour of ammonia and pepper, a very caustic taste, and a strong alkaline action. It is soluble in water in all proportions, and forms crystallizable salts with several acids. (*Ibid.*, May 1, 1852, p. 167.) When piperin is heated with potassa, it yields, among other products, a peculiar acid, which has received the name of *piperic acid*. (*Chem. Gaz.*, Jan. 1, 1858, p. 7.)

In the *Pharmaceutical Journal* (June, 1860, p. 605) is a description by Mr. Evans of the microscopic structure of pepper, to which it may possibly be desirable to recur in instances of supposed adulteration.

and eight of hydrogen, and forms a liquid, but not a concrete compound with muriatic acid.*

Medical Properties and Uses. Black pepper is a warm carminative stimulant, capable of producing general arterial excitement, but acting with greater proportional energy on the part to which it is applied. From the time of Hippocrates it has been employed as a condiment and medicine. Its chief medicinal application is to excite the languid stomach and correct flatulence. It was long since occasionally administered for the cure of intermittents; but its employment for this purpose had passed from the profession to the vulgar, till a few years since revived by an Italian physician, to be again consigned to forgetfulness. Piperin has also been employed in the same complaint, and has even been thought superior to sulphate of quinia; but experience has not confirmed this favourable opinion. That, in its impure state, when mixed with a portion of the acrid principle, it will occasionally cure intermittents, there can be no doubt; but it is not comparable to the preparations of bark, and is probably less active than the alcoholic extract of pepper. In intermittent fever, when the stomach is not duly susceptible to the action of quinia, as sometimes in drunkards, pepper may be found a useful adjuvant to the more powerful febrifuge. The dose of pepper is from five to twenty grains. It may be given whole or in powder; but is more energetic in the latter state. Piperin has been given in doses varying from one to six or eight grains.

Piper longum, though no longer officinal, deserves a brief notice here, if for nothing else, on account of its former position in medicine. This species of Piper differs from its congeners in having its lower leaves cordate, petiolate, seven-nerved, its upper oblong-cordate, sessile, and five-nerved; its flowers in dense, short, terminal, and nearly cylindrical spikes; and its fruit, consisting of very small one-seeded berries or grains, embedded in a pulpy matter. It is a native of Southeastern Asia, and is produced abundantly in Bengal and other parts of Hindostan. The fruit is green when immature, and becomes red as it ripens. It is gathered in the former state, as it is then hotter than when perfectly ripe. The whole spike is taken from the plant, and dried in the sun. *Long pepper*, as the fruit is called, is cylindrical, an inch or more in length, indented on its surface, of a dark-gray colour, a weak aromatic odour, and a pungent fiery taste. M. Dulong found its chemical composition to be closely analogous to that of black pepper. Like that it contains *piperin*, a concrete oil or soft resin upon which its burning acrimony depends, and a volatile oil to which it probably owes its odour. Its medical virtues are essentially the same as those of black pepper; but it is considered inferior to that spice, and is seldom used.

Off. Prep. Confectio Piperis, *Br.;* Oleoresina Piperis, *U. S.;* Pulvis Opii Compositus, *Br.* W.

PIX BURGUNDICA. *U. S., Br.*

Burgundy Pitch.

The prepared resinous exudation from Abies excelsa (Lamarck, *Encyc. Method.*). *U. S.* A resinous exudation from the stem of the Spruce Fir, Abies excelsa, *D. C.* Melted and strained; imported from Switzerland. *Br.*

Poix de Bourgogne, Poix jaune, Poix blanche, *Fr.;* Burgundisches Pech, *Germ.*

The genus Pinus of Linnæus has been been divided into three genera, viz., *Pinus*, *Abies*, and *Larix;* the first including the pines, the second the firs and spruces, and the third the larches; and the division is recognised in this work.

ABIES. *Sex. Syst.* Monœcia Monadelphia.— *Nat. Ord.* Pinaceæ or Coniferæ.

Gen. Ch. MALE FLOWERS. *Catkins* solitary, not racemose; *Scales* staminiferous at the apex. *Stamens* two, with one-celled anthers. FEMALES. *Catkins* simple.

* Pepper is probably not often adulterated in its ordinary form; but, in the state of powder, it is said that various inert powders are often added. One of these detected by Bouchardat, was the parenchyma of potatoes left after the extraction of starch, dried and reduced to powder. The adulterations may be detected by means of a microscope of 300 to 400 power, by means of which a peculiar fecula characteristic of pepper may be noticed through its starch corpuscles, which exhibit themselves as compound granules, preserving the form of the cells which contained, and were quite filled by them. (See *Ann. de Thérap.*, 1874, p. 76.)—*Note to the fourteenth edition.*

Ovaries two. *Stigmas* glandular. *Cone* with imbricated scales, which are thin at the apex, and rounded. *Cotyledons* digitate-partite. *Leaves* solitary in each sheath. *De Cand.*

Abies excelsa. De Candolle. — *A. communis.* Loudon's *Encyc. of Plants.* — *Pinus Abies.* Willd. *Sp. Plant.* iv. 506; Woodv. *Med. Bot.* p. 4. t. 2. The *Norway spruce* is a very lofty tree, rising sometimes one hundred and fifty feet in height, with a trunk from three to five feet in diameter. The leaves, which stand thickly upon the branches, are short, obscurely four-cornered, often curved, of a dusky-green colour, and shining on the upper surface. The male aments are purple and axillary, the female of the same colour, but usually terminal. The fruit is in pendent, purple, nearly cylindrical strobiles, the scales of which are oval, pointed, and ragged at the edges.

This tree is a native of Europe and Northern Asia. Though designated as the source of Burgundy pitch, it furnishes but a part of the substance sold under that name by the druggists. Tingley asserts that the real Burgundy pitch is obtained from the *Abies picea*, or European silver fir tree. According to Geiger, who is probably correct, it is procured from both species. To obtain the *pitch*, portions of the bark are removed so as to lay bare the wood, and the flakes of concrete resinous matter which form upon the surface of the wound, having been detached by iron instruments, are melted with water in large boilers, and then strained through coarse cloths. It is called Burgundy pitch from the province of that name in the east of France. We are told that the greater portion is collected in the neighbourhood of Neufchâtel. According to Mr. Daniel Hanbury, however, it is no longer brought from Switzerland, being supplied to commerce partly from Baden and Austria in Germany, and partly from Finland, where it is largely produced. (*Chem. News*, Oct. 4, 1867, p. 181.)

From various species of pine, in different parts of Europe, a similar product is obtained and sold by the same name. It is prepared by removing the juice which concretes upon the bark of the tree, or upon the surface of incisions, called *galipot* by the French, and purifying it by melting, and straining either through cloth or a layer of straw. A *factitious Burgundy pitch* is made by melting together common pitch, rosin, and turpentine, and agitating the mixture with water, which gives it the requisite yellowish colour. Its odour is different from that of the genuine. Mr. Hanbury gives, as a test of true Burgundy pitch, that it is almost entirely soluble in twice its weight of glacial acetic acid, while the factitious similarly treated forms a turbid mixture, which quickly separates into a thick oily liquid above, and a bright solution below. (*Ibid.*, *loc. citat.*)

As brought to this country, Burgundy pitch is generally mixed with impurities, which require that it should be melted and strained before being used. In its pure state it is hard, brittle, quite opaque, of a yellowish or brownish-yellow colour, and a weak terebinthinate taste and odour. It is very fusible, and at the heat of the body softens and becomes adhesive. It differs from turpentine in containing a smaller proportion of volatile oil.

Medical Properties and Uses. Applied to the skin, in the shape of a plaster, Burgundy pitch acts as a gentle rubefacient, producing a slight inflammation and serous effusion without separating the cuticle. Sometimes it excites a papillary or vesicular eruption; and we have known it to act upon the surface as a violent poison, giving rise to severe pain, swelling, and redness, followed by vesication and even ulceration. It is used chiefly in chronic rheumatic pains, and in chronic affections of the chest or abdomen, which call for a gentle but long-continued revulsion to the skin. A plaster of Burgundy pitch has been found very useful in malignant pustules. (*Ann. de Thérap.*, A.D. 1860, p. 103.)

Off. Prep. Emplastrum Antimonii, *U. S.;* Emplast. Ferri; Emplast. Galbani Comp., *U. S.;* Emplast. Opii, *U. S.;* Emplast. Picis, *Br.;* Emplast. Picis Burgundicæ, *U. S.;* Emplast. Picis cum Cantharide, *U. S.* W.

PIX CANADENSIS. *U. S.*

Canada Pitch. Hemlock Pitch.

The prepared resinous exudation from Abies Canadensis (Michaux, *N. Am. Silva*). *U. S.*

Abies. See PIX BURGUNDICA.

Abies Canadensis. Michaux, *N. Am. Sylv.* iii. 185. — *Pinus Canadensis.* Willd. *Sp. Plant.* iv. 505. This is the *hemlock spruce* of the United States and Canada. When of full growth it is often seventy or eighty feet high, with a trunk two or three feet in diameter, and of nearly uniform dimensions for two-thirds of its length. The branches are slender, and dependent at their extremities. The leaves are very numerous, six or eight lines long, flat, denticulate, and irregularly arranged in two rows. The strobiles are ovate, little longer than the leaves, terminal, and pendulous.

The tree is abundant in Canada, Nova Scotia, and the more northern parts of New England; and is found in the elevated and mountainous regions of the Middle States. Its bark abounds in the astringent principle, and is much used for tanning in the northern parts of the United States. An extract is made from the bark for tanning, which is prepared by evaporation in vacuo, and is said by Mr. N. Spencer Thomas, who prepares it, to have a close resemblance to extract of rhatany, and is proposed by him as a medicine applicable to similar purposes. It no doubt contains tannic acid largely. (*Am. Journ. of Pharm.*, May, 1866, p. 214.) The tree contains much less juice than some other of the Pinaceæ; and very little flows from incisions made into its trunk. But in the trees which have attained their full growth, and are about or have begun to decay, the juice exudes spontaneously, and hardens upon the bark, in consequence of the partial evaporation or oxidation of its volatile oil. The bark thus encrusted is stripped from the tree, broken into pieces, and boiled in water. The pitch melts, rises to the surface, is skimmed off, and is still further purified by a second boiling in water. It is brought to Philadelphia from the north of Pennsylvania, in dark-coloured brittle masses, which, on being broken, exhibit numerous minute fragments of bark interspersed through their substance. From these it is purified in the shops, by melting and straining through linen or canvas. (Ellis, *Journ. of Phil. Col. of Pharm.*, ii. 18.) Another mode of collecting it is to make incisions into the body of the tree, and to remove the juice as it exudes. (Stearns, *Am. Journ. of Pharm.*, Jan. 1860, p. 29.)

Thus prepared it is hard, brittle, quite opaque, of a dark yellowish-brown colour, becoming still darker by exposure to the air, of a weak peculiar odour, and scarcely any taste. It softens and becomes adhesive with a moderate heat, and melts at 198° F. Its constituents are resin and a minute proportion of volatile oil. It is commonly known by the incorrect name of *hemlock gum.*

Medical Properties and Uses. Canada pitch is a gentle rubefacient, closely analogous to Burgundy pitch in its properties, and employed for precisely the same purposes. It is, however, more readily softened by heat, and is sometimes almost too soft for convenient application at the temperature of the body. A volatile oil obtained from Abies Canadensis, and called *oil of spruce*, or *oil of hemlock*, has been employed to produce abortion, with the effect of endangering the life of the female. (J. S. Paige, *N. Y. Journ. of Med.*, viii. 184.)

Off. Prep. Emplastrum Picis Canadensis, *U. S.* W.

PIX LIQUIDA. *U. S., Br.*

Tar.

The impure turpentine from the wood of Pinus palustris and of other species of Pinus, procured by burning. *U. S.* A bituminous liquid, obtained from the wood of Pinus sylvestris (*Linn.*) and other Pines, by destructive distillation. *Br.*

Goudron, *Fr.;* Theer, *Germ.;* Pece liquida, *Ital.;* Alquitran, *Span.*

The tar used in this country is prepared from the wood of various species of pine,

particularly *Pinus palustris* of the Southern States. (See *Terebinthina.*) The dead wood is usually selected, because, when vegetation ceases, the resinous matter becomes concentrated in the interior layers. The wood is cut into billets of a convenient size, which are placed together so as to form a large stack or pile, and then covered with earth as in the process for making charcoal. The stack is built upon a small circular mound of earth previously prepared, the summit of which gradually declines from the circumference to the centre, where a cavity is formed, communicating by a conduit with a shallow ditch surrounding the mound. Fire is applied through an opening in the top of the pile, and a slow combustion is maintained, so that the resinous matter may be melted by the heat. This runs into the cavity in the centre of the mound, and passes thence by the conduit into the ditch, whence it is transferred into barrels. Immense quantities of tar are thus prepared in North Carolina and the southeastern parts of Virginia, sufficient, after supplying our own consumption, to afford a large surplus for exportation. Considerable quantities of tar have been prepared also in the lower parts of New Jersey, in some portions of New England, and in Pennsylvania west of the Alleghany mountains, from the *Pinus rigida*, or pitch pine, and perhaps from some other species.

Properties. Tar has a peculiar empyreumatic odour, a bitterish, resinous, somewhat acrid taste, a colour almost black, and a tenacious consistence intermediate between that of a liquid and solid. It consists of resinous matter, united with acetic acid, oil of turpentine, and various volatile empyreumatic products, and coloured with charcoal. By distillation it yields an acid liquor called *pyroligneous acid* (see *Acidum Aceticum*), and an empyreumatic oil called *oil of tar;* and what is left behind is *pitch.* The empyreumatic oil has been ascertained by Dr. Reichenbach, of Moravia, to contain, besides oil of turpentine, six distinct principles, which he has named *paraffin*, *eupion*, *creasote*, *picamar*, *capnomor*, and *pittacal.* Of these, only picamar and creasote merit particular attention; the former as the principle to which tar owes its bitterness, the latter as the one upon which it probably depends chiefly for its medical virtues. (See *Creasotum.*) Tar yields a small proportion of its constituents to water, which is thus rendered medicinal, and is employed under the name of *tar-water.* It is dissolved by alcohol, ether, and the volatile and fixed oils.

The pitch, left after the evaporation of tar, was formerly officinal, with the British Colleges, under the names of *Pix nigra*, *Pix arida*, or simply *Pix*, but has been omitted in the present British Pharmacopœia. It has a shining fracture, softens and becomes adhesive with a moderate heat, melts in boiling water, and consists of the resin of the pine unaltered, and of various empyreumatic resinous products which have received the name of *pyretin.* (Berzelius, *Trait. de Chim.*, vi. 641 and 680.) It appears to be very gently stimulant or tonic, and has been used internally in ichthyosis and other cutaneous diseases, and recently with great advantage in piles. The dose is from ten grains to a drachm given in pills. Pitch is also used externally in the form of ointment.

Medical Properties and Uses. The medical properties of tar are similar to those of the turpentines. It is occasionally used with advantage in chronic catarrhal affections, and complaints of the urinary passages. Little benefit can be expected from it in genuine phthisis, in the treatment of which it was formerly recommended. Dr. Bateman employed it advantageously as an internal remedy in ichthyosis. It has also been used advantageously, in the same way, in the form of tar-water for the cure and prevention of furuncles. In reference to the administration of tar, it has always been considered desirable to have it in a soluble state, so that it may be brought with facility into a liquid form if thought desirable. Besides, tar in the stomach will probably be found efficacious in proportion to its solubility. This desired end was attained when it was discovered that tar was capable of forming a definite, solid compound with sugar, which was very soluble in water. Saccharated tar contains 4 per cent. of pure tar, resembles sugar in appearance, having a sweet taste and the odour of tar, and may be given in substance or solution as deemed desirable. (See *Pharm. J.*, September, 1871, p. 249.) But glycerin is a more convenient vehicle; and Glycerite of Tar has been adopted as an officinal preparation in the last edition of the U. S. Pharmacopœia. Its vapour, inhaled into the lungs, has

been found serviceable in numerous cases of bronchial disease. Its effects in this way are most conveniently obtained by placing a cup containing tar or oil of tar in a small water-bath, over a common nurse-lamp, and thus impregnating the air of the chamber. Externally applied, in the state of ointment, tar is a very efficient remedy in tinea capitis or scaldhead, and in some cases of psoriasis; and has been used with advantage in foul or indolent ulcers, and other affections of the skin. Some prefer a mixture with glycerin in the form of the officinal Glycerite of Tar.

It may be used in the form of tar-water (see *Infusum Picis Liquidæ*), or in substance made into pills with wheat flour, or mixed with sugar in the form of an electuary. The dose is from half a drachm to a drachm, and may be repeated so as to amount to three or four drachms daily.*

Pulverulent tar is prepared by M. Magnes Lahens, by mixing, in an earthen-ware vessel, two parts of finely divided charcoal and one of liquid tar. The resulting mixture resembles small grains of gunpowder, does not soil the vessel or the fingers, and yields readily to water the tar which it contains; the most favourable temperature for solution being about 20° C. (68° F.). M. Magnes Lahens recommends a syrup prepared from the powder as follows. Take of pulverulent tar 50 grammes, water 180 do., granulated sugar 320 do. Mix the tar and sugar in a mortar, then add the water, and heat the mixture by a water-bath at 60° C. Then remove from the bath, shake until the sugar is all dissolved, and strain when hot, and afterwards again when cold. A tablespoonful of the syrup, added to a tumbler of water, yields a tar-water resembling that of the French Codex. The pulverulent tar may also be used for pills, and for fumigation by throwing a few grains on a heated shovel. (*Pharm. J.*, April, 1872, p. 850.)

Off. Prep. Glyceritum Picis Liquidæ, *U. S.;* Infusum Picis Liquidæ, *U. S.;* Unguentum Picis Liquidæ. W.

PLUMBUM.

Lead.

Plomb, *Fr.;* Blei, *Germ.;* Lood, *Dutch;* Piombo, *Ital.;* Plomo, *Span.;* Chumbo, *Port.*

Lead is not officinal in its metallic state, but enters into a number of important medicinal preparations. It occurs in nature as an oxide, as a sulphuret called *galena*, and in saline combination, forming the native sulphate, phosphate, carbonate, chromate, molybdate, tungstate, and arseniate of lead. The oxide is rare, but galena is exceedingly abundant, and is the ore from which nearly all the lead of commerce is extracted. The process of extraction consists in melting the ore in contact with charcoal. The richest and most extensive mines of galena are found in this country. The lead region of the United States extends in length from the Wisconsin in the north to the Red River of Arkansas in the south, and in breadth about one hundred and and fifty miles.

Properties. Lead is a soft, bluish-gray, and very malleable metal, presenting a bright surface when newly melted or cut. It has a perceptible taste, and a peculiar smell when rubbed. It undergoes but little change in the air, but is acted on by the

* *Tar Beer or Wine of Tar.* A preparation under this name has been used to some extent in Philadelphia in pulmonary affections. The following is the formula recommended by Prof. Procter. Take of *ground malt, honey,* and *tar,* each a pound; *yeast* half a pint. Mix the malt and honey with six pints of water in an earthen vessel; keep the mixture for three hours, with occasional stirring, at the temperature of 150° F., then allow it to cool to 80°, and add the yeast. Sustain the fermentation for 36 hours by a heat between 70° and 80°, then decant the supernatant liquid, add the tar gradually to the dregs, stirring constantly, so as to make a uniform mixture, and return the decanted fluid to the vessel. Stir the whole occasionally for a week, adding water to preserve the measure; then strain with strong expression, allow the expressed liquor to stand until it becomes nearly clear by subsidence, and finally filter through paper. (*Am. Journ. of Pharm.*, xxii. 111.)

A Syrup of Tar is prepared by Mr. Thos. A. Lancaster in the following manner. Take of *tincture of tar* (made in the proportion of two troyounces of tar to a pint of alcohol) f℥ij, *carbonate of magnesium* ℥j or q. s., *white sugar* ℔j avoird. Rub the tincture thoroughly with the carbonate; add half a pint of water gradually; then filter, and, when the liquid ceases to pass, pour water into the filter till the product measures half a pint; lastly, add the sugar and dissolve it by means of a gentle heat. The syrup may be given in the dose of half an ounce or an ounce. (*Ibid.*, Nov. 1859, p. 555.)—*Note to the twelfth edition.*

combined influence of air and rain-water, which give rise to a hydrated protoxide, which is afterwards changed, in part, into carbonate, by absorbing carbonic acid from the atmosphere; and if in water, the carbonate is imparted to it in the state of bicarbonate, which renders the liquid poisonous. This chemical effect on the metal is greater in proportion as the water is purer. (See *page* 140.) Aqueous vapour passed through leaden pipes has a similar corroding effect, which is greater as the lead is purer. (*Am. Journ. of Pharm.*, Nov. 1863, p. 507.) Spring and river water act on lead differently; the lead becoming slowly oxidized, and covering itself with a black coating of suboxide, which adheres strongly to the metal, and thus in some measure protects the water. (Langlois, *Journ. de Pharm. et de Chim.*, 4e sér., ii. 29.) M. Stalmann has satisfied himself by experiment, that an extremely minute quantity of ammonia or of nitric acid will very much promote the action of water upon lead; a millionth of ammonia being sufficient for the purpose. (*Ibid.*, iv. 467.) Metallic lead seems to be liable to the attacks of certain insects, which bore into and sometimes through it, not using it as food, but apparently in search of secure places of retreat for future development. A knowledge of this fact may sometimes be important. (*Am. Journ. of Pharm.*, Jan. 1865, p. 72.) Its sp. gr. is 11·4, melting point about 612°, and eq. 103·5. Exposed to a stream of oxygen on ignited charcoal, it burns with a blue flame, throwing off dense yellow fumes. The best solvent of lead is nitric acid; but the presence of sulphuric acid destroys, and that of muriatic acid lessens its solvent power, on account of the insolubility of the sulphate and chloride of lead. Lead forms five oxides, a dioxide, protoxide, sesquioxide, deutoxide, and red oxide. The *dioxide* consists of two equivalents of lead and one of oxygen. The *protoxide*, called in commerce *massicot*, may be obtained by calcining, in a platinum crucible, the subnitrate of lead, formed by precipitating a solution of the nitrate by ammonium. On a large scale it is manufactured by exposing melted lead to the action of the air. Its surface becomes encrusted with a gray pellicle, which, being scraped off, is quickly succeeded by another; and the whole of the metal, being in this way successively presented to the air, becomes converted into a greenish-gray powder, consisting of protoxide and metallic lead. This, by exposure to a moderate heat, absorbs more oxygen, and is converted wholly into protoxide. This oxide has a yellow colour, and is the only oxide of lead capable of forming salts with the acids. It consists of one eq. of lead 103·5, and one of oxygen 8 = 111·5. A variety of the protoxide, called *litharge*, is very much used in pharmacy, and is officinal in all the Pharmacopœias. (See *Plumbi Oxidum.*) The *sesquioxide*, discovered by Winckelblech, is unimportant. The *deutoxide*, called also *puce* oxide from its *flea*-brown colour, may be obtained by treating red lead with nitric acid. The acid takes up the protoxide and leaves the deutoxide, which may be purified by washing with boiling water. A more productive process is to precipitate four parts of acetate of lead by three of carbonate of sodium, and then to pass into the thin pasty mass of carbonate of lead a stream of chlorine, which converts the protoxide of the carbonate into the brown deutoxide. (*F. Wöhler.*) Solution of chlorinated soda may be conveniently employed to furnish the necessary chlorine. (F. F. Mayer, *Am. Journ. of Pharm.*, Sept. 1856, 410.) Deutoxide of lead is a tasteless powder, of a dark-brown colour. When heated to redness it loses half its oxygen and becomes protoxide. It consists of one eq. of lead 103·5, and two of oxygen 16 = 119·5. The *red oxide*, called in commerce *minium* or *red lead*, is described under another head. (See *Plumbi Oxidum Rubrum.*) Lead combines with iodine, forming the officinal iodide of lead. The acetate, carbonate, and nitrate are also officinal.

The best tests of lead are sulphuretted hydrogen, and a solution of iodide of potassium. The former produces a black precipitate of sulphuret of lead, the latter, a yellow one of iodide of lead.

Medical Properties and Uses. The effects of lead in its various combinations are those of a sedative and astringent. It is used internally for reducing the action of the heart and arteries, and for restraining inordinate discharges; and externally as an abater of inflammation. When introduced into the system in a gradual manner with the food or drinks, or by working in the metal, or when taken in small and

frequently repeated doses, it acts injuriously on the nervous system, producing a peculiar colic, called *lead colic*, sometimes apoplectic symptoms, and occasionally palsy, which is almost always partial, and affects for the most part the upper extremities. Amaurosis has sometimes been traced to the poisonous action of lead. In some instances salivation occurs; and, according to Dr. Henry Burton, the constitutional effects of the metal are indicated by a narrow lead-blue line at the edge of the gum, round two or more of the teeth, as a constant and early sign. According to Mialhe, lead gains access to the circulation by means of the chlorides of the alkalifiable metals in the alimentary canal, which form with the lead a soluble double chloride of lead and potassium, or of lead and sodium. The treatment necessary in lead colic is given under *Carbonate of Lead.* Lead palsy is usually attended with dyspepsia, constipation, tendency to colic, lassitude, and gloominess of mind, and is best treated, after the elimination of the lead, by tonics, aperients, exercise, and avoidance of the cause of the disease. The acute poisonous effects of the lead preparations are to be combated by emetics if free vomiting has not previously occurred, by purges of sulphate of magnesia or sulphate of soda, and by opium. These sulphates are supposed to act as antidotes by forming sulphate of lead. It is probable that they lessen the poisonous effects of the soluble salts of lead; but the sulphate, though insoluble in water, may be to some extent soluble in the gastric juice; and, as to its external use in the form of ointment, it has been found by Flandin to prove poisonous to the inferior animals. Alum has proved, in our experience, an excellent remedy for the poisonous effects of lead.

For the purpose of eliminating lead from the system, warm sulphuretted baths are useful, formed by dissolving four ounces of sulphuret of potassium in thirty gallons of water, in a wooden tub. These baths cause discoloration of the skin, from the formation of sulphuret of lead, and should be repeated every few days, until this effect ceases to be produced. During each bath, the patient should be well washed with soap and water with the aid of a flesh-brush, in order to remove the discoloration. By proceeding in this way, the lead on the skin, or in its pores, is rendered insoluble and inert, and at the same time removed. Dr. Melsens praises iodide of potassium as a means of separating lead from the tissues, acting by rendering the metal soluble, and separating it principally by the urine. (See *Potassii Iodidum.*)

Orfila has determined, by experiments on dogs, the appearance exhibited by the mucous membrane of the stomach, after the use of small doses of the salts of lead. After the action of such doses for two hours, dull white points are visible on the membrane, sometimes in rows and sometimes disseminated, and evidently consisting of the metal, united with the organic tissue. If the animal be allowed to live for four days, the same spots may be seen with the magnifier; and if sulphuretted hydrogen be applied to the surface, they are instantly blackened. (*Archives Gén.*, 3e sér., iv. 244.)

According to M. Gendrin, sulphuric acid, prepared like lemonade, and used both internally and externally, is a prophylactic against the poisonous effects of lead, especially the lead colic. It may be supposed to act by forming the comparatively inert sulphate of lead with the poison. Mr. Benson, a manager of white lead works at Birmingham, has tried this acid, and finds it a preventive of lead colic in his establishment, where it was exceedingly prevalent before its employment. He uses it as an addition to ginger beer, to which bicarbonate of soda is also added to render it brisk, but not in sufficient quantity to neutralize the whole of the acid. On the other hand, the powers of sulphuric acid in preventing the poisonous effects of lead are positively denied by Dr. A. Grisolle, Dr. Melsens, and other authorities. Dr. Grisolle recommends that workmen employed in lead manufactories should use frequent baths, avoid intemperance, and always eat before they enter upon their work in the morning. He supposes that in a great majority of cases the metal is introduced into the system through the stomach by means of the saliva or food.

According to MM. Sandras and Bouchardat, the hydrated sesquisulphuret of iron acts as an antidote to the salts of lead; and its efficacy has been confirmed by its effects in a case reported by M. Lepage. (*Ann. de Thérap.*, 1857, p. 224.) After acute poisoning by lead, the metal has been found in the liver and brain. Indeed, it may be detected in most of the organs, a long time after the ingestion of the poison.

The following table embraces all the officinal preparations of lead.

Plumbi Oxidum; Lithargyrum, *Br.* 1864. *Oxide of Lead. Litharge.*
- Emplastrum Cerati Saponis, *Br. Soap. Cerate Plaster.*
- Emplastrum Plumbi; Emplastrum Lithargyri, *Br.* 1864. *Lead Plaster. Litharge Plaster.*
  - Emplastrum Assafœtidæ, *U. S. Assafetida Plaster.*
  - Emplastrum Ferri. *Iron Plaster.*
  - Emplastrum Galbani, *Br. Galbanum Plaster;* Empt. Galbani Compositum, *U. S. Compound Galbanum Plaster.*
  - Emplastrum Hydrargyri. *Mercurial Plaster.*
  - Emplastrum Opii. *Opium Plaster.*
  - Emplastrum Resinæ. *Resin Plaster. Adhesive Plaster.*
    - Emplastrum Aconiti, *U. S. Aconite Plaster;* Emplast. Arnicæ, *U. S. Arnica Plaster;* Emplast. Belladonnæ. *Belladonna Plaster.*
    - Emplastrum Opii, *Br. Opium Plaster.*
- Emplastrum Saponis. *Soap Plaster.*
  - Ceratum Saponis, *U. S. Soap Cerate.*
  - Emplastrum Calefaciens, *Br. Warm Plaster.*
- Liquor Plumbi Subacetatis. *Solution of Subacetate of Lead. Goulard's extract.*
  - Liquor Plumbi Subacetatis Dilutus. *Dilute Solution of Subacetate of Lead. Lead-water.*
  - Ceratum Plumbi Subacetatis, *U.S.;* Unguentum Plumbi Subacetatis Compositum, *Br. Cerate of Subacetate of Lead, U. S. Compound Ointment of Subacetate of Lead, Br. Goulard's Cerate.*

Plumbi Acetas. *Acetate of Lead. Sugar of Lead.*
- Pilula Plumbi cum Opio, *Br. Pills of Lead and Opium.*
- Suppositoria Plumbi, *U. S.*
- Suppositoria Plumbi Composita, *Br. Compound Lead Suppositories.*
- Suppositoria Plumbi et Opii, *U. S.*
- Unguentum Plumbi Acetatis, *Br. Ointment of Acetate of Lead.*

Plumbi Carbonas. *Carbonate of Lead.*
- Unguentum Plumbi Carbonatis. *Ointment of Carbonate of Lead.*

Plumbi Nitras. *Nitrate of Lead.*

Plumbi Iodidum. *Iodide of Lead.*
- Emplastrum Plumbi Iodidi, *Br. Iodide of Lead Plaster.*
- Unguentum Plumbi Iodidi, *Br. Ointment of Iodide of Lead.* B.

PLUMBI ACETAS. *U.S., Br.*

Acetate of Lead. Sugar of Lead.

Saccharum Saturni, Cerussa acetata, *Lat.;* Acétate de plomb, Sucre de plomb, Sel de Saturne, *Fr.;* Essigsaures Bleioxyd, Bleizucker, *Germ.;* Zucchero di Saturno, *Ital.;* Azucar de plomo, *Span.*

In the British Pharmacopœia the following process is given for preparing this salt. "Take of Oxide of Lead, in fine powder, *twenty-four ounces* [avoirdupois]; Acetic Acid *two pints* [Imperial measure], or *a sufficiency;* Distilled Water *one pint* [Imp. meas.]. Mix the Acetic Acid and the Water, add the Oxide of Lead, and dissolve with the aid of a gentle heat. Filter, evaporate till a pellicle forms, and set aside to crystallize, first adding a little Acetic Acid should the fluid not have a distinctly acid reaction. Drain and dry the crystals on filtering paper, without heat." *Br.* In the U. S. Pharmacopœia the salt is properly placed in the catalogue of the Materia Medica.

Preparation. Acetate of lead is obtained by two methods. By one method, thin plates of lead are placed in shallow vessels filled with distilled vinegar, in such a manner as to have a part of each plate rising above the vinegar; and these are turned from time to time, so as to bring different portions of the metallic surface in contact with the air. The metal, after having become protoxidized, dissolves in the vinegar to saturation, and the solution is evaporated to the point of crystallization. This process is a slow one, but furnishes a salt which is perfectly neutral. The other

method consists in dissolving by the assistance of heat, litharge, or the protoxide of lead obtained by calcination, in an excess of distilled vinegar or of purified pyroligneous acid, contained in leaden boilers. The oxide is quickly dissolved, and, when the acid has become saturated, the solution is transferred to other vessels to cool and crystallize. The crystals having formed, the mother-waters are decanted, and, by evaporation, made to yield a new crop. These are generally yellow, but may be rendered white by repeated solutions and crystallizations.

Acetate of lead is extensively manufactured in Germany, Holland, France, and England, as well as in the United States. It is principally consumed in the arts of dyeing and calico-printing, in which it is employed to form with alum the acetate of alumina, to act as a mordant.

Properties. Acetate of lead is a white salt, crystallized in brilliant needles, which have the shape of prisms, terminated by dihedral summits. Its taste is at first sweet and afterwards astringent. Exposed to the air it effloresces slowly. It dissolves in four times its weight of cold, and in a much smaller quantity of boiling water. It is soluble also in alcohol. Its solution in common water is turbid, in consequence of the formation of carbonate of lead with the carbonic acid which such water always contains. This turbidness may be removed by the addition of a small proportion of vinegar, or of dilute acetic acid. In pure distilled water, free from carbonic acid, it ought to dissolve entirely, and form a clear solution. The commercial acetate is sometimes impure from the presence of sulphate and carbonate of lead. In purchasing it the apothecary should select large crystalline masses. Mr. John Mackay analyzed a specimen of this salt, derived from the London market, which contained nearly 30 per cent. of sulphate of lead. (*Pharm. Journ.*, Jan. 1856, p. 316.) Sulphuric acid, when added to a solution of acetate of lead, produces instantly a precipitate of sulphate of lead; and the disengaged acetic acid gives rise to vapours having the smell of vinegar. The salt when heated, first fuses and parts with its water of crystallization, and afterwards is decomposed, yielding acetic acid and pyroacetic spirit (acetone), and leaving a residue of charcoal and reduced lead. An important property of sugar of lead is its power of dissolving a large quantity of protoxide of lead. (See *Liquor Plumbi Subacetatis.*) It consists of one eq. of acetic acid 51, one of protoxide of lead 111·5, and three of water 27 = 189·5, and its formula is $PbO,C_4H_3O_3+3HO$.

Incompatibles and Tests. Acetate of lead is decomposed by all acids, and by those soluble salts, the acids of which produce with protoxide of lead insoluble or sparingly soluble compounds. Acids of this character are the sulphuric, muriatic, citric, and tartaric. It is also decomposed by lime-water, and by ammonia, potassa and soda; the last two, if added in excess, dissolving the precipitate at first formed. It is decomposed by hard water, in consequence of the sulphate of lime and common salt which such water usually contains. With sulphuretted hydrogen it gives a black precipitate of sulphuret of lead; with iodide of potassium, a yellow one of iodide of lead; and with a carbonated alkali, a white one of carbonate of lead. "Thirty-eight grains dissolved in water require for complete precipitation 200 grain-measures of the *volumetric solution of oxalic acid.*" *Br.*

Medical Properties and Uses. Acetate of lead, in medicinal doses, is a powerful astringent and sedative; in overdoses, an irritant poison. It has sometimes been given in pretty large doses in regular practice without bad effects; and cases are on record where a quarter of an ounce has been swallowed without proving fatal. On the other hand, it sometimes produces colica pictonum, even when given in medicinal doses. It is proper to remark, however, that the immediate effects of an overdose are often escaped by prompt and spontaneous vomiting; and that the remote constitutional effects are not apt to occur so long as the evacuations from the bowels are not materially diminished. The class of diseases in which acetate of lead has been most frequently used are hemorrhages, particularly from the lungs, stomach, intestines, and uterus. Its effect in restraining the discharge of blood is admitted to be very powerful. It has been employed by Dr. Burkart with supposed benefit in pneumonia, especially in cases occurring in the aged, in which bleeding or antimony cannot be borne. It has also been used with advantage in certain forms of

dysentery and diarrhœa, and has been recommended in particular stages of cholera infantum. Combined with opium, it is well suited to the treatment of the diarrhœa occuring in phthisis. It sometimes proves a valuable remedy in checking vomiting. Dr. Irvine, of Charleston, recommended it to compose the irritability of the stomach in yellow fever. Dr. Wood has employed it in several cases of yellow fever, at the beginning of the second stage, with apparently good effect. The dose recommended is two grains every two hours, given steadily until thirty-six grains have been taken. Dr. Wood conceives that the remedy is well suited to obviate the peculiar inflammation of the gastric mucous membrane, and to prevent hemorrhage, either of pure blood, or of altered blood in the form of black vomit. (*Trans. of the College of Phys. of Philad.*, ii. 449.) Dr. Davis, of Columbia, S. C., has used acetate of lead with benefit in the irritable stomach attendant on bilious fever. It has been much extolled by the German practitioners, in the class of fevers attended with ulcerations of the intestines. In some of these cases it was advantageously combined with carbonate of ammonia. The same practitioners have strongly recommended it in aneurism of the aorta, and Dupuytren, on their report of its efficacy, tried it in several cases, and with marked effect in diminishing the size of the aneurismal tumour. Dr. Wood has imitated the practice in aneurism of the aorta, and employed it in several cases of enlarged heart, with encouraging results. In the treatment of the latter disease, the testimony of M. Brachet, of Lyons, is strongly in favour of the remedy. Acetate of lead has been employed by Drs. Neuhold and Hasserbrone, with remarkable success, in strangulated hernia, used in enemata, containing ten grains of the salt dissolved in six fluidounces of tepid water, and repeated every two hours. In mercurial salivation, M. Brachet found it very efficacious, administered in grain pills, night and morning. The solution is frequently used as a collyrium; and, applied by means of cloths, or mixed with crumb of bread, it forms a good application to superficial inflammation. It is sometimes advantageous to associate opium with the solution, in which case the meconate of morphia of the opium is decomposed, with the result of forming acetate of morphia in solution, and meconate of lead which precipitates. A convenient lotion, containing an excess of acetate of lead, may be formed by adding four grains of the acetate and four of opium to a fluidounce of water.

The practitioner should bear in mind that, when long continued in small doses, this medicine is apt to produce dangerous constitutional effects. These are chiefly of two kinds; 1. an affection of the alimentary canal, attended with severe pain and obstinate constipation, called *colica pictonum* or *lead colic;* 2. a chronic affection of the muscles, especially of the extensors of the upper extremities, characterized by an excessive wasting of these organs, and denominated *lead palsy*. Both these affections are apt to be produced in those artisans who work in lead. The approach of these dangerous constitutional symptoms is indicated by a narrow lead-blue line at the edge of the gums.

The dose of acetate of lead is from one to three grains, in the form of pill, repeated every two or three hours. It is generally given combined with opium. The solution for external use may be made by dissolving from two to three drachms in a pint of water; and, if it be wanted clear, a fluidrachm of vinegar or of dilute acetic acid may be added, which immediately dissolves the carbonate of lead, to which its turbidness is owing. When the skin is denuded of the cuticle, the solution should be weaker. The usual strength of the solution as a collyrium is from one to two grains to the fluidounce of *distilled* water.

Off. Prep. Liquor Plumbi Subacetatis; Pilula Plumbi cum Opio, *Br.;* Suppositoria Plumbi, *U. S.;* Suppositoria Plumbi Composita, *Br.;* Supposit. Plumbi et Opii, *U. S.;* Unguentum Plumbi Acetatis, *Br.* B.

PLUMBI CARBONAS, *U. S., Br.*

Carbonate of Lead. White Lead.

Ceruse; Céruse, Carbonate de plomb, Blanc de plomb, Blanc de céruse, *Fr.;* Bleiweiss, *Germ.;* Cerussa, *Lat., Ital.;* Albayalde, *Span.*

Preparation. Carbonate of lead is prepared by two principal methods. By one

method it is obtained by passing a stream of carbonic acid through a solution of subacetate (trisacetate) of lead. The acid combines with the excess of protoxide, and precipitates as carbonate of lead, while a neutral acetate remains in solution. This, by being boiled with a fresh portion of protoxide, is again brought to the state of subacetate, when it is treated with carbonic acid as before. In this way the same portion of acetate repeatedly serves the purpose of being converted into subacetate, and of being decomposed by carbonic acid. The carbonate obtained is washed, dried with a gentle heat, and thrown into commerce. This process, which produces white lead of the first quality, was invented by Thenard, about the year 1802, and is that which is usually pursued in France and Sweden.

A modification of the process of Thenard is now pursued by some manufacturers in England. It consists in mixing litharge with a hundredth part of acetate of lead, and subjecting the mixture, previously moistened with very little water, to a stream of carbonic acid. (*Pelouze.*)

The other method, which consists in exposing lead to the vapours of vinegar, originated in Holland, and is usually pursued in England and the United States; but in England, with some modifications which are not well known. We shall describe this process as pursued by our own manufacturers. The lead is cast into thin sheets, made by pouring the melted lead over an oblong sheet-iron shovel, with a flat bottom, and raised edges on its sides, which is held in a slanting direction over the melting-pot. As many of these sheets are then loosely rolled up as may be sufficient to form a cylinder five or six inches in diameter, and seven or eight high, which is placed in an earthen pot containing about half a pint of vinegar, and having within, a few inches from the bottom, three equidistant projecting portions in the earthenware, on which the cylinder of lead is supported, in order to keep it from contact with the vinegar. The pots thus prepared are placed side by side, in horizontal layers, in a building roughly constructed of boards, with interstices between them. The first layer is covered with boards, on which a stratum of tan or of refuse straw from the stables is strewed; and fresh layers of pots, boards, and tan or straw are successively placed until the building is filled. The sides are also enclosed with straw. The layers of pots contained in one building, called a stack, are allowed to remain undisturbed for about six weeks, at the end of which time they are unpacked, and the cylinder of sheet-lead in each pot, though still retaining its shape, is found almost entirely converted into a flaky, white, friable substance, which is the white lead. This is separated from the lead yet remaining in the metallic state, ground in water, whereby it is washed and reduced to fine powder, and finally dried in long shallow reservoirs, heated by steam.

Pelouze has succeeded in explaining all these processes on the same general principles. In Thenard's process, it is admitted that the same portion of acetate of lead repeatedly unites with protoxide, and gives it up again to carbonic acid to form the carbonate. In the modified English process, referred to above, he supposes that the one per cent. of acetate of lead combines with sufficient litharge to convert it into subacetate, which immediately returns to the state of neutral acetate, by yielding up its excess of base to form the carbonate with the carbonic acid. The acetate is now ready to combine with a fresh portion of litharge, to be transferred to the carbonic acid as before; and thus this small proportion of acetate, by combining with successive portions of the litharge, finally causes the whole of the latter to unite with the carbonic acid. In the Dutch process, Pelouze has rendered it almost certain, that none of the oxygen or carbonic acid of the carbonate is derived from the vinegar. In this process he supposes that the heat, generated by the fermentation of the tan or straw, volatilizes the vinegar, the acetic acid of which, with the assistance of the oxygen of the air, forms with the lead a small portion of subacetate. This, by reacting with the carbonic acid, resulting from the decomposition of the tan or straw, or derived from the atmosphere, forms carbonate of lead, and is brought to the state of neutral acetate. The neutral acetate returns again to the state of subacetate, and, by alternately combining with and yielding up the protoxide, causes the whole of the lead to be finally converted into carbonate.

The temperature of the stacks of pots in the Dutch process is about 113°. If it

falls below 95°, a part of the lead escapes corrosion, and if it rises above 122°, the product is yellow. The form of acetic acid usually employed in this process is vinegar; but the variable nature of that liquid as to strength and purity is an objection to its use; and, accordingly, other forms of the acid have been substituted with advantage; as, for example, the purified acetic acid from wood in a diluted state. For further information in relation to the processes proposed or pursued for making white lead, the reader is referred to a paper by Prof. J. C. Booth, in the *Journal of the Franklin Institute* for Jan. 1842.

Still another method of manufacturing white lead has been proposed by Mr. Peter Spence, having been brought by him before the Nottingham meeting of the British Association. It has the recommendations of great simplicity, and of being applicable to ores or other mixtures of lead otherwise useless. It is based on the fact that oxide and carbonate of lead, unlike any other metallic oxide and carbonate, are dissolved by aqueous solution of caustic potassa or soda, but not of the carbonate of these alkalies; and all that is to be done is to macerate or boil in a caustic solution any impure oxide or carbonate of lead, or any mineral that can by calcination be converted into one of these compounds, after such conversion, and then to precipitate the carbonate of lead by passing carbonic acid through the solution. The white lead thus produced has been tried, and found to have all the qualities of the best article to be had in the market. (*Chem. News*, Sept. 28, 1866, p. 148.)

Properties. Carbonate of lead is a heavy, opaque substance, in powder or friable lumps, insoluble in water, of a fine white colour, inodorous, and nearly insipid. Its beauty as a pigment depends in a great measure on the purity of the lead from which it is manufactured. Sulphuretted hydrogen blackens it. It is wholly soluble, with effervescence, in dilute nitric acid; and the solution is precipitated white by sulphuric acid, and yellow by iodide of potassium. Exposed to heat it becomes yellow, and with charcoal is reduced to the metallic state. It is sometimes adulterated with the sulphates of barium, calcium, and lead, particularly the first. M. Louyet has examined samples of French white lead, containing considerably more than half their weight of sulphate of barium. These sulphates, if present, are left undissolved by nitric acid. Chalk or whiting is another adulteration. This may be detected by adding to the nitric solution of the white lead an excess of potassa, which will redissolve the protoxide of lead first thrown down, but leave a white powder of lime. The British Pharmacopœia gives among the tests, that "the acetic solution when treated with excess of sulphuretted hydrogen, boiled and filtered, gives no precipitate with oxalate of ammonia." *Br.* Neutral carbonate of lead consists of one eq. of carbonic acid 22, and one of protoxide of lead 111·5 = 133·5. Commercial white lead is a compound of the carbonate and hydrate of lead. Mulder and Hochstetter make its formula to be $2(PbO,CO_2)+PbO,HO$. According to Stein, white lead, when submitted to simple calcination, loses 14·5 per cent. of its weight; and a mode of determining its purity is thus afforded. (*Journ. de Pharm.*, Janv. 1859, p. 78.) But the fact seems to be, from the observations of Mr. Wm. Baker, that commercial white lead contains variable proportions of the hydrated oxide, from a mere trace to the amount of 1 eq. to 3 eqs. of the neutral carbonate. (*Chem. News*, Aug. 10, 1861, p. 74.)

Medical Properties and Uses. White lead is ranked in the Materia Medica as an astringent and sedative. It is employed externally only, being used, in the form of ointment, as an application to ulcers, and to inflamed and excoriated surfaces. It is recommended in scalds and burns by Prof. Gross; and Mr. Alfred Freer has found it very useful in erysipelas, eczema, carbuncle, &c. (*Pharm. Journ.*, Aug. 1859, p. 138.) The white lead is first brought to the consistence of cream by linseed oil, as in making common white paint, and then brushed over the inflamed surface. Its external use, however, is viewed by many practitioners as dangerous, on account of the risk of absorption; but the occurrence of bad effects is rare. A case, however, of colica pictonum from the white lead treatment of a severe scald is reported by Dr. G. A. Kunkler, of Madison, Ia. (See *N. A. Medico-chir. Rev.*, July, 1857, p. 605.)

Of the different preparations of lead, the carbonate is considered to be the most poisonous. Being extensively manufactured for the purposes of the arts, it is that

preparation which, by slow absorption, most frequently produces the peculiar spasmodic colic, called *colica pictonum.* This disease is characterized by pain about the region of the navel, and by obstinate constipation attended with a frequent desire to evacuate the bowels, and is supposed to depend upon a spasmodic constriction of the intestinal tube, particularly of the colon. The principal indications in the treatment are, first to relax the spasm, and then to evacuate the bowels by the gentlest means. Opium and mild aperients, used alternately, are, accordingly, the best remedies, and among the latter castor oil and sulphate of magnesia are to be preferred. Indeed, the latter appears peculiarly adapted to the case; for, while it acts as an aperient, it operates to some extent as a counterpoison, by forming sulphate of lead with any soluble compound of the metal which it may meet with in the bowels. Calomel is often useful; and, if it happens to induce ptyalism, the complaint immediately yields. By some practitioners alum is deemed almost a specific in colica pictonum. It has often been advantageously used in lead poisoning; and iodide of potassium and the alkaline bromides have been recommended as eliminative means. In relation to the bromides, see *Journal de Pharmacie* (Oct. 1861, p. 313).

Pharm. Uses. In preparing Liquor Gutta-perchæ, *U. S.*

Off. Prep. Unguentum Plumbi Carbonatis. B.

PLUMBI NITRAS. *U.S., Br.*

Nitrate of Lead.

Plumbum nitricum, *Lat.;* Nitrate de plomb, *Fr.;* Saltpetersaures Bleioxyd, *Germ.;* Nitrato di piombo, *Ital.;* Nitrato de plomo, *Span.*

This salt was introduced into the Materia Medica of the U. S. Pharmacopœia, chiefly as one of the substances employed in the preparation of iodide of lead. Though formerly directed by the Edinburgh and Dublin Colleges, it was not retained in the first edition of the British Pharmacopœia. It holds a place, however, in the present, which gives the formula PbO,NO_5. The following is the process given in the late Dublin Pharmacopœia for its preparation.

"Take of Litharge, in fine powder, *five ounces* [avoirdupois]; Pure Nitric Acid *two fluidounces;* Distilled Water *three pints* [Imp. meas.]; Dilute Nitric Acid *a sufficient quantity.* To the Litharge, placed in a porcelain dish, add the Acid with a pint and a half of the Water, and, applying a sand heat, and occasionally stirring the mixture, evaporate the whole to dryness. Upon the residue boil the remainder of the Water, clear the solution by filtration, and, having acidulated it by the addition of a few drops of the Dilute Nitric Acid, evaporate until a pellicle begins to form. The heat being now withdrawn, crystals will form on the cooling of the solution, which should be dried on blotting-paper in a warm atmosphere, and preserved in a close bottle."

In this process the nitric acid unites directly with the protoxide of lead to form the nitrate. This is in beautiful, white, nearly opaque tetrahedral or octohedral crystals, which are permanent in the air, of a sweet astringent taste, soluble in seven and a half parts of water, and in alcohol, and composed of one eq. of acid 54, and one of protoxide $111{\cdot}5 = 165{\cdot}5$, without water of crystallization. "Its solution is precipitated black by hydrosulphate of ammonium, white by ferrocyanide of potassium, and yellow by iodide of potassium. When triturated with sulphuric acid, it forms a mixture, which colours morphia red, and, on being heated, evolves nitrous fumes." (*U.S.*)

Medical Properties, &c. The effects of this salt upon the system are the same as those of the other soluble salts of lead; but, though formerly employed, it is now quite out of use as an internal remedy. Externally it is occasionally applied to excoriated surfaces; and a solution made in the proportion of ten grains to an ounce of water, and coloured probably with alkanet, has been used on the continent of Europe, as a secret remedy, in sore nipples, chapped hands, cracked lips, &c. It has recently been found useful in the correction of fetid odours dependent on the presence of sulphuretted hydrogen or hydrosulphate of ammonium, which it decomposes. It is employed for this purpose in solution, which may be sprinkled in apartments,

or applied to putrescent ulcers, or mixed with offensive discharges, the odour of which it is desirable to correct. It will not prevent the putrefaction of animal substances; and there is no reason to suppose that it is capable of rendering contagious or marsh miasms innoxious. *Ledoyen's disinfecting fluid* is a solution of nitrate of lead in the proportion of a drachm to an ounce. Should the salt be used internally, the dose would be from the fourth to the half of a grain.

Dr. Ogier Ward has found a solution extremely useful as an injection and lotion in cases of fetid discharges from the uterus and vagina, in gleety discharges from the urethra, in sloughing and indolent ulcers, and in chronic impetiginous affections of the skin. He prepares the solution extemporaneously by dissolving a scruple of carbonate of lead in sufficient diluted nitric acid for solution, and adding a pint of distilled water. The application is to be made twice or three times daily. (*Prov. Med. and Surg. Journ.*, Oct. 15, 1851.) By Moerlonge and Vanzette remarkable efficiency is ascribed to nitrate of lead in the cure of that very painful and obstinate affection, onychia maligna; and their statements have been confirmed by other practitioners. It is applied by sprinkling the powder on the surface, and, according to Dr. J. Scott, of Belfast, Ireland, a complete cure may be relied on in from fourteen to thirty days. (*Dublin Jour. of Med. Sci.*, Feb. 1874, p. 145.) A solution of the salt in glycerin, in the proportion of ten grains to the fluidounce, is spoken of by Dr. J. G. Wilson, Professor of Midwifery in the *Andersonian University*, in a communication to the *Glasgow Med. Journ.*, in the highest terms as a remedy for excoriated and fissured nipples, applied locally to the affected parts, after suckling; care being taken to wash the parts well before the next application of the child, for fear of lead-poisoning. The cases were very rare in which the remedy did not succeed in the hands of Dr. Wilson; and it often succeeded after failure with the ordinary measures. (*M. and S. Reporter*, Aug. 21, 1869, p. 164.)

Off. Prep. Plumbi Iodidum. W.

PLUMBI OXIDUM. *U.S., Br.*

Oxide of Lead. Litharge.

Off. Syn. LITHARGYRUM. PbO. *Br.* 1864.

Plumbi Oxidum Semivitreum, *Lat.;* Semivitrified Oxide of lead; Oxide de plomb fondu Litharge, *Fr.;* Bleiglatte, *Germ.;* Litargirio, *Ital.;* Almartaga, *Span.*

When protoxide of lead is rendered semi-crystalline by incomplete fusion it becomes the semivitrified oxide, or litharge. Almost all the litharge of commerce is obtained, as a secondary product, in the process for extracting silver from argentiferous galenas. After extracting the argentiferous lead from the ore, the alloy is calcined in the open air; whereby the lead becomes oxidized, and by fusion passes into the state of litharge, while the silver remains unchanged. The following is an outline of the process. The lead containing the silver is placed upon an oval slightly excavated dish, about three feet long and twenty inches wide, called a *test*, made by beating pulverized bone-ash, formed into a paste with water, into a mould, the sides of which consist of an elliptical band of iron, and the bottom of strips of sheet-iron, placed at short distances apart. The test is of such a size as exactly to fit an opening in the floor of a reverberatory furnace, where it is placed and adjusted to the level of the floor. On one side of the test the fireplace is situated, and exactly opposite, the chimney; while at one extremity of it the pipe of a strong bellows is placed, and at the other a vertical hole is made, communicating with a gutter leading from the test. The furnace is now lighted, and shortly afterwards the bellows are put in motion. The lead fuses and combines with oxygen, and the resulting oxide, melting also, forms a stratum which swims on the surface, and which is driven, by the blast of the bellows, along the gutter and through the vertical hole into a recipient below, where, upon solidifying, it crystallizes in small scales, which form the litharge. In proportion as the lead is oxidized and blown off the test, fresh portions are added so as to keep it always sufficiently full. The process is continued for eight or ten days, after which no more lead is added. The operation is now confined to the

metal remaining on the test; and, the oxidation proceeding, a period at last arrives when the whole of the lead has run off as litharge, and the silver, known to be pure by its brilliant appearance in the fused state, alone remains. This is then removed, and the process repeated on a fresh portion of argentiferous lead.

Properties. Litharge is in the form of small, brilliant, vitrified scales, some presenting a red, and others a yellow colour. In mass it has a foliaceous structure. It is devoid of taste or smell. It slowly attracts carbonic acid from the air, and contains more of this acid the longer it has been exposed. It is on this account that it commonly effervesces slightly with the dilute acids. It has the property of decolorizing wines, when agitated with them. When heated with the fats and oils, in connection with water, it saponifies them. (See *Emplastrum Plumbi.*) Heated with charcoal, it is reduced to the metallic state. In dilute nitric acid it should be almost entirely soluble; and the solution is affected by potassa in the same manner as that of the carbonate. (See *Plumbi Carbonas.*) As it occurs in commerce, it usually contains iron, copper, and a little silver and silica. It may be purified from iron and copper by digestion in dilute sulphuric acid. The English litharge is most esteemed; that from Germany being generally contaminated with iron and copper. In choosing litharge, samples should be selected which are free from copper, and from fragments of vegetable matter. Copper is detected, if upon adding ferrocyanide of potassium to a nitric solution of the litharge, a brown instead of a white precipitate is produced. Two varieties of litharge are distinguished in commerce, named from their colour, and dependent on differences in the process employed. Sometimes it has a pale-yellow colour and silvery appearance, and is then denominated *silver litharge* or *yellow litharge;* at other times it is of a red colour, and is known under the name of *gold litharge* or *red litharge.* The latter has been said to owe its colour to the presence of a portion of red lead; but M. Leblanc has shown that the two varieties of litharge differ in colour, structure, and density only, and not in chemical composition. In this respect litharge is essentially identical with the protoxide of lead. (See *Plumbum.*) The carbonic acid which it contains is variable; but its average amount is about 4 per cent. Peroxide of lead or red lead in litharge may be detected by heating it in a test tube with chloride of sodium and bisulphate of potassium, and introducing a slip of paper coloured blue by indigo. If either of these oxides be present, the paper will be bleached by the chlorine evolved. (*Journ. de Pharm.*, Mars, 1860, p. 237.)

Litharge is never used internally, but is employed in several pharmaceutical operations, and forms an ingredient in various external applications, used for abating inflammation, and for other purposes. By reaction with olive oil it forms the *Emplastrum Plumbi*, which is the basis of many of the *Plasters.* (See *Emplastra.*) In the arts it is employed in the glazing of pottery, in painting to render oils drying, and as an ingredient in flint glass.

Pharm. Uses. In preparing Digitalinum. *Br.*

Off. Prep. Emplastrum Cerati Saponis, *Br.;* Emplastrum Lithargyri, *Br.*, 1864; Emplastrum Plumbi; Liquor Plumbi Subacetatis; Plumbi Acetas, *Br.* B

PLUMBI OXIDUM RUBRUM.

Red Oxide of Lead.

Red lead, Minium; Deutoxide de plomb, Oxide rouge de plomb, Minium, *Fr.;* Mennig, *Germ.;* Minio, *Ital.; Span.*

Preparation. Red lead is prepared on the large scale in a furnace, with the floor slightly concave and the roof arched, presenting a general resemblance to a baker's oven. The lead is placed on the floor, and gradually raised to a red heat, whereby it melts and becomes covered with a pellicle of protoxide, which is removed by means of a long iron scraper; and the pellicles, as they successively form, are scraped off until the whole of the metal has been converted into them. The product is subjected to further calcination, with occasional stirring, for some time, in order to oxidize any particles of metallic lead. It is thus rendered yellow, and constitutes the *protoxide*

of lead, or *massicot*. This is taken out of the furnace, thrown upon a level pavement, and cooled by being sprinkled with water. It is next reduced to fine powder by trituration and levigation, and dried; and in this state is introduced into large, shallow, square tin boxes, which are placed in another furnace, closed from the air, and heated nearly to redness; the heat being allowed gradually to fall during a period of from twenty-four to thirty hours. At the end of that time the protoxide of lead will have combined with an additional quantity of oxygen, and become the red oxide. This is taken out, and, having been passed through a fine wire sieve, is packed in barrels for the purposes of commerce.

The above is an outline of the French process for making red lead. In England and the United States, the calcination of the protoxide is not performed in tin boxes, but by returning it to the furnace in which it was first calcined. To save the first calcination, litharge is generally used for making the red lead of commerce, which consequently is liable to contain the impurities of that substance, consisting of iron, copper, and a little silver and silica. Copper is hurtful in red lead when used for making glass, to which it communicates colour. In order to have red lead of good quality, it should be made in large quantities at a time. It is also important that it be slowly cooled; for, as the absorption of oxygen by which it is formed takes place during a particular interval of temperature only, it is necessary that the heat, within that interval, should be maintained sufficiently long to allow all the protoxide to absorb its appropriate dose of oxygen. Red lead is also prepared by exposing litharge to a high temperature with nitrate or carbonate of potassium or sodium.

Properties, &c. Red lead is in the form of a heavy, scaly powder, of a bright-red colour, with a slight shade of orange. Its sp. gr. is about 9. When exposed to heat it gives off oxygen, and is reduced to the state of protoxide. It is sometimes adulterated with red oxide of iron and red bole, substances which may be detected by treating the red lead with nitric acid, and testing the nitric solution with tincture of galls. This reagent will produce a black precipitate, in consequence of the iron being dissolved by the nitric acid. If brick-dust be present, it will be left undissolved upon boiling the suspected specimen in water, with sugar and a small quantity of nitric acid. When free from impurities it is wholly reduced on charcoal by means of the blowpipe, giving a globule of metallic lead. It is completely soluble in highly fuming nitrous acid. (*Ed. Pharm.*) When treated with nitric acid it is resolved into protoxide which dissolves, and deutoxide which remains in the form of a dark-brown powder.

The red lead of commerce may be considered as a mixture of what may be called the true red oxide, and variable proportions of protoxide. That this is its nature is rendered probable by the action of cold dilute acetic acid, not used in excess, which takes up a variable quantity of protoxide, leaving a portion unchanged in colour, which may be deemed the pure red oxide. This latter, when analyzed by nitric acid, has been proved, by the coincident results of Dalton, Dumas, and Phillips, to consist of three eqs. of lead, and four of oxygen, equal to $2PbO,PbO_2$ (Dumas), or PbO,Pb_2O_3 (Winckelblech). Mulder gives $Pb_4O_5 = 3PbO,PbO_2$, or $2PbO,Pb_2O_3$, as the usual composition of red lead.

Red lead enters into no officinal preparation. In the arts it is used chiefly as a paint, and in the manufacture of flint glass. B.

PODOPHYLLUM. *U. S.*

May-apple. Podophyllum.

The rhizome of Podophyllum peltatum. *U. S.*

Off. Syn. PODOPHYLLI RADIX. *Podophyllum Root.* The dried rhizome of Podophyllum peltatum, *Linn.* Imported from North America. *Br.*

PODOPHYLLUM. *Sex. Syst.* Polyandria Monogynia. — *Nat. Ord.* Ranunculi, *Juss.;* Podophylleæ, *Lindley.*

Gen. Ch. Calyx three-leaved. *Corolla* nine-petaled. *Berry* one-celled, crowned with the stigma. *Willd.*

Podophyllum peltatum. Willd. *Sp. Plant.* ii. 1141 ; Barton, *Med. Bot.* ii. 9 ; Carson, *Illust. of Med. Bot.* i. 18, pl. 11. The may-apple, sometimes also called *mandrake*, is an indigenous herbaceous plant, and the only species of the genus. The root (rhizome) is perennial, creeping, usually several feet in length, about one-quarter of an inch thick, brown externally, smooth, jointed, and furnished with radicles at the joints. The stem is about a foot high, erect, round, smooth, divided at top into two petioles, and supporting at the fork a solitary one-flowered peduncle. Each petiole bears a large, peltate, palmate leaf, with six or seven wedge-shaped lobes, irregularly incised at the extremity, yellowish-green on their upper surface, paler and slightly pubescent beneath. The flower is nodding. The calyx is composed of three oval, obtuse, concave deciduous leaves. The corolla has from six to nine white, fragrant petals, which are obovate, obtuse, concave, with delicate transparent veins. The stamens are from thirteen to twenty, shorter than the petals, with oblong, yellow anthers, of twice the length of the filaments. The stigma is sessile, and rendered irregular on its surface by numerous folds or convolutions. The fruit is a large oval berry, crowned with the persistent stigma, and containing a sweetish fleshy pulp, in which about twelve ovate seeds are imbedded. It is, when ripe, of a lemon-yellow colour, diversified by round brownish spots.

The plant is extensively diffused through the United States, growing luxuriantly in moist shady woods, and in low marshy grounds. It is propagated by its creeping root, and is often found in large patches. The flowers appear about the end of May and beginning of June ; and the fruit ripens in the latter part of September. The leaves are said to be poisonous. The fruit has a subacid, sweetish, peculiar taste, agreeable to some palates, and may be eaten freely with impunity. From its colour and shape, it is sometimes called *wild lemon*. The root is the officinal portion, and is said to be most efficient when collected after the falling of the leaves. It shrinks considerably in drying.

Properties. The dried root is in pieces about two lines in thickness, with swelling, broad, flattened joints at short intervals. It is much wrinkled lengthwise, is yellowish or reddish-brown externally, and furnished with fibres of a similar, but somewhat paler colour. It was determined, by an experiment of Mr. Wm. Saunders, that these fibres contain as much active matter as the rhizome itself. The fracture is short and irregular, and the internal colour whitish. The powder is light yellowish-gray, resembling that of jalap. The root in its aggregate state is nearly inodorous ; but in powder has a sweetish not unpleasant smell. The taste is at first sweetish, afterwards bitter, nauseous, and slightly acrid. Both the decoction and tincture are bitter ; but alcohol is said to be the best solvent of the active matter. A bitter substance was extracted from the root by William Hodgson, jun., of Philadelphia, by boiling it with quicklime in water, straining the decoction, precipitating the lime with sulphate of zinc, evaporating the clear solution to the consistence of an extract, treating this with cold alcohol of 0·817, filtering and evaporating the alcoholic solution, and treating the residue with boiling distilled water, which deposited the substance referred to on cooling. (*Journ. of the Phil. Col. of Pharm.*, iii. 273.) Though the alcoholic solution of this substance is very bitter, it has upon trial been found not to be the purgative principle of the root. There can be little doubt, as suggested by Prof. F. F. Mayer, of New York, that the principle discovered by Mr. Hodgson is the alkaloid *berberina*. Indeed, the fact has been demonstrated by Mr. John M. Maisch, who separated this alkaloid from the mother-liquor remaining after the precipitation of the tincture by water. (*Am. Journ. of Pharm.*, July, 1863, p. 303.) Prof. Mayer states, moreover, that the root contains, besides berberina, a colourless alkaloid. (*Ibid.*, March, 1863, p. 98.) Analyzed by Mr. John R. Lewis, podophyllum yielded albumen, gum, starch, extractive, lignin, gallic acid, fixed oil, traces of volatile oil, salts of potassa and lime, and two resinous principles, one soluble in alcohol and ether, and the other soluble in alcohol only. Both resins were found to possess the active properties of the root. Six grains operated as a drastic cathartic, with some emetic effect. (*Am. Journ. of Pharm.*, xix. 165.) To these ingredients saponin is to be added, on the authority of Prof. Mayer. (*Ibid.*, March, 1863, p. 98.) Dr. Manlius Smith recommends that the resin should be prepared by forming an alco-

holic tincture of the root, evaporating the tincture till most of the alcohol is driven off, and throwing the residue into water, by which the resin is precipitated. The concentration should not be carried too far; as otherwise the resin separates in clots, which cannot be easily washed. According to Dr. Smith, the resin, when pure, is white, and purges actively. It is called *podophyllin.* (*Ibid.*, xxiv. 306.) For a more complete account of what is known of the resins of podophyllum, the reader is referred to the article on *Resina Podophylli* in *Part II.*

The leaves of the podophyllum peltatum were chemically examined by Mr. Thomas J. Husband, jun., who obtained from them a resinous matter and a portion of the alkaloid berberina, which is found in the root. This resinous matter consisted of two distinct resins, "one soluble in ether and alcohol, the other in alcohol, and both in caustic alkalies and chloroform. Mr. Husband states that the resin obtained from the leaves is similar in its chemical relations to podophyllin, but proved, when taken internally, to be without its purgative properties; eight grains being taken without other effect than slight headache." (*Am. Journ. of Pharm.*, May, 1869, p. 200.)

Medical Properties and Uses. Podophyllum is an active and certain cathartic, producing copious liquid discharges without much griping, or other unpleasant effect. In some cases it has given rise to nausea and even vomiting, but the same result is occasionally experienced from every active cathartic. Its operation resembles that of jalap; but is rather slower, and is thought by some to be more drastic. It is applicable to most inflammatory affections which require brisk purging; and is much employed in various parts of the country, especially, combined with calomel, in bilious fevers and hepatic congestions. It is also frequently used, in connection with bitartrate of potassium, in dropsical, rheumatic, and scrofulous complaints. There do not appear to be sufficient grounds for ascribing to it special cholagogue powers. In minute doses, frequently repeated, podophyllum has been thought to diminish the frequency of the pulse, and to relieve cough; and, for these effects, has been given in hæmoptysis, catarrh, and other pulmonary affections.

The dose of the powdered root, as a purgative, is about twenty grains. An extract is prepared from it possessing all its virtues in a smaller bulk. (See *Extractum Podophylli.*) Podophyllin, or resin of podophyllum, which has become officinal, is considerably used. In its purest state the dose as a laxative is from $\frac{1}{8}$ to $\frac{1}{4}$ of a grain; as a purgative, from $\frac{1}{4}$ of a grain to a grain.

Off. Prep. Extractum Podophylli, *U. S.;* Podophylli Resina, *Br.;* Resina Podophylli, *U. S.* W.

POLYGALA RUBELLA. *U. S. Secondary.*

Bitter Polygala.

The root and herb of Polygala rubella. *U. S.*

POLYGALA. See SENEGA.

Polygala rubella. Willd. *Sp. Plant.* iii. 875; Bigelow, *Am. Med. Bot.* iii. 129. —*P. polygama.* Walter, *Flor. Car.* 179; Pursh, *Flor. Am. Sept.* 465. This species of Polygala is an indigenous, perennial plant, with a branching, somewhat fusiform root, which sends up annually numerous simple, smooth, and angular stems, from four to eight inches in height. The leaves are scattered, sessile, obovate or linear lanceolate, attenuated towards the base, obtuse, and mucronate. The flowers are purple, and in elongated terminal racemes. From the base of the stem proceed other racemes, which lie upon the ground, or are partially buried under it, and bear incomplete but fertile flowers, the calyx of which is without wings.

This plant is found in many parts of the United States, preferring a dry sandy or gravelly soil, and flowering in June and July. The whole plant is officinal. It has a strong and permanent bitter taste, which it yields to water and alcohol.

Medical Properties and Uses. In small doses bitter polygala is tonic, in larger, laxative and diaphoretic. The infusion of the dried plant has been usually employed to impart tone to the digestive organs. (*Bigelow.*) It appears to be closely analogous in medical virtues to *Polygala amara* of Europe, which is used for a similar purpose. W.

POTASSIUM.

Potassium.

Potassium, *Fr.;* Kalium, Kalimetall, *Germ.;* Potassio, *Ital.;* Potasio, *Span.*

Potassium is a peculiar metal, forming the radical of potassa, and of a number of other medicinal preparations. It was discovered in 1807 by Sir H. Davy, who obtained it by decomposing hydrate of potassa by galvanic electricity. It was afterwards procured in larger quantity by Gay-Lussac and Thenard, by bringing the fused alkali in contact with white-hot iron, which attracted the oxygen and set free the metal. The best process is that of Brunner, as modified by Wöhler, which consists in decomposing potassa in the state of carbonate, mixed with charcoal. The mixture of carbonate and charcoal is obtained by heating cream of tartar to redness in a covered crucible. For an account of some improvements in Brunner's process by MM. Mareska and Donny, see *Am. Journ. of Pharm.* (xxv. 70).

Potassium is solid, softer and more ductile than wax, easily cut with a knife, and of a silver-white colour. A newly-cut surface is brilliant; but the metal quickly tarnishes by combining with the oxygen of the air, and assumes the appearance of lead. It possesses a remarkably strong affinity for oxygen, and is capable of taking that element from every other substance. On account of this property it must be kept in liquids, such as naphtha, which are devoid of oxygen. On the same account, when exposed with a fresh-cut surface to the air, it becomes luminous through a slow combustion, like phosphorus in the dark. (*Chem. News*, Feb. 28, 1868, p. 108.) Its sp. gr. is 0·865, melting point 136°, equivalent number 39·2, and symbol K. When thrown upon water it swims, takes fire, and burns with a rose-coloured flame, combining with oxygen, and generating potassa which dissolves in the water. It forms numerous combinations, uniting with most of the non-metallic elements, and with several of the metals. It combines in two proportions with oxygen, forming a protoxide (*dry potassa*) of a gray, and a *teroxide* of a yellowish-brown colour. It also unites with chlorine, and forms officinal compounds with iodine, bromine, sulphur, cyanogen, and ferrocyanogen, under the names of iodide, bromide, sulphuret, cyanide, and ferrocyanide of potassium. Its protoxide (dry potassa) is a strong salifiable base existing in nature always in combination, and forming with acids a numerous and important class of salts. Of these, the acetate, bichromate, hypophosphite, carbonate, bicarbonate, chlorate, citrate, hydrate (caustic potassa), nitrate, permanganate, sulphate, sulphite, tartrate, and bitartrate are officinal, and will be described under their respective titles. B.

POTASSII BICHROMAS. *U.S.*

Bichromate of Potassium.

Off. Syn. POTASSÆ BICHROMAS. *Bichromate of Potash.* $KO,2CrO_3$. *Br.*

Red chromate of potassa; Kali chromicum rubrum, *Lat.;* Bichrômate de potasse, *Fr.;* Zweifach Chromsaures Kali, *Germ.*

This salt is most conveniently prepared from the neutral or yellow *chromate of potassium*, by acidulating its solution with sulphuric acid, and setting it aside for a day or two. The acid withdraws one eq. of potassa from two of the neutral chromate, thus generating one eq. of the bichromate, which separates in orange-red crystals. The yellow chromate is obtained by igniting four parts of powdered chrome-iron ore (FeO,Cr_2O_3) with one part of nitre, and lixiviating the resulting mass with water. The solution, by evaporation, yields the yellow salt in crystals. In this process, the nitric acid of the nitre furnishes oxygen to convert the sesquioxide of chromium into chromic acid, which then unites with the potassa of the same salt. The iron, in the mean time, is sesquioxidized and rendered insoluble. Sometimes impure carbonate of potassium (pearlash) is substituted for part of the nitre in the calcination. Omitting the nitre entirely, Stromeyer, of Norway, in performing the ignition, has used lime along with the pearlash, with economical results. When lime is employed,

chromate of calcium is formed, which is extracted by lixiviation, and decomposed by a soluble salt of potassium. When desired, the bichromate may be obtained directly from the solution of chromate of potassium, derived from the treatment of the ore, by acidulating it with sulphuric acid, without first crystallizing it. For an account of the patent process of Prof. J. C. Booth, of this city, for obtaining bichromate of potassium, see *Pharm. Journ.* (xv. 34).

Bichromate of potassium is in the form of orange-red, anhydrous, prismatic (tabular, *U. S.*) crystals, soluble in ten parts of cold and much less boiling water, but insoluble in alcohol. Its solution has an acid reaction. Its taste is cooling and bitter. Exposed to a heat somewhat under redness, it fuses, without decomposition, into a red liquid, which congeals on cooling into a crystalline mass, and then falls into powder. At a red heat, it evolves oxygen, the neutral chromate and sesquioxide of chromium being left, of which the former body is dissolved, when the mixture is acted on by water. (*U. S.*) It consists of two eqs. of chromic acid and one of potassa. When one eq. of this salt is heated with four of sulphuric acid, *chromium-alum* is formed, and oxygen evolved ($KO,2CrO_3$ and $4SO_3 = Cr_2O_3,3SO_3 + KO,SO_3$ and $3O$).

Medical Properties, &c. Bichromate of potassium, in small doses, is alterative, in larger, emetic. Externally it acts as an irritant and caustic. It was first used internally in 1850, by M. Robin, who gave it in secondary syphilis; and Prof. Heyfelder, of Erlangen, and M. Vicente afterwards employed it in the same disease with encouraging results. It acts like the mercurials on the syphilitic poison, and occasionally produces salivation. It was recommended, in 1827, by Dr. Cumin, in saturated solution, as a caustic application to tubercular elevations, excrescences, and warts, and in 1850 by M. Puche in syphilitic vegetations. It causes the morbid parts to shrivel and fall off. Dissolved in water, in the proportion of five grains gradually increased to a drachm to the fluidounce, it has been found useful in affections of the mucous membranes requiring astringents; and a solution has also been used with advantage for correcting the fetor of sloughing wounds. The dose as an alterative is one-fifth of a grain daily, in the form of pill made with extract of gentian, to be increased gradually to five or six pills a day. As an emetic the dose is three-quarters of a grain. It may be used as a caustic in the form of powder. A solution of it has been used, as a local application, in various diseases of the skin, "with complete success." (*Chem. News*, Jan. 20, 1865, p. 35.)

In overdoses it operates as a violent irritative and corrosive poison, producing severe vomiting, frequent dark hemorrhagic dejections, violent abdominal pains, &c. More than one fatal case is on record. When the stomach does not relieve itself by vomiting, magnesia, bicarbonate of sodium, or a solution of soap should be immediately given as an antidote.

Bichromate of potassium is manufactured largely for the use of calico-printers. The workmen engaged in making it are liable to painful ulcerations of the hands; and, in consequence of the acrid vapours evolved, violent irritation of the nostrils is apt to be experienced, with severe pricking sensations and excessive sneezing, followed in time by destruction of the mucous membrane and even the septum itself. It is asserted that this result may be avoided by breathing through the mouth exclusively; the profuse secretion of saliva produced carrying off the poisonous particles. (*B. and F. Med.-chir. Rev.*, Oct. 1863, p. 533.) It was introduced into the Dublin Pharmacopœia of 1850, not as a therapeutic agent, but to be used in forming artificial valerianic acid by reacting with fusel oil (*Alcohol Amylicum*), as a step in the process for preparing valerianate of sodium. (See *Sodii Valerianas.*) For a full account of the manufacture of the chromium salts, used as dyes and pigments, see the *Pharmaceutical Journal* (xv. 32).

Pharm. Uses. In the preparation of Sodæ Valerianas. A solution of this salt, under the title of *volumetric solution of bichromate of potash*, has been introduced as a test into the British Pharmacopœia. B.

POTASSII BITARTRAS. *U.S.*

Bitartrate of Potassium. Cream of Tartar.

Off. Syn. POTASSÆ TARTRAS ACIDA. *Acid Tartrate of Potash.* KO,HO, $C_8H_4O_{10}$. *Br.*

Supertartrate of potassa, Crystals of tartar, Cream of tartar; Cremor tartari, *Lat.;* Tartrate acide de potasse, Crême de tartre, *Fr.;* Doppelt weinsaures Kali, Weinsteinrahm, *Germ.;* Cremore di tartaro, *Ital.;* Cremor de tartaro, *Span.*

During the fermentation of wines, especially those that are tart, a peculiar matter is deposited in the casks, forming a crystalline crust, called *crude tartar* or *argol.* That deposited from red wines is of a reddish colour, and called *red tartar;* while that derived from white wines is of a dirty-white colour, and denominated *white tartar.* Both kinds consist of potassa, united with an excess of tartaric acid, forming bitartrate of potassium, rendered impure by tartrate of calcium, more or less colouring matter, and other matters which are deposited during the clarification of the wine. The deposition of the tartar is thus explained. The bitartrate exists naturally in the juice of the grape, held in solution by saccharine matter. When the juice is submitted to fermentation in the process for converting it into wine, the sugar disappears, and is replaced by alcohol, which, not being competent to dissolve the salt, allows it to precipitate as a crystalline crust. It is from this substance that bitartrate of potassium is obtained by a process of purification.

The wines made in the United States of course deposit tartar; but as yet the product has not been collected for the purposes of commerce. According to Mr. E. S. Wayne, of Cincinnati, the American catawba wine deposits about three pounds of crude tartar from a hundred gallons. We are informed by him that American tartar contains at least 15 per cent. of tartrate of calcium.

The process for purifying crude tartar is founded upon the greater solubility of bitartrate of potassium in hot than in cold water. The tartar, previously pulverized, is boiled with water in copper boilers. The solution, when saturated, is transferred to earthen pans, where it deposits on cooling a crystalline layer, nearly free from colour. This is redissolved in boiling water; and the solution, having been mixed with 4 or 5 per cent. of pipe-clay, is evaporated to a pellicle. The clay precipitates with the colouring matter; and the clear solution, as it cools, deposits white crystals in crusts, which, upon being exposed to the air on linen for several days, acquire an increased degree of whiteness. These constitute the *crystals of tartar* of pharmacy. The salt, however, as met with in the shops, is generally, for greater convenience, in the form of powder, to which the name *cream of tartar* properly belongs.

Wittstein proposes to free cream of tartar from lime by dilute muriatic acid, which dissolves the lime preferably, and, if not used in excess, will take up very little of the potassa salt. For remarks on this subject by Tenner, of Berne, see the *Amer. Journ. of Pharm.* (Jan. 1862, p. 39).

Properties. Bitartrate of potassium occurs in commerce in white crystalline crusts, or masses of aggregated crystals, and is received in that state from France by our wholesale druggists, who procure its pulverization for the use of the apothecaries. In crystals it is hard and gritty between the teeth, and dissolves slowly in the mouth; in powder it has a white colour. It is a permanent salt, having a sour not ungrateful taste and acid reaction, soluble in 184 parts of cold, and 18 of boiling water, but insoluble in alcohol. When exposed to heat it is decomposed, exhales a peculiar odour, gives rise to several pyrogenous acids, and the usual products of the destructive distillation of vegetable matter; carbonate of potassium, mixed with charcoal, being left. Its solution is precipitated by solutions of baryta, strontia, and lime, which form insoluble tartrates, and by acetate of lead, forming tartrate of lead. "The precipitate produced by a watery solution of chloride of barium is soluble in nitric acid." *U.S.* With salifiable bases which form soluble tartrates, it gives rise to double salts, consisting of neutral tartrate of potassium, and the tartrate of the base added. Several of them are important medicines, and will be described under their respective titles. Cream of tartar, though sparingly soluble in water,

becomes abundantly so by the addition of borax or boracic acid. (See *Sodii Boras.*)

The cream of tartar of commerce is not pure bitartrate of potassium. It usually contains from 2 to 5 per cent. of tartrate of calcium, an amount admissable in samples for medicinal use. But it sometimes contains from 6 to 13 per cent. of tartrate of calcium, according to the analyses of Mr. J. M. Maisch. It is said to be purposely mixed with various substances, such as sand, clay, gypsum, flour, chalk, alum, and sulphate of potassium. Sand, clay, and gypsum may be detected by their insolubility in a hot solution of potassa; flour, by striking a blue colour with iodine; chalk, by its effervescing with dilute acids; alum, an unlikely sophistication, by its astringent taste; and any soluble sulphate, by causing a precipitate with chloride of barium, not entirely soluble in nitric acid. The action of the last-mentioned test is explained by the fact, that the tartrate of barium is soluble in nitric acid, but not the sulphate. Another sophistication of cream of tartar is said to be with sugar of milk. The best security against fraud is to purchase the crystals, which are not so liable to adulteration as the powder. The U. S. Pharmacopœia gives the following test. The salt is dissolved freely by a hot solution of potassa, from which it is again deposited by the addition of an acid; and whatever remains undissolved is impurity. According to the Br. Pharmacopœia, 188 grains ignited till gas ceases to be evolved, leave an alkaline residue (carbonate of potassium) which requires for exact neutralization 1000 grain-measures of the *volumetric solution of oxalic acid.* This Pharmacopœia admits a slight impurity of lime, probably in the form of tartrate.

Composition. Cream of tartar consists of two eqs. of tartaric acid 132, one of potassa 47·2, and one of water 9 = 188·2. The water cannot be expelled without decomposing the salt, and is supposed to act the part of a base.

Medical Properties and Uses. Bitartrate of potassium is cathartic, diuretic, and refrigerant. In small doses it acts as a cooling aperient, in large ones as a hydragogue cathartic, producing copious watery stools; and, from this latter property, as well as its tendency to excite the action of the kidneys, it is much used in dropsical affections. It is frequently prescribed in combination with senna, sulphur, or jalap. (See *Confectio Sulphuris* and *Pulvis Jalapæ Compositus.*) Its solution in boiling water, sweetened with sugar and allowed to cool, forms an acid, not unpleasant, refrigerant drink, advantageously used in some febrile affections, and frequently employed as a domestic remedy. The beverage called *imperial* (*potus imperialis*) is a drink of this kind, made by dissolving half an ounce of the salt in three pints of boiling water, and adding to the solution four ounces of white sugar, and half an ounce of fresh lemon peel. *Cream of tartar whey* is prepared by adding about two drachms of the bitartrate to a pint of milk. It may be given, diluted with water, in dropsical complaints. The dose of cream of tartar is a drachm or two as an aperient; and from half an ounce to an ounce as a hydragogue cathartic, mixed with molasses, or suspended in water. As a diuretic in dropsical cases, it may be given in the dose of a drachm and a half or two drachms, several times a day.

In pharmacy, cream of tartar is employed to obtain the neutral tartrate of potassium (soluble tartar), tartrate of potassium and sodium (Rochelle salt), tartrate of antimony and potassium (tartar emetic), and tartrate of iron and potassium (tartarized iron). Deflagrated with nitre, or incinerated alone, it is converted into a pure form of carbonate of potassium, called salt of tartar. In the laboratory it is used to procure potassa in a pure state, and for making black and white flux. *Black flux* is prepared by deflagrating cream of tartar with half its weight of nitre; and *white flux*, by deflagrating it with twice its weight of the same salt.

Off. Prep. Acidum Tartaricum, *Br.;* Antimonii et Potassii Tartras, *U. S.;* Antimonium Tartaratum, *Br.;* Confectio Sulphuris, *Br.;* Ferri et Potassii Tartras, *U.S.;* Ferrum Tartaratum, *Br.;* Potassii et Sodii Tartras, *U. S.;* Potassæ Tartras, *Br.;* Potassii Tartras, *U. S.;* Pulvis Jalapæ Compositus; Soda Tartarata, *Br.* B.

POTASSII CARBONAS IMPURA. *U.S.*

Impure Carbonate of Potassium.

The impure carbonate of potassium known in commerce by the name of *pearl-ash. U.S.*

"The soluble matter contained in one hundred grains of this salt, neutralizes not less than fifty-eight grains of officinal sulphuric acid." *U.S.*

Pearlash, Pearlashes, Impure potassa, Impure subcarbonate of potassa; Potasse du commerce, *Fr.;* Rohe Pottasche, *Germ.;* Potasch, *Dutch;* Potaske, *Dan.;* Potaska, *Swed.;* Potassa del commercio, *Ital.;* Cenizas claveladas, *Span.*

The alkali potassa is the protoxide of the metal potassium. (See *Potassium.*) It exists in various states of purity. In its most impure state, it is the common potash of commerce. This, subjected to calcination, is rendered purer, and is then called *pearlash*, the form of the alkali designated by the name at the head of this article.

Natural State and Preparation. Potash and pearlash of commerce are procured from the ashes of wood by lixiviation, and the subsequent evaporation of the solution obtained. The alkali exists in the wood, principally in the state of acetate; and, being of a fixed and incombustible nature, is left behind after the incineration. The wood is burnt on the ground, in a place sheltered from the wind. The ashes consist of a soluble and insoluble portion. The soluble part is made up of carbonate of potassium, together with sulphate, phosphate, and silicate of potassium, and the chlorides of potassium and sodium; the insoluble portion, of carbonate and subphosphate of calcium, aluminium, oxidized iron and manganese, and a little carbonaceous matter that has escaped combustion. The ashes are lixiviated in barrels with the addition of a portion of lime, and the soluble substances above mentioned are taken up. The lixivium is then evaporated in large iron kettles, which for several days are kept constantly full. The evaporation is continued until the mass has become of a black colour, and of the consistence of brown sugar. It is now subjected to as powerful a heat as can be raised by the best wood fire for a number of hours, by which it is fused. During the fusion, the combustible impurities are for the most part burnt out, and a gaseous matter is emitted, which agitates the more fluid part. When the fusion is complete, the liquid becomes quiescent, and looks like melted iron. It is now transferred, by means of large iron ladles, to iron pots, where it congeals in cakes. These are broken up and packed in tight barrels, and constitute the *potash* of commerce. (*Dr. G. A. Rogers*, in *Silliman's Journal.*)

If it is intended to make *pearlash*, the process is varied. In this case the black matter of the consistence of brown sugar, called *black salts* by our manufacturers, instead of being fused, is transferred from the kettles to a large oven-shaped furnace, so constructed that the flame may play over the alkaline mass, which in the mean time is stirred by means of an iron rod. The ignition is in this way continued, until the combustible impurities are burnt out, and the mass, from being black, becomes of a dirty bluish-white colour. (*Rogers.*)

The ashes of plants amount generally to not more than a few parts in the hundred; and of these a portion only consists of potassa. The different parts of the same vegetable, and, for a stronger reason, different plants, furnish variable quantities of ashes. Ligneous plants yield less than herbaceous, the trunk less than the branches, and the branches less than the leaves. The bark yields more ashes than the wood; and the leaves of trees which drop their foliage in winter more than the leaves of evergreens. The following table gives the quantity of potassa contained in the ashes of one thousand parts of the undernamed plants:

Pine	0·45	Wheat straw	4·18	Dry oak leaves	24·0
Poplar	0·75	Flax	5·0	Common nettle	25·0
Birch	1·29	Rush	5·08	Black elder	25·5
Beech	1·45	Common thistle	5·37	Vetch	27·5
Oak	2·03	Vine branches	5·5	Poke	45·6
Oak bark	2·08	Barley straw	5·8	Wheat stalks	47·0
Box	2·26	Beech bark	6·0	Stems of potatoes	55·0
Willow	2·85	Fern	6·2	Wormwood	73·0
Linden	3·27	Indian corn stalks	17·5	Fumitory	79·0
Elm	3·9	Sun-flower stalks	19·4	Angelica	96·2
Maple	3·9				

Commercial History. Potash and pearlash are made in those countries in which forests abound. Accordingly, the alkali is extensively manufactured in Canada and the United States, and constitutes an important export of this country. It is prepared chiefly in the State of New York, which is supposed to furnish three-fourths of our exports of this alkali. It is also produced in considerable quantities in the northern countries of Europe, especially in Russia, and on the shores of the Baltic. It is of different qualities as it occurs in commerce, and is distinguished by the country or place of manufacture, as *American*, *Russian*, *Dantzic potash*, &c.

Potash has been extracted from felspar by Prof. Fuchs, by igniting it with lime, which renders the alkali slowly soluble in water. Dr. E. Meyer, of Berlin, has found that the extraction is facilitated by digesting the ignited mass with water under a pressure of seven or eight atmospheres. (*Pharm. Journ. and Trans.*, June, 1857, p. 607.) Other minerals have recently become the sources of potassa salts, especially a deposit of mixed chlorides of potassium and magnesium, overlying a bed of common salt, at Stassfurt, near Magdeburg, in Prussia. They are also extracted by M. Bulard from sea-water. (*Ibid.*, Feb. 1867, p. 451.) For observations on Bulard's process, by Mr. J. Lawrence Smith, see *Chemical News* (Sept. 2, 1870, p. 112).

Properties. Potash is in the form of fused masses, of a stony appearance and hardness, and caustic burning taste. Its colour is variegated; but reddish and dark-brown are the predominant hues. When exposed to the air it absorbs moisture and deliquesces; and, if sufficiently long exposed, finally becomes liquid. *Pearlash* is of a white colour, with usually a tinge of blue. As it occurs in commerce, it is in tight casks, containing about three hundred and fifty pounds, in which it forms one entire, hard, concrete mass. In the shops it is found in coarse powder, intermingled with lumps as dug out of the casks, presenting an opaque granular appearance, like table salt or Havana sugar. It is deliquescent, and has a burning alkaline taste. It is soluble in water, with the exception of impurities. The soluble matter in 100 grains of the salt of medium quality will neutralize about 58 grains of officinal sulphuric acid. It differs from potash principally in containing less combustible impurities, and in being less caustic and deliquescent. The colouring matter of both these forms of alkali is derived from carbonaceous impurities, and small portions of iron and manganese.

Composition. The basis of both pot and pearlash is carbonate of potassium; but this is associated with certain salts, and with insoluble impurities. Several varieties of potash found in commerce were analyzed by Vauquelin, whose principal results are contained in the following table. The quantity examined of each kind was 1152 parts.

Kinds of Potash.	Caustic Hydrate of Potassa.	Sulphate of Potassa.	Chloride of Potassium.	Insoluble Residue.	Carbonic Acid and water.
American potash . .	857	154	20	2	119
Russian potash . . .	772	65	5	56	254
Pearlash	754	80	4	6	308
Dantzic potash . . .	603	152	14	79	304

These results, calculated for 100 parts, show that the American potash contains 74 per cent. of pure hydrated alkali, and the Russian 67 per cent. Pearlash, it is seen, is more rich in carbonic acid than potash; and this result of analysis corresponds with the qualities of the two substances as prepared in the United States; potash being known to be far more caustic than pearlash. Besides the impurities shown by the table, phosphate and silicate of potassium and chloride of sodium are present. According to Mr. Stevenson Macadam, the potashes of commerce contain iodine and a trace of bromine, which shows that the forest trees from which the alkali is obtained must contain a very minute proportion of these non-metallic elements. (*Chem. Gaz.*, Aug. 2, 1852, p. 284.)

As the potash of commerce is valuable in the arts in proportion to the quantity

of real alkali which it contains, it is important to possess an easy method of ascertaining its quality in that respect. The process by which this is accomplished is called *alkalimetry*, and the instrument used an *alkalimeter*. The best mode of proceeding, which is applicable to the commercial forms of soda as well as those of potassa, is that proposed by Faraday, and described by Turner as follows. Take a cylindrical tube, sealed at one end, nine and a half inches long, and three-quarters of an inch in diameter, and pour into it one thousand grains of water, marking with a file the point at which the water stands. Divide the space occupied by the water into one hundred equal parts, graduating from above downwards; and, opposite to the numbers 23·44, 48·96, 54·63, and 65, severally, write the words soda, potassa, carbonate of sodium, and carbonate of potassium. Then prepare a dilute sulphuric acid having the specific gravity 1·127, which may be formed by adding to the strong acid about four times its volume of distilled water. An acid of this strength, if added to the tube so as to reach any one of the heights denoted by the above numbers, will be just sufficient to neutralize one hundred grains of the alkali written opposite to it. Suppose, for example, that the dilute acid be added until it stands opposite to the word carbonate of potassium, we shall then have the exact quantity necessary to neutralize one hundred grains of that carbonate; and if we add pure water, until the liquid reaches to 0, or the beginning of the scale, it is evident that the acid has been brought to the bulk of a hundred measures, each of which would be competent to neutralize one grain of the carbonate in question. All that is now necessary, in order to ascertain the quality of any commercial sample of this carbonate, is to dissolve one hundred grains of it in warm water, filter the solution to remove insoluble impurities, and add by degrees the dilute acid from the tube until the solution is exactly neutralized, as shown by litmus paper. The number of divisions of acid, expended in attaining this point, may be read off from the tube; and for each division one grain of pure carbonate is indicated.

This method of testing the potash of commerce indicates its alkaline strength, assuming this to be dependent solely on potassa; but soda, a cheaper alkali, may be present as an adulteration, and its proportion is important to be known. To solve this problem, M. O. Henry proposes that the saturating power of a given weight should be first determined in relation to sulphuric acid, and afterwards the proportion of carbonate of potassium in an equal weight, by first converting it into an acetate, and then precipitating the potassa by hyperchlorate (oxychlorate) of sodium, the reacting salts being in alcoholic solution. The precipitated hyperchlorate of potassium indicates the proportion of carbonate of potassium. The amount of the latter determines how much of the sulphuric acid was expended in saturating the potassa; and the soda is indicated by the amount of this alkali equivalent to the remainder of the acid. (*Journ. de Pharm.*, vii. 214.) Another method of detecting soda in the potash of commerce, proposed by Pagenstecher, is to convert the suspected alkali into a sulphate, and to wash the sulphate formed with a saturated solution of sulphate of potassium. If the whole of the saline matter be sulphate of potassium, the washing will cause no loss of weight; but if part of it be sulphate of sodium, this will be washed away, on account of its solubility in a saturated solution of sulphate of potassium. (*Ibid.*, Mars, 1848, 239.) Frémy has proposed the metantimoniate of potassium as a test for soda in potash. In applying this test, the potash is converted into a neutral chloride of potassium, and treated with a recent solution of the metantimoniate. If the alkali examined contain 2 or 3 per cent. of soda, a precipitate will be almost instantly formed. If a less proportion of soda be present, time and agitation will be necessary to effect the precipitation. Frémy states that, by this test, he can detect the half of 1 per cent. of soda in commercial potash. (*Philos. Mag.*, Oct. 1848, 325.) Good potash should not contain a proportion of chlorides, indicating more than 2 per cent. of chlorine by the test of nitrate of silver. If a larger proportion is shown, adulteration with common salt may be suspected. A standard solution of the silver salt may be made, a known measure of which shall be just sufficient to precipitate all the chlorine in a given weight of good potash, after having been supersaturated with nitric acid. If a further addition of the test causes a precipitate, the presence of too much chlorine is shown.

Pearlash, from its impurity, is never used as a medicine. Purified to a certain extent, it takes the name of carbonate of potassium.

Off. Prep. Potassii Carbonas, *U.S.* B.

POTASSII CHLORAS. *U.S.*

Chlorate of Potassium.

Off. Syn. POTASSÆ CHLORAS. *Chlorate of Potash. Br.*

Hyperoxymuriate of potassa; Chlorate de potasse, *Fr.*; Chlorsaures Kali, *Germ.*

In the U. S. Pharmacopœia, Chlorate of Potassium is placed in the Catalogue of Materia Medica; in the British, it is ranked among the Preparations, with the formula KO,ClO_5.

The salt may be conveniently obtained by the process of Graham, which consists in mixing carbonate of potassium with an equivalent quantity of hydrate of lime, before submitting it to the action of chlorine. The gas is absorbed with avidity, and the mass becomes hot, while water is given off. The lime converts the carbonate into caustic potassa, and the reaction then takes place between six eqs. of potassa and six of chlorine, with the result of forming five eqs. of chloride of potassium, and one of chlorate of potassium. ($6KO$ and $6Cl = 5KCl$ and KO,ClO_5.) The products are, therefore, carbonate of calcium, chloride of potassium, and chlorate of potassium. The chloride and chlorate are separated from the carbonate by solution in hot water, and the chlorate from the chloride by priority of crystallization. The Br. Pharmacopœia has adopted this process, with the following directions. "Take of Carbonate of Potash *twenty ounces* [avoirdupois]; Slaked Lime *fifty-three ounces* [avoird.]; Distilled Water *a sufficiency;* Black Oxide of Manganese *eighty ounces* [avoird.]; Hydrochloric Acid *twenty-four pints* [Imperial measure]. Mix the Lime with the Carbonate of Potash, and triturate them with a few ounces of the Water so as to make the mixture slightly moist. Place the Oxide of Manganese in a large retort or flask, and, having poured upon it the Hydrochloric Acid, diluted with six pints [Imp. meas.] of water, apply a gentle sand heat, and conduct the Chlorine as it comes over, first through a bottle containing six [fluid]ounces of Water, and then into a large carboy containing the mixture of Carbonate of Potash and Slaked Lime. When the whole of the chlorine has come over, remove the contents of the carboy, and boil them for twenty minutes with seven pints [Imp. meas.] of the Water; filter and evaporate till a film forms on the surface, and set aside to cool and crystallize. The crystals thus obtained are to be purified by dissolving them in three times their weight of boiling Distilled Water, and again allowing the solution to crystallize."

In the first process, a large proportion of the potassa is lost by being converted into chloride of potassium. Prof. F. C. Calvert, of Manchester, almost entirely avoided this loss by his new process, in which he reacts upon one eq. of caustic potassa, mixed with five and a half eqs. of lime, with a stream of chlorine. The potassa is dissolved in sufficient water to form a solution, containing $10\frac{1}{4}$ per cent. of the alkali (sp. gr. 1·110), and mixed with the lime; and the mixture, after having been gradually heated to 122°, is subjected to a rapid current of chlorine to saturation, the reaction caused by which raises the temperature to about 194°. The product is then evaporated nearly to dryness, the residue dissolved in boiling water, and the solution filtered and set aside to crystallize. The strength of the solution of potassa, together with the increased temperature, determines the combination of part of the chlorine with calcium instead of potassium; and the oxygen from the lime converts the remaining chlorine into chloric acid. A higher or lower density of the potassa solution was found not to give equally favourable results. This process has been tried on a large scale, and is said to have been successful. While the original process gives but 43 parts of chlorate to 100 of anhydrous potassa, this process yields 260 parts. The same result in relation to the loss of potassa was gained in the British process by the use of a larger proportion of slaked lime.

The chlorate of potassium of commerce is prepared by the reaction of solutions of chloride of potassium and hypochlorite of calcium, with the assistance of heat. The

chlorate of potassium crystallizes during the refrigeration of the liquor, and chloride of calcium remains in solution (KCl and $3(CaO,ClO) = KO,ClO_5$ and $3CaCl$).

Properties. Chlorate of potassium is a white anhydrous salt, of a cooling and slightly acerb taste. It crystallizes in rhomboidal plates of a pearly lustre. It is soluble in 16 parts of water at 60°, and in two and a half parts of boiling water. When thrown on burning coals, it augments their combustion remarkably. This property is due to the presence of oxygen, which may be evolved from the salt, in the proportion of nearly 39 per cent., by heating it a little above its point of fusion. The residue is chloride of potassium. Sulphuric acid dropped on the crystals causes them to become first yellow and then red. *U. S.*

Chlorate of potassium is characterized also by becoming first yellow, and then red by admixture with a little sulphuric acid, and by the action of that acid evolving chlorous acid gas (quadroxide of chlorine), known by its yellow colour, and explosive property when heated; by its bleaching power when mixed first with muriatic acid and then with water; and by its property of exploding violently when triturated with a small portion of sulphur or phosphorus, or even kermes mineral. Its usual impurity is chloride of potassium, which may be detected by a precipitate of chloride of silver being produced on the addition of nitrate of silver. This test does not precipitate the chlorine of the chloric acid. Chlorate of potassium consists of one eq. of chloric acid 75·5, and one of potassa 47·2 = 122·7.

This salt is an excellent test of manganese existing in organic matter. If a small portion of such matter, containing even a trace of manganese, be thrown on the surface of the *pure* melted salt in a test-glass, after the combustion has ceased, the cooled saline mass will be found to have a rose or pinkish tint, caused by the formation of permanganate of potassium. (*Neues Repert.*, vi. 247.) A similar discoloration of the salt, produced by the use of pure charcoal in the same manner, will evince the presence of manganese in the chlorate as an impurity.

Medical Properties. According to M. Socquet, the physiological action of chlorate of potassium is to depress the circulation, without the least effect on the digestive organs. From experiments made by Dr. O'Shaughnessy and others, it gives a bright scarlet colour to the venous blood, and passes undecomposed into the urine. The first trials made with it as a medicine were founded upon the supposition that it would prove an oxidizing remedy; and hence it was employed in scurvy, and in syphilis and liver complaints as a substitute for mercury. In scurvy its use has been recently revived. It has also been employed in acute articular rheumatism, pseudomembranous angina and croup, ulcerative and gangrenous stomatitis of infants, and mercurial and maternal stomatitis. In these ulcerous affections, there can be no doubt of its great efficacy in very many instances. Dr. Alexander Harkin, of Dublin, recommends it highly in scrofula and consumption. (*Dub. Quart. Journ.*, Nov. 1861.) At an earlier date, it had been tried advantageously in presumed cases of phthisis by Dr. Davenport, of Iowa. (*Am. Med. Monthly*, Sept. 1860.) Dr. Austin Flint, however, as the result of his own observations, denies that it has any specific influence on the disease. (*Am. Journ. of Med. Sci.*, Oct. 1861, p. 321.) It is much employed, and by some practitioners mainly relied on in scarlatina, diphtheria, and fetid breath. It has obtained some reputation also as a resolvent; and Mr. W. Craig, of Ayr, in Scotland, has reported three cases of large ovarian tumours, two of which disappeared, and the third was diminished, under the use of a dessertspoonful, thrice daily, of a saturated aqueous solution of the chlorate. (*Edin. Med. Journ.*, Nov. 1865, p. 427.) It has been thought in some instances to have prevented abortion.

Externally, chlorate of potassium in solution has been used in several diseases. Mr. Moore, of London, has found it very useful as an application to indolent and scrofulous ulcers and phagedæna, to ulcerations of the nose, mouth, and tongue, and for cleansing cancerous sores. It is even asserted to have caused the healing of cancroid ulcers. (*Journ. de Pharm.*, Mars, 1864, p. 269.) M. Ganjot found it successful in a case of severe phagedenic ulcers, which had long resisted other remedies; applying to each ulcer, morning and evening, by means of a compress, a solution containing one part of the salt in 25 parts of water. (*Ann. de Thérap.*, 1866, p. 132.) Dr. S. F. Starley, of Fairfield, Texas, succeeded in curing, in a month, a case of long-standing

catarrh of the bladder, by injecting into the bladder, daily at first, and afterwards every two or three days, from four to six ounces of a solution containing a drachm in eight ounces of water. (*Med. and Surg. Reporter*, Aug. 24, 1867, p. 169; from the *South. Journ. of Med. Sci.*) Dr. Bedford Brown, of N. C., has employed it with success, in the form of injection, in gonorrhœa in women, leucorrhœa, and ulceration of the os uteri. (*Am. Journ. of Med. Sci.*, July, 1857, p. 66.) The dose is from fifteen to thirty grains every three or four hours, given in sufficient gum water, sweetened water, or lemonade to dissolve it. When administered as a prophylactic in salivation, a smaller dose will answer. No nicety need be observed in the dose. Taken to the extent of five drachms in twenty-four hours, it was found to produce diuresis, abundant salivation, and a strong saltish taste. When used as a wash or injection, from a drachm to half an ounce of the salt may be dissolved in a pint of water. A solution in glycerin, in the proportion of one part of the salt to ten of the menstruum, has been especially recommended as a dressing for ill-conditioned wounds and ulcers. The remedy has also been applied in the form of very fine powder dusted on the surface.

Off. Prep. Potassæ Permanganas, *Br.;* Trochisci Potassæ Chloratis, *Br.;* Trochisci Potassii Chloratis, *U. S.* B.

POTASSII FERROCYANIDUM. *U. S.*

Ferrocyanide of Potassium.

Off. Syn. POTASSÆ PRUSSIAS FLAVA. *Yellow Prussiate of Potash. Syn.* FERROCYANIDE OF POTASSIUM. $K_2FeC_6N_3+3HO$. A salt obtained by fusing animal substances, such as the cuttings of horns, hoofs, and skins, with carbonate of potash in an iron pot, lixiviating the crude product with water, and purifying the salt by crystallization. *Br.*

Ferrocyanuret of potassium, Ferrocyanate of potassa, Ferroprussiate of potassa, Prussiate of potassa; Proto-cyanure jaune de fer et de potassium, *Fr.;* Cyaneisenkalium, *Germ.*

It is the yellow double cyanide of potassium and iron, the salt from which cyanide of potassium is obtained by calcination at a low red heat.

Ferrocyanide of potassium is prepared on the large scale by heating animal matters, such as dried blood, hoofs, chips of horn, woollen rags, old leather, the refuse of tallow-chandlers called *greaves*, and other substances rich in nitrogen, with the pearl-ash of commerce and scrap iron, in an egg-shaped iron pot called a shell, ladling out the pasty mass called the *melt*, and, after it has cooled sufficiently, dissolving it in water, and evaporating the solution so that crystals may form. The melt, while still hot, contains cyanide of potassium only, the ferrocyanide being produced solely by the action of the water. The best temperature for making the solution is between 158° and 176°; and the conversion of the cyanide into the ferrocyanide is facilitated by the presence of finely divided amorphous sulphuret of iron, and of caustic potassa. (A. Reimann, *Chem. Gaz.*, Jan. 1, 1855.)

Some years ago this salt was manufactured by a process which dispensed with the use of animal matter; the necessary nitrogen being obtained by a current of atmospheric air. Fragments of charcoal, impregnated with 30 per cent. of carbonate of potassium, were heated to white redness in a cylinder, through which a current of air was drawn by a suction pump. This process is understood to have succeeded in a chemical sense, but failed on the score of economy, chiefly from the circumstance that the necessary fire-clay tubes could not be made to resist the combined action of the alkali and heat. The process of Richard Brunnquell consists in passing ammonia through tubes, filled with charcoal and heated to redness, so as to form cyanide of ammonium, and converting this into ferrocyanide of potassium by contact with solution of potash and suitable iron compounds. (*Chem. Gaz.*, Nov. 1, 1856.)

Properties. Ferrocyanide of potassium is in large, beautiful, transparent, permanent, four-sided, tabular crystals, of a lemon-yellow colour, devoid of odour, but possessing a sweetish, yet somewhat bitter, saline taste. It dissolves in between three and four times its weight of cold water, and in about its own weight of boiling water, but is insoluble in alcohol. It acts but slightly, if at all, on turmeric paper. The

alkaline reaction, when it exists, is probably owing to the presence of a little free potassa. When heated to 140° it loses its water of crystallization, amounting to 12·6 per cent., and becomes white. When ignited, the insoluble residue amounts to 18·7 per cent. of sesquioxide of iron, resulting from the oxidation of the iron of the salt. It is characterized by striking a deep-blue colour with the salts of sesquioxide of iron, a deep-brown one with the salts of copper, and a white one with those of zinc, the several precipitates formed being ferrocyanides of the respective metals. Heated with eight or ten times its weight of concentrated sulphuric acid, it evolves carbonic oxide. (*Fownes.*) Half an ounce of the salt yields about 250 cubic inches of the gas. (*C. Grimm and G. Ramdohr.*) When boiled with dilute sulphuric acid, it emits the smell of hydrocyanic acid. Ferrocyanide of potassium consists of two eqs. of cyanide of potassium 130·4, one of cyanide of iron 54, and three of water 27 = 211·4 ($2KCy,FeCy+3HO$). The water present is just sufficient to convert the iron and potassium into protoxides, and the cyanogen into hydrocyanic acid. Apart from the water, it is generally considered to consist of a compound radical, called *ferrocyanogen*, formed of three eqs. of cyanogen and one of iron (tercyanide of iron), united with two eqs. of potassium. Hence its officinal name. The salt is remarkably pure as it occurs in commerce.

Medical Properties, &c. Judging from the experiments of the German physicians, this salt possesses but little activity. Callies, as quoted by Pereira, found the commercial salt slightly poisonous, but the pure salt unproductive of harm in the dose of several ounces. It should be borne in mind that it is the commercial salt which is used medicinally. Westrumb and Hering proved that it passed with rapidity into the blood and urine. The late Dr. Burleigh Smart, of Kennebec, Maine, found it to possess active medical properties. (*Am. Journ. of Med. Sci.*, xv. 362.) Its primary effect was that of a sedative, diminishing the fulness and frequency of the pulse, and allaying pain and irritation. It acted also, under favourable circumstances, as a diaphoretic and astringent; but, as a diaphoretic, only in cases attended with excessive vascular action and increased heat of skin. As an astringent, its power was most conspicuous in the colliquative sweats of chronic bronchitis and phthisis. The same power was evinced in several cases of leucorrhœa. It sometimes produced ptyalism, unattended, however, by swelling of the salivary glands or fetor of the breath. Its properties as an anodyne and sedative rendered it applicable to cases of neuralgic pains and hooping-cough, in which diseases, especially the latter, Dr. Smart found it useful. When given in an overdose, it occasioned vertigo, coldness, and numbness, with a sense of gastric sinking. The form of administration which Dr. Smart preferred was that of solution, in the proportion of two drachms to the fluidounce of water. Of this the dose for an adult is from 30 to 45 drops, equivalent to from 10 to 15 grains of the salt, repeated every four or six hours.

This salt is manufactured on a large scale, chiefly for the use of dyers and calico-printers. In pharmacy it is employed to prepare diluted hydrocyanic acid, Prussian blue, and the cyanides of potassium and silver.

Off. Prep. Acidum Hydrocyanicum Dilutum; Argenti Cyanidum, *U. S.;* Ferri Ferrocyanidum, *U. S.;* Hydrargyri Cyanidum, *U.S.;* Potassii Cyanidum, *U. S.* B.

POTASSII HYPOPHOSPHIS. *U. S.*

Hypophosphite of Potassium.

This was introduced into the Materia Medica List at the late revision of the U. S. Pharmacopœia, A.D. 1870, which gives the following description.

"In white, opaque, confused, crystalline masses having a disagreeable bitter taste. It is extremely deliquescent, very soluble in water and alcohol, and insoluble in ether. If heated in the air it burns with a yellow flame; heated to redness out of contact of the air, it evolves easily-inflammable phosphoretted hydrogen; when evaporated to dryness in contact with nitric acid, it detonates violently." *U. S.*

This salt is prepared by mixing solutions of hypophosphite of calcium and granulated carbonate of potassium, in the proportion of six ounces of the former dis-

solved in four pints of water, to 5·75 ounces of the latter in half a pint. As a result of double decomposition between the two salts, carbonate of calcium and hypophosphite of potassium are formed; the former being precipitated, and the latter held in solution. The carbonate of calcium is removed by filtration, and the clear solution is evaporated till a pellicle forms, after which it is constantly stirred, with continuance of the heat, until the salt granulates. The heat employed in the evaporation should be kept considerably below 212°, for fear of explosion. If the salt is required quite pure, it should be dissolved in the granulated state, in officinal alcohol, and the solution evaporated to a syrupy consistence, and then set aside to crystallize. The hypophosphite of calcium used in the formation of this salt may be prepared by a formula, given under the head of *hypophosphite of calcium* (see *page* 195).

The properties of the hypophosphite of potassium have been given above, in the description of the Pharmacopœia. Its composition is represented by the formula KO,2HO,PO.

Medical Properties and Uses. This salt was brought into notice a few years since, along with several other *hypophosphites*, as those of *calcium*, *sodium*, *ammonium*, &c., in consequence of their supposed efficiency in the introduction of phosphorus into the system, in cases in which this element might be thought to be deficient. Upon this principle they were recommended by Dr. Churchill, of Paris, in the treatment of phthisis, and came into extensive employment; but experience has hardly confirmed the first favourable impression of their usefulness in this complaint. There seem, however, to be good grounds for their application to diseases attended with deficiency of nerve power from debility of the brain; and in certain scrofulous affections of children, especially those connected with a disorded condition of the bones. The dose of the hypophosphite of potassium is for adults from ten to thirty grains three times a day, and may be given dissolved in water, or in the form of syrup.

W.

POTASSII NITRAS. *U.S.*

Nitrate of Potassium.

KO,NO_5. Nitrate of potash of commerce, purified, if necessary, by crystallization from solution in distilled water. *Br.*

Nitre, Saltpetre; Nitrate de potasse, Azotate de potasse, Salpêtre, *Fr.;* Salpetersaures Kali, Salpeter, *Germ., Dutch, Dan., Swed.;* Nitro, *Ital., Span., Port.*

Nitre or saltpetre is both a natural and artificial product. It occurs in many countries, existing in the soil on which it forms a saline efflorescence, in the fissures of calcareous rocks, and in caves. It has been found in different parts of Europe, in Egypt, and in Peru; but the country in which it is most abundantly produced is India, whence the principal part is furnished for the demands of commerce. In the United States it is found, for the most part, in caverns situated in limestone rock, called saltpetre caves, where it is associated with nitrate of calcium. The earths contained in them are lixiviated, and yield, according to their richness, from one to ten pounds of crude nitre to the bushel. These caves are particularly numerous in Kentucky, and furnished a large proportion of the nitre consumed in the United States during the last war with England. According to Mr. E. S. Wayne, of Cincinnati, nitre earth exists near Nashville, Tenn., which yields 15 per cent. of nitre, and is said to be sufficiently abundant to supply the demand of the United States. In Bradford County, Penn., a solid, uncrystalline deposit of very pure nitre exists in a sandstone rock. (*Prof. W. H. Ellet.*) "A mountain" of the salt is said to have been discovered by Dr. Harrison among the Rocky Mountains, "six miles N. E. of Crystal Peak." (*Am. Journ. of Pharm.*, Jan. 1866, p. 87.) Nitre exists also in the vegetable kingdom, having been found in tobacco, borage, bugloss, parietaria, hemlock, and the sun-flower. The artificial sources of nitre are certain mixtures of animal and vegetable substances with wood-ashes and calcareous matter, called nitre-beds; and certain materials, impregnated with saltpetre, consisting principally of plaster rubbish, derived from the demolition of old buildings. The ashes of tobacco stems,

consisting almost exclusively of carbonate and chloride of potassium in nearly equal parts, have been proposed by M. Commaille as an artificial source of nitre, by adding them to the ordinary nitre-beds. (*Journ. de Pharm.*, Fév. 1856, 106.)

Preparation from its Natural Sources. In India the saline earth, which contains about seven parts of nitre in a thousand, is lixiviated in large mud filters, lined with stiff clay, and furnished with false bottoms of bamboo, covered with grass mats, on which wood-ashes are laid. The filters being then filled with the saline earth, water is added, and the solution filters through the wood-ashes, with the effect of converting the nitrate of calcium present, amounting to nearly 1 per cent., into nitrate of potassium. The solution obtained is evaporated in earthen pots, filtered, and set aside to crystallize. The impure nitre thus obtained contains from 45 to 70 per cent. of the pure salt. It is redissolved and crystallized, and thrown into commerce under the name of crude saltpetre.

Besides the nitre obtained in India by the filtration of the soil deposited during the overflow of the Ganges, it appears, from the report of Dr. J. W. Palmer, that much of the crude salt is obtained, in the northwestern Provinces of Hindostan, from the saline incrustations formed in and around the mud walls surrounding the dwellings of the natives. The scrapings from these sources are lixiviated, and the impure solution allowed to evaporate in shallow pans exposed to the sun. The impure nitre extracted from the earthy matters crystallizes out; while common salt, to the extent of from 1 to 9 per cent., remains in the mother-liquor, and is recovered by subsequent evaporation to dryness. (See *Am. Journ. of Pharm.*, Sept. 1868, p. 436.)

Artificial Preparation. The plan of forming saltpetre in artifical nitre-beds is principally practised in Germany; while the method of obtaining it from old plaster rubbish is followed in France. *Artificial nitre-beds* are formed of animal and vegetable remains, together with ashes and calcareous earth, which are mixed up with a portion of loose soil and placed under sheds, to shelter the mixture from the rain; while the sides are left open to permit the free access of air. The mixture is disposed in little ranges or heaps, which are frequently turned over with a spade, and sprinkled with urine, as a substance containing a large quantity of nitrogen. At the end of two or three years, the nitrogen is converted into nitric acid, and this, by uniting with the potassa existing in the vegetable remains, forms nitre. When the contents of the bed contain about four ounces of the salt for every cubic foot of the materials, they are deemed fit to be lixiviated. The lixiviation is performed with boiling water, which is repeatedly thrown upon fresh portions of the mass, until the solution obtained is sufficiently strong. The lixivium is of a brown colour, and contains chiefly the nitrate of potassium, but at the same time more or less of the nitrates of calcium and magnesium, and of common salt. The earthy nitrates are then decomposed by a solution of wood-ashes, the potassa of which converts them into nitre, and precipitates the earths. The solution being further evaporated, the common salt rises to the surface as a scum, and is removed. The solution is then allowed to cool, and the nitrate crystallizes in dirty-white crystals, called crude nitre. Nitrate of calcium may be converted into nitre by adding it to a solution of sulphate of potassium. Sulphate of calcium is precipitated, and nitrate of potassium remains in solution.

When obtained from old plaster rubbish, the material is reduced to powder and lixiviated, in order to exhaust it of everything soluble. The solution is found to contain the nitrates of potassium and calcium, and common salt, and is treated with wood-ashes, which convert the nitrate of calcium into nitrate of potassium, with precipitation of the earth as a carbonate. The liquor is separated from the precipitate and concentrated by heat; and the common salt, as it rises to the surface, is skimmed off. When the solution is so strong as to mark 45° of Baumé's areometer, it is allowed to cool and crystallize; and the crystals form the crude nitre of this process. The salt obtained in this way generally contains from 85 to 88 per cent. of pure nitre; the remainder being made up of chloride of sodium, and certain deliquescent salts. The details of this process, as formerly practised in Paris, are given by Thenard.

Theory of Nitrification. It is generally supposed that the continuous formation of nitre in nitre earths, and in artificial nitre-beds, depends upon the oxidation of

the nitrogen of ammonia, thus generating nitric acid, the formation of which is facilitated by the presence of alkaline and earthly bases, with which the acid unites. The ammonia is derived, for the most part, from the organic remains in the nitre earths, and from the animal matter which is an essential ingredient in the artificial mixtures. According to Schoenbein, whose statement has been confirmed by Goppelsröder, the formation of the nitric acid is always preceded by that of nitrous acid. (*Journ. de Pharm.*, Avril, 1862, p. 334.)

Purification. Nitrate of potassium, as first obtained, either from natural or artificial sources, is called in commerce crude saltpetre, and requires to be purified before it can be used in medicine, or in most of the arts. The process, which is founded principally on the fact that nitre is more soluble than common salt in hot water, is conducted in the following manner in France. Thirty parts of saltpetre are boiled with six parts of water, and the portion which remains undissolved, or is deposited, consisting of common salt, is carefully removed. As the ebullition proceeds, a little water is added from time to time, to hold the nitre in solution. When common salt ceases to be separated, the solution is clarified with glue, and more water is added, at intervals, until the whole, including that previously added, amounts to ten parts. The clear solution is now transferred to large, shallow copper coolers, where it is agitated with wooden instruments to hasten the cooling, and to cause the nitre to crystallize in small grains. The purification is completed by washing the salt with water, or a saturated solution of nitre, in a kind of wooden hopper, with holes in the bottom stopped with pegs. The liquid employed is allowed to remain in contact with the nitre for several hours, after which it is permitted to drain off by taking out the pegs. The salt is now dried, and takes the name of purified nitre.

In Sweden, the process of purification is conducted in a different manner. The solution of the crude nitre is boiled until a saline crust (common salt) forms on its surface, and until it is so far concentrated that a small portion of it crystallizes upon cooling. The crust being removed, the solution is filtered, and diluted with 1-48th of water, with a view to retain in solution the common salt, which, being somewhat less soluble in cold than in boiling water, would otherwise be in part precipitated on refrigeration. The solution is now allowed to cool, and, at the moment crystals begin to form, is stirred constantly to cause the salt to crystallize in small grains. The granular salt is then washed after the French method, as above described, dried, and, being fused, is cast in sheet-iron moulds so as to form masses, each weighing from ten to twenty pounds. The preparation of nitre in this manner by fusion is, according to Berzelius, attended with several advantages; such as occupying less space, losing nothing by waste in transportation, and presenting, in this state, an obvious index of its quality. This index is the character of its fracture. When the salt is perfectly pure, the fracture is radiated, the radii being generally large. The presence of 1-80th of common salt renders the radii smaller; and of 1-40th, or a larger quantity, produces a zone in the substance of the mass devoid of the radiated structure, or causes this structure to disappear entirely. On the other hand, the melting of the salt has the disadvantage of converting it in part into nitrite if the heat be too high, and of rendering it difficult to pulverize.

Commercial History. Nitre is received in this country from Calcutta, packed in grass-cloth bags, containing from one hundred and fifty to one hundred and seventy-five pounds. The greater portion of it arrives at Boston. Its quality varies considerably. That which comes in dirty-yellow crystals is called *crude saltpetre;* while the finer lots, in small, comparatively clear crystals, approaching to white, are called *East India refined.* Very little crude saltpetre is at present obtained from native sources in the United States. The *refined saltpetre* is almost exclusively prepared by our own chemists.

As connected with the subject of saltpetre, it may be proper in this place to notice what is incorrectly called *South American saltpetre*, considerable quantities of which have been received within a few years from Peru and Chili. It is nitrate of sodium, and comes in bags containing about 270 pounds of the salt in the crude state. This nitrate is used by our manufacturing chemists, and is better suited than nitre for preparing nitric and sulphuric acids, on account of its greater proportional quantity

of acid. It is, however, not applicable to the purpose of making gunpowder, from its tendency to absorb moisture.

Nitrate of sodium may be decomposed, so as to yield nitre, by means of *caustic* American potash (red potash of commerce), by Mr. Rotch's patented process. This process gives a nitre equal in purity to the East India refined. For the details, see the *Pharm. Journ. and Trans.* (xi. 36). The same salt will furnish nitre by double decomposition with pearlash. (*Ibid.*, xi. 236.) Mr. Hill decomposes nitrate of sodium by means of chloride of potassium, forming, by double decomposition, nitrate of potassium and chloride of sodium. The latter is got rid of, in the usual manner, by evaporating the solution of the mixed salts.

Properties. Nitre is a white salt, possessing a sharp, cooling, and slightly bitterish taste, and generally crystallized in long, striated, semi-transparent, six-sided prisms, with dihedral summits. It dissolves in four or five times its weight of cold, and in about two-fifths of its weight of boiling water. It is sparingly soluble in rectified spirit, but insoluble in absolute alcohol. It undergoes no alteration in the air, unless this is very moist. It yields a yellow precipitate with bichloride of platinum, showing that potassa forms its base. It is devoid of water of crystallization; but is apt to contain a portion of liquid, mechanically lodged within the substance of the crystals. This is particularly the case with the *large* crystals, and, according to Berzelius, is a source of impurity; as the liquid in question is a portion of the mother-water in which they were formed. It is on this account that Berzelius recommends that the solution of the purified salt should be stirred during crystallization, so as to cause it to shoot into *small* crystals. When exposed to heat, nitre fuses, without losing weight, at about 662°. The fused mass, when cast in moulds, or formed into little circular cakes, constitutes that form of nitre kept in the shops under the name of *crystal mineral* or *sal prunelle.** If the heat is increased, the salt is decomposed, evolves pure oxygen, and is reduced to the state of nitrite, which, in powder, emits orange-coloured fumes of hyponitric acid, and nitric oxide on the addition of sulphuric acid. Upon a further continuance of the heat, the nitrous acid itself is decomposed, and a large additional quantity of oxygen is evolved, contaminated, however, with more or less nitrogen. On account of the large proportion of oxygen which it contains, nitre increases the combustion of many substances in a remarkable degree. When thrown on burning coals, it deflagrates with bright scintillations. In the reaction of nitre with charcoal, carbonic acid is produced, and never carbonic oxide; and the nitric acid is variously decomposed into nitrous acid, nitric oxide, or nitrogen, according to the proportion of the charcoal and to the heat employed. (*A. Vogel, jun.*) Nitre may be readily recognised by its effect in increasing the combustion of live coals, when thrown upon them; and by evolving white or reddish vapours on the addition of sulphuric acid. Its most usual impurity is common salt, which is seldom entirely absent, and which injures it for the manufacture of gunpowder. The presence of this salt, or of chloride of potassium, will cause a precipitate with nitrate of silver. If a sulphate be present, a precipitate will be formed with chloride of barium. Of the pure salt, 100 grains, treated with 60 grains of sulphuric acid, and ignited until it ceases to lose weight, yield 86 grains of sulphate of potassium. If the residue weighs less, part of it is probably sulphate of sodium, and the nitre tested may be assumed to have contained nitrate of sodium. The refined or purified saltpetre of commerce is sufficiently pure for medicinal use. Nitrate of potassium is composed of one eq. of nitric acid 54, and one of potassa 47·2 = 101·2.† M. Violette, on mixing a few grains, each, of nitrate of sodium and acetate of sodium, previously fused, noticed a few gaseous bubbles given off; and, at the same

* *Sal prunelle*, as directed to be made in the French Codex of 1837, is a mixture of nitrate and sulphate of potassium. It is prepared by fusing nitre in a Hessian crucible, adding 1-128th part of sulphur, and pouring out the product on a smooth marble slab, where it is allowed to congeal. The sulphur immediately takes fire, and, by combining with oxygen from a part of the nitric acid of the nitre, becomes sulphuric acid, which then unites with a small portion of potassa, to form sulphate of potassium.

† A method of estimating the nature and amount of the various impurities in commercial saltpetre has been published by M. Persoz, and may be seen in the *Am. Journ. of Pharm.*, Nov. 1861, p. 543.

time, a violent explosion took place, which scattered the vial in fragments over his laboratory. On heating a mixture of a grain each of nitrate of potassium and acetate of sodium, the mixture remained fluid at 300° F. and perfectly quiet; but, when the temperature was increased to about 350° C., a slight ebullition was noticed, instantly followed by a loud explosion, with light and smoke like exploded gunpowder. (*Am. J. of Pharm.*, March, 1873, p. 128; from *Journ. de Pharm. et de Chim.*, xvi. 333.)

Medical Properties. Nitre is considered refrigerant, diuretic, and diaphoretic, and is much used in inflammatory diseases. It is known to be a powerful antiseptic. It generally promotes the secretion of urine and sweat, lessens the heat of the body and the frequency of the pulse, and has a tendency to keep the bowels in a soluble condition. When taken in health, in quantities increasing gradually from one to five drachms daily, for the space of from eight to twelve days, it was found by F. Löffler to produce general weakness, lowness of spirits, constant disposition to sleep, and slow and weak pulse. Towards the end of the experiment, the pulse several times fell to twenty beats in the minute. During the use of the medicine, the appetite and digestion continued good, and the bowels were regular; though, occasionally, some pain was experienced in the abdomen, followed by purging. The blood, drawn at the end of the period, resembled cherry juice in colour, exhibited paler blood corpuscles than in health, coagulated very quickly, forming a clot of diminished firmness, was more watery than natural, and contained a smaller proportion of fat. (*Am. Journ. of Med. Sci.*, xviii. 204; from *Schmidt's Jahrb.*)

Nitre is very frequently prescribed with tartar emetic and calomel, forming a combination usually called the *nitrous powder*, which promotes most of the secretions, particularly those of the liver and skin, and which in many cases is advantageously employed in lessening and modifying febrile excitement. The formula usually preferred is eight or ten grains of nitre, the eighth of a grain of tartar emetic, and from the fourth to the half of a grain of calomel, exhibited every two or three hours. Nitre is frequently given in active hemorrhages, particularly hæmoptysis, and is a useful ingredient of gargles in certain stages of inflammatory sorethroat. Dr. Frisi, an Italian physician, found it very efficacious, in a case of obstinate spasmodic asthma, in affording speedy relief, and cutting short the attack as often as it was repeated. In the same disease, nitrous fumigation has been found useful, performed by inhaling the fumes from a piece of burning touch-paper about the size of a playing card, prepared by dipping blotting paper in a saturated solution of nitre, and afterwards drying it. M. Vohl has examined the vapour resulting from the burning of paper thus impregnated, and found it to consist of carbonic acid and oxide, cyanogen, ammonia, nitrogen, aqueous vapour, and carbonate and nitrite of potassium; and ascribes the beneficial results of its inhalation to the ammonia and nitrite of potassium. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 155, A.D. 1866.) In the form of sal prunelle, it has been strongly recommended by M. Debout, in polydipsia, given in the dose of a drachm daily. Dr. Henry Tiedemann, of this city, praises nitre as a remedy in dysentery. The usual dose is from ten to fifteen grains, dissolved in water or some mucilaginous liquid, and repeated every two or three hours. If given too freely, or for too long a period, it is apt to excite pain in the stomach. In an overdose (half an ounce to an ounce or more), taken in concentrated solution, it causes heat and pain in the stomach, vomiting and purging of blood, great prostration, convulsions, and sometimes death. On dissection, the stomach and intestines are found inflamed. A fatal case of poisoning by nitre, in which, although three ounces and a half were taken at one dose, no painful symptoms were manifested, is related by Dr. John Snowden, in the *New Jersey Med. Reporter* (viii. 117). The treatment consists in the speedy removal of the poison from the stomach, and in the administration of mucilaginous drinks, laudanum to allay pain and irritation, and cordials to sustain the system. No antidote is known.

Notwithstanding the toxical properties of nitre when taken largely in concentrated solution, it may be given, in divided doses, to the extent of one or two ounces in twenty-four hours, if copiously diluted with water. Administered in this way, the salt acts as a sedative on the circulation, decreasing the force and frequency of the

pulse. It is chiefly in *acute* rheumatism that large doses have been employed; and both M. Gendrin and M. Martin-Solon bear testimony to its remarkable efficacy in that disease, when thus given. Dr. Henry Bennett, of London, also speaks highly of its efficacy in the same disease; and his favourable report of it is confirmed by some well-conducted clinical experiments by Dr. R. Rowland, of the same city. The remedy was given by the latter in a quantity never exceeding half an ounce in twenty-four hours, dissolved in a pint of water. Thus administered, it produced no inconvenience. Large doses of this salt have also been employed with success in general dropsy, following remittent fever. It is best given, dissolved in sweetened barley-water, in the proportion of half an ounce to a pint and a half or two pints of the liquid.

Dr. Mangenot recommends, for the removal of cutaneous nævi, the topical use of nitre, applied by friction with the moistened finger, dipped into the powdered salt. (*Half-yearly Abstract*, Jan. to July, 1857, p. 120.)

In pharmacy nitre is employed to form crocus of antimony, to procure nitric acid, and sometimes in the preparation of sweet spirit of nitre. It enters into the composition of moxa. In the laboratory it is used to make black and white flux, as an oxidizing agent, and to yield oxygen at a red heat. In the arts it is employed in the production of aqua fortis (common nitric acid), the manufacture of sulphuric acid, and the fabrication of gunpowder. The Br. Pharmacopœia uses it in the purification of bismuth.

Off. Prep. Collodium, *U. S.* B.

POTASSII PERMANGANAS. *U.S.*

Permanganate of Potassium. Hypermanganate of Potassium.

Off. Syn. PERMANGANAS POTASSÆ. *Permanganate of Potash.* KO,Mn_2O_7. *Br.*

This is a new officinal of the U. S. and Br. Pharmacopœias. In the former it is placed in the Materia Medica list, as an article to be procured from the manufacturer. In the latter a process is given for its preparation. The following is the British formula.

"Take of Caustic Potash *five ounces* [avoirdupois]; Black Oxide of Manganese, in fine powder, *four ounces* [avoird.]; Chlorate of Potash *three ounces and a half* [avoird.]; Diluted Sulphuric Acid *a sufficiency;* Distilled Water *two pints and a half* [Imperial measure]. Reduce the Chlorate of Potash to fine powder, and mix it with the Oxide of Manganese; put the mixture into a porcelain basin, and add to it the Caustic Potash, previously dissolved in four [fluid]ounces of the Water. Evaporate to dryness on a sand bath, stirring diligently to prevent spurting. Pulverise the mass, put it into a covered Hessian or Cornish crucible, and expose it to a dull red heat for an hour, or till it has assumed the condition of a semifused mass. Let it cool, pulverise it, and boil with a pint and a half [Imp. meas.] of the Water. Let the insoluble matter subside, decant the fluid, boil again with half a pint [Imp. meas.] of the Water, again decant, neutralise the united liquors accurately with the Diluted Sulphuric Acid, and evaporate till a pellicle forms. Set aside to cool and crystallise. Drain the crystalline mass, boil it in six [fluid]ounces of the Water and strain through a funnel, the throat of which is lightly obstructed by a little asbestos. Let the fluid cool and crystallise, drain the crystals, and dry them by placing them under a bell jar over a vessel containing sulphuric acid." *Br.*

By this process chlorate of potassium yields oxygen to binoxide of manganese, converting it into permanganic acid, which unites with the potassa to form the permanganate, chloride of potassium being formed at the same time; but as the whole of the materials, however accurately the proportions may be calculated, do not react upon each other to the desired result, portions of the binoxide and of the potassa remain. Hence, when exhausted by water, the solution contains with the permanganate and chloride an uncertain proportion of potassa, which requires to be neutralized by sulphuric acid. Unfortunately, it is extremely difficult to get rid of the

sulphate and chloride of potassium, in the crystallization, which, therefore, are apt to contaminate the permanganate. At best, the product is small and uncertain in amount; and the process, therefore, which is a modification of Gregory's, is not likely to be generally adopted. Several other processes have been employed, among which a very simple one is that by Græger. This chemist prepared the salt by first obtaining the pure oxide of manganese by calcining the carbonate, then calcining together a mixture of 130 parts of the oxide, 100 parts of chlorate of potassium, and 184 parts of hydrate of potassa, as free from carbonic acid as possible. The carbonate is easily procured, as an incidental product in the preparation of chlorine, by precipitating the muriatic liquor by carbonate of sodium. To complete the process, the salt is obtained separate by solution, evaporation, and crystallization. (*Ann. de Thérap.*, 1867, p. 230.) According to Dr. E. R. Squibb, the best of the methods proposed is the following by M. Béchamp, of Montpellier.

Ten parts of binoxide of manganese, in fine powder, are intimately mixed with 12 parts of potassa dissolved in a little water, and the mixture is thoroughly dried. This is introduced into an earthenware retort, furnished with a tube passing through the tubulure nearly to the bottom. The retort is placed in a furnace, and to the beak a bent tube is adapted, the end of which dips into mercury. Heat is then applied, and a current of oxygen, or of atmospheric air freed from carbonic acid, is made to enter into the retort through the tube in the tubulure, as long as absorption continues. The mass is then exhausted with water, and carbonic acid is passed through the solution until it acquires a red or purple colour. After standing so as to allow of the subsidence of the undissolved matter, the liquid is decanted, evaporated without ebullition, and allowed to crystallize. The crystals are purified by a second crystallization. In this process the requisite oxygen for peroxidizing the manganese is supplied from a distinct source, and the disadvantage from the presence of other salts avoided. The action of the carbonic acid is to convert into carbonate the excess of potassa, which, so long as allowed to remain, prevents the conversion into permanganic acid of the manganic acid formed in the earlier stage of the process.

For satisfactory results it is desirable that, while a heat sufficient in degree and sufficiently prolonged is employed, it should not be so great as to decompose the new acid formed, and that a long continuance of heat in the extraction of the salt from the mass by water, and in the subsequent evaporation of the solutions, should be avoided, as it also favours decomposition. Hence the propriety of using a steam-heat, and of obtaining the salt with as little admixture as possible of other salts, which require repeated solution and evaporation to separate them. The latter is one of the main advantages of Béchamp's process. Dr. Squibb, after much attention to the subject, and many experiments, proposes a method in which the difficulties are avoided, and which has the recommendation of simplicity and economy. We have space only for an outline of his process, and refer for details to his article in the *Am. Journ. of Pharm.* for Sept. 1864.

Fused hydrate of potassa is heated with a little water in a cast-iron vessel, the bottom of which is made nearly red-hot; binoxide of manganese is added, and the mixture stirred till dry. It is then powdered, and subjected repeatedly to the action of water at an elevated temperature, being stirred to dryness after each addition. This operation is repeated four times. After the last addition of water the vessel is removed from the fire, and, time being allowed for subsidence, the clear liquor is decanted. The operation is twice repeated with the residue, after which the undissolved matters are thrown away. The liquors thus obtained are mixed and evaporated, care being taken to avoid too high a heat; and the residue is set aside to crystallize. The crystals are then drained in a funnel, the neck of which is obstructed with pieces of glass; as it is of the utmost importance that the salt shall not come in contact with organic matter. A further product of crystals is obtained by a repetition of the process; the mother-water being used, instead of pure water, for the solution of the potassa. The crystals thus obtained are washed with distilled water, then dissolved in boiling distilled water, and recrystallized. The yield of pure crystals may be from 16 to 25 per cent. of the oxide employed, according to the care used in conducting the process.

Subsequent experience has convinced Dr. Squibb that the recrystallization is unnecessary and wasteful; the product of crystals first obtained being sufficiently pure for all ordinary purposes, and the little free potassa contained therein being useful, if not essential, in preserving the salt from decomposition in solution. (*Am. Journ. of Pharm.*, Jan. 1865, p. 22.)

The rationale of this process, which appears to us to be an excellent one, is probably as follows. When the binoxide of manganese and potassa are heated together, a portion of the binoxide, under the influence of the potassa and heat, gives up to another portion so much oxygen as to convert it into manganic acid (MnO_3), which combines with potassa to form the manganate. But this salt, when dissolved in water, rapidly changes to the permanganate, probably by the surrender of one eq. of oxygen by one eq. of the manganic acid, by which it is converted into deutoxide (MnO_2), to two other eqs. of manganic acid, converting them into one eq. of the permanganic (Mn_2O_7). The manganic acid thus becomes a carrier of oxygen from the deutoxide, and, though a small portion may be formed at once, yet, by its successive formation and decomposition, it at length gives a considerable proportional product.

Properties. Permanganate of potassium (KO,Mn_2O_7) is in the form of slender prismatic crystals, of a dark-purple colour, inodorous, and of a sweetish, astringent taste. It is said to be soluble in 16 parts of water at 60° (*Brande and Taylor*); but, according to M. Reveil, it is dissolved by 5 times its weight at common temperatures. (*Arch. Gén.*, Janv. 1864, p. 24.) Its solution, even with a minute proportion of the salt, has a beautiful lilac-colour. If the solution be evaporated to dryness, the salt has the form of an intensely black powder. If suddenly heated, the crystals detonate; evolving oxygen, and leaving a black residue, which yields potassa to water, recognised by its alkaline reaction, and by giving, when acidulated with muriatic acid, a yellow precipitate with bichloride of platinum. (*Br.*) Moderately heated, they are partially volatilized, giving out violet vapours, of a disagreeable metallic odour. (*Am. Journ. of Pharm.*, Sept. 1862, p. 409.) This salt, in consequence of the facility with which it parts with oxygen, is one of the most powerful oxidizing agents known. It causes the combustion of certain inflammable bodies, imparts oxygen to almost all organic substances, and in chemistry is employed to bring various compounds to a higher degree of oxidation. It has been conjectured that a part of the oxygen contained in it is in the state of ozone, and to this has been ascribed its extraordinary oxidizing power. But the readiness with which it yields oxygen in the nascent state, is sufficient to account for the phenomena. It may be kept indefinitely if pure, and carefully secured from contact with organic substances, or other decomposing agents; but, in fact, in consequence of the almost universal presence of organic matter in the air, it is generally partially decomposed, and, when dissolved, leaves a slight residue of hydrated binoxide of manganese. In reference to the metals, mercury is quickly oxidized at the expense of the salt; a mixture of protoxide of mercury and oxide of manganese being deposited as a brown powder, and caustic potassa remaining in solution. Zinc remains unchanged indefinitely in a solution of the permanganate, silver is little affected, and copper not at all even at 212° F. (Giles, *Journ. de Pharm. et de Chim.*, Mai, 1868, p. 397.)

The U. S. Pharmacopœia gives as a test, that its solution is instantly decolorized by the solution of arsenite of potassium, with the production of a brown precipitate. The British requires that 5 grains, dissolved in water, should be completely decolorized by not less than 44 grains of granulated sulphate of iron, acidulated with two fluidrachms of officinal dilute sulphuric acid.

Medical Properties and Uses. Permanganate of potassium was first brought to the notice of the profession, in 1857, by Mr. Condy, as a powerful disinfectant; and, since that time, has been very extensively and satisfactorily employed, so that it now ranks among the most efficient agents, and by some is considered superior to all others. Not only has it an extraordinary power of destroying fetid odours from organic sources; but it is thought even to destroy poisonous emanations, and thus to prove useful in preventing the spread of infectious diseases. It is used also very successfully in the treatment of fetid and gangrenous ulcers, abscesses, and wounds of all kinds, of fetid discharges from the mucous membrane in ozæna, otorrhœa, and leu-

corrhœa, and of diphtheritic affections; and it has proved serviceable even in cancerous ulcers, as of the face, mouth, and uterus. In this country, it has been employed extensively, and with extraordinary success, in hospital gangrene. As a local stimulant it has also been used in chronic and indolent ulcers. Dr. T. L. Leavitt, of this city, has employed it with the most satisfactory results in carbuncle. (*Am. Journ. of Med. Sci.*, Jan. 1867, p. 131.) In all these cases, it is applied to the diseased surface in solution of various strengths, according to the effect desired. In concentrated solution, it is capable of acting as a caustic, and therefore requires caution. With the view to its caustic action, it may be sprinkled on the diseased surface by means of a pepper-box, or applied in strong solution. As a disinfectant lotion it may be of various strengths, from one to ten grains to the fluidounce of water. M. Demarquay, who was among the first to employ it, uses for injection in cancer of the womb, and for application to gangrenous and fetid abscesses, a solution varying in strength from 5 to 20 parts of the salt to 100 of water, trying the weaker solution first. (*Ann. de Thérap.*, A.D. 1864, p. 251.) M. O. Reveil recommends as a standard solution 10 parts dissolved in 90 parts of water. This may be used of its full strength in dressing cancerous, phagedenic, and atonic ulcers, and diphtheritic patches at the beginning. In consequence of its action on organic bodies, it should be applied by a pencil of amianthus, or sprinkled over a dressing of the same material upon the surface. For dressing simple wounds, or as an injection in ozæna, leucorrhœa, &c., half a fluidounce may be used to a pint of water; in gangrenous and diphtheritic wounds and scrofulous ulcers, and as a gargle in unhealthy ulcers of the mouth and fauces, a fluidounce to the pint; as a gargle in croup and diphtheritic angina with offensive breath, and as a wash for the hands after post-mortem examinations, two fluidounces to the pint. Of the same normal solution M. Reveil gives from ten to thirty drops internally through the day, equivalent to from one to three grains. (*Arch. Gén.*, Janv. 1864, p. 25.) Dr. Thomas Warden, of the British Navy, has met with extraordinary success from it in gonorrhœa; in a few cases in which he has had the opportunity, curing his patients in two or three days. He gave the solution in the proportion of from five to fifteen grains to the fluidounce, injected at least four times a day. It gave no pain or other inconvenience. (*Lancet*, Dec. 3, 1870, p. 779.) Dr. Thomas, of Chicago, has employed the permanganate in oxaluria with the most happy result. He dissolves eight grains of the salt in two fluidounces of water, and gives a teaspoonful of the solution three times a day. (*Med. & S. Reporter*, May 28, 1870, p. 445; from *Michigan Med. University Journ.*) In preparing any solution of permanganate for use, it is of the utmost importance to avoid all organic matters; even the presence of matters of this kind adhering to the surface of unwashed bottles being often sufficient to render the solution unfit for disinfectant purposes.

Internally the medicine has been recommended in diabetes, by Mr. Sampson, of London; but experience has not confirmed the hopes that were at one time entertained of its efficiency. More recently we have been told that it has been used with supposed benefit, in cases of purulent infection, in the dose of half a grain or a grain repeated several times a day; and it is one of the remedies which is likely to prove useful in diphtheria, scarlatina, and other affections in which it may be presumed that noxious organic matters have entered the circulation. Dr. James F. Duncan has recently used it with encouraging success in acute rheumatism. He gives it in the form of Condy's disinfectant fluid, containing 9·26 grains in a fluidounce, of which he mixes one part with seven of distilled water, and administers half a fluidounce every two hours. (*Braithwaite's Retrosp.*, liv. 206.) Dr. Isaac Kay, of Springfield, Ohio, has found excellent effects from the permanganate in petechial fever, or spinal meningitis, giving a tablespoonful of a solution of one grain in an ounce of water, in other words half a grain of the salt, repeated every hour. (*Boston Med. and Surg. Journ.*, lxx. 373.) In diphtheria the remedy has proved extraordinarily successful, both given internally and applied locally, in the hands of Dr. Louis Mackall, Jr., of Georgetown, D. C. To a child of 11 years he gave a teaspoonful of a solution containing one drachm to a pint and a half of water. The solution for external use contained a drachm in a pint. (*Am. J. of Med. Sci.*, Jan. 1865, p. 87.)

Off. Prep. Liquor Potassii Permanganatis, *U.S.;* Liquor Potassæ Permanganatis, *Br.* W.

POTASSII SULPHAS. *U.S.*

Sulphate of Potassium.

Off. Syn. POTASSÆ SULPHAS. *Sulphate of Potash.* KO,SO_3. *Br.*

Vitriolated tartar; Tartarum vitriolatum, Arcanum duplicatum, Sal de duobus, *Lat.;* Sulfate de potasse, Potasse vitriolée, *Fr.;* Schwefelsaures Kali, Vitriolisirtir Weinstein, *Germ.;* Solfato di potassa, *Ital.*

Several chemical processes give rise to sulphate of potassium as a secondary product. Thus, it is produced in the distillation of nitric acid from a mixture of nitre and sulphuric acid; in the decomposition of sulphate of magnesium by carbonate of potassium, in one of the processes for preparing carbonate of magnesium; in the manufacture of sulphuric acid; and in the decomposition of tartrate of potassium by sulphate of calcium. When nitric acid is obtained by calcining a mixture of nitre and sulphate of iron, the residue consists of sesquioxide of iron and sulphate of potassium, the latter of which, being alone soluble, is separated by means of water, and crystallized from its solution. The impure sulphate of potassium with sulphur, forming the residue of the combustion of sulphur and nitre in making sulphuric acid, is employed in the manufacture of alum.

The U. S. Pharmacopœia places sulphate of potassium in the list of the Materia Medica; the British, among the preparations, obtaining it from the salt which remains after the distillation of nitric acid. This salt is a supersulphate of potassium, and must be so treated as to be brought to the neutral state. In the British process it is brought to that state by saturation, in boiling solution, with slaked lime. The solution is then filtered to separate the sulphate of calcium, and carbonate of potassium is added at the boiling temperature to remove lime and sulphate of calcium. It is again filtered, then either neutralized or rendered slightly acid with diluted sulphuric acid; and, finally, having been evaporated to a pellicle, is set aside for twenty-four hours to crystallize.

The manufacturer of tartaric acid who avails himself of sulphate of calcium to decompose tartrate of potassium, forms sulphate of potassium as a collateral product. For the manner in which the latter salt may be economically crystallized for use in the arts, see *Am. Journ. of Pharm.* (xxiii. 343).

Properties. Sulphate of potassium is a white anhydrous salt, in the form of small, aggregated, transparent, very hard crystals, permanent in the air, having the shape usually of short six-sided prisms, terminated by six-sided pyramids, and possessing a nauseous, somewhat bitter taste. Insoluble in alcohol, it is slowly soluble in about nine and a half times its weight of cold, and in less than four times its weight of boiling water. (*Gay-Lussac.*) Its solution is precipitated yellow by bichloride of platinum, and white by chloride of barium. Added to a solution of sulphate of aluminium, it generates alum, recognised by the octohedral shape of its crystals. It is decomposed by tartaric acid, which forms bitartrate of potassium, and by the soluble salts of baryta, strontia, lime, silver, and lead, forming insoluble, or sparingly soluble sulphates. This salt is not liable to adulteration. It consists of one eq. of sulphuric acid, 40, and one of potassa $47{\cdot}2 = 87{\cdot}2$.

The *plate-sulphate of potassa*, so well described by Prof. Penny, of Glasgow, is, when pure, the double sulphate of potassium and sodium, having the formula $3(KO,SO_3) + NaO,SO_3$. It is so called from the circumstance of being crystallized in hard thick cakes, or slabs, consisting of successive crops of crystals. It is a technical product from kelp, and may be formed by allowing successive quantities of concentrated kelp-ley to run into coolers, there to crystallize in successive layers; the mother-liquor being drawn off by a siphon, after the deposit of each layer. (*Philos. Mag.*, Dec. 1855.)*

* POTASSÆ SULPHAS CUM SULPHURE. *Ed. Sulphate of Potassa with Sulphur. Sal Polychrestus Glaseri. Sal Polychrest.* This is an old preparation which was retained in the Edinburgh Pharmacopœia, but was omitted in the British, and consequently in the twelfth edition of the present work. Its antiquity, however, if nothing else, entitles it to some notice; and the account given of it by Dr. Bache, in previous editions of the Dispensatory, is introduced here as a note.

Medical Properties and Uses. Sulphate of potassium is a mild purgative, operating usually without heat, pain, or other symptom of irritation. In small doses of from a scruple to half a drachm, it operates as an aperient, and is useful in removing obstructions; in larger doses, of four or five drachms, it acts slowly as a purge. Combined with rhubarb, in the proportion of about a drachm of the salt to ten grains of the root, Dr. Fordyce recommended it as an excellent alterative cathartic in the visceral obstructions of children, characterized by a tumid abdomen, and defective digestion and nutrition; and we can bear testimony to its efficacy in such cases. The late Dr. A. T. Thomson found it, in combination with rhubarb or aloes, "more useful than any of the other saline purgatives in jaundice and dyspeptic affections." On the continent of Europe it is frequently given as an aperient after delivery, and for the purpose of drying up the milk. It enters into the composition of Dover's powder.

Notwithstanding the general sentiment of practitioners as to the safety of sulphate of potassium as a purgative, several cases are on record of supposed poisoning from its use. A case has been reported (1856), in which death was attributed to this salt, the amount taken having been estimated at an ounce and a half. M. Moritz attributed the poisonous effects of the salt, in a case under his notice, to the presence of a notable quantity of sulphate of zinc; but this explanation cannot be admitted as adequate. In other cases, the salt, though found to be pure, seemed to act as a poison. In these cases its effects may be attributed, sometimes to the largeness of the dose, and perhaps also to the insufficiency of water used to dissolve it; at other times, where the dose used was moderate, to the existence of a predisposition to gastric inflammation. For further information in relation to this subject, the reader is referred to a paper by the late Dr. T. Romeyn Beck, in the *Amer. Jour. of the Med. Sci.* (N. S., vii. 88).

Off. Prep. Pilula Colocynthidis Composita, *Br.;* Pulvis Ipecacuanhæ Compositus. B.

It was prepared by mixing thoroughly equal parts of nitrate of potassium and sulphur, then throwing the mixture in small successive portions into a red-hot crucible: and, when the deflagration had ceased, and the salt had cooled, reducing it to powder, and keeping it in well-closed bottles.

When the mixture, indicated in this formula, is thrown into a red-hot crucible, each successive portion melts, and the sulphur floats on the surface of the nitre with the appearance of a brown oil, burns vividly, and gives rise to a copious evolution of sulphurous acid gas. The product of the deflagration is a grayish-white friable mass, intermixed apparently with unconsumed sulphur.

The nature of this preparation has not been well determined. On the supposition that it is the sulphate of potassium, mixed with a portion of sulphur, as the Edinburgh name implies, its formation may be thus explained. By the combined influence of the sulphur and of the heat employed, the nitric acid of the nitre is totally decomposed, and is thus enabled to furnish sufficient oxygen to convert a portion of the sulphur into sulphuric acid, which, as soon as formed, combines with the base of the nitre, to form the sulphate of potassium. This is left mixed with a portion of sulphur which has escaped combustion; but the greater part of the latter undergoes ordinary combustion, and is dissipated as sulphurous acid fumes.

Supposing the saline matter to be a sulphate containing a little free sulphur, this combustible is evidently used in great excess; but whether this excess is necessary to obtain the exact preparation desired by the Edinburgh College, it is not easy to determine. The late Dr. Duncan ascertained that the product amounted only to four-tenths of the materials employed. It is, therefore, smaller than it ought to be, even supposing that the residue consisted of nothing but sulphate of potassium.

Dr. Duncan was of opinion that the preparation under consideration cannot be viewed as a sulphuretted sulphate, and for the following satisfactory reasons. In the first place, it is more soluble in water than sulphate of potassium, and forms a yellowish solution, the water leaving undissolved only a small residue of a black colour, which is not sulphur. In the second place, it exhales during solution a sulphurous smell, and its taste is sulphurous. These facts seem to show that a small portion of sulphite of potassium is present in the preparation, or at least some sulphurous acid in a state of loose combination. It does not yield sulphuretted hydrogen on the addition of an acid, and is not precipitated by the salts of lead. These characters are inconsistent with the opinion of Mr. John Mackay, of Edinburgh, who believes that this preparation contains sulphuret of potassium. (See his remarks on it, in the *Pharm. Journ. and Trans.* for Jan. 1842.)

Properties, &c. This salt has an acid and sulphurous taste, and an acid reaction with test paper. When pulverized, it yields a pale yellowish-white powder. It is soluble in eight times its weight of cold water. It is, however, not a uniform preparation; different specimens, apparently prepared with equal care, exhibiting some points of difference in properties. It was called by the earlier chemists *sal Polychrestus Glaseri*, or *sal Polychrest.* Its other properties coincide generally with those of sulphate of potassium, which may be considered as its basis.

Medical Properties and Uses. The medical effects of this preparation differ but little, if at all, from those of sulphate of potassium. Its action on the system is stated by Dr. Duncan to resemble that of the sulphurous mineral waters which contain a portion of neutral salt. The dose is from half a drachm to a drachm. B.

POTASSII SULPHIS. *U.S.*

Sulphite of Potassium.

"In white opaque fragments or powder, very soluble in water. It has a saline and sulphurous taste. Sulphuric acid added to its solution gives rise to the odour of burning sulphur, without impairing the transparency of the liquid. With bichloride of platinum it yields a yellow precipitate." *U.S.*

This salt was introduced into the Materia Medica list of the U. S. Pharmacopœia at its late revision; having recently been adopted generally as a medicine with several other sulphites, in consequence of the prevalence of the views which ascribe anti-parasitic or antizymotic powers to the sulphurous acid contained in them.

Preparation. Sulphite of potassium is prepared by causing sulphurous acid to pass through a solution of potassa strong almost to saturation. A solution of carbonate of potassium may be substituted for the caustic alkali. The sulphite crystallizes from the alkaline solution thus treated.

Properties. The sulphite of potassium crystallizes in leaves or needles. It decrepitates when heated. In the air it effloresces, absorbing oxygen, and being partially converted into the sulphate. It dissolves in an equal weight of cool water. From the hyposulphite of potassium, it is distinguished by letting fall no sulphur on the addition of sulphuric acid; and the smell of burning sulphur under the same influence, is a proof that it is a sulphite. The occurrence of a yellow precipitate, when it is added to a solution of chloride of platinum, shows that it is a salt of potassa.

Medical Properties and Uses. The effects on the system and uses in medicine are essentially the same as those of the other sulphites. They produce little impression on the system, and have never been shown to have poisonous effects in whatever dose administered. From four to six drachms in 24 hours have been given without unpleasant results. The sulphite of potassium after administration, is absorbed into the circulation, from which it escapes with the urine, in which, if examined in a few hours after the taking of the medicine, it is found in the state of the sulphite unchanged; but at a later period, at the end of 24 hours, the sulphate of potassium is found in the urine instead of the sulphite; proving that the salt undergoes in the body the same change as when exposed to the atmosphere out of it; that is, the sulphurous acid absorbs oxygen and is converted into the sulphuric, and the salt consequently into the sulphate. According to Dr. Polli, the sulphite given to dogs, if these are afterwards killed, is found in all the fluids and solids of the body. The most decided effects on the system appear to be a slight laxative operation, and an increased secretion of urine. The chief remedial power of this salt is based on its hostility, through its acid constituent, to the lower forms of organic life, especially the microscopic animalcules and fungi. Among its first applications was to the cure of the sarciculus ventriculi; but, though the sarciculus was destroyed, the disease of the stomach was little improved, showing that the fungus was not the cause of the gastric affection, but in some degree probably the effect, as affording conditions favourable to its development. The most important application of the medicine has been to the cure or prevention of the various diseases supposed to be owing to the action on the system of microscopic animalcula or fungi, finding their way into the system, and there producing fermentative processes supposed to constitute the essence of the disease. Intermittent and remittent fevers, typhoid fever, puerperal fever, malignant erysipelas, hospital gangrene, and all affections connected with putrefactive inflammation; in fact, all the diseases classed together as zymotic have been made the subject of their action; but the trials have been by no means so successful as to unite medical opinion in their favour; and this use of the sulphites must be considered as among the eccentricities of medicine; but with all the unfavourable reports, so many have been in their favour, as to justify the use of these remedies by those disposed to try them. The sulphite of potassium may be given in the dose of from fifteen grains to a drachm, and repeated so as to amount to from a fourth of an ounce to an ounce in 24 hours.

The local effects of the salt are probably less doubtful than the constitutional. In

all cases of cutaneous disease originating in or maintained by microscopic parasites, it may be applied in solution with hope of good effect. A solution containing one part of the salt in five or ten parts of water may be applied by compresses to the part affected. For this purpose, however, the sulphite of sodium is preferred by some on account of its more ready solubility. W.

PRINOS. *U.S. Secondary.*

Black Alder.

The bark of Prinos verticillatus. *U.S.*

PRINOS. *Sex. Syst.* Hexandria Monogynia.—*Nat. Ord.* Aquifoliaceæ.

Gen. Ch. Calyx small, six-cleft. *Corolla* monopetalous, subrotate, six-parted. *Berry* six-seeded; seeds nuciform. *Nuttall.*

Prinos verticillatus. Willd. *Sp. Plant.* ii. 225; Bigelow, *Am. Med. Bot.* iii. 141; Barton, *Med. Bot.* i. 203. The black alder is an indigenous shrub, with a stem six or eight feet high, furnished with alternate, spreading branches, and covered with a bluish-gray bark. The leaves, which stand alternately or irregularly on short petioles, are oval, pointed, tapering at the base, acutely serrate, of a dark-green colour, smooth above, but downy on the veins beneath. The flowers are small, white, nearly sessile, and grow three or four together at the axils of the leaves. They are often diœcious. The calyx is persistent; the segments of the corolla obtuse; the stamens usually six, and furnished with oblong anthers; the germ large, green, and roundish, with a short style, terminating in an obtuse stigma. The fruit when ripe consists of glossy, scarlet, roundish berries, about the size of a pea, containing six cells and six seeds. Several of these berries are clustered, so as to form little bunches at irregular intervals on the stem. In the latter part of autumn, after the leaves have fallen, they still remain attached to the stem, and render the shrub a striking object in the midst of the general nakedness of vegetation. Hence the plant is often called *winterberry.*

It grows in all parts of the United States, from Canada to Florida, frequenting low wet places, such as swamps, and the borders of ponds, ditches, and streams. Its flowers appear in June. The berries, which have a bitter, sweetish, somewhat acrid taste, are sometimes used medicinally for the same purposes with the bark, which is the officinal portion.

The dried bark is in slender pieces, more or less rolled, brittle, greenish-white internally, and covered with a smooth epidermis, easily separable, and of a whitish-ash colour, alternating or mingled with brown. It has no smell, but a bitter and slightly astringent taste. Boiling water extracts its virtues. The suggestion having been made by Prof. Maisch, that the bark might owe a certain yellowness which it exhibits to the existence in it of the alkaloid berberina, Mr. Thos. J. Lerch endeavoured to determine the point by a series of experiments, which seem to have proved the negative; not a trace of berberina having been detected. (*Am. Journ. of Pharm.*, June, 1873, p. 251.)

Medical Properties and Uses. Black alder is usually considered tonic and astringent; and is among the remedies proposed as substitutes for Peruvian bark, with which, however, it has very little analogy. It has been recommended in intermittent fever, diarrhœa, and other diseases connected with debility, especially gangrene and mortification. It is a popular remedy in gangrenous or flabby and ill-conditioned ulcers, and in chronic cutaneous eruptions, in which it is given internally, and applied locally in the form of a wash or poultice. It may be used in substance or decoction. The dose of the powder is from thirty grains to a drachm, to be repeated several times a day. The decoction, which is usually preferred both for internal and external use, may be prepared by boiling two ounces of the bark with three pints of water to a quart, and given in the dose of two or three fluidounces. A saturated tincture, as well of the berries as of the bark, is sometimes employed. W.

PRUNUM. *U.S., Br.*

Prunes.

The dried fruit of Prunus domestica. *U.S.* The dried drupe of the Plum, Prunus domestica. *Linn.* From Southern Europe. *Br.*

Pruneaux, *Fr.;* Pflaumen, *Germ.;* Pruni, *Ital.;* Ciruelas secas, *Span.*

PRUNUS. *Sex. Syst.* Icosandria Monogynia. — *Nat. Ord.* Amygdaleæ.

Gen. Ch. Calyx inferior, bell-shaped, deciduous, with five obtuse, concave segments. *Petals* five, roundish, concave, spreading, larger than the segments of the calyx, into the rim of which they are inserted. *Filaments* awl-shaped, nearly as long as the corolla, from the rim of the calyx within the petals. *Anthers* short, of two round lobes. *Ovary* superior, roundish. *Style* of the length of the stamens. *Stigma* obicular, peltate. *Drupe* roundish or elliptical. *Nut* hard, somewhat compressed, of one cell, and two more or less distinct sutures with an intermediate furrow. *Leaves* rolled up when young. (*Lindley.*)

Prunus domestica. Willd. *Sp. Plant.* ii. 995; Woodv. *Med. Bot.* p. 520, t. 187. The cultivated prune or plum tree is so well known as to render a minute description unnecessary. We merely give the specific character. "*Peduncles* subsolitary; *leaves* lanceolate-ovate, convolute; *branches* not spiny." The varieties of the tree produced by cultivation are very numerous. Nearly one hundred are to be found in the British gardens. Though at present growing wild in various parts of Europe, it is thought to have been brought originally from Asia Minor and Syria. It is the dried fruit only that is officinal.

The prunes brought to our market come chiefly from the South of France, the best from Bordeaux. They are derived from the variety of the tree named *Juliana* by Linnæus. The fresh fruit, called *Prune de Saint Julien* by the French, is of an oval shape, nearly an inch in length, and of a deep-violet colour. It is prepared by drying in the sun, after having been exposed to the heat of an oven. The finest prunes, used on the tables in France, are prepared from the larger kinds of plums, such as the *Saint Catharine*, and *Reine-Claude* or *green-gage*. An inferior sort is brought from Germany.

Prunes have a feeble odour, and a sweet mucilaginous taste, which is generally also somewhat acid. They contain uncrystallizable sugar, malic acid, and mucilaginous matter. In Germany a kind of brandy is obtained from them, which in some districts is largely consumed. Bonneberg, a German chemist, has extracted from prunes crystallizable sugar, equal to that of the cane.

Medical Properties and Uses. Prunes are laxative and nutritious, and, stewed with water, form an excellent diet in costiveness, especially during convalescence from febrile and inflammatory diseases. Imparting their laxative property to boiling water, they serve as a pleasant and useful addition to purgative decoctions. Their pulp is used in the preparation of laxative confections. Too largely taken, in a debilitated state of the digestive organs, they are apt to occasion flatulence, and griping pain in the stomach and bowels.

Off. Prep. Confectio Sennæ. W.

PRUNUS VIRGINIANA. *U.S.*

Wild-cherry Bark.

The bark of Cerasus serotina (*De Cand.*). *U.S.*

CERASUS. See LAURO-CERASUS.

This genus, which is now generally admitted, includes a large number of species formerly embraced in the genus Prunus of Linnæus.

Cerasus serotina. De Candolle, *Prodrom.* ii. 540; Torrey and Gray, *Flora of N. America*, i. 410. — *Cerasus Virginiana.* Michaux, *N. Am. Sylv.* ii. 205. According to Torrey and Gray, the name *Prunus Virginiana*, which has been wrongly applied

to this species, was given by Linnæus to the *choke-cherry*, a small tree or shrub, growing in the Northern States, and bearing a dark-red, globular, astringent fruit, about as large as that of the *wild-cherry*. This is described, in the Flora of N. America of these authors, under the name of *Cerasus Virginiana*. The officinal species, or wild-cherry tree, is, according to Michaux, one of the largest productions of the American forest. Individuals were seen by that botanist on the banks of the Ohio, from eighty to one hundred feet high, with trunks from twelve to fifteen feet in circumference, and undivided to the height of twenty-five or thirty feet. But, as usually met with in the Atlantic States, the tree is much smaller. In the open fields it is less elevated than in forests, but sends out more numerous branches, which expand into an elegant oval summit. The trunk is regularly shaped, and covered with a rough, blackish bark, which detaches itself semicircularly in thick narrow plates. The leaves are oval-oblong, or lanceolate-oblong, acuminate, unequally serrate, smooth on both sides, of a beautiful brilliant green, and supported alternately upon petioles, which are furnished with from two to four reddish glands. The flowers are small, white, and collected in long erect or spreading racemes. They appear in May, and are followed by globular drupes, about the size of a pea, and when ripe of a shining blackish-purple colour.

This tree grows throughout the Union, flourishing most in those parts where the soil is fertile and the climate temperate, and abounding in the Middle Atlantic States, and in those which border on the Ohio. In the neighbourhood of Philadelphia, it affects open situations, growing solitarily in the fields and along fences, and seldom aggregated in woods or groves. It is highly valued by the cabinet-makers for its wood, which is compact, fine-grained, susceptible of polish, and of a light-red tint, which deepens with age. The leaves have been found by Prof. Procter to yield volatile oil and hydrocyanic acid on distillation, and in such proportion that a water distilled from them might with propriety be substituted for the cherry-laurel water. (*Proceed. of Am. Pharm. Assoc.*, 1858, p. 325.) The fruit has a sweetish, astringent, bitter taste; and is much used in some parts of the country to impart flavour to spirituous liquors. The inner bark is the part employed in medicine, and is obtained indiscriminately from all parts of the tree, though that of the roots is thought to be most active. Mr. J. S. Perot has ascertained that it is stronger when collected in autumn than in the spring. Thus, from a portion gathered in April he obtained 0·0478 per cent. of hydrocyanic acid, and from another in October 0·1436 per cent., or about three times as much. The parcels tried were taken from the same tree, and the same part of the tree. (*Am. Journ. of Pharm.*, xxiv. 111.) The bark should be preferred recently dried, as it deteriorates by keeping.

Properties. Wild-cherry bark, as kept in the shops, is in pieces of various sizes, more or less curved laterally, usually destitute of epidermis, of a lively reddish-cinnamon colour, brittle and pulverizable, presenting a reddish-gray fracture, and affording a fawn-coloured powder. In the fresh state, or when treated with water, it emits an odour resembling that of peach leaves. Its taste is agreeably bitter and aromatic, with the peculiar flavour of the bitter almond. It imparts its sensible properties to water, either cold or hot, producing a clear reddish infusion closely resembling Madeira wine in appearance. Its peculiar flavour as well as medical virtues are injured by boiling, in consequence partly of the volatilization of the principles upon which they depend, partly upon a chemical change effected by the heat. From an analysis by Dr. Stephen Procter, it appears to contain starch, resin, tannin, gallic acid, fatty matter, lignin, red colouring matter, salts of lime and potassa, and iron. He obtained also a volatile oil, associated with hydrocyanic acid, by distilling the same portion of water successively from several different portions of the bark. This oil was of a light-straw colour, and very analogous in its properties to the volatile oil of bitter almonds. In the quantity of two drops it proved fatal to a cat in less than five minutes. (*Journ. of the Philad. Col. of Pharm.*, vi. 8.) Prof. William Procter proved that, as in the case of bitter almonds, the volatile oil and hydrocyanic acid do not exist ready formed in the bark, but are the result of the reaction of water with amygdalin, which he ascertained to be one of its constituents. In order, however, that this change may take place, the agency of another principle, probably

analogous to if not identical with *emulsin* or the *synaptase* of Robiquet, is also essential; and, as this principle becomes inoperative at the boiling temperature, we can understand how decoction may interfere with the virtues of the bark. (*Am. Journ. of Pharm.*, x. 197.) The conjecture was advanced, in former editions of this work, that wild-cherry bark might contain also *phloridzin*, a bitter principle proved to exist in the bark of the apple, pear, cherry, and plum trees; but Mr. Perot sought for this principle, without success, in specimens of the bark of different ages, and taken from different parts of the tree; so that the tonic property, which is undoubtedly possessed by the bark, must reside either in the portion of amygdalin which may remain undecomposed, in the pure volatile oil resulting from its reaction with water, or in some yet undiscovered principle. (*Ibid.*, xxiv. 111.) That the last of these inferences is the correct one, would seem to be proved by an experiment by Prof. Procter, who found the bitterness of an extract of the bark to remain after it had been wholly deprived of amygdalin. (See the author's *Treatise on Therapeutics, &c.*, i. 291.) The sedative properties of the bark depend upon the hydrocyanic acid which it yields. As the beautiful wine-colour of the infusion varies in different specimens of the bark, the shade being much lighter in some than others, the question has been advanced whether this diversity might be owing to the season of the collection, or to what other cause. Mr. Jos. Lemberger, wishing to answer this question, prepared infusions from the bark collected every month of the year, and on comparing them, found that they varied with the season in which they were gathered; the darkest infusions proceeding from the bark gathered in April, October, and November, the lightest from those of January and August, and the intermediate from the other months, September yielding the deeper of these. He also seems to have determined that the depth of colour was proportionate to the quantity of tannic acid separable from the infusions, and consequently that the cause of the greater or less intensity of the colour was the greater or less production of this principle. (*Am. Journ. of Pharm.*, July, 1872, p. 303.)

Medical Properties and Uses. This bark is among the most valuable of our indigeneous remedies. Uniting with a tonic power the property of calming irritation and diminishing nervous excitability, it is admirably adapted to the treatment of diseases in which debility of the stomach, or of the system, is united with general or local irritation. When largely taken it diminishes the action of the heart, an effect ascribable to the hydrocyanic acid. Dr. Eberle found copious draughts of the cold infusion, taken several times a day, and continued for nearly two weeks, to reduce his pulse from seventy-five to fifty strokes in the minute. The remedy is highly useful, and has been much employed in this country, in the hectic fever of scrofula and consumption. In the general debility which often succeeds inflammatory diseases, it is also advantageous; and it is well adapted to many cases of dyspepsia. It has been given successfully in intermittent fever, but is much inferior to cinchona.

It may be used in the form of powder, infusion, fluid extract, or syrup. The dose of the powder is from thirty grains to a drachm; of the infusion, which is properly directed in the Pharmacopœia to be prepared with cold water, two or three fluidounces; of the fluid extract, a fluidrachm; and of the syrup, half a fluidounce. These preparations are all officinal, and are described in the *second part* of the work, under their titles respectively.

Off. Prep. Extractum Pruni Virginianæ Fluidum, *U. S.;* Infusum Pruni Virginianæ, *U. S.;* Syrupus Pruni Virginianæ, *U. S.* W.

PYRETHRUM. *U. S. Secondary.*

Pellitory.

The root of Anacyclus Pyrethrum (*De Candolle*). *U. S.*

Off. Syn. PYRETHRI RADIX. *Pellitory Root.* The root of Anacyclus Pyrethrum. *De Cand.* Imported from the Levant. *Br.*

Pyrèthre, *Fr.;* Bertram Wurzel, *Germ.;* Pietrø, *Ital.;* Pelitre, *Span.*

ANACYCLUS. Differing from Anthemis by its winged and obcordate *achenia*. *Lindley.* See ANTHEMIS.

Anacyclus Pyrethrum. De Cand. *Prodrom.* vi. 15. — *Anthemis Pyrethrum.* Willd. *Sp. Plant.* iii. 2184; Woodv. *Med. Bot.* p. 50, t. 20. The root of this plant is perennial, and sends up numerous stems, usually trailing at the base, erect in their upper portion, eight or ten inches high, and terminated by one large flower. The leaves are doubly pinnate, with narrow nearly linear segments of a pale-green colour. The florets of the disk are yellow; the rays white on their upper surface, and reddish or purple beneath and at their edges.

The plant is a native of the Levant, Barbary, and the Mediterranean coast of Europe. The root is the part used under the name of pellitory, or *pellitory of Spain.* According to Hayne, the pellitory of the shops is derived from the *Anacyclus officinarum,* a plant cultivated in Thuringia for medical purposes. This remark, however, can apply only to Germany.

Properties. The dried root of *A. Pyrethrum* is about the size of the little finger, cylindrical, straight or but slightly curved, wrinkled longitudinally, of an ash-brown colour externally, whitish within, hard and brittle, and sometimes furnished with a few radicles. It is destitute of odour, though, when fresh, of a disagreeable smell. Its taste is peculiar, slight at first, but afterwards acidulous, saline, and acrid, attended with a burning and tingling sensation over the whole mouth and throat, which continues for some time, and excites a copious flow of saliva. Its analysis by Koene gives, in 100 parts, 0·59 of a brown, very acrid substance, of a resinous appearance, and insoluble in caustic potassa; 1·06 of a dark-brown, very acrid fixed oil, soluble in potassa; 0·35 of a yellow acrid oil, also soluble in potassa; traces of tannin; 9·40 parts of gum; inulin; 7·60 parts of sulphate and carbonate of potassium, chloride of potassium, phosphate and carbonate of calcium, alumina, silica, &c.; and 19·80 of lignin, besides loss. (See *Am. Journ. of Pharm.*, viii. 175.)

Medical Properties and Uses. Pellitory is a powerful irritant, used almost exclusively as a sialagogue in certain forms of headache, rheumatic and neuralgic affections of the face, of toothache, &c., or as a local stimulant, in palsy of the tongue or throat, and in relaxation of the uvula. For these purposes it may be chewed, or employed as a gargle in decoction or vinous tincture. The dose as a masticatory is from thirty grains to a drachm. An alcoholic extract is sometimes employed by dentists as a local application to carious teeth, with a view to its benumbing effect before plugging.

Off. Prep. Tinctura Pyrethri, *Br.* W.

QUASSIA. *U. S.*

Quassia.

The wood of the Simaruba excelsa. *U. S.*

Off. Syn. QUASSIÆ LIGNUM. *Quassia Wood.* The wood of Picræna excelsa, *Lindley.* From Jamaica. *Br.*

Bois de quassie, *Fr.;* Quassienholz, *Germ.;* Legno della quassia, *Ital.;* Leno de quassia, *Span.*

QUASSIA. *Sex. Syst.* Decandria Monogynia. — *Nat. Ord.* Simarubaceæ.

Gen. Ch. Calyx five-leaved. *Petals* five. *Nectary* five-leaved. *Drupes* five, distant, bivalve, one-seeded, inserted into a fleshy receptacle. *Willd.*

Of the species included by Linnæus in this genus, some, as *Quassia amara,* are hermaphrodite; others, as *Q. excelsa* and *Q. Simaruba,* are monœcious or polygamous. The latter have been associated by De Candolle in a distinct genus, named *Simaruba,* which has been again divided by Lindley into *Simaruba* with monœcious, and *Picræna* with polygamous flowers. To the last-mentioned genus the proper Quassia plant, Q. excelsa of Linnæus, belongs.

The medicine was formerly obtained from *Quassia amara;* but more than twenty years since, Lamarck stated that, in consequence of the scarcity of this tree, *Quassia excelsa* had been resorted to as a substitute, and the Pharmacopœias at present agree in acknowledging the latter as the officinal plant. The genuine quassia plant, however, of Surinam is the *Q. amara;* and we shall, therefore, give a brief description of both species.

Quassia excelsa. Willd. *Sp. Plant.* ii. 569. — *Simaruba excelsa.* De Cand. *Pro-*

drom. i. 733; Hayne, *Darstel. und Beschreib.* &c. ix. 16. — *Picræna excelsa.* Lindley, *Flor. Med.* 208. As its name imports, this is a lofty tree, attaining sometimes not less than one hundred feet in height, with a straight, smooth, tapering trunk, which is often three feet in diameter near its base, and covered with a smooth, gray bark. The leaves are pinnate, with a naked petiole, and oblong pointed leaflets standing upon short footstalks, in opposite pairs, with a single leaflet at the end. The flowers are small, of a yellowish-green colour, and disposed in panicles. They are polygamous and pentandrous. The fruit is a small black drupe. This species inhabits Jamaica and the Caribbean islands, where it is called *bitter ash.* The wood is the officinal portion.

Quassia amara. Willd. *Sp. Plant.* ii. 567; Woodv. *Med. Bot.* p. 574, t. 204. The bitter quassia is a small branching tree or shrub, with alternate leaves, consisting of two pairs of opposite pinnæ, with an odd one at the end. The leaflets are elliptical, pointed, sessile, smooth, of a deep-green colour on their upper surface, and paler on the under. The common footstalk is articulated, and edged on each side with a leafy membrane. The flowers, which are hermaphrodite and decandrous, are bright red, and terminate the branches in long racemes. The fruit is a two-celled capsule containing globular seeds. Quassia amara is a native of Surinam, and is said also to grow in some of the West India islands. Its root, bark, and wood were formerly officinal. They are excessively bitter, as in fact are all parts of the plant. It is uncertain whether any of the produce of this tree now reaches our markets.

Quassia comes in cylindrical billets of various sizes, from an inch to near a foot in diameter, and several feet in length. These are frequently invested with a light-coloured smoothish bark, brittle, and but slightly adherent, and possessing in at least an equal degree the virtues of the wood. Their shape and structure clearly evince that they are derived from the branches or trunk, and not, as some have supposed, from the root of the tree. In the shops they are usually kept split into small pieces, or rasped.*

Properties. The wood is at first whitish, but becomes yellow by exposure. It is inodorous, and has a purely bitter taste, surpassed by that of few other substances in intensity and permanence. It imparts its active properties, with its bitterness and yellow colour, to water and alcohol. Its virtues depend upon a peculiar bitter crystallizable principle, denominated *quassin*, which was first discovered by Winckler. It may be obtained pure by the following process of Wiggers. A filtered decoction of quassia is evaporated to three-quarters of the weight of the wood employed, slaked lime is added, and the mixture, having been allowed to stand for a day, with occasional agitation, is again filtered. A considerable quantity of pectin, besides other substances, is thus separated. The clear liquor is evaporated nearly to dryness, and the resulting mass exhausted by alcohol of the sp. gr. 0·835, which leaves behind gum, common salt, nitre, &c., in large amount, and dissolves quassin with some common salt and nitre, and a brown organic substance. In order to separate the quassin from these latter principles, which are soluble in water, the solution is evaporated to dryness, the resulting mass is dissolved in the least possible quantity of absolute alcohol, a large proportion of ether is added, and the liquor, previously separated by filtration from the brown mass which the ether has thrown down, is evaporated to dryness; and this process is repeated till the quassin remains behind quite colourless, and affords no evidence of the presence of the above-mentioned salts. Lastly, in order to obtain it in a crystalline form, to which it is not strongly disposed, pour the alcoholic solution mixed with ether upon a little water, and allow it to evaporate spontaneously. *Quassin* is white, opaque, unalterable in the air, inodorous, and of an intense bitterness, which in the solutions of this principle is almost insupportable.

* Mr. Edward Parrish has called attention to a bark, known in the market under the name of *quassia bark.* (*Am. Journ. of Pharm.*, xxix. 104.) A specimen in our possession is in pieces, very broad, slightly curved laterally, thin in proportion to their other dimensions, covered with a thin, greenish-brown, rough epidermis, yellowish-white and striated on their inner surface, of a feeble odour, and a quassia-like bitterness. The inner layers of the proper bark are very fibrous and tough, and, on the broken surface, of a light-yellow colour. It is uncertain whether the bark is from the Quassia excelsa; but there is little doubt that it is either from that or some analogous tree. (*Note to the eleventh edition.*)

The bitterness is pure, and resembles that of the wood. When heated, quassin melts like a resin. It is but slightly soluble in water, 100 parts of which at 54° dissolve only 0·45, and that slowly. By the addition of salts, especially of those with which it is associated in quassia, its solubility is strikingly increased. It is also but slightly soluble in ether, but is very soluble in alcohol, more so in that liquid hot than cold, and the more so the purer it is. Quassin is perfectly neuter, though both alkalies and acids increase its solubility in water. It is precipitated by tannic acid from its aqueous solution, which is not disturbed by iodine, chlorine, corrosive sublimate, the salts of iron, sugar of lead, or even subacetate of lead. Its ultimate constituents are carbon, hydrogen, and oxygen. Among the salts contained in quassia, Mr. George Whipple has detected a considerable proportion of sulphate of sodium. (*Pharm. Journ.*, xiii. 643.)

Medical Properties and Uses. Quassia has in the highest degree all the properties of the simple bitters. It is purely tonic, invigorating the digestive organs, with little excitement of the circulation, or increase of animal heat. It has not been very long known as a medicine. About the middle of the last century, a negro of Surinam, named Quassi, acquired considerable reputation in the treatment of the malignant fevers of that country, by a secret remedy, which he was induced to disclose to Mr. Rolander, a Swede, for a valuable consideration. Specimens were taken to Stockholm by this gentleman in the year 1756; and the medicine soon became popular in Europe. The name of the negro has been perpetuated in the generic title of the plant. But the quassia of Surinam is not now in use, having been superseded by the product of Quassia excelsa, from the West Indies. This medicine is useful whenever a simple tonic impression is desirable. It is particularly adapted to dyspepsia, and to that debilitated state of the digestive organs which sometimes succeeds acute disease. It may also be given with advantage in the remission of certain fevers in which tonics are demanded. No one at present would expect from it any peculiar controlling influence over malignant fevers. It is said to be largely employed in England by the brewers, to impart bitterness to their liquors.

It is most conveniently administered in infusion or extract. (See *Infusum Quassiæ* and *Extractum Quassiæ*.) The difficulty of reducing the wood to powder is an objection to its use in substance. It may, however, be employed in a dose varying from a scruple to a drachm, repeated three or four times a day. Some dyspeptic patients, who have become habituated to its bitterness, chew the wood occasionally with benefit.

Off. Prep. Extractum Quassiæ; Infusum Quassiæ; Tinctura Quassiæ. W.

QUERCUS ALBA. *U.S.*

White Oak.

The inner bark of Quercus alba. *U. S.*

QUERCUS TINCTORIA. *U.S.*

Black Oak.

The inner bark of Quercus tinctoria. *U. S.*

Off. Syn. QUERCUS CORTEX. OAK BARK. The dried bark of the small branches and young stems of Quercus pedunculata (*Willd.*); collected in spring, from trees growing in Britain. *Br.*

Ecorce de chêne, *Fr.*; Eichenrinde, *Germ.*; Corteccia della quercia, *Ital.*; Corteza de roble, *Span.*

QUERCUS. *Sex. Syst.* Monœcia Polyandria.—*Nat. Ord.* Amentaceæ, *Juss.*; Cupuliferæ, *Richard*; Corylaceæ, *Lindley*.

Gen. Ch. MALE. *Calyx* commonly five-cleft. *Corolla* none. *Stamens* five to ten. FEMALE. *Calyx* one-leafed, entire, rough. *Corolla* none. *Styles* two to five. *Nut* coriaceous, surrounded at the base by the persistent calyx. *Willd.*

This genus comprises not less than eighty species, of which between thirty and forty are within the limits of the United States. Many of these are applied to important

practical purposes. In the northern hemisphere, the oak is the most valuable, as it is the most widely diffused of all forest trees. Notwithstanding the great number of species, few, comparatively, have found a place in the officinal catalogues. *Q. robur*, or common European oak, was formerly recognised by the British Colleges; but at present only *Q. pedunculata*, or European white oak, is admitted in the Br. Pharmacopœia. As these do not grow in the United States, and their products are not imported, it is unnecessary to treat of them particularly in this work. According to Michaux, they grow in the same countries, frequently together, constituting the greater part of the forests of Europe, and spreading over almost the whole northern section of Asia, and the northern coast of Africa. *Q. pedunculata* is the common British oak, celebrated as well for its majestic growth, and the venerable age which it attains, as for the strength and durability of its timber. Our own Pharmacopœia recognises only *Q. alba* or white oak, and *Q. tinctoria* or black oak; but other species afford barks equally useful, and perhaps as much employed. Such are *Q. falcata* or Spanish oak, *Q. prinus* or white chestnut oak, and *Q. montana* or rock chestnut oak. The following remarks in relation to white-oak bark will apply also to that of the three last-mentioned species. The bark of *Q. tinctoria* is somewhat peculiar.

There is some difference between the character of the barks directed by the two Pharmacopœias; the U. S. ordering the inner bark, that is, bark old enough to require the separation of the superficial layers, because effete with age; the Br., the young and smooth bark, in which the epidermis is yet too thin and adhesive to require or readily admit of separation.

1. *Quercus alba.* Willd. *Sp. Plant.* iv. 448; Michaux, *N. Am. Sylv.* i. 17. Of all the American species, the *white oak* approaches nearest, in the character of its foliage, and the properties of its wood and bark, to *Q. pedunculata* of Great Britain. When allowed to expand freely in the open field, it divides at a short distance from the ground into numerous widely spreading branches, and attains under favourable circumstances a magnificent size. Its trunk and large branches are covered with a whitish bark, which serves to distinguish it from most of the other species. The leaves are regularly and obliquely divided into oblong, obtuse, entire lobes, which are often narrowed at their base. When full grown, they are smooth and light-green on their upper surface, and glaucous beneath. Some of the dried leaves remain on the tree during the whole winter. The acorns are large, ovate, contained in rough, shallow, grayish cups, and supported singly or in pairs upon peduncles nearly an inch in length.

The white oak abounds in the Middle States, and extends also through the whole Union, though comparatively rare in the northern, southern, and western sections. It is the most highly valued for its timber of all the American oaks, except the *live oak* (*Q. virens*), which is preferred in ship-building. The bark is sometimes used for tanning, but that of the *red* and *Spanish oaks* is preferred. All parts of the tree, with the exception of the epidermis, are more or less astringent, but this property predominates in the fruit and bark.

White-oak bark, deprived of its epidermis, is of a light-brown colour, of a coarse, fibrous texture, and not easily pulverized. It has a feeble odour, and a rough, astringent, and bitterish taste. Water and alcohol extract its active properties. The chief soluble ingredients are tannin, gallic acid, and extractive matter. It is upon the tannin that its medical virtues, as well as its use in the preparation of leather, chiefly depend. The proportion of this ingredient varies with the size and age of the tree, the part from which the bark is derived, and even the season when it is gathered. It is most abundant in the young bark; and the English oak is said to yield four times as much in spring as in winter. Sir H. Davy found the inner bark most abundant in tannin, the middle portion or cellular integument much less so, and the epidermis almost wholly destitute as well of this principle as of extractive.

Gerber discovered, in European oak bark, a peculiar bitter principle upon which he conferred the name of *quercin*. It is obtained by boiling the bark with water acidulated with one hundredth of sulphuric acid, adding first milk of lime until the sulphuric acid is removed, and then a solution of carbonate of potassium so long as a white precipitate is produced, filtering the liquor, evaporating to the consistence of

a thin extract, adding alcohol, and finally evaporating the spirituous solution down to a small volume, and allowing it to rest for some days. Yellow crystals form, which may be obtained colourless by repeated crystallizations. Quercin is a neuter principle, in small, white crystals, inodorous, very bitter, readily soluble in water, less so in alcohol containing water, and insoluble in absolute alcohol, ether, and oil of turpentine. (*Arch. der Pharm.*, xxxiv. 167.)

2. *Quercus tinctoria.* Willd. *Sp. Plant.* iv. 444; Michaux, *N. Am. Sylv.* i. 91. The *black oak* is one of our largest trees, frequently attaining the height of eighty or ninety feet. Its trunk is covered with a deeply furrowed bark, of a black or dark-brown colour. The leaves are ovate-oblong, pubescent, slightly sinuated with oblong, obtuse, mucronate lobes. The fructification is biennial. The acorn is globose, flattened at top, and placed in a saucer-shaped cup.

Black-oak bark has a more bitter taste than that of the other species, and may be distinguished also by staining the saliva yellow when it is chewed. Its cellular integument contains a colouring principle, capable of being extracted by boiling water, to which it imparts a brownish-yellow colour, which is deepened by alkalies and rendered brighter by acids. Under the name of *quercitron*, large quantities of this bark, deprived of its epidermis and reduced to coarse powder, are sent from the United States to Europe, where it is used for dyeing wool and silk of a yellow colour. The colouring principle is called *quercitrin*, or, from its property of combining with salifiable bases, *quercitric acid*. It was discovered by M. Chevreul; and its properties have been investigated by MM. Bolley and Rigaud. These chemists obtained it by forming a tincture of the bark with alcohol of the sp. gr. 0·849, freeing this from tannin and a brown substance by gelatin, distilling off the alcohol, and replacing it as it was evaporated by water. The quercitrin was deposited, and afterwards purified by repeated solution in alcohol, and separation by water as before. Thus procured, it is yellow, slightly bitter, inodorous, in microscopic crystals of the right-rhombic system, soluble in 425 parts of boiling water (Rigaud), almost insoluble in cold water, sparingly soluble in ether, and freely soluble in alcohol and alkaline solutions. Its formula is given as $C_{36}H_{19}O_{20}$. (*Chem. Gaz.*, no. 290, p. 428.)* According to Rigaud, quercitrin is a glucoside, being resolvable into glucose, and a neuter substance which he calls *quercetin*. (*Journ. de Pharm.*, Janv. 1860, p. 76.) Besides this principle, the bark contains much tannin; but it is less used in tanning than the other barks, in consequence of the colour which it imparts to the leather.

Medical Properties and Uses. Oak bark is astringent and somewhat tonic. It has been given with advantage in intermittent fever, obstinate chronic diarrhœa, and certain forms of passive hemorrhage; but it is not much employed as an internal remedy. Externally applied it is often productive of benefit. The decoction may be advantageously used as a bath, particularly for children, when a combined tonic and astringent effect is desirable, and the stomach is not disposed to receive medicines kindly. It has been employed in this way in marasmus, scrofula, intermittent fevers, chronic diarrhœa, and cholera infantum. As an injection in leucorrhœa, a wash in prolapsus ani and hemorrhoidal affections, and as a gargle in slight inflammation of the fauces, attended with prolapsed uvula, the decoction is often useful. It has also been recommended as an injection into dropsical cysts. Reduced to powder and made into a poultice, the bark was recommended by the late Prof. Barton as an excellent application in external gangrene and mortification; and the infusion obtained from tanners' vats has been used beneficially as a wash for flabby, ill-conditioned ulcers. The bark may be given in the form of powder, extract, or decoction. The dose of the powder is from thirty grains to a drachm, of the extract about half as much, of the decoction two fluidounces. (See *Decoctum Quercûs.*)

Black-oak bark is considered inferior to the white-oak bark as an internal remedy, in consequence of being more disposed to irritate the bowels.

* Quercitrin has been found also in various other plants; as in the leaves of Ruta graveolens, and the flower-buds of Capparis spinosa, Sophora Japonica, and Æsculus Hippocastanum or horse-chestnut. (*Chem. Gaz.*, May 2, 1859, p. 161.) As this principle is capable of assuming various colours under various chemical influences, the idea has been advanced that it might be the colouring principle of flowers. (*Am. Journ. of Pharm.*, May, 1860, p. 222.)

Acorns, besides the bitter and astringent principles of the bark, contain a peculiar saccharine matter (*quercite*), which is insusceptible of the vinous fermentation. (*Journ. de Pharm.*, 3e sér., xx. 335.) They are sometimes used as a tonic or astringent; and a decoction made from roasted acorns has been long employed in Germany as a remedy in scrofula. Before roasting they should be deprived of their shells; and the cotyledons, according to Dausse, should lose, during the process, 140 parts of their weight out of 500. (*Pharm. Cent. Blatt*, Oct. 9, 1850, p. 687.) From half an ounce to an ounce may be prepared as coffee, and the whole taken at breakfast with cream and sugar. (*Richter.*)

Off. Prep. Decoctum Quercûs, *Br.;* Decoctum Quercûs Albæ, *U. S.* W.

RANUNCULUS. *U. S. Secondary.*

Crowfoot.

The corm and herb of Ranunculus bulbosus. *U. S.*

Ranunculus. *Sex. Syst.* Polyandria Polygynia.—*Nat. Ord.* Ranunculaceæ.

Gen. Ch. Calyx five-leaved. *Petals* five, having the inner side of each claw furnished with a melliferous pore. *Seeds* naked, numerous. *Nuttall.*

Most of the plants belonging to this genus have the same acrid properties. Several of them grow together in our fields and pastures, and, from their close resemblance, are confounded under the common name of *butter-cup*, applied to them from the colour and shape of their flowers. Those which are most abundant are believed to have been introduced from Europe. Such are *R. bulbosus*, *R. acris*, and *R. repens*, which, with *R. sceleratus*, may be indiscriminately used. In Europe, *R. sceleratus* appears to have attracted most attention; in this country, *R. bulbosus*. The latter is the only one designated by our Pharmacopœia. *R. acris* and *R. Flammula* were formerly directed by the Dublin College, but have been discarded in the Br. Pharmacopœia.

Ranunculus bulbosus. Willd. *Sp. Plant.* ii. 1324; Bigelow, *Am. Med. Bot.* iii. 60. This species of crowfoot is perennial, with a solid, fleshy root (corm or cormus), and several annual, erect, round, and branching stems, from nine to eighteen inches high. The radical leaves, which stand on long footstalks, are ternate or quinate, with lobed and dentate leaflets. The leaves of the stem are sessile and ternate, the upper more simple. Each stem supports several solitary, bright-yellow, glossy flowers, upon furrowed, angular peduncles. The leaves of the calyx are reflexed, or bent downwards against the flowerstalk. The petals are obcordate, and arranged so as to resemble a small cup. At the inside of the claw of each petal is a small cavity, covered with a minute wedge-shaped emarginate scale. The fruit consists of numerous naked seeds, in a spherical head. The stem, leaves, peduncles, and calyx are hairy.

In May and June our pastures are everywhere adorned with the rich yellow flowers of this species of Ranunculus. Somewhat later *R. acris* and *R. repens* begin to bloom, and a succession of similar flowers is maintained till September. The two latter species prefer a moister ground, and are found most abundantly in meadows. *R. sceleratus* frequents ponds and ditches. In all these species, the whole plant is pervaded by a volatile acrid principle, which is dissipated by drying or by heat, and may be separated by distillation. Dr. Bigelow found that water distilled from the fresh plant had an acrid taste, and produced when swallowed a burning sensation in the stomach; and that it retained these properties for a long time, if kept in closely-stopped bottles. Dr. Clarus discovered, in R. sceleratus, besides the acrid volatile oil, a nearly inert resin, and a narcotic principle called *anemonin*. The volatile oil is soluble in ether, and is decomposed, on standing, into a white amorphous substance having acid properties (*anemonic acid*), and into anemonin. Other species of Ranunculus probably have the same constituents. (*B. and F. Med.-chir. Rev.*, Jan. 1859, p. 181.) The plant itself, when chewed, excites violent irritation in the mouth and throat; inflaming and even excoriating the tongue and inside of the cheeks and lips, if not quickly discharged. Both the root and herb of *R. bulbosus* are officinal.

Medical Properties and Uses. Crowfoot, when swallowed in the fresh state, produces heat and pain in the stomach, and, if the quantity be considerable, may excite

fatal inflammation. Dr. Clarus states that it has also narcotic properties, diminishing the frequency of the pulse and respiration, and producing palsy of the extremities. These properties he ascribes to the anemonin. It is, however, never used internally; though the juice and distilled water of some species of Ranunculus are said to act as a prompt and powerful emetic. The property for which it has attracted the attention of physicians is that of inflaming and vesicating the skin; and, before the introduction of the Spanish fly into use, it was much employed for this purpose. But the uncertainty and occasional violence of its action have nearly banished it from regular practice. While on some individuals it appears to produce scarcely any effect, on others it acts very speedily, exciting extensive and troublesome inflammation, which sometimes terminates in deep, obstinate ulcers. It probably varies in strength with the season; and, in the dried state, or boiled with water, is wholly inert. The decoction, moreover, is inert in consequence of the escape of the acrid principle. Nevertheless, the plant has been very properly retained in the Pharmacopœia, in the catalogue of medicines of secondary importance; as occasions may happen, when the practitioner in the country may find advantage in having recourse to its powerful rubefacient and epispastic operation. W.

RESINA. *U.S., Br.*

Resin.

The residue after the distillation of the volatile oil from the turpentine of Pinus palustris and of other species of Pinus. *U.S.* The residue of the distillation of the turpentines from various species of Pinus (*Linn.*) and Abies (*Lam.*). *Br.*

Résine blanche, Résine jaune, *Fr.;* Fichtenharz, *Germ.;* Ragea di pino, *Ital.;* Resina de pino, *Span.*

After the distillation of the volatile oil from the turpentines (see *Terebinthina*), a resinous matter remains, which on the continent of Europe is called *colophony*, but with us is commonly known by the name of *rosin*. It is the RESINA of the U. S. and Br. Pharmacopœias. It is sometimes called *resina flava* or *yellow resin*. When this, in a state of fusion, is strongly agitated with water, it acquires a distinct appearance, and is denominated *resina alba* or *white resin*. Before describing this officinal, it may be proper to enumerate the characteristic properties of the proximate principles denominated resins.

Resins are solid, brittle, of a smooth and shining fracture, and generally of a yellowish colour and semitransparent. When perfectly pure, they are probably inodorous and often insipid; but, as usually found, they have a slight odour, and a somewhat acrid or bitterish taste. Their sp. gr. varies from 0·92 to 1·2. They are fusible by a moderate heat, decomposed at a higher temperature, and in the open air take fire, burning with a yellow flame and much smoke. Insoluble in water, they are dissolved by ether and the volatile oils, and generally by alcohol; and their alcoholic and ethereal solutions afford precipitates upon the addition of water. With pure potassa and soda they unite to form soaps, which are soluble in water; and the same result takes place when they are heated with solutions of the alkaline carbonates. Concentrated sulphuric acid dissolves them with mutual decomposition; and nitric acid converts them into artificial tannin. They readily unite by fusion with wax and the fixed oils.*

Common or *yellow resin*, in its purest state, is beautifully clear and pellucid, but much less so as usually found in the shops. Its odour and taste are generally in a slight degree terebinthinate; its colour yellowish-brown with a tinge of olive, and more or less dark according to its purity, and the degree of heat to which it has been exposed in its preparation. Sometimes it is almost black. It is rather heavier than water. At 276° F. it melts, is completely liquid at 306°, begins to emit bubbles of

* M. Losch recommends the following process for rendering the resins as white as possible: Boil together 5 parts of the resin, 1 of carbonate of potassium or of sodium, and 20 of water, until a perfectly homogeneous mass is obtained; allow this to cool, and pass into it sulphurous acid, which saturates the alkali, and precipitates the resin in white flakes. Finally, wash the precipitate well with water, and dry it. (*Journ. de Pharm.*, Juin, 1856, p. 465.)—*Note to the eleventh edition.*

gas at 316°, and is entirely decomposed at a red heat. Its ultimate constituents are carbon, hydrogen, and oxygen, in variable proportions. It appears, from the researches of Unverdorben, to contain three distinct resinous bodies, two of which, denominated *pinic* and *sylvic acids*, pre-existed in the turpentine, and the third, called *colophonic acid*, is formed by the agency of heat in the distillation. The *pinic acid* is dissolved by cold spirit of the sp. gr. 0·865, and is thus separated from the sylvic acid. It is obtained pure by adding to the solution a spiritous solution of acetate of copper, dissolving the precipitated pinate of copper in strong boiling alcohol, decomposing this salt with a little muriatic acid, and adding water, which throws down the pinic acid as a resinous powder. The *sylvic acid* is obtained by treating the residue of the common resin with boiling spirit of 0·865, which dissolves it, and lets it fall upon cooling. Both of these resinous acids are colourless. Pinic acid is soluble in weak cold alcohol; sylvic acid is insoluble in the same menstruum when cold, but is dissolved by it when boiling hot, and by strong alcohol at all temperatures. The salts which they form with the alkalies are soluble, those with the earths and metallic oxides, insoluble in water. *Colophonic acid* differs from the others in having stronger acid properties, and in being less soluble in alcohol. It is of a brown colour; and common resin is more or less coloured in proportion to the quantity of this acid which it contains. (*Kane's Chemistry.*) The experiments of Unverdorben were made with European colophony. It is somewhat uncertain whether exactly the same results would be afforded by the common resin of this country, which is obtained from a different species of pine. By the destructive distillation of resin an oleaginous product is obtained, called *resin oil*, which in various degrees of purity is used in currying leather, lubricating machinery, preparing printers' ink, &c.

White resin differs from the preceding only in being opaque and of a whitish colour. These properties it owes to the water with which it is incorporated, and which gradually escapes upon exposure, leaving it more or less transparent.

Medical Uses. Resin is important as an ingredient of ointments and plasters, but is never used internally. According to Professor Olmsted, it has the property of preventing the oxidation of fatty substances, and thus contributes to the preservation of ointments. (*Am. Journ. of Pharm.*, xxii. 325.)

Off. Prep. Ceratum Cantharidis, *U. S.;* Ceratum Extracti Cantharidis, *U. S.;* Ceratum Resinæ, *U. S.;* Ceratum Resinæ Compositum, *U. S.;* Charta Epispastica, *Br.;* Emplastrum Calefaciens, *Br.;* Emplast. Cantharidis, *Br.;* Emplast. Hydrargyri, *U. S.;* Emplast. Picis, *Br.;* Emplast. Resinæ; Emplast. Saponis, *Br.;* Unguentum Resinæ, *Br.;* Unguent. Terebinthinæ, *Br.* W.

RHAMNI SUCCUS. *Br.*

Buckthorn Juice.

The recently expressed juice of the ripe berries of common Buckthorn, Rhamnus catharticus (*Linn.*). *Br.*

The juice of Rhamnus catharticus, recognised by the London College, was rejected by the framers of the first British Pharmacopœia, but has been restored to its officinal rank in the last edition; and, therefore, claims consideration again in this part of the U. S. Dispensatory, from which it was transferred in the twelfth edition to the *third part*, as not at that time belonging to either of the officinal lists. The berries were directed by the Edinburgh College.

Rhamnus. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Rhamnaceæ.

Gen. Ch. "*Calyx* tubular. *Corolla* scales defending the stamens, inserted into the calyx. *Berry.*" (*Willd.*)

Rhamnus catharticus. Willd. *Sp. Plant.* i. 1092; Woodv. *Med. Bot.* p. 594, t. 210. The purging buckthorn is a shrub seven or eight feet high, with branches terminating in a sharp spine. The leaves are in fascicles, on short footstalks, ovate, serrate, veined. The flowers are usually diœcious, in clusters, small, greenish, peduncled, with a four-cleft calyx, and four very small scale-like petals, placed in the male flower behind the stamens, which equal them in number. The fruit is a four-

seeded berry. The shrub is a native of Europe, and has been found growing wild in this country. It was first discovered in the Highlands of New York by Dr. Barratt. (*Eaton's Manual.*) It flowers in May and June, and ripens its fruit in the latter part of September. The berries and their juice are used. When ripe they are of the size of a pea, round, somewhat flattened at top, black, smooth, shining, with four seeds in a green, juicy parenchyma. Their odour is unpleasant, their taste bitterish, acrid, and nauseous. The expressed juice has the colour, odour, and taste of the parenchyma. It is reddened by the acids, and from deep-green is rendered light-green by the alkalies. Upon standing it soon begins to ferment, and becomes red in consequence of the formation of acetic acid. Evaporated to dryness, with the addition of lime or an alkali, it forms the colour called by painters *sap-green.* The dried fruit of another species, *R. infectorius*, yields a rich yellow colour, for which it is employed in the arts under the name of *French berries.*

Vogel obtained from the juice of the berries a peculiar colouring matter, acetic acid, mucilage, sugar, and a nitrogenous substance. Hubert found green colouring matter, acetic and malic acids, brown gummy matter, and a bitter substance which he considered as the purgative principle. M. Fleury obtained a peculiar crystallizable principle, which is contained both in the expressed juice and the residue remaining after expression, and for which he proposed the name of *rhamnin;* but he did not ascertain whether it possessed cathartic properties. (See *Journ. de Pharm.*, xxvii. 666.) Winckler obtained from the ripe fruit a principle which he called *cathartin*, and believes that the rhamnin of Fleury, which was obtained from the unripe berries, is converted into that principle and grape sugar as the fruit matures. (*Chem. Gaz.*, viii. 232.) The *cathartin* of Winckler, which must not be confounded with the substance of the same name at one time supposed to be the purgative principle of senna, may be procured by evaporating the expressed juice of the berries to the consistence of syrup, treating this repeatedly with boiling absolute alcohol till it ceases to yield bitterness to the menstruum, mixing the tinctures, allowing the liquor to become cold, filtering, adding a large excess of ether, allowing the mixed liquids to stand, then filtering, evaporating in a water-bath, and repeating the process with the residue. The cathartin thus obtained is a pale-yellow powder, very bitter, soluble in water and alcohol but not in ether, and actively cathartic in the dose of from one to three grains. (See *N. Y. Journ. of Pharm.*, April, 1853, and *Am. Journ. of Pharm.*, xxv. 526.)

W. Stein obtained from the berries, in an olive-green state, after having removed the fat by petroleum ether (benzine of American commerce), by exhausting a portion of the berries with water and alcohol, and precipitating by acetate of lead, &c., and afterwards exhausting another portion by 80 per cent. alcohol, water, and ether, several distinct principles, 1. a colouring principle *rhamnin*, soluble in water; 2. another colouring principle, *rhamnotin*, insoluble in water; 3. a substance precipitated by gelatin, *rhamnotannin;* 4. a nitrogenous compound, *rhamnin ferment;* and 5. a gum, *rhamnin gum.* Deficient space forbids us to give in detail, the mode of preparing, and the distinctive properties of these principles, for which we must be content with referring to the *Am. Journ. of Pharm.* (July, 1869, p. 331; from *Journ. für prakt. Chem.*, cv. 97).

Medical Properties and Uses. Both the berries and the expressed juice are actively purgative; but, as they are apt to occasion nausea and severe griping, with much thirst and dryness of the mouth and throat, they are now little employed. They formerly enjoyed considerable reputation as a hydragogue cathartic in dropsy; and were given also in rheumatism and gout. The only shape in which they are now used is that of syrup, which is sometimes added to hydragogue or diuretic mixtures. A syrup is directed in the Br. Pharmacopœia. The dose of the recent berries is about a scruple, of the dried a drachm, of the expressed juice a fluidounce, and of the syrup from four to eight fluidrachms. Under the name of *cortex frangulæ*, the bark of *Rhamnus Frangula* is used in Germany as a cathartic. Buchner found in this bark a peculiar yellow volatile colouring principle which he called *rhamnoxanthin*, and which may be obtained by subjecting the alcoholic and ethereal extract to distillation. (*Journ. de Pharm.*, 3e sér., xxiv. 293.) The bark is spoken of very favourably as a gentle aperient, given in the form of decoction, made by boiling half

an ounce in a pint of water, and given in the dose of one or two fluidounces, night and morning. (*Am. J. of Pharm.*, Oct. 1871, p. 456.)

Off. Prep. Syrupus Rhamni, *Br.* W.

RHEUM. *U.S.*

Rhubarb.

The root of Rheum palmatum, and of other species of Rheum, from China, Chinese Tartary, and Thibet. *U.S.*

Off. Syn. RHEI RADIX. *Rhubarb Root.* The dried root, deprived of the bark, from one or more undetermined species of Rheum (*Linn.*), from China, Chinese Tartary, and Thibet. Imported from Shanghai and Canton, and brought overland by way of Moscow. *Br.*

Rhabarbarum; Rhubarbe, *Fr.;* Rhabarber, *Germ.;* Rabarbaro, *Ital.;* Ruibarbo, *Span.;* Hainoung, *Chinese;* Schara-modo, *Thibet.*

RHEUM. *Sex. Syst.* Enneandria Trigynia.—*Nat. Ord.* Polygonaceæ.

Gen. Ch. Calyx petaloid, six-parted, withering. *Stamens* about nine, inserted into the base of the calyx. *Styles* three, reflexed. *Stigmas* peltate, entire. *Achenium* three-cornered, winged, with the withered calyx at the base. *Embryo* in the centre of the albumen. (*Lindley.*)

Notwithstanding the length of time that rhubarb has been in use, it has not yet been determined from what precise plant the Asiatic drug is derived. The remoteness of the region where it is collected, and the jealous care with which the monopoly of the trade is guarded, have prevented any accurate information on the subject. All that we certainly know is that it is the root of one or more species of Rheum. The U. S. Pharmacopœia refers it to *R. palmatum*, with other species not designated; the British recognises no particular species.

The terms *rha* and *rheon*, from the former of which were derived the names *rhabarbarum* and *rhubarb*, and from the latter the botanical title *Rheum*, were applied by the ancients to a root which came from beyond the Bosphorus, and which is supposed, though upon somewhat uncertain grounds, to have been the product of the *Rheum Rhaponticum*, growing on the banks of the Caspian Sea and the Wolga. This species was also at one time believed to be the source of the medicine now in use; but the true rhubarb has long been known to be wholly distinct from the Rhapontic, and derived from a different source. It was not till the year 1732 that any probable information was obtained as to its real origin. At that time plants were received from Russia by Jussieu in France, and Rand in England, which were said to be of the species affording the genuine rhubarb, and were named by Linnæus, under this impression, *Rheum Rhabarbarum*, a title which has since given way to *Rheum undulatum*. Subsequently, Kauw Boerhaave obtained from a merchant, who dealt in the rhubarb of Tartary, some seeds which he said were those of the plant producing the root sold by him. These, having been planted, yielded two species of Rheum, *R. undulatum*, and another which Linnæus named *R. palmatum*. Seeds transmitted by Dr. Mounsey from St. Petersburg to Dr. Hope, and planted in the botanic garden at Edinburgh, produced the latter species; and the same was also raised at Upsal from a root received by Linnæus from De Gorter, and was described A.D. 1767 by the younger Linnæus, two years after the appearance of Dr. Hope's paper in the Philosophical Transactions. Thus far the evidence appears equally in favour of *R. palmatum* and *R. undulatum*. The claims of another species were afterwards presented. Pallas, upon exhibiting the leaves of *R. palmatum* to some Bucharian merchants, was told that the leaves of the rhubarb plant were entirely different in shape; and the description he received of them corresponded more closely with those of *R. compactum*, than of any other known species. Seeds of this plant were, moreover, sent to Miller from St. Petersburg, as those of the true Tartarian rhubarb. A few years since the attention of naturalists was called to a fourth species, for which the same honour has been claimed. Dr. Wallich, superintendent of the botanical garden at Calcutta, received seeds that were said to be

those of the plant which yielded the Chinese rhubarb, growing on the Himalaya mountains and the highlands of Tartary. These produced a species not previously described, which Dr. Wallich named *R. Emodi*, from the native title of the plant. It is the *R. australe* of Mr. Don and of Colebrooke, and has been ascertained to afford a root which, though purgative, is very unlike the officinal rhubarb. Other species have been found to grow in the Himalaya mountains, from which a kind of rhubarb used by the natives is said to be procured; but none of it reaches the markets of this country or Europe. From what has been said, it is obvious that no species yet mentioned can be considered as the undoubted source of commercial rhubarb; the plant having, in no instance, been seen and examined by naturalists in its native place. Sievers, an apothecary sent to Siberia, in the reign of Catharine II., with the view of improving the cultivation of the native rhubarb, asserts, from information given him by the Bucharians, that all the seeds procured under the name of true rhubarb are false, and pronounces "all the descriptions in the Materia Medicas to be incorrect." This assertion, however, has no relation to *R. australe* which has been subsequently described; but it is said that the roots of that plant, dried by the medical officers of the British army, differ from true rhubarb in appearance and power.

All the plants of this genus are perennial and herbaceous, with large branching roots, which send forth vigorous stems from four to eight feet or more in height, surrounded at their base with numerous very large petiolate leaves, and terminating in lengthened branching panicles, composed of small and very numerous flowers, resembling those of the Rumex or dock. There is some difficulty in arranging the species, in consequence of the tendency of the cultivated plants to form hybrids; and it is frequently impossible to ascertain to which of the wild types the several garden varieties are to be referred. The following descriptions are from the *Flora Medica* of Dr. Lindley.

Rheum palmatum. Willd. *Sp. Plant.* ii. 489; Lindley, *Flor. Med.* p. 358; Carson, *Illust. of Med. Bot.* ii. 22, pl. 69. "Leaves roundish-cordate, half palmate; the lobes pinnatifid, acuminate, deep dull-green, not wavy, but uneven and very much wrinkled on the upper side, hardly scabrous at the edge, minutely downy on the under side; sinus completely closed; the lobes of the leaf standing forwards beyond it. Petiole pale-green, marked with short purple lines, terete, obscurely channeled quite at the upper end. Flowering stems taller than those of any other species." This species is said to inhabit China in the vicinity of the great wall. It has been cultivated in England and France for its root, which is admitted to approach more nearly in odour, taste, and the disposition of its colours, than that of any other known species, to the Asiatic rhubarb.

R. undulatum. Willd. *Sp. Plant.* ii. 489; Lindley, *Flor. Med.* p. 357; Woodv. *Med. Bot.*, 3d ed., v. 81. "Leaves oval, obtuse, extremely wavy, deep-green, with veins purple at the base, often shorter than the petiole, distinctly and copiously downy on each side, looking as if frosted when young, scabrous at the edge; sinus open, wedge-shaped, with the lower lobes of the leaves turned upwards. Petiole downy, blood-red, semi-cylindrical, with elevated edges to the upper side, which is narrower at the upper than the lower end." This is a native of Siberia, and probably Tartary and China. It was cultivated by the Russian government as the true rhubarb plant; but the culture has been abandoned. It contributes to the rhubarb produced in France.

R. compactum. Willd. *Sp. Plant.* ii. 489; Lindley, *Flor. Med.* p. 358; Carson, *Illust. of Med. Bot.* ii. 24, pl. 71. "Leaves heart-shaped, obtuse, very wavy, deep-green, of a thick texture, scabrous at the margin, quite smooth on both sides, glossy and even on the upper side; sinus nearly closed by the parenchyma. Petiole green, hardly tinged with red except at the base, semi-cylindrical, a little compressed at the sides, with the upper side broad, flat, bordered by elevated edges, and of equal breadth at each end." This plant is said to be a native of Tartary and China. It is one of the garden rhubarbs, and has been cultivated in France for its root.

R. australe. Don, *Prod. Flor. Nepal.* p. 75. — *R. Emodi.* Wallich; Lindley, *Flor. Med.* p. 354; Carson, *Illust. of Med. Bot.* ii. 24, pl. 70. "Leaves cordate, acute, dull-green, but little wavy, flattish, very much wrinkled, distinctly rough, with coarse

short hairs on each side; sinus of the base distinctly open, not wedge-shaped but diverging at an obtuse angle, with the lobes nearly turned upwards. Petioles very rough, rounded-angular, furrowed; with the upper side depressed, bordered by an elevated edge, and very much narrower at the upper than the lower end." The root of this species was at one time conjectured to be the source of officinal Asiatic rhubarb, but has been found to have scarcely any resemblance to it. The plant has been cultivated both in Europe and this country, and its petioles answer well for tarts, &c.

R. Rhaponticum. Willd. *Sp. Plant.* ii. 488; Lindley, *Flor. Med.* p. 357; Loudon's *Encyc. of Plants*, p. 335. "Leaves roundish-ovate, cordate, obtuse, pale-green, but little wavy, very concave, even, very slightly downy on the under side, especially near the edge, and on the edge itself; scabrous at the margin; sinus quite open, large, and cuneate. Petiole depressed, channeled on the upper side, with the edges regularly rounded off, pale-green, striated, scarcely scabrous. Panicles very compact and short, always rounded at the ends, and never lax as in the other garden species. Flowering stem about three feet high." The Rhapontic rhubarb grows upon the banks of the Caspian Sea, in the deserts between the Wolga and the Oural, and in Siberia. It is said also to grow upon the borders of the Euxine. It is cultivated as a garden plant in Europe and this country; and large quantities of the root are produced for sale in France. It is said by Royle to be the source of the English rhubarb.

Besides the above species, *R. leucorrhizum*, growing in the Kirghese desert in Tartary, *R. Caspicum* from the Altai mountains, *R. Webbianum*, *R. speciforme*, and *R. Moorcraftianum*, natives of the Himalaya mountains, and *R. crassinervium* and *R. hybridum*, cultivated in Europe, but of unknown origin, yield roots which have either been employed as purgatives, or possess properties more or less analogous to those of officinal rhubarb, though they have not entered into general commerce.

The leafstalks of the different species of Rheum have a pleasant acid taste, and are used for making tarts and pies. It is for this purpose mainly that the plants are cultivated in the United States. Mr. T. A. Lancaster has shown that the acidity is owing to the presence of binoxalate of potassium. (*Am. Journ. of Pharm.*, May, 1859, p. 193.) Lindley states that R. Rhaponticum, R. hybridum, and R. compactum, and hybrid varieties of them, are the common garden rhubarbs.*

After all the researches hitherto made, it appears not improbable that the discovery of the true rhubarb plant of China has been reserved for the present times. From buds received in Paris by the *Société d'Acclimation* from M. Dabry, who procured them from the region of Thibet, where the best rhubarb is thought to grow, plants have been obtained, by great care, which present quite peculiar characters, and for which the name of *Rheum officinale* has been proposed by M. Baillon, who is paying particular attention to the subject. The newly-named species is said to have leaves about one and a half metres (nearly 5 feet) in length, with an expansion nearly orbicular and deeply five-lobed and incised, pale-green and glabrous above, and loaded beneath with a white down. The flower stems are about two metres high, branching, leafed to the summit, with numerous whitish flowers, remarkable for the depth of their convex receptacles, and the green colour of their disc. (*Journ. de Pharm.*, Nov. 1872, p. 389.)

In relation to the culture and preparation of rhubarb, our information is almost as uncertain as on the subject of its natural history. The accounts received from the Bucharian merchants are very discordant, and few intelligent travellers have penetrated into the country where the medicine is collected. We shall present, however, a brief abstract of what we have been able to collect upon the subject from the authorities we have consulted.

* *Wine from the Rhubarb Plant.* Large quantities of wine are said to be prepared, at Belvidere, Illinois, from the garden rhubarb. The plant, having been cut when mature, is submitted to pressure; and the expressed juice, with an equal bulk of water and seven pounds of sugar for each gallon, is made to undergo the vinous fermentation. The wine is fit for use at the end of three years. It has a pleasant sweetish taste, said to resemble that of imported sherry; and an alcoholic strength varying from 7 to 10 per cent. The possession of an aperient property is, perhaps, its strongest recommendation. Ten thousand gallons are stated as the product of a single season. (*Am. Journ. of Pharm.*, Jan. 1866.)—*Note to the thirteenth edition.*

Rhubarb is produced abundantly in the elevated lands of Tartary, about the lake Koko Norr, and is said to be cultivated in the neighbouring Chinese province of Shen-see, and in that of Setchuen. From these sources it is generally supposed that our supplies of Russian and Chinese rhubarb are exclusively derived; but the root is also collected in Boutan and Thibet, on the north of the Himalaya mountains; and it is probable that the plant pervades the whole of Chinese Tartary. It flourishes best in a light sandy soil. It is stated by Mr. Bell, who, on a journey from St. Petersburg to Pekin, had an opportunity of observing it in a growing state, that it is not cultivated by the Tartars, but springs up spontaneously, in tufts, wherever the seeds have fallen upon the heaps of loose earth thrown up by the marmots. In other places the thickness of the grass prevents their access to the soil. The root is not considered sufficiently mature for collection till it has attained the age of six years. It is dug up twice a year in Tartary, in the spring and autumn; in China not till the winter. After removal from the ground, it is cleaned, deprived of its cortical portion and the smaller branches, and then divided into pieces of a convenient size. These are bored with holes, and strung upon cords to dry; according to Mr. Bell, about the tents and on the horns of sheep; according to Sievers, under sheds, by which the rays of the sun are excluded, while the air has free access. The Chinese are said first to place the pieces on a stone slab heated by fire beneath, and afterwards to complete the drying process by exposing them to the sun and air. In Boutan the roots are hung up in a kind of drying-room, in which a moderate and regular heat is maintained. Much time and attention are devoted to the preparation of the root; and Sievers states that a year sometimes elapses from the period of its collection, before it is ready for exportation. A large proportion of its weight is lost in drying, according to some accounts four-fifths, to others not less than seven-eighths. It is probably in order to favour the drying that the bark is removed. The trade in rhubarb is said to centre in the Chinese town of Si-nin, where a Bucharian company or family is established, which possesses a monopoly of this trade, in consideration of a certain tribute paid to the government. To this city the rhubarb is brought from the various places of its collection, and, having been duly assorted and undergone further preparation, is transmitted partly to Russia, partly to the coast of China; so that the drug which reaches us through St. Petersburg is procured from the same neighbourhood with that imported from Canton. But it will soon be seen that there are differences between the Russian and Chinese rhubarb, which would seem to indicate a different origin, and might authorize doubts as to the entire accuracy of the above accounts. It is at least probable that the drug produced in the province of Setchuen, whence the best China rhubarb is said to be brought, takes a more direct route to the coast than that through the town of Si-nin. Besides the two commercial varieties just mentioned, a third occasionally comes to us from Europe, where the cultivation of rhubarb has been carried on for some time, especially in France, Belgium, and Great Britain. Of these three varieties we shall treat under different heads.

1. *Chinese Rhubarb.*

India Rhubarb. Rheum Sinense vel *Indicum.* Much the largest proportion of rhubarb consumed in this country is brought from Canton. Though somewhat inferior to the Russian, its comparative cheapness gives it a decided preference in our markets; and, when of good quality, it does not disappoint the expectations of the physician.

It is in cylindrical or roundish pieces, sometimes flattened on one or both sides, of a dirty-brownish yellow colour externally, appearing as if the cortical portion of the root had been removed by scraping, and the surface rendered smooth and somewhat powdery by attrition. The best pieces are heavier than the Russian rhubarb, have a texture rather close and compact, and, when broken, present a ragged uneven surface, variegated with intermingled shades of dull-red, yellowish, and white, which are sometimes diversified or interrupted by darker colours. The pieces are generally perforated with small holes, intended for convenience of suspension during the drying process; and portions of the suspending cord are not unfrequently found remain-

ing in the holes. Chinese rhubarb has a peculiar somewhat aromatic smell, and a bitter astringent taste, is gritty when chewed, imparts a yellow colour to the saliva, and affords a yellowish powder with a reddish-brown tinge. With the pieces of good quality others often come mingled, defective from decay or improper preparation. These are usually lighter, and of a dark or russet colour. Like all the other varieties of rhubarb, this is liable to be attacked by worms; and in almost every large parcel pieces may be found which have suffered from this cause. The want of proper care in its selection by the Chinese merchants, and the exposure incident to a long sea-voyage, are causes which contribute to its inferiority to the Russian rhubarb. As the whole contents of the chest imported are usually powdered together, including the worst as well as the best pieces, it follows that the powder is inferior in efficacy to the selected and sound pieces. We are told by English pharmaceutists that, owing to a wide-spread destruction by the rebels, or some unknown cause, of the rhubarb plant in its native country, both the quantity and quality of Chinese rhubarb have been recently lowered in the market: but that the plant was recovering itself in China, and consequently that the root is now improving in both these respects (*Pharm. Journ. and Trans.*, Oct. 1868, p. 247.)

In former editions of this work, we have noticed a variety of rhubarb imported from Canton, which was evidently prepared, before leaving China, so as to resemble the Russian, having an angular surface as if pared with a knife. The pieces were obviously selected with great care, as they were remarkably free from defects. But in most of those which came under our notice, the small penetrating hole was observable, which characterizes the Chinese rhubarb, though it had in some instances been filled with the powdered root, so as in some measure to conceal it. Besides, the colours were not quite so bright as those of Russian rhubarb. This is undoubtedly the variety described by Pereira, under a distinct head, as the *Dutch-trimmed* or *Batavian rhubarb*, and considered by him as probably Bucharian or Russian rhubarb of inferior quality, sent by the way of Canton. A sufficient proof, we think, that this is not the case, is the presence in most pieces of the small penetrating hole, occasionally filled with remains of the cord, and in some pieces almost shaved away in the paring process. We have never seen such a hole in any piece of true Russian rhubarb, which does not appear to be strung up like the Chinese when dried.

Under the title of *Canton stick rhubarb*, Pereira describes a variety of which small quantities have been imported from Canton into London. It closely resembles the English stick rhubarb, and is supposed to be derived from the branches of the root of the plant which yields the true Chinese rhubarb.

2. *Russian Rhubarb.*

Turkey Rhubarb. Bucharian Rhubarb. Rheum Russicum vel *Turcicum.* The rhubarb taken to Russia from Tartary undergoes a peculiar preparation, in conformity with the stipulations of a contract with the Bucharian merchants who furnish the supply. The best is selected, and each piece perforated in order to ascertain whether it is sound in the centre. From Si-nin it is conveyed by the Bucharian merchants to the frontier town of Kiachta, where it undergoes a rigid inspection by an apothecary stationed at that place by the Russian government. All the pieces which do not pass examination are committed to the flames; and the remainder is sent to St. Petersburg. This variety is sometimes called *Turkey Rhubarb*, from the circumstance that it was formerly derived from the Turkish ports, whither it is said to have been brought from Tartary by caravans through Persia and Natolia. The circumstance of the identity of the Russian and Turkey rhubarb, and its decided difference from the Chinese, would appear to indicate a distinct origin for the two varieties. Inferior parcels of the root, which will not pass the inspection of the Russian authorities, are said to enter Russia by Taschkent, and to be known to the druggists of that country by the name of *Taschkent rhubarb.*

The pieces of Russian rhubarb are irregular and somewhat angular, appearing as if the bark had been shaved off longitudinally by successive strokes of a knife, and a portion of the interior substance removed with each shaving. They have a cleaner

and fresher appearance than the Chinese, and their colour both internally and externally, though of the same general character, is somewhat more lively. They are less compact and heavy; and are cut with less facility, owing to their giving way before the knife. Another distinction is the character of the perforations, which in the Russian rhubarb are large, frequently reaching only to the centre, and evidently made for the purpose of inspection; while in the Chinese they are small, penetrate completely through the pieces, and were intended for the passage of a suspending cord. The taste and smell of the former closely resemble those of the latter, except that the Russian is rather more aromatic. There is the same crackling under the teeth, and the same yellow stain imparted to the saliva; but the colour of the powder in this variety is a bright yellow, without the brownish tinge exhibited by the Chinese. When thin slices, previously boiled in water, are examined by the microscope, they exhibit numerous clusters of minute crystals of oxalate of calcium. Mr. Quekett found between 35 and 40 grains of them in 100 grains of the root. They are observed both in the Russian and Chinese rhubarb.

The care which renders the Russian rhubarb so free from defects, tends greatly to enhance its price, and consequently to limit its consumption. Its great comparative value in the market has led to frequent attempts at adulteration; and the pieces of Chinese rhubarb are sometimes cut down and prepared so as to resemble the Russian. The fraud, however, may be detected by adverting to the peculiarities in texture, colour, and weight, by which the varieties are distinguished, and to the occasional presence of the small penetrating hole, or vestiges of it. We have seen a specimen in which the hole was enlarged at its two extremities, and closed by powder in the middle, with the view of imitating the larger perforations of the Russian pieces. Sometimes worm-eaten pieces are made to resemble the sound, by filling up the holes with a mixture of pulverized rhubarb and mucilage, and covering over the surface with the powder. By removing this, the fraud is at once revealed.

Within a few years genuine Russia rhubarb has been gradually diminishing, and at this time (Jan. 1869) has wholly disappeared from the market, both European and American. This is owing to the suspension of the inspection established by the Russian government at Kiachta, through which a certain excellence of character, and certain peculiarities of form, were given to that variety of rhubarb which distinguished it from all others. It is to be hoped that similar regulations may be again established, causing a return of the genuine Russia rhubarb to our markets. In the mean time, as the cultivation probably goes on as before, we shall receive really the same rhubarb through other channels, but somewhat different in form, and mixed with much that is inferior.*

* In the *American Journal of Pharmacy* (May, 1867, p. 212) is a paper by Adolph Fero. of Moscow, translated by Prof. Maisch from the *Pharmaceut. Zeitschrift für Russland* (Nov. 1866, pp. 473–481), which gives an account of the rhubarbs at that time in Russian commerce, and to which the reader is referred for interesting observations on this subject. We have space only for a very brief notice of the several varieties.

1. *North-Chinese Rhubarb.* By this name the author distinguishes the rhubarb now entering Russia by various routes along the northern Chinese frontier, and especially through Siberia to the fair at Nishni-Novogorod, where it comes in chests containing 200 lbs. The pieces weigh from one to seven ounces, are mostly uncut or only split longitudinally, resemble the Russian in shape and colour, are entirely or partially destitute of the cortical part, and are usually perforated with holes for suspension, but rarely with those made for inspection, and with these only in imitation of the Russian. Their mean length is 2¾ inches, breadth 1¾. Their texture is somewhat loose, frequently porous.

2. *Bucharian Rhubarb.* This is taken from Bucharia to Russia, being first carried to the Caspian Sea, and then up the Wolga to Nishni-Novogorod, whence it is distributed. The pieces of this variety are marked with the perforating holes for suspension, and sometimes with others in imitation of the Russian, intended for inspection. There are two kinds, one deprived of the cortical portion, the other in the natural state in this respect. In the former the surface is smooth, the outer part seeming to have been carefully removed by a file; the latter has longitudinal wrinkles. Generally, the dimensions exceed those of the former variety, being on the average 3½ inches long, 2½ wide, and 1¼ thick; the root being divided longitudinally into two halves, with the cut surface somewhat curved by contraction. The surface of the pieces is usually purposely sprinkled with the powder. In compactness this resembles the Chinese rhubarb; and its texture is more woody and fibrous than in any other variety.

The proper Russian rhubarb is also described under the name of the *Muscovite*, and the Chinese rhubarb, as we denominate it, under that of *South Chinese*: but in reference to these there is nothing that especially requires attention. (*Note to the thirteenth edition.*)

3. *European Rhubarb.*

In various parts of Europe, particularly in England, France, Belgium, and Germany, the rhubarb plants have been cultivated for many years; and considerable quantities of the root are annually brought into the market. It is imported into this country from England and France.

English Rhubarb. This formerly came in two forms. In one the root was cut and perforated in imitation of the Russian. The pieces were of various shape and size, sometimes cylindrical, but more commonly flat, or somewhat lenticular, and of considerable dimensions. We have for a long time seen none of this variety in our markets. In the other, the pieces are somewhat cylindrical, five or six inches long by an inch or less in thickness, and more or less irregular upon the surface, as if they had shrunk unequally in drying. This is called *stick rhubarb* in England, and until very recently was occasionally met with in our shops. English rhubarb is lighter than the Asiatic, more spongy, and often somewhat pasty under the pestle. It is redder, and when broken exhibits a more compact and regular marbling; the pinkish lines being arranged like rays from the centre towards the circumference. The powder also has a deeper reddish tint. The odour is feeble and less aromatic than that of the Asiatic varieties; the taste is astringent and mucilaginous with little bitterness; and the root, when chewed, scarcely feels gritty between the teeth, and but slightly colours the saliva. Few crystals of oxalate of calcium are discoverable by means of the microscope. Most of the commercial English rhubarb is now cultivated near Banbury, and is said to be the product of R. Rhaponticum.

The cultivation of rhubarb in England has within a few years taken a new start, and the demand for the root has greatly increased both at home and abroad; so that at present it even exceeds the production. Mr. Rufus Usher, who is engaged in this culture at Banbury, and whose plantations of rhubarb exceed forty acres in extent, ascribes the increased demand to the improved quality of the product, which he believes to have arisen from the propagation by offsets instead of by seeds; the roots, in the former method, having a tendency to return to the original type; while, through the seeds, new varieties are formed in which the old characters are lost. (*Am. Journ. of Pharm.*, Nov. 1867, p. 481; from *Pharm. Journ.*, Aug. 1867.) But, notwithstanding this increased demand for English rhubarb, little if any is imported into the U. States; and the result of an investigation which has been made into the subject at our request is that, in two of our largest drug centres, none of this variety is to be found in the market.

French Rhubarb. Rhapontic Rhubarb. Krimea Rhubarb. The rhubarb produced in France is, according to Guibourt, chiefly from *R. Rhaponticum*, *R. undulatum*, and *R. compactum;* that of *R. palmatum*, which most closely resembles the Asiatic, having been found to degenerate so much as not to be a profitable object of culture. Most of the French rhubarb is produced in the neighbourhood of L'Orient, in the department of Morbihan; and the spot where it grows has, from this circumstance, received the name of *Rheumpole.* Two kinds are described by Guibourt, both under the name *Rhapontic root.* One proceeds from the R. Rhaponticum, growing in the gardens in the environs of Paris; the other, from this and the two other species above mentioned, cultivated at Rheumpole. The former is in pieces of the size of the fist or smaller, ligneous in appearance, of a reddish-gray colour on the outside, internally marbled with red and white arranged in the form of crowded rays proceeding from the centre to the circumference, of an odour like that of Asiatic rhubarb, but more disagreeable, of a mucilaginous and very astringent taste, not crackling under the teeth, but tinging the saliva yellow, and affording a reddish-yellow powder. The pieces of the latter are irregularly cylindrical, three or four inches long, and from one to two or even three inches thick, less ligneous in appearance than the preceding, and ex-

Mr. Adoph Fero, of Moscow, who has given the above account of the rhubarbs in Russia at the time he writes, has sent a communication to the *Pharm. Zeitschrift* (Sept. 1870, p. 511), in which he corrects an error in his first paper in reference to the rhubarb circulating in Russia under the name of Bucharian. It does not, as he at first supposed, come from Bucharia; but, as satisfactorily proved by Prof. Dragendorff, is imported into Russia from the West. It was imported from England, and most probably cultivated there. (*Am. Journ. of Pharm.*, Jan. 1871, p. 16.)—*Note to the fourteenth edition.*

ternally of a pale or brownish-yellow colour, less inclining to redness. In exterior aspect, this variety bears considerable resemblance to Chinese rhubarb; but may be distinguished by its more disagreeable odour, its astringent and mucilaginous taste, its want of crackling under the teeth, and its radiating fracture, in which properties it is similar to the preceding variety. Considerable quantities of this drug have been imported into the United States from France, under the name of *Krimea rhubarb;* and it has been employed to adulterate the powder of the better kinds.* It appears to have displaced in France the *Rhapontic root* formerly imported from the Euxine. Whether from difference in species, or from the influence of soil and climate, none of the European rhubarbs equals the Asiatic in purgative power.†

Choice of Rhubarb. In selecting good rhubarb, without reference to the commercial variety, those pieces should be preferred which are moderately heavy and compact, of a lively colour, brittle, presenting when broken a fresh appearance, with reddish and yellowish veins intermingled with white, of an odour decidedly aromatic, of a bitter and astringent not mucilaginous taste, feeling gritty and staining the saliva yellow when chewed, and affording a powder either bright yellow, or yellow with but a slight reddish-brown tinge. When very light, rhubarb is usually rotten or worm-eaten; when very heavy and compact, it is of inferior species, culture, or preparation. Rotten, worm-eaten, or otherwise inferior rhubarb is often powdered, and coloured yellow with turmeric; and the shavings left when Chinese rhubarb is trimmed for powdering, or to imitate the Russian, are applied to the same purpose.

Chemical Properties. Rhubarb yields all its activity to water and alcohol. The infusion is of a dark reddish-yellow colour, with the taste and odour of rhubarb; and the residue, after sufficient maceration, is whitish, inodorous, and insipid. By long boiling, the virtues of the medicine are impaired. Many attempts have been made to analyze the root, with various results. Among them, are those of the two Henrys and Caventou of Paris, Brande of London, Peretti of Rome, and Hornemann, Brandes, and Schlossberger and Döpping of Germany. Brandes found, in 100 parts of Chinese rhubarb, 2 of pure *rhabarbaric acid*, 7·5 of the same acid impure, 2·5 of gallic acid, 9·0 of tannin, 3·5 of colouring extractive, 11·0 of uncrystallizable sugar with tannin, 4·0 of starch, 14·4 of gummy extractive, 4·0 of pectic acid, 1·1 of malate and gallate of calcium, 11·0 of oxalate of calcium, 1·5 of sulphate and chloride of potassium, 1·0 of silica, 0·5 of phosphate of calcium and oxide of iron, 25·0 of lignin, and 2·0 of water. The most recent elaborate analysis which has come to our notice is that of Schlossberger and Döpping. Besides extractive, tannic and gallic acids, sugar, starch, pectin, lignin, oxalate of calcium, and various inorganic salts, they discovered three colouring principles, holding an intermediate place between resin and extractive matter, being freely soluble in alcohol, and slightly so in water. Two of these were uncrystallizable, and denominated *brown resin* and *red resin*, or *phæoretin* and

* M. E. Billot gives the following method of detecting the rhapontic root, when used in powder to adulterate Russian or Chinese rhubarb. On a little of the suspected powder, upon a plate, let fall two or three drops of oil of anise, oil of fennel, or other essential oil; then add magnesia, and rub the mixture well for three or four minutes. If the powder be pure, it will remain yellow; but if it contain the smallest quantity of the French rhapontic root, it will assume a reddish tint, varying from a salmon to a bright rose-colour, according to the quantity of the impurity present. (See *Am. Journ. of Pharm.*, May, 1860. p. 224.)

† Besides the varieties of rhubarb above described, others are noticed by writers. Pallas speaks of a *white rhubarb*, brought to Kiachta by the Bucharian merchants, who conveyed to that place the drug for Russian commerce. It was white as milk, of a sweet taste, and equal to the best rhubarb in quality. It was supposed to be the product of *R. leucorrhizum*. At present, however, it is unknown in St. Petersburg. The *Himalaya rhubarb* is produced by R. australe, and other species mentioned in the text as growing in the Himalaya mountains. According to Dr. Royle, it makes its way to the lower countries in Hindostan, where it sells for one-tenth of the price of the best rhubarb. Mr. Twining tried it in the Hospital at Calcutta, and found it superior as a tonic and astringent to Russian rhubarb, and nearly equal to it in purgative power. A variety known in Russia as *Bucharian rhubarb*, differing from the variety which we call Russian, and which is known in Russia as Chinese rhubarb, is imported into that country from Tartary, and reaches St. Petersburg by Nishni. Parcels of it are said also to reach Vienna, by the way of Brody in Gallicia. Still another variety is that called *Siberian rhubarb*, which is known in Russia by the name *Siberian Rhapontic root*. As these are inferior kinds, and probably never reach our markets, we have not thought it necessary to swell our pages with descriptions of them. The reader who wishes further information is referred to papers by Pereira, in the *London Pharmaceutical Journal*, republished in the *Am. Journ. of Pharm.* (xviii. 63 and 123).

erythroretin; the other, crystallizable in granular crystals, and identical with the *chrysophanic acid*, previously discovered by Rochleder and Heldt in the yellow lichen, or Parmelia parietina of Sprengel. Another resinous substance was also obtained, which was named *aporetin;* but, as it was insoluble in the alcohol from which it had been precipitated by ether, and was isomeric with phæoretin, there is reason to think that it was a product of the operation. The three principles above referred to were obtained by exhausting rhubarb with alcohol, evaporating the tincture, exhausting the extract with water, dissolving the residue in the least possible quantity of alcohol, and treating this solution with ether. A precipitate was produced, a portion of which (aporetin) was insoluble in alcohol, and the remainder was obtained separate by solution in that fluid and evaporation. This was *phæoretin.* It is a yellowish-brown powder, very slightly soluble in water and ether, freely soluble in alcohol and in alkaline solutions, with which it produces an intense reddish-brown colour, and from which it is thrown down yellow by the mineral acids. The ethereal solution of the alcoholic extract, after all the aporetin and phæoretin had been separated, was allowed to evaporate spontaneously, and a large quantity of crystalline granules was obtained, of a beautiful yellow colour. These being washed with ether constituted the *chrysophanic acid.* When the ethereal solution showed no longer a disposition to deposit crystals, it was evaporated, and yielded a product having all the properties of the resins, and forming beautiful purple combinations with potassa and ammonia. This was the *erythroretin*, or red resin of rhubarb. The matter dissolved by water from the alcoholic extract was found to have the odour and taste of rhubarb in a high degree. In this, no doubt, was contained the peculiar active principle or principles of rhubarb; but Schlossberger and Döpping were not more successful than their predecessors in isolating them. They obtained a slightly bitter extractive matter; but it wanted the flavor of rhubarb. (*Pharm. Journ.*, iv. 136, 232, 318, and viii. 190.)

Many distinguished chemists have sought for the purgative ingredient of rhubarb, and some not without supposed success; but scarcely has the new principle been described and named, before the fallacy of its claim has been determined. The *caphopicrite* of Henry, the *rhabarbarin* of Pfaff and others, the *rheumin* of Hornemann, the *rhabarbaric acid* of Brandes, and, lastly, the *rhein* of Professor Dulk, have all been shown to be bodies more or less complex; and certainly no one of them can be admitted to be the peculiar purgative principle. The astringency of rhubarb undoubtedly resides in its tannic acid. Some have supposed that the tonic and cathartic properties reside in different principles; but we are disposed to think, from the correspondence of the bitterness with the purgative property, that they reside in the same substance; and, from the fact that exposure to heat diminishes the cathartic power, there is reason to believe that this substance, when isolated, will prove to be more or less volatile.

Chrysophanic acid (*chrysophane*) is one of the most interesting constituents. Most of the hitherto supposed active principles have been mixtures of this with other substances. The rhabarbaric acid of Brandes probably approaches nearest to it in character. When pure it is beautifully yellow, without smell or taste, disposed to an imperfect granular crystallization, almost insoluble in cold water, more soluble in hot water and in ether, but most freely and yet feebly so in alcohol. Benzole appears to be its best solvent. When heated it emits yellow vapours. Alkaline solutions dissolve it with the production of a beautiful red colour; and the solution with potassa, when evaporated, changes first to violet, and then to blue. It forms definite compounds with the alkalies, but its acid properties are very feeble, and even carbonic acid separates it from its combinations. Its formula, according to Pilz, is $C_{20}H_8O_6$. (*Journ. de Pharm.*, Mars, 1862, p. 254.) It is probably the chief ingredient in the fine yellow colouring matter produced by the reaction of nitric acid on rhubarb, which, in consequence of the magnificent purples produced by it with the alkalies, M. Garot has proposed, under the name of *erythrose*, to introduce into the arts as a dye-stuff. (See *Journ. de Pharm.*, xvii. 5.)*

* Messrs. W. De la Rue and H. Müller obtain chrysophanic acid by treating with benzole rhubarb previously deprived of soluble matter by water, distilling off most of the benzole from the

There are other interesting principles in rhubarb. Some have been disposed to ascribe its odour to a volatile oil; but this has not been isolated. Tannic acid is an important constituent. It is of that variety which precipitates the salts of sesquioxide of iron of a greenish colour. The oxalate of calcium is interesting from its quantity, and from the circumstance that, existing in distinct crystals, it occasions the grittiness of the rhubarb between the teeth. The proportion seems to vary exceedingly in different specimens. According to Scheele and Henry, it constitutes nearly one-third, and Quekett found, as already stated, between 35 and 40 per cent.; while Brandes obtained only 11, and Shrader only 4·5 parts in the hundred. Little or no difference of composition has been found between the Russian and Chinese rhubarb. The European contains but a small proportion of oxalate of calcium, and is therefore less gritty when chewed. It has, however, more tannin and starch than the Asiatic.

When powdered rhubarb is heated, odorous yellow fumes rise, which are probably in part the vapour of chrysophanic acid. Its infusion is reddened by the alkalies, in consequence of their union with this acid, and their reaction on the other colouring principles. It yields precipitates with gelatin, most of the acids, the salts of sesquioxide of iron, acetate of lead, nitrate of protoxide of mercury, nitrate of silver, protochloride of tin, lime-water, and solutions of quinia. Nitric acid occasions at first a turbidness, and afterwards the deposition of a yellow precipitate. The substances producing precipitates may be considered as incompatible with the infusion.*

Medical Properties and Uses. The medical properties of rhubarb are peculiar and valuable. Its most remarkable singularity is the union of a cathartic with an astringent power; the latter of which, however, does not interfere with the former, as the purgative effect precedes the astringent. It is also tonic and stomachic; invigorating, in small doses, the process of digestion. It is not probable that these properties reside in a single proximate principle; and, as rhubarb owes its chief value to their combination, it is not to be expected that chemical analysis will be productive of the same practical advantages in this, as in some other medicines, the virtues of which are concentrated in one ingredient. In its purgative operation, rhubarb is moderate, producing fecal rather than watery discharges, and appearing to affect the muscular fibre more than the secretory function. It sometimes occasions griping. Its colouring principle is absorbed, and may be detected in the urine. By its long-continued use, the perspiration, especially that of the axilla, is said to become yellow, and the milk of nurses cathartic. It gives a yellow colour to the alvine discharges.

The conditions of disease to which it is applicable may be inferred from its peculiar properties. When the stomach is enfeebled, or the bowels relaxed, at the same time that a gentle cathartic is required, rhubarb, as a general rule, is preferable to all others. Hence its use in dyspepsia attended with constipation, in diarrhœa when purging is indicated, in the secondary stages of cholera infantum, in chronic dysentery, and in almost all typhous diseases when fecal matter has accumulated in the intestines, or the use of cathartic medicine is necessary to prevent such accumulation. When employed in cases of habitual constipation, its astringent tendency should be counteracted by combining it with soap. Magnesia is also an excellent associate in disorders of the stomach and bowels. By combination with other cathartics, rhubarb frequently acquires additional activity, while it gives increased efficiency to the associated substance. A mixture of calomel and rhubarb is a brisk and powerful cathartic, often used at the commencement of bilious fevers. As a general rule, rhubarb is not applicable to cases attended with much inflammatory action. Its griping effect may be counteracted by combining it with aromatics.

solution, and allowing it to cool. The chrysophanic acid is deposited in an impure state. By treating this with hot benzole, an insoluble matter is left, and more of the same is deposited when the solution cools. By filtering this is separated, and the acid is obtained from the clear liquor by concentration and crystallization. The undissolved matter is a new principle, which the authors propose to name *emodin*. (*Pharm. Journ.*, xvii. 576.)—*Note to the twelfth edition.*

* For a method of detecting the presence of turmeric in powdered rhubarb by the influence of chloroform on the colouring principles of each of these substances, and of distinguishing through the same agency between the true Chinese rhubarb and that of European origin, the reader is referred to a paper, by Mr. W. L. Howre, contained in the *Amer. Journ. of Pharm.* (Jan. 1874, p. 16): from *Pharm. Journ.* (Nov. 15, 1873.)—*Note to the fourteenth edition.*

The dose of rhubarb as a purgative is from twenty to thirty grains, as a laxative and stomachic from five to ten grains. European rhubarb must be given in double or treble the dose to produce an equal effect. Few medicines are used in a greater variety of forms. It is most effectual in substance. It is frequently given in the shape of pill, combined with an equal proportion of soap, when its laxative effect is desired. The infusion is much used in cases of delicate stomach, and is peculiarly adapted to children. The syrup, tincture, and fluid extract are also useful preparations. They are all officinal.

By the roasting of rhubarb its cathartic property is diminished, probably by the volatilization of the purgative principle, while its astringency remains unaffected. This mode of treatment has, therefore, been sometimes resorted to in cases of diarrhœa. By long boiling the same effect is said to be produced.

Powdered rhubarb has been usefully applied to indolent and sloughing ulcers. It is said to have proved purgative when sprinkled over a large ulcerated surface; and the same effect is asserted to have been produced by rubbing it, mingled with saliva, over the abdomen.

Off. Prep. Extractum Rhei; Extractum Rhei Alcoholicum, *Pharm.*, 1860, *U. S.;* Extractum Rhei Fluidum, *U. S.;* Infusum Rhei; Pilulæ Rhei, *U. S.;* Pil. Rhei Comp.; Pulvis Rhei Comp.; Syrupus Rhei, *Br.;* Syrupus Rhei Aromaticus, *U. S.;* Tinctura Rhei; Tinct. Rhei et Sennæ, *U. S.;* Vinum Rhei. W.

RHŒADOS PETALA. *Br.*

Red-Poppy Petals.

The fresh petals of Papaver Rhœas. *Linn.* From indigenous plants. *Br.*

Coquelicot, *Fr.;* Wilder Mohn, Klapperrose, *Germ.;* Rosolaccio, *Ital.;* Amapola, *Span.*

PAPAVER. See OPIUM.

Papaver Rhœas. Willd. *Sp. Plant.* ii. 1146; Woodv. *Med. Bot.* p. 387, t. 139. The *red* or *corn poppy* is distinguished by its hairy stem, which is branched, and rises about a foot in height, by its incised pinnatifid leaves, by its urn-shaped capsule, and by the full, bright, scarlet colour of its petals. It is a native of Europe, where it grows wild in great abundance, adorning especially the fields of grain with its brilliant flower. It has been naturalized in this country.

Its capsules contain the same kind of milky juice as that found in *P. somniferum*, and an extract has been prepared from them having the properties of opium; but the quantity is too small to repay the trouble of its preparation. M. Tilhoi has shown that the extract contains morphia, but in a proportion exceedingly minute compared with that in which it exists in opium. (*Journ. de Pharm.*, ii. 513.) The petals are the officinal portion. They have a narcotic smell, and a mucilaginous, slightly bitter taste. By drying, they lose their odour, and assume a violet-red colour. Chevallier believed that he had detected a very minute proportion of morphia in an extract obtained from them; but Prof. Attfield seems to have determined satisfactorily the non-existence of morphia in the petals; having sought this alkaloid by three different processes, using a pound of the petals in each experiment, and failed to detect the least evidence of its presence. (*Pharm. Journ.*, Oct. 1873, p. 291.) Their operation on the system is exceedingly feeble, and they are valued more for their beautiful scarlet colour, which they communicate to water, than for their medical virtues. According to Lee Meier, the colouring principles of the flowers are two acids, which he denominates *rhœadic* and *papaveric acids.* (See *Am. Journ. of Pharm.*, xviii. 211.) A syrup is prepared from them, which was formerly prescribed as an anodyne in catarrhal affections; but is now little esteemed, except for its colour.

An alkaloid has been discovered in this species of poppy by O. Hesse, who proposes to name it *rhœadin* (*rhœadia*). It seems to pervade all parts of the plant, from which, as the first step in its preparation, a watery extract is prepared. This is treated with carbonate of sodium, and repeatedly agitated with ether; the ethereal liquid is shaken with a solution of bitartrate of sodium: and the mixture is precipitated by ammonia. The precipitate is washed with cold water, dried and boiled with

alcohol, by which colouring matter and another alkaloid in small quantity, probably thebaina, are removed. The residue, consisting mainly of rhœadia, is purified by combining it with acetic acid, treating with animal charcoal, and precipitating with ammonia. The alkaloid is in small white prismatic crystals, tasteless, fusible at 450° F., becoming brown at the same temperature and partially subliming. It is almost insoluble in water, alcohol, ether, chloroform, benzole, ammonia, solution of carbonate of sodium, and lime-water; but is dissolved by dilute acids, which produce colourless solutions. Its composition is represented by the formula $C_{42}H_{21}NO_{12}$. It does not appear to be poisonous. Muriatic and sulphuric acids moderately concentrated decompose and dissolve it, with the production of a purple colour, which disappears under the action of the alkalies, but is restored by acids. One part of the alkaloid produces a purple colour with 10,000 parts of water, an intense rose colour with 20,000 parts, and a perceptible redness with 800,000 parts. This is a very delicate test, by means of which the alkaloid may be detected in all parts of Papaver Rhœas, in the ripe capsules of the opium poppy, and in opium itself. It is said also to exist in Merks' porphyroxin. (*Am. Journ. of Pharm.*, March, 1867, p. 122.)

Off. Prep. Syrupus Rhœados, *Br.* W.

RHUS GLABRUM. *U. S. Secondary.*

Sumach.

The fruit of Rhus glabrum. *U. S.*

RHUS. *Sex. Syst.* Pentandria Trigynia.—*Nat. Ord.* Anacardiaceæ.

Gen. Ch. Calyx five-parted. *Petals* five. *Berry* small, with one nuciform seed. *Nuttall.*

Of this genus there are several species possessing poisonous properties, which should be carefully distinguished from that here described. For an account of them the reader is referred to the article *Toxicodendron.*

Rhus glabrum. Willd. *Sp. Plant.* i. 1478. This species of Rhus, called variously *smooth sumach*, *Pennsylvania sumach*, and *upland sumach*, is an indigenous shrub from four to twelve feet or more in height, with a stem usually more or less bent, and divided into straggling branches, covered with a smooth, light-gray, or somewhat reddish bark. The leaves are upon smooth petioles, and consist of many pairs of opposite leaflets, with an odd one at the extremity, all of which are lanceolate, acuminate, acutely serrate, glabrous, green on their upper surface, and whitish beneath. In the autumn their colour changes to a beautiful red. The flowers are greenish-red, and disposed in large, erect, terminal compound thyrses, which are succeeded by clusters of small crimson berries, covered with a silky down.

The shrub is found in almost all parts of the United States, growing in old neglected fields, along fences, and on the borders of woods. The flowers appear in July, and the fruit ripens in the early part of autumn. The bark and leaves are astringent, and are largely used, especially the leaves, in tanning leather and in dyeing. Mr. W. J. Watson found, in the bark of the root, albumen, gum, starch, tannic and gallic acids, caoutchouc, resin, colouring matter, and evidences of volatile oil. (*Am. Journ. of Pharm.*, xxv. 194.) Excrescences are produced under the leaves resembling galls in character, and containing large quantities of tannic and gallic acids. These have been used as a substitute for the imported galls by Dr. Walters, of New York, who thought them in every respect preferable. They may be collected at little expense; as they are produced very abundantly, especially in the Western States. From the experiments of Dr. Stenhouse, it appears that the tannic acid of sumach is identical with that of galls, being, like it, resolved, under the influence of sulphuric acid, into glucose and gallic acid; and this change is supposed to take place spontaneously in sumach when long kept. (*Ibid.*, xxxiv. 252.) The only officinal part of the plant is the fruit.

The berries have a sour, astringent, not unpleasant taste, and are often eaten by the country people with impunity. According to Mr. Cozzens, of New York, the acid to which they owe their sourness is the malic, and is contained in the pubes-

cence which covers their surface; as, when it is washed away by warm water, the berries are wholly free from acidity. Professor W. B. Rogers found the acid to be combined with lime, in the state of bimalate.* Mr. W. J. Watson ascertained that free malic acid and bimalate of calcium coexist in the berries, which contain also, upon the same authority, tannic and gallic acids, fixed oil, extractive, red colouring matter, and a little volatile oil. A wine has been prepared from the fruit by adding sugar to an infusion and fermenting, which is spoken of by Dr. John H. Griscom, of New York, as a valuable remedy. (*Med. and Surg. Reporter*, Feb. 9, 1867, p. 118.)

Medical Properties and Uses. Sumach berries are astringent and refrigerant; and their infusion has been recommended as a cooling drink in febrile complaints, and a pleasant gargle in inflammation and ulceration of the throat. By Dr. Fahnestock an infusion of the inner bark of the root, employed as a gargle, is considered almost as a specific in the sore-mouth attending inordinate mercurial salivation. (*Am. Journ. of Med. Sciences*, v. 61.) W.

ROSÆ CANINÆ FRUCTUS. *Br.*

Fruit of the Dog Rose. Hips.

The ripe fruit of the Dog Rose, Rosa canina (*Linn.*), and other indigenous allied species. *Br.*

Rose sauvage, *Fr.;* Hundsrose, *Germ.*

Rosa. See ROSA CENTIFOLIA.

Rosa canina. Willd. *Sp. Plant.* ii. 1077; Woodv. *Med. Bot.* p. 493, t. 177. The *dog rose, wild brier*, or *heptree*, is a native of Europe, and distinguished as a species by its glabrous ovate germs, smooth peduncles, prickly stem and petioles, and ovate, smooth, rigid leaves. It is eight or ten feet high, and bears white or pale-red flowers, having usually five obcordate fragrant petals. The plant has been introduced into this country, but is not much cultivated.

The fruit is fleshy, smooth, oval, red, and of a pleasant, sweet, acidulous taste; and contains sugar, and uncombined citric and malic acids.

The pulp, separated from the seeds and the silky bristles in which they are embedded, is employed in Europe for the preparation of a confection, intended chiefly as an agreeable vehicle for other medicines.

Off. Prep. Confectio Rosæ Caninæ, *Br.* W.

ROSA CENTIFOLIA. *U. S.*

Pale Rose. Hundred-leaved Rose.

The petals of Rosa centifolia. *U. S.*

Off. Syn. ROSÆ CENTIFOLIÆ PETALA. *Cabbage-rose Petals.* The fresh petals, fully expanded, of Rosa centifolia. *Linn.* From plants cultivated in Britain. *Br.*

Roses à cent feuilles, *Fr.;* Hundertblätterige Rose, *Germ.;* Rosa pallida, *Ital.;* Rosa de Alexandria, *Span.*

Rosa. *Sex. Syst.* Icosandria Polygynia.—*Nat. Ord.* Rosaceæ.

Gen. Ch. Petals five. *Calyx* urceolate, five-cleft, fleshy, contracted at the neck. *Seeds* numerous, hispid, attached to the inner side of the calyx. *Willd.*

Rosa centifolia. Willd. *Sp. Plant.* ii. 1071; Woodv. *Med. Bot.* p. 495, t. 178. This species of rose has prickly stems, usually from three to six feet high. The leaves

* Prof. Rogers suggested that *malic acid* might be advantageously procured from this source. Prof. Procter informs us that he has obtained it by the following process. Pour boiling water on the ripe berries; macerate for twelve hours; strain, evaporate to one-fourth, and again strain; resume the evaporation and continue it till the liquid assumes the consistence of thin syrup; then set it aside to crystallize. Wash the crystals of bimalate of calcium with a little water, and recrystallize from a boiling solution. Dissolve the salt in hot water, and decompose it with a solution of acetate of lead. Wash the precipitated malate of lead, suspend it in water, and pass sulphuretted hydrogen through the liquid until the whole of the lead is separated. Lastly, filter, and evaporate to dryness in a porcelain vessel. Malic acid, thus obtained, may be used in preparing the *malates of iron* and *manganese*, both of which have been employed medicinally in Europe.

consist of two or three pairs of leaflets, with an odd one at the end, closely attached to the common footstalk, which is rough, but without spines. The leaflets are ovate, broad, serrate, pointed, and hairy on the under surface. The flowers are large, with many petals, generally of a pale-red colour, and supported upon peduncles beset with short bristly hairs. The germ is ovate, and the segments of the calyx semi-pinnate. The varieties of *R. centifolia* are very numerous, but may be indiscriminately employed. The plant is now cultivated in gardens all over the world; but its original country is not certainly known. It has sometimes been mistaken for the damask rose, which is a distinct species.

The petals are the officinal portion. They are extremely fragrant, and have a sweetish, slightly acidulous, somewhat bitterish taste. Their odour is said to be increased by iodine. It depends on a volatile oil, which may be separated by distillation with water. (See *Oleum Rosæ.*) They should be collected when the flower is fully expanded, but has not begun to fall. Their fragrance is impaired but not lost by drying. They may be preserved fresh, for a considerable time, by compressing them with alternate layers of common salt in a well-closed vessel, or beating them with twice their weight of that substance.

The petals are slightly laxative, and are sometimes administered in the form of syrup combined with cathartic medicines; but their chief use is in the preparation of rose-water. (See *Aqua Rosæ.*)

Off. Prep. Aqua Rosæ; Syrupus Sarsaparillæ Compositus, *U. S.* W.

ROSA GALLICA. *U. S.*

Red Rose.

The petals of Rosa Gallica. *U. S.*

Off. Syn. ROSÆ GALLICÆ PETALA. *Red-rose Petals.* The fresh and dried unexpanded petals of Rosa Gallica. From plants cultivated in Britain. *Br.*

Roses rouges, *Fr.;* Französische Rose, Essig-rosen, *Germ.;* Rosa domestica, *Ital.;* Rosa rubra ó Castillara, *Span.*

Rosa. See ROSA CENTIFOLIA.

Rosa Gallica. Willd. *Sp. Plant.* ii. 1071; Woodv. *Med. Bot.* p. 498, t. 179. This species is smaller than *R. centifolia*, but resembles it in the character of its foliage. The stem is beset with short bristly prickles. The flowers are very large, with obcordate widely-spreading petals, which are of a rich crimson colour, and less numerous than in the preceding species. In the centre is a crowd of yellow anthers on thread-like filaments, and as many villose styles bearing papillary stigmas. The fruit is oval, shining, and of a firm consistence. The red rose is a native of the south of Europe, and is cultivated in gardens throughout the United States.

The petals, which are the part employed, should be gathered before the flower has blown, separated from their claws, dried in a warm sun or by the fire, and kept in a dry place. Their odour, which is less fragrant than that of *R. centifolia*, is improved by drying. They have a velvety appearance, a purplish-red colour, and a pleasantly astringent and bitterish taste. Their constituents, according to M. Cartier, are tannin, gallic acid, colouring matter, a volatile oil, a fixed oil, albumen, soluble salts of potassa, insoluble salts of lime, silica, and oxide of iron. (*Journ. de Pharm.*, vii. 531.) According to M. Filhol, the astringency of red roses is ascribable less to tannic acid, of which they contain but a trace, than to quercitrin, which he obtained in notable proportion, and with which their colour is probably connected. They also contain much uncrystallizable sugar. (*Repert. de Pharm.*, Mai, 1863.) The sensible properties and medical virtues of the flowers are extracted by boiling water. Their infusion is of a pale-reddish colour, which becomes bright red on the addition of sulphuric acid. As their colour is impaired by exposure to light and air, they should be kept in opaque well-closed bottles or canisters.

Medical Properties and Uses. Red roses are slightly astringent and tonic, and were formerly thought to possess peculiar virtues. They are at present chiefly employed in infusion, as an elegant vehicle for tonic and astringent medicines.

Off. Prep. Confectio Rosæ, *U. S.;* Confect. Rosæ Gallicæ, *Br.;* Infusum Rosæ Acidum, *Br.;* Infusum Rosæ Compositum, *U. S.;* Mel Rosæ, *U. S.;* Pilulæ Aloës et Mastiches, *U. S.;* Syrupus Rosæ Gallicæ. W.

ROSMARINUS. *U. S.*

Rosemary.

The leaves of Rosmarinus officinalis. *U. S.*

Romarin, *Fr.;* Rosmarin, *Germ.;* Rosmarino, *Ital.;* Romero, *Span.*

ROSMARINUS. *Sex. Syst.* Diandria Monogynia.—*Nat. Ord.* Lamiaceæ or Labiatæ.

Gen. Ch. Corolla unequal, with the upper lip two-parted. *Filaments* long, curved, simple, with a tooth. *Willd.*

Rosmarinus officinalis. Willd. *Sp. Plant.* i. 126; Woodv. *Med. Bot.* p. 329, t. 117. Rosemary is an evergreen shrub, three or four feet high, with an erect stem, divided into many long, slender, ash-coloured branches. The leaves are numerous, sessile, opposite, more than an inch long, about one-sixth of an inch broad, linear, entire, obtuse at the summit, folded backward at the edges, of a firm consistence, smooth and green on the upper surface, whitish and somewhat downy beneath. The flowers are pale-blue or white, and disposed in opposite groups at the axils of the leaves, towards the ends of the branches. The seeds are four in number, oblong, and naked in the bottom of the calyx.

The plant grows spontaneously in the countries which border on the Mediterranean, and is cultivated in the gardens of Europe and this country. The flowering summits are the officinal portion, though the leaves alone are now recognized in the U. S. Pharmacopœia. They have a strong balsamic odour, which is possessed, but in a less degree, by all parts of the plant. Their taste is bitter and camphorous. These properties are imparted partially to water, completely to alcohol, and depend on a volatile oil which may be obtained by distillation. (See *Oleum Rosmarini.*) The tops lose a portion of their sensible properties by drying, and become inodorous by age.

Medical Properties and Uses. Rosemary is gently stimulant, and has been considered emmenagogue. In the practice of this country it is scarcely used; but in Europe, especially on the continent, it enters into the composition of several syrups, tinctures, &c., to which it imparts its agreeable odour and excitant property. It is sometimes added to sternutatory powders, and is used externally in connection with other aromatics in the form of fomentation. In some countries it is employed as a condiment; and its flowers, which are much sought after by the bees, impart their peculiar flavour to the honey of the districts in which the plant abounds.

Off. Prep. Oleum Rosmarini. W.

ROTTLERA. *U. S. Secondary.*

Kameela.

The glandular powder and hairs obtained from the capsules of Rottlera tinctoria (Roxburgh). *U. S.*

Off. Syn. KAMALA. *Kamala.* A powder which consists of the minute glands that cover the capsules of Rottlera tinctoria. *Roxb. Corom.* Imported from India. *Br.*

This is an officinal recently introduced into the U. S. and Br. Pharmacopœias. In our own, the Latin name Rottlera has been adopted from the generic title of the plant which yields the medicine, while the ordinary Indian name *Kameela* (often spelled *Kamala*) is used as the English synonyme. In the Br. Pharmacopœia *Kamala* is given both as the Latin and English title.

The genus Rottlera, to which the plant producing the medicine belongs, was named in honour of the Rev. Dr. Rottler, a Danish missionary, and as now recognised was established by Roxburgh. It belongs to the Natural Order of Euphorbiaceæ, and, besides the officinal R. tinctoria, includes another species having medical virtues, the

Rottlera Schimperi, a large tree of Abyssinia, the bark of which, under the name of *cortex musenæ* or *musena bark*, has attracted some attention from its presumed anthelmintic virtues.*

Rottlera tinctoria (*Mallotus Philippinensis*, De Cand. *Prodrom.* xv. 980), which is described and figured by Roxburgh in his treatise on *The Plants of the Coast of Coromandel* (ii. 36), is a small tree from 15 to 20 feet in height, growing throughout Hindostan, in several of the E. India islands, and, it is said, in China and Australia. The fruit is a roundish three-valved, three-celled capsule, of about the size of a small cherry, marked externally with three furrows, and thickly covered with a red powder. This is the officinal part of the plant. The capsules are gathered in February and March, when full-grown, and the powder carefully brushed from them. This is largely collected in some parts of Hindostan, where it forms an important article of commerce, being extensively employed as a dye-stuff. Specimens of it, under the name of *wurrus*, were sent to England in 1852, and examined by Mr. D. Hanbury, who published an account of it in the *Pharmaceutical Journal* for June, 1853 (xii. 405). It was not till several years afterward that it began to attract attention in Great Britain as a medicine.†

Properties. Kameela, as brought to our market, is a light, finely granular, and very mobile powder, of a brownish-red or madder colour, with little smell or taste, but producing a slight sense of acrimony in the mouth, and feeling gritty under the teeth. It is inflammable, and flashes almost like gunpowder when dropped into the flame of a candle. It is insoluble in cold, and but very slightly soluble in boiling water; but is dissolved by alkaline solutions, which give a resinous precipitate on the addition of an acid. Alcohol and ether dissolve a large proportion of it, forming a deep-red solution, from which water precipitates resinous matter. Under the microscope, Mr. Hanbury found it to consist of "garnet-red, semi-transparent, roundish granules, from $\frac{1}{500}$ to $\frac{1}{250}$ of an inch in diameter, more or less mixed with minute stellate hairs, and the remains of stalks and leaves, the latter of which are easily removed by careful sifting." (*Pharm. Journ.*, Feb. 1858, p. 406.) It has been examined chemically by Dr. Thos. Anderson, of Glasgow, and by G. Leube, in Germany. As given by the former, the constituents are, in 100 parts, 78·19 of resinous colouring matter, 7·34 of albumen, 7·14 of cellulose, &c., a trace of volatile oil and volatile colouring matter, 3·84 of ashes, and 3·49 of water. Of the resinous colouring substances, Dr. Anderson obtained one in a pure state by allowing a concentrated ethereal solution to stand for two days, draining and pressing in bibulous paper the resulting mass of granular crystals, and purifying them from adhering resin by repeated solution in ether and crystallization. To this substance he gave the name of *rottlerin*. It is in the form of minute crystalline plates, of a yellow colour and a satin-like lustre, insoluble in water, sparingly soluble in cold, but more so in boiling alcohol, and readily dissolved by ether, and by alkaline solutions, which assume a dark-red colour. Rottlerin melts when heated moderately, and at a higher heat is decomposed, giving off pungent vapours. Its formula, according to Dr. Anderson, is $C_{22}H_{10}O_6$. (*Ibid.*, p. 407.) Leube found a resin soluble in ether and cold alcohol, another resin soluble in ether and boiling alcohol, starch, gum, extractive, tannin, albumen, and citric acid. He failed in obtaining the rottlerin of Dr. Anderson. The ashes were in the extraordinary proportion of 25·85 per cent., and of the ashes 83·8 per cent. consisted of insoluble silica. (*Ibid.*, Sept. 1860, p. 168.) Silica probably enters essentially into the constitution of the minute granules, and its presence accounts for their grittiness under the teeth. The existence of rottlerin, which

* *Cortex Musenæ.* This bark is in quills several inches long, an inch or more in diameter, rough and fissured externally, with a brown epidermis, and beneath this successively a thin greenish cellular coat, a thicker pale-yellow periderm, and a tough very fibrous liber. It is inodorous, but has a sweetish nauseous taste, followed by an enduring sense of acrimony in the fauces. It was found by Mr. C. Thiel to contain an acrid substance analogous to saponin, a bitter principle, a fatty wax-like substance, yellow colouring matter, extractive, and various salts. It is said to be used in Abyssinia, in connection with koosso, in the treatment of the tape-worm. (*Neues Jahrb. für Pharm.*, Jan. 1863, p. 374.)—*Note to the twelfth edition.*

† A peculiar kind of kameela, evidently not the product of Rottlera tinctoria, is said to have been imported from Aden. Nothing is yet known of its place of growth, or of the plant which yields it. (*Pharm. Journ.*, Sept. 1871, p. 205.)—*Note to the fourteenth edition.*

had come into some doubt by the failure of Leube to find it, has been abundantly confirmed by Mr. Thos. B. Groves, who, however, states that it is changed by exposure, and may, therefore, not be detected in old specimens. (*Pharm. Journ.*, Sept. 1872, p. 228.) The active constituent is supposed to be the resin extracted by ether.

Medical Properties and Uses. Kameela is actively purgative in full doses, sometimes acting violently, and occasionally causing nausea, but seldom vomiting. It appears to have been long used in India in the treatment of tape-worm, but has been only within a few years known in Europe and this country. Its properties as a vermifuge were first investigated by Dr. C. Mackinnon, a British Army Surgeon in India, who published the results of his observations in the *Indian Annals of Medical Science*, in 1854. He found it extraordinarily efficient in the treatment of tænia, having used it in 50 cases, and failed in bringing away the worm only in two. The testimony of other practitioners in India and Great Britain goes to confirm the statements of Dr. Mackinnon, and there can be little doubt of the vermifuge powers of the medicine. It is given without previous preparation of the patient, in the dose of from one to three drachms, suspended in water, mucilage, or syrup. In the latter dose it sometimes acts violently. The worm is usually expelled dead at the third or fourth stool. If the first dose fail to operate on the bowels, it may be repeated in four hours, or followed by a dose of castor oil. Dr. Anderson, British Army Surgeon in India, has employed the medicine successfully in the form of tincture, made in the proportion of six ounces to sixteen fluidounces of rectified spirit, of which the dose is from one to four fluidrachms. As an external remedy, kameela is used by the people of India in various affections of the skin, particularly scabies. Dr. Wm. Moore, of Dublin, has employed it usefully in herpetic ring-worm. (*Dub. Hosp. Gaz.*, Nov. 15, 1857.) W.

RUBIA. *U. S. Secondary.*

Madder.

The root of Rubia tinctorum. *U.S.*

Garance, *Fr.;* Krappwurzel, *Germ.;* Robbia, *Ital.;* Rubia de tintoreros, Granza, *Span.*

Rubia. *Sex. Syst.* Tetrandria Monogynia. — *Nat. Ord.* Rubiaceæ. *Juss.*

Gen. Ch. Corolla one-petaled, bell-shaped. *Berries* two, one-seeded. *Willd.*

Rubia tinctorum. Willd. *Sp. Plant.* i. 603; Woodv. *Med. Bot.* p. 173, t. 67. The root of the *dyers' madder* is perennial, and consists of numerous long, succulent fibres, varying in thickness from the size of a quill to that of the little finger, and uniting at top in a common head, from which also proceed side-roots that run near the surface of the ground, and send up many annual stems. These are slender, quadrangular, jointed, procumbent, and furnished with short prickles, by which they adhere to the neighbouring plants upon which they climb. The leaves are elliptical, pointed, rough, firm, about three inches long and nearly one inch broad, having rough points on their edges and midrib, and standing at the joints of the stem in whorls of four, five, or six together. The branches rise in pairs from the same joints, and bear small yellow flowers at the summit of each of their subdivisions. The fruit is a round, shining, black berry.

The plant is a native of the south of Europe and the Levant, and is cultivated in Asia Minor, France, Holland, and the south of Italy. It is from Holland that commerce derives its chief supply. The root, which is the part used, is dug up in the third summer, and, having been deprived of its cuticle, is dried by artificial heat, and then reduced to a coarse powder. In this condition it is packed in barrels, and sent into the market. Madder from the Levant is in the state of the whole root; from the south of France, either whole or in powder. The plant is also cultivated in this country, in the States of Delaware and Ohio.

The root consists of a reddish-brown bark, and a ligneous portion within. The latter is yellow in the recent state, but becomes red when dried. The powder, as kept in the shops, is reddish-brown.

Madder has a weak peculiar odour, and a bitterish astringent taste; and imparts these properties, as well as a red colour, to water and alcohol. It contains, accord-

ing to M. Runge, five distinct colouring substances; a red, a purple, an orange, a yellow, and a brown. According to M. Decaisne, only yellow colouring matter is found in the recent root; and it is under the influence of atmospheric air that this changes to red. The most interesting of the colouring substances is the *alizarin* of Robiquet and Collin. It may be obtained from the alcoholic extract by sublimation, in the method employed by Mohr in obtaining benzoic acid. (*Journ. de Pharm.*, 3e sér., xxxi. 267.) It is orange-red, inodorous, insipid, crystallizable, capable of being sublimed without change, scarcely soluble in cold water, soluble in boiling water, and very readily so in alcohol, ether, the fixed oils, and alkaline solutions. The alcoholic and watery solutions are rose-coloured; the ethereal, golden-yellow; the alkaline, violet and blue when concentrated, but violet-red when sufficiently diluted. A beautiful rose-coloured lake is produced by precipitating a mixture of the solutions of alizarin and alum. Rochleder finds a close analogy between alizarin and the chrysophanic acid of rhubarb. (See *Chem. Gaz.*, A.D. 1852, p. 243.) M. Roussin claims to have succeeded in preparing alizarin from naphthalin. (See *Am. Journ. of Pharm.*, Nov. 1861, p. 558.) Another colouring principle, called *purpurine*, has been found in madder associated with alizarin, from which it has also been artificially prepared by M. F. de Lalande, by the joint action of sulphuric and arsenic acids, the latter in small proportion. (*Journ. de Pharm.*, Nov. 1874, p. 366.) Madder also contains sugar; and Döbereiner succeeded in obtaining alcohol from it by fermentation and distillation, without affecting its colouring properties. It is much used by the dyers.

Medical Properties and Uses. Madder was formerly thought to be emmenagogue and diuretic; and was used in amenorrhœa, dropsy, jaundice, and visceral obstructions. It is still occasionally prescribed in suppressed menstruation; but physicians generally have no confidence in its efficacy in this or any other complaint. When taken into the stomach it imparts a red colour to the milk and urine, and to the bones of animals, without sensibly affecting any other tissue. The effect is observable most quickly in the bones of young animals, and in those nearest the heart. Under the impression that it might effect some change in the osseous system, it has been prescribed in rachitis, but without any favourable result. The dose is about half a drachm, repeated three or four times a day. W.

RUBUS. *U.S.*

Blackberry.

The bark of the root of Rubus Canadensis, and of Rubus villosus. *U.S.*

Rubus. *Sex. Syst.* Icosandria Polygynia.—*Nat. Ord.* Rosaceæ.

Gen. Ch. Calyx five-cleft. *Petals* five. *Berry* compound, with one-seeded acini. *Willd.*

Of this extensive genus not less than twenty species are indigenous in the United States, where they are called by the various names of *raspberry*, *blackberry*, *dewberry*, *cloudberry*, &c. Most of them are shrubby or suffruticose briers, with astringent roots and edible berries; some have annual stems without prickles. The only officinal species are *R. Canadensis* and *R. villosus*, which, so far as relates to their medical properties, are so closely alike as not to require a separate description.

1. *Rubus Canadensis.* Willd. *Sp. Plant.* ii. 105; Gray, *Manual of Bot. &c.*, p. 121.—*R. trivialis.* Pursh, *Flor. Am. Sept.* p. 347. The *dewberry*, sometimes also called *low blackberry*, or *creeping blackberry*, has a slender, somewhat prickly stem, which runs along the ground, and occasionally puts forth roots. The leaves are composed of three or five leaflets, which are ovate or ovate-lanceolate, generally pointed, sharply serrate, thin, and nearly smooth. The flowers are large, white, and arranged in racemes, with leaf-like bractes. The plant grows abundantly in old fields and neglected grounds in the Northern and Middle States. Its fruit is large, black, and of a very pleasant flavour, and ripens somewhat earlier than that of *R. villosus.*

2. *R. villosus.* Willd. *Sp. Plant.* ii. 1085; Bigelow, *Am. Med. Bot.* i. 160; Barton, *Med. Bot.* ii. 151. The stem of the blackberry is somewhat shrubby, from three to

seven feet high, branching, more or less furrowed and angular, and armed with strong prickles. The smaller branches and young shoots are herbaceous. The leaves are ternate or quinate; the leaflets ovate, acuminate, unequally and sharply serrate, and pubescent on both sides; the footstalk and midrib usually armed with short recurved prickles. The flowers are large, white, and in erect racemes, with a hairy, prickly stalk. The calyx is short, with acuminate segments. The fruit is first green, then red, and, when perfectly ripe, of a shining black colour and very pleasant taste. It is a compound berry, consisting of numerous pulpy one-seeded globules or acini attached to the receptacle. This species of Rubus is, perhaps, the most abundant of those indigenous in the United States, growing in neglected fields, along fences, on the borders of woods, in forest glades, and wherever tillage or too much shade and moisture does not interfere with it. Its flowers appear from May to July, and its fruit is ripe in August.

The berries of both these species of Rubus are much used as food; and a jelly made from them is in great esteem as an article of diet, and even as a remedy in dysenteric affections. The plant is now largely cultivated for the sake of its fruit, which has been greatly increased in size and beauty, under culture, if not equally improved in flavour. The roots only are officinal.

The blackberry root is branching, cylindrical, of various dimensions, from nearly an inch in thickness down to the size of a straw, ligneous, and covered with a thin bark, which is externally of a light-brownish or reddish-brown colour, and in the dried root is wrinkled longitudinally. The dewberry root is usually smaller, without the longitudinal wrinkles, but with transverse fissures through the epidermis, and of a dark-ash colour, without any reddish tinge. Both are inodorous. The bark in both has a bitterish strongly astringent taste, and the ligneous portion is nearly insipid, and comparatively inert. The smaller roots, therefore, should be selected for use; or, if the thicker pieces are employed, the cortical part should be separated, and the wood rejected. Their virtues are extracted by boiling water, and by diluted alcohol, and depend chiefly upon tannin, which is an abundant constituent.

Medical Properties and Uses. Dewberry and blackberry roots are tonic and strongly astringent. They have long been a favourite domestic remedy in bowel affections, and from popular favour have passed into regular medical use. Given in decoction, they are usually acceptable to the stomach, without being offensive to the taste; and may be employed with great advantage in cases of diarrhœa from relaxation of the bowels, whether in children or adults. We can add our own decided testimony to that of others who have spoken favourably of their use in this complaint; and there is no doubt that they are applicable to all other cases in which the vegetable astringents are found serviceable. The decoction may be prepared by boiling an ounce of the smaller roots, or of the bark of the larger, in a pint and a half of water down to a pint; of which from one to two fluidounces may be given to an adult three or four times, or more frequently, during the twenty-four hours. The dose of the powdered root is 20 or 30 grains. The fluid extract, which is now officinal, is an excellent preparation, and may be given in the dose of 30 minims.* The syrup is also officinal.

Off. Prep. Extractum Rubi Fluidum, *U. S.;* Syrupus Rubi, *U. S.* W.

RUMEX. *U. S. Secondary.*

Yellow Dock.

The root of Rumex crispus. *U. S.*

Rumex. *Sex. Syst.* Hexandria Trigynia.— *Nat. Ord.* Polygonaceæ.

Gen. Ch. Calyx three-leaved. *Petals* three, converging. *Seed* one, three-sided.

* *Aromatic Syrup of Blackberry.* Take of Blackberry Root ℥ij; Cinnamon, Cloves, each, ℥iss; Mace ℥i; Sugar ℥xxx. Reduce the root and spices to a powder which will pass through a sieve of 50 meshes to the square inch, moisten this with two fluidounces of alcohol, put into a percolator, and displace with water till 17 fluidounces have passed, and dissolve the sugar in the filtrate. A fluidounce is equivalent to 30 grains of the root. (*Am. Journ. of Pharm.*, Nov. 1859, p. 552.)—*Note to the twelfth edition.*

Willd. Calyx six-parted, persistent, the three interior divisions petaloid, connivent. *Seed* one, three-sided, superior, naked. *Stigmata* multifid. *Nuttall.*

Several species of Rumex have sour leaves, and are distinguished by the common name of *sorrel* from the others, which are called *dock*. Of the former, *Rumex Acetosa*, or *common English sorrel*, formerly held a place in the London and Dublin Pharmacopœias. *R. Acetosella* is the common sorrel of our fields, though supposed to have been originally introduced from Europe. The leaves of both these plants are agreeably sour to the taste, and owe their acidity to binoxalate of potassium with a little tartaric acid. They quite lose this taste in drying. They are refrigerant and diuretic, and may be used advantageously as an article of diet in scurvy. For this purpose they are prepared in the form of salad. The juice of the leaves forms with water an agreeable acidulous drink, sometimes used in fevers. Taken very largely, the leaves are said to have produced poisonous effects. (See *Wood's Quarterly Retrospect*, i. 109.) *R. scutatus* also ranks among the sorrels.

Of the proper docks, though one only is recognised by the Pharmacopœia, several others have been used. The roots of *R. Patientia* and *R. Alpinus*, European plants, and of *R. aquaticus*, *R. acutus*, and *R. sanguineus*, belonging both to Europe and the United States, may be employed indiscriminately with those of the officinal species. *R. Britannica* and *R. obtusifolius* were formerly officinal, but were dismissed at the late revision of the Pharmacopœia, and the present officinal species adopted in their place. *R. Hydrolapathum* (Hudson), which is the *R. aquaticus* of the late Dublin Pharmacopœia, is thought to be the *Herba Britannica* of the ancients, celebrated for the cure of scurvy and diseases of the skin. The docks are herbaceous plants with perennial roots. The flowers are in terminal or axillary panicles. Some of the species are diœcious; but the one here described has perfect flowers.

Rumex crispus. Willd. *Sp. Plant.* ii. 251; Gray, *Manual of Botany, &c.*, p. 377. From a perennial, spindle-shaped, yellow root, which penetrates deeply into the ground, a stem rises annually, three or four feet high, furnished with smooth, lanceolate leaves, strongly waved at their margins, and terminating in panicled racemes of small, inconspicuous, greenish flowers. The lower leaves are truncate or cordate at the base, and those which spring from the root have long footstalks. The flowers are in crowded whorls, upon long wand-like racemes, which are leafless above. The valves or inner sepals of the calyx are roundish-cordate, entire or slightly denticulate, and one or all grain-bearing. This species of dock is a native of Europe, but has become naturalized in this country, and is now a common weed, growing in roads and fields.

Dock root, from whatever species derived, has an astringent, bitter taste, with little or no smell. It readily yields its virtues to water by decoction. According to Riegel, the root of *R. obtusifolius* contains a peculiar principle called *rumicin*, resin, extractive matter resembling tannin, starch, mucilage, albumen, lignin, sulphur, and various salts, among which are phosphate of calcium, and different acetates and malates. (*Journ. de Pharm.*, 3e sér., i. 410.) Rumicin, in its pure state, has since been ascertained, by Karl von Thann, to be identical with chrysophanic acid. (See *Rheum.*) (*Chem. Central Blatt*, Nov. 10, 1858, p. 795.) The leaves of most of the species are edible when young, and are occasionally used as spinage. They are somewhat laxative, and form an excellent diet in scorbutic cases. The roots are used to dye a yellow colour.

The officinal species, R. crispus, has been carefully examined by Dr. J. H. Salisbury, of New York; and the following statements are derived from his paper, published in the *New York Journal of Medicine* (March, 1855, p. 211.) The seeds are astringent, but less bitter than the root. The leaves are bitterish, pungent, and astringent to the taste, with a smell like that of bruised sorrel. The petioles are decidedly sour, and contain nearly one per cent. of oxalic acid. The root, which is the officinal part, is spindle-shaped, yellow, and covered with an easily separable and nearly tasteless epidermis, within which are successively the cortical layers, a ligneous portion, and a central medulla. The cortical part, which is easily separated, fleshy, and tender, is the most active. It has a bitter and astringent taste, and yielded, on analysis, starch, a little sugar, albuminous matter, gummy matter, bitter

extractive, tannic acid of the kind which gives green precipitates with the salts of iron, lignin, and various salts. The root yields its virtues to water and alcohol, but is injured by long boiling.

Medical Properties and Uses. Dock root is astringent, and gently tonic, and is also supposed to possess an alterative property, which renders it useful in scorbutic disorders, and cutaneous eruptions, particularly the itch, in the cure of which it enjoyed at one time considerable reputation. It is said to have proved useful in scrofula and syphilis. Dr. Thomson found a decoction of the root of *R. Patientia* very efficacious in obstinate ichthyosis. *R. aquaticus* and *R. Britannica* are the most astringent. The roots of some species unite a laxative with the tonic and astringent property, resembling rhubarb somewhat in their operation. Such are those of *R. crispus* and *R. obtusifolius;* and *R. Alpinus* has in some parts of Europe the name of *mountain rhubarb.* This resemblance is not singular, as the two genera belong to the same natural family. Dock root is given in powder or decoction. Two ounces of the fresh root bruised, or one ounce of the dried, may be boiled in a pint of water, of which two fluidounces may be given at a dose, and repeated as the stomach will bear it. The root has often been applied externally in the shape of ointment, cataplasm, and decoction, to the cutaneous eruptions and ulcerations for which it has been used internally. The powdered root is recommended as a dentifrice, especially when the gums are spongy. W.

RUTA. *U.S.*

Rue.

The leaves of Ruta graveolens. *U. S.*

Rue odorante, *Fr.;* Garten-Raute, *Germ.;* Ruta, *Ital.;* Ruda, *Span.*

Ruta. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Rutaceæ.

Gen. Ch. Calyx five-parted. *Petals* concave. *Receptacle* surrounded by ten melliferous points. *Capsule* lobed. *Willd.*

Ruta graveolens. Willd. *Sp. Plant.* ii. 542; Woodv. *Med. Bot.* p. 487, t. 174. Common rue is a perennial plant, usually two or three feet high, with several shrubby branching stems, which, near the base, are woody and covered with a rough bark, but in their ultimate ramifications are smooth, green, and herbaceous. The leaves are doubly pinnate, glaucous, with obovate, sessile, obscurely crenate, somewhat thick and fleshy leaflets. The flowers are yellow, and disposed in a terminal branched corymb upon subdividing peduncles. The calyx is persistent, with four or five acute segments; the corolla consists of four or five concave petals, somewhat sinuate at the margin. There are usually ten stamens, but sometimes only eight. The plant is a native of the south of Europe, but cultivated in our gardens. It flowers from June to September. The whole herb is active; but the leaves are usually employed.

These have a strong disagreeable odour, especially when rubbed. Their taste is bitter, hot, and acrid. When recent, and in full vigour, they have so much acrimony as to inflame and even blister the skin, if much handled; but the acrimony is diminished by drying. Their virtues depend chiefly on a volatile oil, which is very abundant, and is contained in glandular vesicles, apparent over the whole surface of the plant. (See *Oleum Rutæ.*) They contain, also, according to Mähl, chlorophyll, albumen, an azotized substance, extractive, gum, starch or inulin, malic acid, and lignin; and, according to Bornträger, a peculiar acid which he calls *rutinic acid.* (*Chem. Gazette*, Sept. 1845, p. 385.) Rutinic acid is the colouring principle of rue, and has been found in various other plants. It was thought, at one time, that it might be identical with quercitrin; but, though analogous to that principle, it has been shown to be distinct. Like quercitrin, it seems to play an important part in the colouring of plants. (*Journ. de Pharm.*, Août, 1862, p. 165.) Both alcohol and water extract their active properties.

Medical Properties and Uses. Rue is stimulant and antispasmodic, and, like most other substances which excite the circulation, occasionally increases the secretions,

especially when deficient from debility. It appears to have a tendency to act upon the uterus; in moderate doses proving emmenagogue, and in larger, producing a degree of irritation in the organ which sometimes determines abortion. Taken very largely it acts as an acrid narcotic poison. Three cases are recorded by Dr. Hélie in which it was taken by pregnant women, with the effect of producing dangerous gastro-intestinal inflammation and cerebral derangement, which continued for several days, but ended at length in recovery. In each instance miscarriage resulted. Great depression and slowness of the pulse attended the narcotic action of the poison. In one of these cases, three fresh roots of the size of the finger were used in the form of decoction. (*Ann. d'Hyg. Pub. et de Méd. Lég.*, xx. 180.) A case is recorded by Dr. G. F. Cooper in the *Nashville Journ. of Med. and Surg.*, in which a man, convalescent from dysentery, having added some brandy to a handful of the bruised herb, expressed it, and took the whole of the liquor, with fatal effects. The prominent symptoms were vomiting, violent tormina, tenesmus with bloody stools, abdominal distension with tenderness, and severe strangury. (*Med. Exam.*, N.S., ix. 720.) Rue is sometimes used in hysterical affections, worms, flatulent colic, and amenorrhœa, particularly in the last complaint. It has also been highly recommended in uterine hemorrhage, especially when dependent on an atonic state of the organ. The ancients employed it as a condiment, and believed it to possess, besides other valuable properties, that of resisting the action of poisons. Its excitant and irritating properties require that it should be used with caution. The dose of the powder is from fifteen to thirty grains two or three times a day. The medicine is also given in infusion and in extract.

Off. Prep. Oleum Rutæ. *U.S.* W.

SABADILLA. *U.S., Br.*

Cevadilla.

The seed of Veratrum Sabadilla (*Retzius*). *U.S.* The dried Fruit of Asagræa officinalis. *Lind.* Imported from Mexico. *Br.*

Cévadille, *Fr.;* Sabadillsame, *Germ.;* Cebadilla, *Span.*

There has been much uncertainty in relation to the botanical origin of cevadilla. At one time it was generally believed to be derived from *Veratrum Sabadilla*, which is recognised in the U. S. Pharmacopœia. But Schiede, during his travels in Mexico, ascertained that it was, in part at least, collected from a different plant, of the same natural order of Melanthaceæ, growing upon the eastern declivity of the Mexican Andes. This was considered by Schlechtendahl as another species of Veratrum, by Don as an Helonias, and by Lindley as belonging to a new genus which he named Asagræa. Hence it has been variously denominated *Veratrum officinale*, *Helonias officinalis*, and *Asagræa officinalis*. The Edinburgh College recognised this plant, under Don's title of Helonias officinalis, as one of the sources of cevadilla; in the present British Pharmacopœia it is admitted, under Lindley's name of Asagræa officinalis, as the only source. More exact information, however, is wanted before we can determine its precise origin. It has been adopted in the Pharmacopœias solely on account of its employment in the preparation of veratria. It is brought from Vera Cruz.*

* Until more definite information is obtained on the subject, we give in a note a brief description of the two plants above referred to.

Veratrum Sabadilla. Retzius, *Obs.* i. 31; Carson, *Illust. of Med. Bot.* ii. 50, pl. 94. See *Veratrum Album.* The leaves of this plant are numerous, ovate-oblong, obtuse, with from eight to fourteen ribs, glaucous beneath, and all radical. The flower-stem is erect, simple, and round, rises three or four feet in height, and bears a spreading, simple, or but slightly branched panicle of somewhat nodding flowers, supported upon very short pedicels. The flowers, which are of a blackish-purple colour, approximate in twos and threes, the fertile turning at length to one side, and the sterile falling off. The segments of the corolla are ovate-lanceolate, and without veins. The capsules occupy only one side of the stem. This plant grows in Mexico and the West Indies, and was cultivated by Descourtilz at San Domingo, from seeds obtained in Mexico.

Asagræa officinalis. Lindley, *Botan. Reg.*, June, 1839.— *Veratrum officinale.* Schlechtendahl, *Linnæa*, vi. 45.— *Helonias officinalis.* Don, *Ed. New Philos. Journ.*, October, 1832, p. 234. The following is the generic character given by Lindley. "*Flowers* polygamous, racemose, naked.

Cevadilla seeds usually occur in commerce mixed with the fruit. This consists of three coalescing capsules or follicles, which open above, and appear like a single capsule with three cells. It is three or four lines long and a line and a half in thickness, obtuse at the base, light-brown or yellowish, smooth, and in each capsule contains one or two seeds. A resemblance, existing or supposed, between this fruit and that of barley is said to have given rise to the Spanish name cevadilla, which is a diminutive of barley. The seeds are elongated, pointed at each end, flat on one side and convex on the other, somewhat curved, two or three lines long, wrinkled, slightly winged, black or dark-brown on the outside, whitish within, hard, inodorous, and of an exceedingly acrid, burning, and durable taste. Cevadilla was found by Pelletier and Caventou to contain a peculiar organic alkali which they named *veratria*, combined with gallic acid; fatty matter, consisting of olein, stearin, and a peculiar volatile fatty acid denominated *cevadic* or *sabadillic acid;* wax; yellow colouring matter; gum; lignin; and salts of potassa and of lime, with a little silica. From 100 parts of the seeds, separated from their capsules, Meissner obtained 0·58 of veratria. M. Couërbe discovered another alkaloid in the seeds, which he denominated *sabadillin;* and a third has been found by M. Weigelin, and named *sabatrine.** Besides the principles above mentioned, a peculiar acid was discovered by Merck, called *veratric acid*, which is in colourless crystals, fusible and volatilizable without decomposition, but slightly soluble in cold water, more soluble in hot water, soluble in alcohol, insoluble in ether, having the properties of reddening litmus paper, and forming soluble salts with the alkalies. For an account of the mode of preparing veratria, its properties, and remedial applications, and for a more particular notice of sabadillin (*sabadillia*), see *Veratria* in *Part II.*

Medical Properties and Uses. Cevadilla is an acrid, drastic emeto-cathartic, operating occasionally with great violence, and in overdoses capable of producing fatal effects. It was known as a medicine in Europe so early as the year 1572; but has never been much employed. It has been used chiefly as an anthelmintic, especially in cases of tænia, in which it has been given in doses varying from five to thirty grains. It has also been given in different nervous affections. It is the principal ingredient of the *pulvis Capucinorum*, sometimes used in Europe for the destruction of vermin in the hair. It is considered by the Mexicans useful in hydrophobia, and was em-

Perianth six-partite, segments linear, veinless, almost equal, with a nectariferous excavation at the base, equal to the stamens. *Stamens* alternately shorter; anthers cordate as if unilocular, after dehiscence shield-shaped. *Ovaries* three, quite simple, attenuated into an obscure stigma. *Follicles* three, acuminate, papery; seeds scimitar-shaped, corrugated, winged. Bulbous herbs, with grass-like leaves, and small, pale, and densely racemed flowers. *A. officinalis*, which is the only known species, has linear, acuminate, subcarinate leaves, roughish at the margin, and four feet in length by three lines in breadth, and a round flower-stem, about six feet high, terminating in a very dense, straight, spike-like raceme, eighteen inches long. The flowers are white, with yellow anthers.

* *Sabadillia* (*Sabadilline*). *Sabatria* (*Sabatrine*). The following is the result of M. Weigelin's investigations. The seeds were exhausted by boiling water acidulated with sulphuric acid; and to the decoction, after concentration, alcohol was added to precipitate the mucilaginous parts. After 20 hours of rest and decantation, the alcohol was separated by distillation, the liquid left was filtered, and precipitated by ammonia at a boiling heat. A yellowish granular precipitate was thus obtained. To separate this from veratria, it was dissolved in ether, which on evaporation abandoned a reddish resin, and this by a series of solutions in alcohol, and precipitations in water, was changed to a white powder.

The ammoniacal solution filtered contains the sabatria, which is taken from it by agitation with amylic alcohol, distilling, taking up with alcohol the blackish residue, adding an equal bulk of water, decolorizing by animal charcoal, filtering, distilling off the alcohol, and adding ammonia to the watery residue. The product thus obtained was a resin, which was dissolved by ether. The sabatria is dissolved, and impure sabadillia remains.

The sabadillia may be obtained crystallized in benzine, but not in alcohol or water. It is not altogether insoluble in ether. In concentrated sulphuric acid it is dissolved with a red colour. Ammonia does not precipitate it from its solutions. Benzine and amylic alcohol take it from its acid or alkaline solutions. Its aqueous solution produces no reaction with bichromate, sulphocyanide, the ferrocyanide, and iodide of potassium, nor with the chloride of platinum, picric acid or phosphate of sodium. It is neither sternutatory nor emetic. It accelerates the heart's pulsations. Its formula is $C_{41}H_{66}N_2O_{13}$. Its chloraurate is amorphous, and its chlorhydrate gummy and colourless, as also is the sulphate.

The *sabatria* which is met with in the sabadillin of commerce, and which may be separated by ether, has the composition $C_{51}H_{86}N_2O_{17}$. Its reactions are the same as those of sabadillia, as well as its physiological action. The veratria of commerce always contains sabadillia and sabatria. (*Ann. de Thérap.*, 1873, p. 40.)—*Note to the fourteenth edition.*

ployed by M. Fouilhoux, of Lyons, in a supposed case of that disease, in the dose of about nine grains, with asserted success. Externally applied, it is highly irritating, and is even said to be corrosive. Its chief employment at present is for the preparation of veratria.

Off. Prep. Veratria. W.

SABBATIA. *U. S. Secondary.*

Sabbatia. American Centaury.

The herb of Sabbatia angularis (Pursh, *Flor. Amer. Sept.*). *U. S.*

Sabbatia. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Gentianaceæ.

Gen. Ch. Calyx five to twelve-parted. *Corolla* rotate, five to twelve-parted. *Stigmas* two, spiral. *Anthers* at length revolute. *Capsule* one-celled, two-valved, many-seeded. *Nuttall.*

Sabbatia angularis. Pursh, *Flor. Am. Sept.* 137; Bigelow, *Am. Med. Bot.* iii. 147; Barton, *Med. Bot.* i. 255.—*Chironia angularis.* Linn. The American centaury is an annual or biennial herbaceous plant, with a fibrous root, and an erect, smooth, four-sided stem, winged at the angles, simple below, sending off opposite axillary branches above, and one or two feet in height. The leaves, which vary considerably in length and width, are ovate, entire, acute, nerved, smooth, opposite, and sessile, embracing half the circumference of the stem at their base. The flowers are numerous, growing on the ends of the branches, and forming together a large terminal corymb. The calyx is divided into five lanceolate segments, considerably shorter than the corolla. This is deeply five-parted, with obovate segments of a delicate rose-colour, which is paler and almost white in the middle of their under-surface. The anthers are yellow, and, after shedding their pollen, become revolute. The style, which is bent downward, and is longer than the stamens, terminates in two linear stigmas, which become spirally twisted together. The plant is widely diffused through the Middle and Southern States, growing in low meadow grounds, and, in wet seasons, upon uplands, in woods, and neglected fields. It flowers in July and August. In its general aspect as well as medical properties, it bears a close resemblance to *Erythræa Centaurium*, or European centaury, for which it was mistaken by the earlier settlers. The whole herb is employed, and should be collected when in flower.

All parts of it have a strongly bitter taste, without any admixture of astringency, or other peculiar flavour. Both alcohol and water extract its bitterness, together with its medical virtues. It has been examined by Mr. John F. Huneker, who, in his inaugural essay, states that he has found in it a small proportion of erythrocentaurin previously discovered by M. Méhu, a French chemist, in Erythræa Centaurium of Europe. Mr. Huneker also obtained from American centaury, resin, chlorophyll, fatty matter, gum, albumen, pectin, bitter extractive, traces of volatile oil, an organic acid, red colouring matter, and salts. (*Am. Journ. of Pharm.*, May, 1871, p. 207.)

Medical Properties and Uses. American centaury has the tonic properties of the simple bitters, and is very analogous in its action to the other plants of the same natural family. It has long been popularly employed as a prophylactic and remedy in our autumnal intermittent and remittent fevers; and was formerly much esteemed by some physicians in the latter of these complaints. The condition to which it was considered applicable was that existing between the paroxysms, when the remission was such as to call for tonics, but was not deemed sufficient to justify a resort to the preparations of Peruvian bark. It is occasionally useful, during the progress of a slow convalescence, by promoting appetite and invigorating digestion; and may be employed for the same purpose in dyspepsia and diseases of debility. The most convenient form for administration is that of infusion. A pint of boiling water, poured on an ounce of the herb and allowed to cool, may be given in the dose of two fluid-ounces, repeated every hour or two during the remission of fevers, and less frequently in chronic affections. The dose of the powder is from thirty grains to a drachm. The decoction, extract, and tincture are also efficient preparations. W.

SABINA. *U. S.*

Savine.

The tops of Juniperus Sabina. *U. S.*

Off. Syn. SABINÆ CACUMINA. *Savine Tops.* The fresh and dried tops of Juniperus Sabina. *Linn.* Collected in spring, from plants cultivated in Britain. *Br.* Sabine, *Fr.;* Sevenbaum, *Germ.;* Sabina, *Ital., Span.*

JUNIPERUS. See JUNIPERUS.

Juniperus Sabina. Willd. *Sp. Plant.* iv. 852; Woodv. *Med. Bot.* p. 10, t. 5. This is an evergreen shrub, from three to fifteen feet high, with numerous erect, pliant branches, much subdivided. The bark of the young branches is light-green, that of the trunk rough, and reddish-brown. The leaves, which completely invest the younger branches, are numerous, small, erect, firm, smooth, pointed, dark-green, glandular in the middle, opposite, and imbricated in four rows. The flowers are male and female on different trees. The fruit is a blackish-purple berry, of an ovoid shape, marked with tubercles and the remains of the calyx and petals, and containing three seeds.

The savine is a native of the south of Europe and the Levant, and is said to grow wild in the neighbourhood of our northwestern lakes. The ends of the branches, and the leaves by which they are invested, are collected for medical use in the spring. When dried they fade very much in colour.

The tops of *Juniperus Virginiana*, or common red cedar, are sometimes substituted in the shops for savine, to which they bear so close a resemblance as to be with difficulty distinguished. The two species, however, differ in their taste and smell. In *J. Virginiana*, moreover, the leaves are sometimes ternate.

The tops and leaves of the savine plant have a strong, heavy, disagreeable odour, and a bitter, acrid taste. These properties, which are less striking in the dried than the recent leaves, are owing to a volatile oil, which is obtained by distillation with water. (See *Oleum Sabinæ.*) The leaves impart their virtues to alcohol and water. From an analysis by Mr. C. H. Needles, they appear to contain volatile oil, gum, tannic or gallic acid, resin, chlorophyll, fixed oil, bitter extractive, lime, and salts of potassa. (*Am. Journ. of Pharm.*, xiii. 15.)

Medical Properties and Uses. Savine is highly stimulant, increasing most of the secretions, especially those of the skin and uterus, to the latter of which it is supposed to have a peculiar direction. It has been much used in amenorrhœa, and occasionally as a remedy for worms. The late Professor Chapman strongly recommended it in chronic rheumatism; and it is employed in Germany, both internally and externally, in chronic gout. In overdoses it may produce dangerous gastro-intestinal inflammation, and should therefore be used with caution. In no case should it be employed when much general or local excitement exists. In pregnancy it should always be given with great caution; though it has recently been recommended as an effective remedy in certain forms of menorrhagia, and is asserted to prove occasionally useful in preventing threatened abortion. (See *Am. Journ. of Med. Sci.*, N. S., viii. 475.) It may be conveniently administered in the form of powder, of which the dose is from five to fifteen grains, three or four times a day. A fluid extract is now among the preparations in the U. S. Pharmacopœia. It may be given in the same number of drops.

As an external irritant, savine is useful, in the form of cerate, for maintaining a discharge from blistered surfaces; but as the preparation sold in this country under the name of savine ointment is often feeble, either from the age of the drug, or the substitution of red cedar, it has in some measure fallen into disrepute. (See *Ceratum Sabinæ.*) In powder or infusion, savine is used in Europe as an application to warts, indolent, carious, and gangrenous ulcers, psora, and tinea capitis; and the expressed juice of the fresh leaves, diluted with water, is sometimes applied to similar purposes.

Off. Prep. Ceratum Sabinæ, *U. S.;* Extractum Sabinæ Fluidum, *U. S.;* Oleum Sabinæ; Tinctura Sabinæ, *Br.;* Unguentum Sabinæ, *Br.* W.

SACCHARUM. *U. S.*

Sugar.

The sugar of Saccharum officinarum, refined. *U. S.*

Off. Syn. SACCHARUM PURIFICATUM. *Refined Sugar*, $C_{24}H_{22}O_{22}$. Pure cane sugar prepared from the juice of the stem of Saccharum Officinarum. *Br.*

White sugar; Sucre pur, Sucre en pains, *Fr.;* Weisser Zucker, *Germ.;* Zucchero en pane, *Ital.;* Azucar de pilon, Azucar refinado, *Span.*

SYRUPUS FUSCUS. *U. S.*

Molasses.

The impure, dark-coloured syrup, obtained in making sugar from Saccharum officinarum. *U. S.*

Off. Syn. THERIACA. *Treacle.* SACCHARI FÆX, *Lond.* The uncrystallized residue of the refining of sugar. *Br.*

Mélasse, *Fr.;* Zuckersatz, Zukersyrup, *Germ.;* Melazzo, *Ital.;* Melaca, *Span.*

Among the saccharine principles distinguished by the chemist are cane sugar, or sugar properly so called, derived from the sugar cane, the beet, and the sugar maple; glucose or grape sugar, with which starch sugar, diabetic sugar, the crystallizable sugar of honey, and the saccharine matter of the glucosides are identical; uncrystallizable sugar; sorbite, from the berries of the mountain ash (*Sorbus acuparia*); lactin, or sugar of milk; inosite, or sugar of muscular flesh; mannite, with which mushroom sugar is identical; and glycerin. *Glucose* or *grape sugar* is conveniently obtained by spreading crystalline honey on porous tiles, dissolving what remains on their surface in alcohol, and crystallizing. The product is about one-fourth of the weight of the honey. It is also largely prepared from starch by the action of very weak sulphuric acid at a high temperature. (See *Am. Journ. of Pharm.*, Jan. 1866, p. 1.)* Glucose, as obtained from a concentrated syrup, is in the form of crystalline grains; but, when crystallized from its alcoholic solution, it has the shape of square tables or cubes. It is less sweet than cane sugar. It is also less soluble in water, and much more soluble in alcohol. It has the sp. gr. 1·386. Strong mineral acids hardly act on grape sugar, but destroy cane sugar with facility. On the other hand, grape sugar is destroyed by alkalies, with which cane sugar forms definite compounds. Dissolved in water and subjected to prolonged ebullition, grape sugar undergoes very little alteration. Its solution rotates the plane of polarization of polarized light to the right, and is capable of undergoing the vinous fermentation directly, without passing through any intermediate state. It is characterized, also, in boiling solution, by reducing the potassa-tartrate of copper, and by becoming brown by the action of the alkalies. The name of *glucosides* has been given to certain organic substances which are resolvable, by the presence of acids, or other slight chemical influence, into glucose and some other proximate principle, as in the instance of tannic acid, which is resolved into glucose and gallic acid. *Uncrystallizable sugar* (*fruit sugar* or *chulariose*), an isomeric form of glucose, found in honey and the juice of fruits, is generated from cane sugar by solution in water or weak acids, and long boiling. Hence it is present in molasses. An aqueous solution of this sugar turns the plane of polarization to the left, and, like grape sugar, is susceptible of the vinous fermentation without an intermediate change. In consequence of this effect on polarized light, it has been named by the French chemists *inverse sugar* (*sucre interverté*); its rotatory power being the reverse of that of the sugar from which it is produced. Uncrystallizable sugar is transformed into grape sugar, when it is made to assume a crystalline structure, but not by mere solidification.† (*Soubeiran.*) A solution of *cane sugar*,

* See also *Pharm. Journ. and Trans.* (Oct. 1870, p. 323), for an elaborate account, by Prof. Charles A. Joy, of different methods of preparing glucose, and of its use in the arts, which have become extensive and important. (*Note to the fourteenth edition.*)

† In relation to this variety there has been considerable difference of opinion. It has even been doubted whether it is a distinct form of sugar, or a mixture of others. The question of its indi-

like that of grape sugar, has a rotating power to the right. When it ferments, it is not, as is generally supposed, first converted into grape sugar. It is found both by Mitscherlich and Soubeiran to be first changed into uncrystallizable sugar; and, as the change proceeds, the rotating power to the right of the cane sugar gradually lessens and disappears, and is replaced by the rotating power to the left of the uncrystallizable sugar formed. *Sorbin*, discovered by M. Pelouze, is in perfectly transparent crystals, having the same taste as cane sugar, but is not susceptible of fermentation. *Lactin*, or *sugar of milk*, is now officinal. (See *Saccharum Lactis.*) *Inosite* is a sugar found in the juice of flesh. For a description of *mannite* and *glycerin*, see the articles *Manna* and *Glycerina.*

Besides the sugars enumerated, chemical writers mention *dulcose* (*dulcite* or *dulcin*), a substance like mannite from an unknown plant of Madagascar; *phycite*, obtained from Protococcus vulgaris; *quercite*, obtained from acorns; *melampyrite*, from *Melampyrum nemorosum* and other Scrophularineæ; *mycose* or the sugar of ergot; *melitose*, the peculiar sugar of Australian manna, at first thought to be grape sugar; *trehalose*, the crystallizable principle of Turkish manna; *melizotose*, in Briançon manna; *pinite*, obtained from a sugar of California, said to be derived from Pinus Lambertiana; and *phaseomannite*, obtained from kidney beans before they are ripe. Of these saccharine substances, melitose, trehalose, mycose, and melizotose, though differing in some of their properties from cane sugar, agree with it in composition, and in the property of being modified by acids, and transformed into sugars analogous to glucose. (Berthelot, *Journ. de Pharm.*, Oct. 1858, p. 292.)* In relation to *melampyrite*, the latest researches give reason to think that it is identical with dulcite. (Gmelin, *Handbook*, xv. 543.)

Cane sugar is manufactured extensively on the continent of Europe from the beet, and in considerable quantities, in Canada and the northern and northwestern parts of the United States, from the sap of the sugar maple (*Acer saccharinum*). In the year 1850, according to the census returns, thirty-four millions of pounds of crude maple sugar were made within the limits of the United States.† Cane sugar may also be obtained from cornstalks, and from the *Chinese sugar cane*, or *Sorghus saccharatus.* The juice of the latter contains from 10 to 16 per cent. of sugar, crystallizable and uncrystallizable, the latter greatly predominating. Hence it is not well suited to produce crystallized sugar, but yields molasses abundantly. It also affords good grain for bread, and excellent fodder for domestic animals. In India sugar is made from the sap of different species of palm. In 1844 more than 6000 tons of crude *palm sugar*, called *jaggary*, were manufactured. It is more easily refined, and at less cost than the sugar from the cane. (*Stevens.*) But the supply of sugar from these sources is insignificant, when compared with that obtained from the sugar cane itself, which is extensively cultivated in the East and West Indies, Brazil, and some of our Southern States, particularly Louisiana. This plant is the *Saccharum officinarum* of botanists, and is the source of the officinal sugar of the Pharmacopœias.

SACCHARUM. *Sex. Syst.* Triandria Digynia.—*Nat. Ord.* Graminaceæ.

Gen. Ch. Calyx two-valved, involucred, with long down. *Corolla* two-valved. *Willd.*

Saccharum officinarum. Willd. *Sp. Plant.* i. 321; *Philos. Trans.* lxix. 207. The *sugar cane* is an herbaceous plant, possessing a jointed, succulent root, from which arise several shining, jointed, solid stems, from an inch to two inches in diameter, and from six to twelve feet high, and containing a white and juicy pith. The colour of the stem is yellow, greenish-yellow, purple, or striped. The joints are about three inches apart, and give origin to the leaves, which embrace the stem at their base, are three or four feet long and about an inch wide, flat, acuminate, longitudinally striated, furnished with a white midrib, glabrous, finely dentate, and of a green

viduality has been examined by M. E. J. Maumené, who appears to have determined it indisputably in favour of the distinct character of this variety. See a paper by M. Maumené, in the *Journ. de Pharm.* (Mars, 1870, p. 227).—*Note to the fourteenth edition.*

* In relation to the fermentation of several of the sugars, in presence of chalk and certain animal substances, such as cheese, &c., the reader is referred to some interesting observations of M. Berthelot, contained in the *Journ. de Pharm.* for Oct. 1856.

† In regard to the preparation of maple sugar, see a paper by Dr. Geo. D. Gibb in the *Br. Am. Journ. of Med. Sci.* (July, 1851), and another by M. J. B. Avequin in the *Am. Journ. of Pharm.* (Jan. 1858, p. 72).—*Note to the twelfth edition.*

colour inclining to yellow. The flowers are pinkish, surrounded by a long silky down, and disposed in a large, terminal, nearly pyramidal panicle, composed of subdivided spikes, and two or three feet in length. The plant has a general resemblance to the Indian corn. Four varieties are mentioned; 1. the *common*, with a yellow stem; 2. the *purple*, with a purple stem and richer juice; 3. the *gigantic*, with a very large light-coloured stem; and 4. the *Otaheitan*, which was introduced into the West Indies from the island of Tahiti (Otaheite) by Bougainville and Bligh, and is distinguished by its greater height, the longer intervals between its joints, and the greater length of the hairs which surround the flowers.

The sugar cane is cultivated by cuttings, which are planted in rows, and which, by giving rise to successive shoots, furnish five or six crops before the plants require to be renewed. At the end of a year the plant generally flowers, and in four or five months afterwards the canes are completely ripe, at which time they have a yellowish colour, and contain a sweet viscid juice. The quantity of sugar which they yield is variable. According to Avequin, of New Orleans, the proportion of cane sugar in the recent stalk is about 10 per cent., of uncrystallizable sugar from 3½ to 4 per cent. Cane juice is said to contain from 17 to 23 per cent. of crystallizable sugar, though scarcely 7 per cent. is extracted in practice.

Preparation and Purification. The canes, when ripe, are cut down close to the earth, topped, and stripped of their leaves, and then crushed between vertical iron rollers in a mill. The juice constituting 90 per cent. of the cane, though scarcely 50 per cent. is actually obtained, is of a pale-greenish colour, sweet taste, and balsamic odour, and has a sp. gr. varying from 1·033 to 1·106. As it runs out it is received in suitable vessels, and, being quickly removed, is *immediately* mixed with lime, in the form of milk of lime, in the proportion of about 1 part of the earth to 800 of the juice, and heated in a boiler to 140°. The exact proportion of the lime cannot be determined, as the juice varies in quality in different seasons; but the manufacturer should aim at making the liquor neutral, or very slightly alkaline. The gluten and albumen rise to the top, and form a thick scum, from underneath which the liquid is drawn off by a cock into a copper boiler, where it is concentrated by heat, the scum being carefully skimmed off as it forms. Filtering the juice through cloth filters before heating it is advantageous. When sufficiently concentrated, the juice is transferred to shallow vessels called coolers, from which, when it assumes a granular aspect, it is drawn off into wooden vessels with perforated bottoms, the holes in which are temporarily plugged. At the end of twenty-four hours, the liquid is strongly agitated with wooden stirrers, in order to accelerate the granulation of the sugar, which is completed in six hours. The stoppers are now removed, and the syrup is allowed to drain off from the sugar, which in this state is granular, of a yellowish colour, and moist. It is next dried in the sun, and being introduced into hogsheads, forms the *brown sugar* of commerce. The syrup, by a new evaporation, furnishes an additional portion of sugar; and the liquid which finally remains, incapable of yielding more sugar with advantage, is called *molasses*. Eight pounds of the juice yield, on an average, one pound of brown sugar. In the process of extraction, it is important that the juice should be concentrated by a moderate heat; as a high temperature causes more of the cane sugar to be converted into uncrystallizable sugar, and, therefore, increases the amount of the molasses. This conversion takes place slowly, even in the cold, if the juice is allowed to stand; and hence the importance of manufacturing it at once into sugar. According to M. Maumené, the cane sugar in crude beet juice may be preserved without change by converting it into saccharate of lime; and he supposes that this is true of all vegetable juices, containing cane sugar. In the case of beet juice, he recommends the addition of an amount of slaked lime, equal to half the weight of the sugar supposed to be present; an amount which will be about 5 per cent. of the weight of the juice. When the juice is to be manufactured, the sugar is set free by saturating nine-tenths of the lime with carbonic, phosphoric, or sulphuric acid. (*Journ. de Pharm.*, Nov. 1856.) It may be set free also by animal charcoal, which is now generally employed for the purpose. A mode of evaporating cane juice is said to have been adopted in Antigua by Mr. Alfred Fryer, by which it seems that the change into uncrystallizable sugar is altogether avoided, and a great saving is thus

effected. The precise steps of the process are not given; but it would appear to consist in a very rapid evaporation to absolute dryness, by means of heated air. The sugar thus prepared is in solid mass. (*Chem. News*, June 30, 1865, p. 302.)

Brown sugar is sometimes partially purified by boiling it with lime-water, and, after sufficient concentration, allowing the syrup to crystallize in large inverted conical vessels, pierced at the apex and plugged. The surface of the crystalline mass being covered with a thin mixture of clay and water, the plug is removed, and the water from the clay, percolating the mass, removes the coloured syrup, which flows out at the hole. Sugar, thus prepared, approaches to the white state, and constitutes the clayed sugar of commerce, usually called, in this country, *Havana sugar*.

There is no doubt that a large proportion of the sugar is lost in the ordinary process of manufacture; and several plans have been proposed to prevent this loss. In December, 1847, Dr. John Scoffern, of England, took out a patent for the use of subacetate of lead as a purifying agent, added to the cane juice in the proportion of one-sixth of 1 per cent. When applied to cane juice, it separates the impurities completely, thus avoiding the labour of skimming, and furnishes the whole of the sugar, instead of about one-third, as by the ordinary process. When used in refining operations, it enables the refiner to work up residues, which would not furnish sufficient sugar to repay the cost of the old process. The lead is finally removed from the sugar solutions in the form of sulphite of lead by the action of sulphurous acid gas, forced through them by mechanical means. In this way Dr. Scoffern alleges that the whole of the lead may be separated; but even if it is not, he believes that a minute proportion of sulphite of lead in the sugar would not prove injurious. In this opinion he is supported by several eminent chemists and physicians; but the position is controverted by others equally eminent, and, we think, on just grounds; as we should feel doubt of the wholesomeness of an aliment so extensively used as sugar, containing a proportion of lead, however minute. Such is the view taken in France, where the process of Dr. Scoffern is prohibited. Another patented process for the defecation of cane juice, and of the syrups of sugar refineries, is that of R. & J. Oxland, in which acetate of aluminium is used. The details of the process are given in the *Chem. Gazette* for Nov. 16, 1849, to which the reader is referred. M. Melsens, of Brussels, has proposed a third process, which consists in the use of bisulphite of calcium. This salt is alleged to act as an antiseptic, preventing the operation of any ferment; as an absorber of oxygen, opposing the action of that gas on the juice; as a clarifier, rendering insoluble at 212° all coagulable matters; as a bleacher of pre-existing colouring matters, and a preventive of the formation of new ones; and, lastly, as a substance furnishing a base to neutralize hurtful acids, which unite with the lime, displacing the weaker sulphurous acid. M. Melsens admits that he has made his experiments with cane juice on a small scale only, and, therefore, leaves the application of the principles of his method to the intelligence of the manufacturers themselves. M. Emil Pfeiffer has proposed another refining process, which consists in the use of superphosphate of calcium, an agent previously recommended by Brande. (See *Chem. Gaz.*, April 15, 1856.) M. Emile Rousseau proposes sulphate of calcium as the best addition to saccharine juices in the manufacture of sugar. This coagulates the albuminous matters. The clear juice is then agitated with hydrated peroxide of iron, which oxidizes and destroys the colouring matters, and, besides, absorbs the alkaline and earthy salts, and removes the small quantity of sulphate of calcium remaining in the solution. (See *Am. Journ. of Pharm.*, Sept. 1862, p. 461.) M. Emile Monnier uses sulphurous acid as the bleaching agent. The acid is obtained by burning sulphur, and is conducted into a chamber which contains the sugar. About 4 parts of sulphur are required for 1000 of sugar. This undergoes no change under the action of the acid. When the operation is completed, the sugar is dissolved in water, and the sulphurous acid neutralized by a little lime. (*Chem. News*, May 15, 1868, p. 234.) M. Reynoso finds alumina the best defecating agent that he has employed; having succeeded by means of it in throwing down almost all impurities at the same time most adhesive and most hurtful. He adds the acid phosphate of aluminium to the cane juice, and decomposes this with lime, by which the phosphate of calcium is produced and alumina separated; and all these, with some

lime in excess, cause the elimination of colouring and nitrogenous matters, so that there only remain in the liquid some of the salts which normally accompany the sugar in the juice. (*Journ. de Pharm.*, 4e sér., ii. 232.)

The refining of brown sugar forms a distinct branch of business, and the methods pursued have undergone many improvements. By the original process, the sugar was boiled with lime-water, and clarified by heating it with bullocks' blood. The clarified syrup was then strained through cloth filters, whereby it was rendered limpid. It was next transferred to a boiler, where it was subjected to ebullition until it was brought to a proper concentration; when it was allowed to cool in conical moulds, and to drain for the separation of the molasses. This last boiling required to be continued so long, that the action of the fire and air frequently decomposed the sugar to such an extent as to cause a loss of 25 per cent. in molasses. This disadvantage led to the abandonment of prolonged boiling; and now the sugar refiners boil the syrup in shallow boilers, which are suspended in such a way as to admit of their being emptied with the greatest quickness, without putting out the fire.

The process of refining was still further improved by Messrs. Philip Taylor and Howard. The former introduced the improvement of heating the syrup with great rapidity, by means of steam made to pass through a series of tubes traversing the boiler; and the latter devised the plan of causing the syrup to boil under a diminished pressure, created by a suction pump, set in motion by a steam engine, while it was heated by steam circulating round the boiler. In this way, the syrup was made to boil at a lower temperature, and with a diminished contact of the air; and the loss of cane sugar by change into uncrystallizable was in great measure avoided.

After the syrup is sufficiently concentrated by any one of these methods, it is transferred to coolers, where it is agitated to cause it to granulate. In this state it is poured into unglazed earthenware moulds of a conical shape, with a hole in the apex, which is stopped with a paper plug. The moulds are placed, with the apex downwards, above stone-ware pots, intended to receive the uncrystallizable syrup. When the mass has completely concreted, the moulds are unstopped, to allow the coloured syrup to drain off. To separate the remains of this syrup, the operation called *claying* is performed. This consists in removing from the base of the loaf a layer of the sugar, about an inch thick, and replacing it with pure sugar in powder, which is covered with a mixture of pipe clay and water of about the consistence of cream. The water gradually leaves the clay, dissolves the pure sugar, and percolates the mass as a pure syrup, removing in its progress the coloured syrup. Sometimes the purification is performed without the use of clay, by allowing a saturated solution of pure sugar to percolate the loaf. When all the coloured syrup is removed, the loaf is taken out of the mould and placed in stoves to dry. It now constitutes *white* or *purified sugar*. The syrup which drains from the loaves contains a considerable quantity of cane sugar, and is used in subsequent operations. The syrups of lowest quality are employed in forming inferior white sugar, from which a syrup finally drains, containing so little cane sugar as not to repay the expense of extracting it. This constitutes *sugar-house molasses*. Good brown sugar, in the process of refining, yields about 70 per cent. of white sugar.

The application of animal charcoal to the refining of sugar is now very extensive, not less than 5000 tons of charred bones being used for this purpose annually in the Clyde refineries, in Scotland. For valuable practical remarks on the use of this agent in the purification of sugar, the reader is referred to a paper by Dr. Wallace in the *Transactions of the Philosophical Society of Glasgow*, copied in the *American Journal of Pharmacy* (Sept. 1868, p. 425).

Commercial History. Cane sugar was known to the ancients. It was originally obtained from India, where it was extracted from the sugar cane. About the period of the Crusades, the Venetians brought it to Europe; but, at that time, it was so scarce and costly as to be used exclusively as a medicine. Upon the discovery of the Cape of Good Hope and the maritime route to the East Indies, the commerce in sugar passed into the hands of the Portuguese. Subsequently, the cultivation of the cane extended to Arabia, Egypt, Sicily, Spain, and the Canaries, and finally, upon the discovery of the new world, to America, where it was pursued with the greatest

success, and continues to be so. In America it is produced most abundantly in the West Indies, which supply the greater part of the consumption of Europe, little comparatively being taken thither from Brazil or the East Indies. The consumption of the United States, before the late war, was more than half supplied by Louisiana and some of the neighbouring States. The crop of sugar of Louisiana, in 1847, was estimated at 240,000 hogsheads; in 1853, at 322,000. The crop of Cuba for the latter year is supposed to have reached 600,000 hogsheads. Latterly, our planters have introduced into Louisiana the variety of cane called the Otaheitan cane, which is hardier and more productive than the common cane, and better suited to the climate of our Southern States.

Properties. Sugar, in a pure state, is a solid of a peculiar grateful taste, permanent in the air, phosphorescent by friction, and of the sp. gr. 1·6. It dissolves readily in half its weight of cold water, and to almost an unlimited extent in boiling water. The solution, when thick and ropy, is called *syrup.* An aqueous solution of sugar, kept in a warm place, has the property of corroding iron, partially immersed in it, just above the line where the surface of the liquid touches the metal; and the solution itself becomes impregnated with protoxide of iron, and of a deep red-brown colour. A similar effect is produced on lead; but zinc and copper are but slightly acted on. (Dr. J. H. Gladstone, *Annals of Pharmacy*, iii. 208.) A solution of sugar possesses the property also of dissolving a large quantity of hydrate of lime, forming a compound, called *syrup of lime.* When a concentrated syrup is gently heated, and spirit added to it, the liquid, on cooling, forms white semi-transparent crystals of hydrated sugar, having the shape of oblique four-sided prisms, and called *sugar-candy.* Sugar is nearly insoluble in absolute alcohol, but dissolves in four times its weight of boiling alcohol, of the sp. gr. 0·83. When heated to 365°, it melts into a viscid, colourless liquid, which, on being suddenly cooled, forms a transparent amorphous mass, called *barley sugar.* At a higher temperature (between 400° and 420°) it loses two eqs. of water, and is converted into a black porous mass, having a high lustre, called *caramel.** At a still higher heat it yields combustible gases, carbonic acid, empyreumatic oil, and acetic acid; and there remains one-fourth of its weight of charcoal, which burns without residue. Sugar renders the fixed and volatile oils to a certain extent miscible with water, and forms with the latter an imperfect combination, called in pharmacy *oleo-saccharum.* When in solution, it is not precipitated by subacetate of lead, a negative property which distinguishes it from most other organic principles.

Tests. Cane sugar may be distinguished from grape sugar by Trommer's test, which consists in the use of sulphate of copper and caustic potassa. If a solution of cane sugar be mixed with a solution of sulphate of copper, and potassa be added in excess, a deep-blue liquid is obtained, which, on being heated, lets fall, after a time, a little red powder. A solution of grape sugar, similarly treated, yields, by heat, a copious greenish precipitate, which rapidly changes to scarlet, and eventually to dark-red. Prof. Böttger finds that, when a liquid containing grape sugar is boiled with carbonate of sodium and some basic nitrate of bismuth, a gray coloration or blackening of reduced bismuth is produced. Cane sugar, similarly treated, has no effect on the test. Dr. Donaldson's test for sugar in the *animal fluids* is formed of 5 parts of carbonate of sodium, 5 of caustic potassa, 6 of bitartrate of potassium, 4 of sulphate of copper, and 32 of distilled water. A few drops of this solution, being added to an animal fluid, and the mixture heated over a spirit-lamp, a yellowish-green colour is developed, if sugar be present. J. Horsley's test for sugar in diabetic urine is an alkaline solution of chromate of potassium, a few drops of which, boiled with the urine, will make it assume a deep sap-green colour. M. J. Nicklés points out, in the bichloride of carbon, obtained by decomposing sulphide of carbon by chlorine and aqueous vapour, a new test for distinguishing glucose and cane sugar.

* A colouring substance called *caramel brown* is now largely manufactured from sugar by decomposing it by means of heat carefully applied, with manipulations calculated to ensure a uniform product. It is in the form either of a stiff paste, in which it is used for colouring leather, or in that of a syrup, for colouring liquids. For the precise mode of preparation, see a paper by Mr. Thos. Sherlock in the *Chemical News* for June 7, 1867 (p. 282). It may be made either from cane sugar, molasses, or glucose. (*Note to the thirteenth edition.*)

This test mixed with cane sugar in a glass tube, kept for some time near 212°, causes a darkening of the sugar, gradually increasing till it becomes black. Glucose undergoes no such change. (*Journ. de Pharm.*, 4e sér., iii. 119.)

Action of Acids and Alkalies, &c. The mineral acids act differently on cane sugar, according as they are concentrated or dilute. Strong nitric acid, with the assistance of heat, converts it into oxalic acid. (See *Oxalic Acid, page* 60.) The same acid, when weak, converts it into *saccharic acid*, confounded by Scheele with malic acid. Concentrated muriatic or sulphuric acid chars it. Diluted muriatic acid, when boiled with cane sugar, converts it into a solid, brown, gelatinous mass. Weak sulphuric acid, by a prolonged action at a high temperature, converts cane sugar, first into uncrystallizable sugar, afterwards into grape sugar, and finally into two substances, analogous to ulmin and ulmic acid, called *sacchulmin* and *sacchulmic acid*. Vegetable acids are supposed to act in a similar way. Maumené has found that cane sugar undergoes the change into uncrystallizable sugar when kept for a long time in aqueous solution, as well as when heated with acids. When the boiling with acids is prolonged for several days in open vessels, oxygen is absorbed, and, besides sacchulmin and sacchulmic acid, formic acid is generated. Soubeiran admits the change of the uncrystallizable into grape sugar, but attributes it to a molecular transformation of the sugar, independently of the action of the acid; as, according to his observation, the conversion takes place only after rest. In confirmation of his views, this chemist states that he found the same changes to be produced by boiling sugar with water alone. Not only does cane sugar change into the uncrystallizable when boiled with water; but, as clearly shown by an experiment of M. E. M. Rault, in aqueous solution, under the influence of light, at ordinary temperatures, it slowly changes into glucose; but this alteration does not take place in the dark. (*Pharm. Journ.*, Jany. 1872, p. 643.)

Cane sugar unites with the alkalies and some of the alkaline earths, forming definite combinations which render the sugar less liable to change. It also unites with protoxide of lead. Boiled for a long time with aqueous solutions of potassa, lime, or baryta, the liquid becomes brown, formic acid is produced, and two new acids are generated; one brown or black and insoluble in water, called *melassic acid*, the other colourless and very soluble, named *glucic acid*. Alkalies and the alkaline earths are said to lessen the rotatory power of sugar in relation to polarized light; but the sugar recovers its power when the alkali is saturated. (*Journ. de Pharm.*, 4e sér., iv. 314.)

The account above given of the action of acids and alkalies on cane sugar explains the way in which lime acts in the manufacture and refining of sugar. The acids, naturally existing in the saccharine juice, have the effect of converting the cane sugar into uncrystallizable sugar, by which a loss of the former is sustained. The lime, by neutralizing these acids, prevents that result. An excess of lime, however, must be carefully avoided; as it injures the product of cane sugar both in quantity and quality. The change in sugar which precedes fermentation, namely, the conversion of cane sugar into the uncrystallizable kind, points to the necessity of operating on the juice before that process sets in; and hence the advantage of grinding canes immediately after they are cut, and boiling the juice with the least possible delay.

The following is a description of the several forms of sugar in common use, including the two officinal varieties.

Purified or *white sugar*, as obtained on a large scale, is in concrete, somewhat porous masses, called loaves, consisting of an aggregate of small crystalline grains. When carefully refined, it is brittle and pulverulent, perfectly white, inodorous, and possessed of the pure saccharine taste. Cane sugar is sometimes adulterated with starch sugar, which may be detected by adding to a concentrated solution of the suspected sugar, first a small portion of fused potassa, and afterwards, at the boiling temperature, a few drops of nitrate of cobalt. This test, if the cane sugar be pure, will produce a violet-blue precipitate, a reaction prevented by the presence of a small proportion of starch sugar. (*Dr. G. Reich.*)* Indigo is said to be sometimes added

* *Estimation of Cane Sugar and Glucose.* The aqueous solution of a mixture of ferridcyanide of potassium (red prussiate of potassa), with half its weight of hydrate of potassa, has no chemical action on a solution of cane sugar, cold or hot, yet communicates to it, even in very small propor-

by refiners to the purified sugar to give increased brilliance to its whiteness. In such instances, when the sugar is used in preparing syrup, the foam which forms on the surface assumes a blue colour, on exposure to the air. (*Journ. de Pharm.*, 4e sér., ii. 128.)

Unpurified or *brown sugar* is in the form of a coarse powder, more or less moist and sticky, consisting of shining crystalline grains intermixed with lumps, having an orange-yellow colour more or less deep, a sweet, cloying taste, and heavy peculiar smell. It varies very much in quality. The best sort is nearly dry, in large sparkling grains of a clear yellow colour, and possesses much less smell than the inferior kinds. It consists of cane sugar, associated, according to Messrs. Alexander and Morfit, with variable quantities of hygroscopic moisture, uncrystallizable sugar, gum, albumen, extractive, saline matter, and insoluble organic and inorganic substances. (*Chem. Gaz.*, April 15, 1858, p. 153.) Among the inorganic substances is a small proportion of lime. By keeping it becomes soft and gummy, and less sweet, a change attributed to the lime.

Molasses is of two kinds, the West India and sugar-house. *West India molasses* is a black ropy liquid, of a peculiar odour, and sweet empyreumatic taste. When mixed with water and with the skimmings of the vessels used in the manufacture of sugar, it forms a liquor, which, when fermented and distilled, yields rum. *Sugar-house molasses* has the same general appearance as the West India, but is thicker, and has a different flavour. Its sp. gr. is about 1·4, and it contains about 75 per cent. of solid matter. Both kinds of molasses consist of uncrystallizable sugar, more or less cane sugar which has escaped separation in the process of manufacture or refining, and gummy and colouring matter. When the molasses from cane sugar is treated with a boiling, concentrated solution of bichromate of potassium, and boiled, a violent reaction takes place, and the liquid becomes green; but if it be adulterated with only an eighth of starch-sugar molasses, the reaction is prevented, and the colour is not changed. (*Dr. G. Reich.*)

Composition. The following formulas express the composition of the different varieties of sugar, so far as known. *Cane sugar*, $C_{12}H_{11}O_{11}$. Of the same composition are *mycose*, *melitose*, *melizotose*, and *trehalose*, which, as before stated, constitute a group closely analogous to cane sugar, though differing in some of their properties. The formula of *glucose* or grape sugar is $C_{12}H_{12}O_{12}$; and *uncrystallizable sugar*, also named variously *chulariose*, *inverse sugar*, and *levulose*, which is characterized by a left rotatory power in reference to polarized light, has the same composition. With these also agree *sorbite* and *inosite*. The formula of *mannite* and of *dulcite* (dulcin or dulcose) is $C_{12}H_{14}O_{12}$.

Med. and Pharm. Uses, &c. The uses of sugar as an aliment and condiment are numerous. It is nutritious, but not capable of supporting life when taken exclusively as aliment, on account of the absence of nitrogen in its composition. It is a powerful antiseptic, and is used for preserving meat and fish; for which purpose it possesses the advantage of acting in a much less quantity than is requisite of common salt, and of not altering the taste, or impairing the nutritious qualities of the aliment. Prof. Marchand has ascertained that a solution of sugar has no action on the teeth out of the body. It may hence be inferred that the popular notion that sugar is injurious to the teeth is unfounded.

The medical properties of *sugar* are those of a demulcent; and as such it is much

tion, a decided and persistent yellowness. With a solution of glucose or grape sugar it loses its colour slowly if cold, and more rapidly as the temperature is raised. If a few drops be added to a solution of glucose at 140°, the yellow colour at first produced very soon disappears, and, if the heat be raised to 170°, is immediately destroyed. If now the addition continue to be made, the colour will continue to disappear so long as any of the glucose remains. By experiment it was ascertained that 10·98 grammes of the ferridcyanide were sufficient to destroy 1 gramme of sugar converted by muriatic acid into glucose. A normal solution may be made by mixing 10·98 grammes of the ferridcyanide with 5·50 grammes of hydrate of potassa and dissolving this in 100 cubic centimetres of water. Suppose a mixture of cane sugar and glucose to be tested. Dissolve 1 gramme of it in 40 cubic centimetres of water, heat to 160° F., and add one-tenth of the normal solution. If there is much glucose the colour disappears; in which case the solution is to be added by cubic centimetres till the colour ceases to disappear. As many centimetres of the normal liquid as are used, so many hundredths of the 10·98 grammes of the ferridcyanide, and of course of one gramme of glucose, will have been consumed, indicating that quantity of the latter in the mixture. (Gentele, *Journ. de Pharm.*, Mars, 1860, p. 208.)—*Note to the twelfth edition.*

used in catarrhal affections, in the form of candy, syrup, &c. According to M. Provençal, it acts as a powerful antaphrodisiac, when taken in the quantity of a pound or more daily, dissolved in a quart of cold water. For an account of the supposed therapeutic power of the vapour of boiling cane juice, in bronchitis and incipient consumption, applied by living in a sugar-house, the reader is referred to the papers of Dr. S. A. Cartwright, of New Orleans, contained in the 47th and 51st volumes of the *Boston Med. and Surg. Journal.* In pharmacy, sugar is employed to render oils miscible with water, to cover the taste of medicines, to give them consistency, to preserve them from change, and to protect certain ferruginous preparations from oxidation. Accordingly it enters into the composition of the compound infusion of roses, of several mixtures, pills, and powders, of many fluid extracts, syrups, confections, and of all the troches. *Molasses* is used for forming pills, for which it is well fitted, preserving them soft and free from mouldiness, on account of its retentiveness of moisture and antiseptic qualities.

The influence of sugar in preventing changes in organic substances may be ascribed to an extraordinary osmotic power in its solutions, by which infusoria and all other of the lower forms of life, to which fermentative processes are now generally ascribed, are almost instantly destroyed; the organism collapsing through the rapid exosmose of its fluids into the saccharine medium. All the different kinds of sugar susceptible of the alcoholic fermentation have this power. (Dr. Louis Mandl, *Archives Gén. de Méd.*, 5e sér., xvi. 49, Juillet, 1860.) Under the *Off. Prep.* below mentioned, only those preparations are included in which the sugar is essential from its chemical influence.

Off. Prep. of Saccharum. Ferri Carbonas Saccharata, *Br.;* Liquor Calcis Saccharatus, *Br.;* Mistura Ferri Composita, *Br.;* Pilula Ferri Carbonatis, *U. S.;* Pilula Ferri Iodidi, *Br.;* Pilulæ Ferri Iodidi, *U. S.* Syrupus. B.

SACCHARUM LACTIS. *U. S., Br.*

Sugar of Milk.

A crystalline substance obtained from whey. *U. S.* $O_{24}H_{24}O_{24}$. A crystallized sugar obtained from the whey of milk by evaporation. *Br.*

Lactose; Sucre de lait, *Fr.;* Milchzucker, *Germ.*

Sugar of milk, or *lactin*, is found only in milk, of which it forms about 5 per cent. (*Boussingault.*) It is manufactured largely in Switzerland and the Bavarian Alps, as an article of food and for medicinal purposes. In preparing it, milk is first coagulated by the addition of a little dilute sulphuric acid, and the resulting *whey* is evaporated to a syrupy consistence, and set aside for several weeks, in a cool place, to crystallize. The crystals, which constitute the sugar of milk, are then decolorized by animal charcoal and repeated crystallizations.*

Sugar of milk is a hard, somewhat gritty, white substance, crystallized in four-sided prisms, and possessing a slightly sweet taste. In commerce it sometimes occurs in cylindrical masses, in the axis of which is a cord, around which the crystals have been deposited. It dissolves slowly in six parts of cold and three of boiling water, without forming a syrup. It is insoluble in ether, and but slightly soluble in alcohol. Its sp. gr. is 1·54 (1·5, *U. S.*). It is not susceptible of the vinous fermentation by the direct influence of yeast; but, after the action of dilute acids, which first convert it into grape sugar, it is capable of furnishing a spirituous liquor. It is well known that both mares' and cows' milk, after becoming sour, is capable of forming an intoxicating drink, by fermentation. By the action of nitric acid, sugar of milk is converted into mucic (sacchlactic) acid. When anhydrous it consists of $C_{12}H_{11}O_{11}$; when crystallized, of $C_{12}H_{11}O_{11}+HO$. (*Staedeler and Krause.*) These formulas make anhydrous sugar of milk isomeric with cane sugar, and the crystallized with anhydrous grape sugar. Fudakowski has ascertained that sugar of milk, when treated with weak sulphuric acid, is divided into two peculiar saccharine bodies; one crystallizable, and previously noticed by Pasteur (*Comptes Rendus*, xlii. 347), the other new. The latter is more soluble in alcohol than the former, has a sweeter taste,

* For a method of estimating the proportion of lactin in milk, see an article by M. Poggiale in the *Journ. de Pharm.*, Août, 1858, p. 130.

ferments more easily, crystallizes in prisms, while the former is tabular, and has a different polarizing action. (*Journ. de Pharm.*, 4e sér., v. 479; from *Zeitschr. für Chem.*, 1867, p. 32.)

Sugar of milk has been proposed by Dr. Turnbull, of England, as a non-nitrogenous article of diet, in consumption and other pulmonary diseases. Dr. Ruschenberger used it with good effect as nourishment in a case of extreme irritability of stomach, following profuse loss of blood from menorrhagia. (*Trans. of the Philad. Col. of Phys.*, ii. 48.) B.

SAGO. *U. S.*

Sago.

The prepared fecula of the pith of Sagus Rumphii, and of other species of Sagus. *U. S.*

Sagou, *Fr.;* Sago, *Germ., Ital.;* Sagu, *Span.*

Numerous trees, inhabiting the islands and coasts of the Indian Ocean, contain a farinaceous pith, which is applied to the purposes of nutriment by the natives. Such are *Sagus Rumphii*, *Sagus lævis*, *Sagus Ruffia*, *Saguerus Rumphii*, and *Phœnix farinifera*, belonging to the family of *palms;* and *Cycas circinalis*, *Cycas revoluta*, and *Zamia lanuginosa*, belonging to the *Cycadaceæ*. Of these, *Sagus Rumphii*, *Sagus lævis*, and *Saguerus Rumphii* probably contribute to furnish the sago of commerce. Crawford, in his History of the Indian Archipelago, states that it is derived exclusively from *Metroxylon Sagu*, identical with *Sagus Rumphii;* but Roxburgh ascribes the granulated sago to *S. lævis*, and one of the finest kinds is said by Dr. Hamilton to be produced by the *Saguerus Rumphii* of Roxburgh. The farinaceous product of the different species of Cycas, sometimes called *Japan sago*, does not enter into general commerce.

SAGUS. *Sex. Syst.* Monœcia Hexandria.—*Nat. Ord.* Palmaceæ.

Gen. Ch. Common spathe one-valved. *Spadix* branched. MALE. *Calyx* three-leaved. *Corolla* none. *Filaments* dilated. FEMALE. *Calyx* three-leaved, with two of the leaflets bifid. *Corolla* none. *Style* very short. *Stigma* simple. *Nut* tessellated-imbricated, one-seeded. *Willd.*

Sagus Rumphii. Willd. *Sp. Plant.* iv. 404; Carson, *Illust. of Med. Bot.* ii. 44, pl. 88. The *sago palm* is one of the smallest trees of its family. Its extreme height seldom exceeds thirty feet. The trunk is proportionately very thick, quite erect, cylindrical, covered with the remains of the old leafstalks, and surrounded by a beautiful crown of foliage, consisting of numerous, very large, pinnate leaves, extending in all directions from the summit, and curving gracefully downwards. From the basis of the leaves proceed long, divided and subdivided flower and fruit-bearing spadices, having smooth branches. The fruit is a roundish nut, covered with a checkered imbricated coat, and containing a single seed.

The tree is a native of the East India islands, growing in the Peninsula of Malacca, Sumatra, Borneo, Celebes, the Moluccas, and a part of New Guinea. It flourishes best in low and moist situations. Before attaining maturity, the stem consists of a shell, usually about two inches thick, filled with an enormous volume of spongy medullary matter like that of elder. This is gradually absorbed after the appearance of fruit, and the stem ultimately becomes hollow. The greatest age of the tree is not more than thirty years. Large quantities of a kind of sugar called jaggary are procured from its juice. At the proper period of its growth, when the medullary matter is fully developed, and has not yet begun to diminish, the tree is felled, and the trunk cut into billets six or seven feet long, which are split in order to facilitate the extraction of the pith. This is obtained in the state of a coarse powder, which is mixed with water in a trough, having a sieve at the end. The water, loaded with farina, passes through the sieve, and is received in convenient vessels, where it is allowed to stand till the insoluble matter has subsided. It is then strained off; and the farina which is left may be dried into a kind of meal, or moulded into whatever shape may be desired. For the consumption of the natives it is usually formed into cakes of various sizes, which are dried, and exten-

sively sold in the islands. The commercial sago is prepared by forming the meal into a paste with water, and rubbing it into grains. It is produced in the greatest abundance in the Moluccas, but of the finest quality on the eastern coast of Sumatra. The Chinese of Malacca refine it so as to give the grains a fine pearly lustre. Malcolm states that it is also refined in large quantities at Singapore. In this state it is called *pearl sago*, and is in great repute. It is said that not less than five or six hundred pounds of sago are procured from a single tree. (*Crawford.*)

Pearl sago is that which is now generally used. It is in small grains, about the size of a pin's head, hard, whitish, of a light-brown colour, in some instances translucent, inodorous, and with little taste. It may be rendered perfectly white by a solution of chloride of lime. *Common sago* is in larger and browner grains, of more unequal size, of a duller aspect, and frequently mixed with more or less of a dirty-looking powder.

Sago meal is imported into England from the East Indies; but we have met with none in the markets of this country. It is in the form of a fine amylaceous powder, of a whitish colour, with a yellowish or reddish tint, and of a faint but somewhat musty odour.

Common sago is insoluble in cold water, but by long boiling unites with that liquid, becoming at first soft and transparent, and ultimately forming a gelatinous solution. Pearl sago is partially dissolved by cold water, probably owing to heat used in its preparation. Chemically considered, it has the characters of starch. Under the microscope the granules of sago meal appear oval or ovate, and often truncated so as to be more or less mullar-shaped. Many of them are broken, and in most the surface is irregular or tuberculated. They exhibit upon their surface concentric rings, which are much less distinct than in potato starch. The hilum is circular when perfect, and cracks either with a single slit or a cross, or in a stellate manner. The granules of pearl sago are of the same form, but are all ruptured, and exhibit only indistinct traces of the annular lines, having been altered in the process employed in preparing them. Those of common sago are very similar to the particles of sago meal, except that they are perhaps rather less regular and more broken. (*Pereira.*)

Potato starch is sometimes prepared in Europe so as to resemble bleached pearl sago, for which it is sold. But, when examined under the microscope, it exhibits larger granules, which are also more regularly oval or ovate, smoother, less broken, and more distinctly marked with the annular rugæ than those of sago; and the hilum often cracks with two slightly diverging slits.

Sago is used exclusively as an article of diet. Being nutritive, easily digestible, and wholly destitute of irritating properties, it is frequently employed in febrile cases, and in convalescence from acute disorders, in the place of richer and less innocent food. It is given in the liquid state, and in its preparation care should be taken to boil it long in water, and stir it diligently, in order that the grains may be thoroughly dissolved. Should any portion remain undissolved, it should be separated by straining; as it might offend a delicate stomach. A tablespoonful to the pint of water is sufficient for ordinary purposes. The solution may be seasoned with sugar and nutmeg or other spice, and with wine, when these are not contra-indicated. W.

SALIX. *U. S. Secondary.*

Willow.

The bark of Salix alba. *U. S.*

Ecorce de saule, *Fr.;* Weidenrinde, *Germ.;* Corteccia di salcio, *Ital.;* Corteza de sauce, *Span.*

SALIX. *Sex. Syst.* Diœcia Diandria. — *Nat. Ord.* Salicaceæ.

Gen. Ch. MALE. *Amentum* cylindrical. *Calyx* a scale. *Corolla* none. *Glands* of the base nectariferous. FEMALE. *Amentum* cylindrical. *Calyx* a scale. *Corolla* none. *Style* two-cleft. *Capsule*, one-celled, two-valved. *Seeds* downy.

This is an extensive genus, comprising, according to Nuttall, not less than one hundred and thirty species, which, with very few exceptions, are natives of Europe, and of the northern and temperate parts of North America. Though most of them are probably possessed of similar medical properties, only one is recognised as officinal; viz., *S. alba*, which has been introduced into this country. *S. Russelliana*, which

has also been introduced from Europe, is said by Sir James Smith to be the most valuable species. *S. purpurea*, a European species, is stated by Lindley to be the most bitter, and *S. pentandra* is preferred by Nees von Esenbeck. Many native species are in all probability equally active with the foreign; but they have not been sufficiently tried in regular practice to admit of a positive decision. The younger Michaux speaks of the root of *S. nigra*, or *black willow*, as a strong bitter, used in the country for the prevention and cure of intermittents. In consequence of the pliability of the young branches, the willow is well adapted for the manufacture of baskets and other kinds of wicker-work; and several species, native and introduced, are employed for this purpose in the United States. *S. Babylonica*, or *weeping willow*, is a favourite ornamental tree. The degree of bitterness in the bark is probably the best criterion of the value of the several species.

Salix alba. Willd. *Sp. Plant.* iv. 710; Smith, *Flor. Brit.* 1071. The common European or white willow is twenty-five or thirty feet in height, with numerous round spreading branches, the younger of which are silky. The bark of the trunk is cracked and brown, that of the smaller branches smooth and greenish. The leaves are alternate, upon short petioles, lanceolate, pointed, acutely serrate with the lower serratures glandular, pubescent on both sides, and silky beneath. There are no stipules. The flowers appear at the same time with the leaves. The *amenta* are terminal, cylindrical, and elongated, with elliptical-lanceolate, brown, pubescent scales. The stamens are two in number, yellow, and somewhat longer than the scales; the style is short; the stigmas two-parted and thick. The capsule is nearly sessile, ovate, and smooth. The white willow is now very common in this country. It flowers in April and May; and the bark is easily separable throughout the summer.

That obtained from the branches rolls up when dried into the form of a quill, has a brown epidermis, is flexible, fibrous, and of difficult pulverization. Willow bark has a feebly aromatic odour, and a peculiar bitter astringent taste. It yields its active properties to water, with which it forms a reddish-brown decoction. Pelletier and Caventou found, among its ingredients, tannin, resin, a bitter yellow colouring matter, a green fatty matter, gum, wax, lignin, and an organic acid combined with magnesia. The proportion of tannin is so considerable that the bark has been used for tanning leather. A crystalline principle has also been obtained from it, which, having the medical virtues of the willow, has received the name of *salicin*. When pure, it is in white, shining, slender crystals, inodorous, but very bitter, with the peculiar flavour of the bark. It is soluble in cold water, much more so in boiling water, soluble in alcohol, and insoluble in ether and oil of turpentine. It neutralizes neither acids nor salifiable bases, and is not precipitated by any reagent. Concentrated sulphuric acid decomposes it, receiving from it an intense and permanent bright-red colour, and producing a new compound called *rutulin*. It ranks with the glucosides, being resolved by boiling with dilute muriatic and sulphuric acids into grape sugar, saligenin, and a white, tasteless, insoluble resinous substance named *saliretin*. *Saligenin* is a colourless, crystallizable substance, fusible and volatilizable, soluble in water, alcohol, and ether, and if heated above 212°, giving off aqueous vapour and salicylous acid. (*Gmelin's Handbook.*) Nitric acid produces with salicin at first two principles called respectively helicin and helicoidin, and afterwards picric and oxalic acids. (*Journ. de Pharm.*, xxx. 43.) Distilled with bichromate of potassium and sulphuric acid, it yields, among other products, a volatile oleaginous liquid, identical with one of the components of oil of spiræa, and, from its acid properties, denominated *salicylous acid*. This is considered by Dumas as consisting of a peculiar compound radical, called *salicyl*, and hydrogen. The formula of salicyl is $C_{14}H_5O_4$. Salicylous acid has recently come into practical value as a medicine; and will be considered fully in *Part III.* The discovery of salicin is claimed by Buchner, of Germany, and Fontana and Rigatelli, of Italy; but M. Leroux, of France, deserves the credit of having first accurately investigated its properties. Braconnot procured it by adding subacetate of lead to a decoction of the bark, precipitating the excess of lead by sulphuric acid, evaporating the colourless liquid which remained, adding near the end of the process a little animal charcoal previously washed, and filtering the liquor while hot. Upon cooling it deposited the salicin in a crystalline form. (*Journ. de Chimie Médicale*, Jan.

1831.) The following is the process of Merck. A boiling concentrated decoction of the bark is treated with litharge until it becomes nearly colourless. Gum, tannin, and extractive matter, which would impede the crystallization of the salicin, are thus removed from the liquid; while a portion of the oxide is dissolved in union probably with the salicin. To separate this portion of oxide, sulphuric acid is first added and then sulphuret of barium, and the liquor is filtered and evaporated. Salicin is deposited, and may be purified by repeated solution and crystallization. (*Turner's Chemistry.*) Erdmann has given another process. Sixteen ounces of the bark are macerated for twenty-four hours in four quarts of water mixed with two ounces of lime, and the whole is then boiled for half an hour. The process is repeated with the residue. The decoctions having been mixed, and allowed to become clear by subsidence, the liquor is poured off, concentrated to a quart, then digested with eight ounces of ivory-black, filtered, and evaporated to dryness. The extract is exhausted by spirit containing 28 per cent. of alcohol, and the tincture evaporated so that the salicin may crystallize. This is purified by again dissolving, treating with ivory-black, and crystallizing. Merck obtained 251 grains from 16 ounces of the bark and young twigs of *Salix helix*, and Erdmann 300 grains from the same quantity of the bark of *Salix pentandra*. It may probably be obtained from any of the willow barks having a bitter taste. Braconnot procured it from various species of Populus, particularly *P. tremula* or European aspen.

Medical Properties and Uses. The bark of the willow is tonic and astringent, and has been employed as a substitute for Peruvian bark, particularly in intermittent fever. It has attracted much attention from the asserted efficacy of salicin in the cure of this complaint. There seems to be no room to doubt, from the testimony of numerous practitioners in France, Italy, and Germany, that this principle has the property of arresting intermittents; though the ascription to it of equal efficacy with sulphate of quinia was certainly incorrect. It is asserted that, when freely taken, it is passed by the kidneys, and may be separated by alcohol from the residue left on the evaporation of the urine. The bark may be employed in substance or decoction, in the same doses and with the same mode of preparation as cinchona. The dose of salicin is from two to eight grains, to be so repeated that from twenty to forty grains may be taken daily, or in the interval between the paroxysms of an intermittent. Magendie has seen fevers cut short in one day by three doses of six grains each. The decoction of willow has been found beneficial as an external application to foul and indolent ulcers. Salicylous acid and the salicylites have been used in medicine by M. Demartis, of France, and have been found to exert a direct sedative influence on the economy without any previous excitement, which renders them useful in inflammatory and febrile affections. He gave the salicylite of potassium in the dose of about four grains. (*Ann. de Thérap.*, 1854, p. 77.)

W.

SALVIA. *U.S.*

Sage.

The leaves of Salvia officinalis. *U.S.*

Sauge, *Fr.;* Salbey, *Germ.;* Salvia, *Ital., Span.*

Salvia. *Sex. Syst.* Diandria Monogynia. — *Nat. Ord.* Lamiaceæ or Labiatæ. *Gen. Ch. Corolla* unequal. *Filaments* affixed transversely to a pedicel. *Willd.*

Salvia officinalis. Willd. *Sp. Plant.* i. 129; Woodv. *Med. Bot.* p. 352, t. 127. Common garden sage is a perennial plant, about two feet high, with a quadrangular, pubescent, branching, shrubby stem, furnished with opposite, petiolate, ovate-lanceolate, crenulate, wrinkled leaves, of a grayish-green colour, sometimes tinged with red or purple. The flowers are blue, variegated with white and purple; and are disposed on long terminal spikes, in distant whorls, each composed of a few flowers, and accompanied with ovate, acute, deciduous bractes. The calyx is tubular and striated, with two lips, of which the upper has three acute teeth, the under two. The corolla is tubular, bilabiate, ringent, with the upper lip concave, and the lower divided into three rounded lobes, of which the middle is the largest. The filaments are supported upon short pedicels, to which they are affixed transversely at the middle.

Sage grows spontaneously in the south of Europe, and is cultivated abundantly in our gardens. There are several varieties, differing in the size and colour of their flowers, but all possessing the same medical properties. The flowering period is in June, at which time the plant should be cut, and dried in a shady place. The leaves are the officinal portion.

Both these and the flowering summits have a strong fragrant odour, and a warm, bitterish, aromatic, somewhat astringent taste. They abound in a volatile oil, which may be obtained separate by distillation with water, and contains a considerable proportion of camphor. Sulphate of iron strikes a black colour with their infusion.

Medical Properties and Uses. Sage unites a slight degree of tonic power and astringency with aromatic properties. By the ancients it was highly esteemed; but it is at present little used internally, except as a condiment. In the state of infusion it may be given in debility of the stomach with flatulence, and is said to have been useful in checking the sweats of hectic fever. But its most useful application is as a gargle in inflammation of the throat, and relaxation of the uvula. For this purpose it is usually employed in infusion, with honey and alum, or vinegar. The dose of the powdered leaves is from twenty to thirty grains. The infusion is prepared by macerating an ounce of the leaves in a pint of boiling water, of which two fluidounces may be administered at once. When intended merely as a pleasant drink in febrile complaints, or to allay nausea, the maceration should continue but a very short time, so that all the bitterness of the leaves may not be extracted.

Two other species of Salvia—*S. pratensis* and *S. Sclarea*—are ranked among officinal plants in Europe. The latter, which is commonly called *clarry*, has been introduced into our gardens. Their medical properties are essentially the same as those of the common sage; but they are less agreeable, and are not much used. In Europe, the leaves of *S. Sclarea* are said to be introduced into wine in order to impart to it a muscadel taste.

Off. Prep. Infusum Salviæ, *U. S.* W.

SAMBUCUS. *U. S.*

Elder.

The flowers of Sambucus Canadensis. *U. S.*

Off. Syn. SAMBUCI FLORES. *Elder Flowers.* The fresh Flowers of Sambucus nigra. *Linn.* From indigenous plants. *Br.*

Sureau, *Fr.;* Hollunder, *Germ.;* Sambuco, *Ital.;* Sauco, *Span.*

SAMBUCUS. *Sex. Syst.* Pentandria Trigynia.—*Nat. Ord.* Caprifoliaceæ.

Gen. Ch. Calyx five-parted. *Corolla* five-cleft. *Berry* three-seeded. *Willd.*

Sambucus Canadensis. Willd. *Sp. Plant.* i. 1494. Our indigenous *common elder* is a shrub from six to ten feet high, with a branching stem, covered with a rough gray bark, and containing a large spongy pith. The small branches and leafstalks are very smooth. The leaves are opposite, pinnate, sometimes bipinnate, and composed usually of three or four pairs of oblong-oval, acuminate, smooth, shining, deep-green leaflets, the midribs of which are somewhat pubescent. The flowers are small, white, and disposed in loose cymes, having about five divisions. The berries are small, globular, and deep-purple when ripe.

The shrub grows in low, moist grounds, along fences, and on the borders of small streams, in all parts of the United States, from Canada to the Carolinas, and westward as far as Texas. It flowers from May to July, and ripens its fruit early in autumn. The flowers, which are officinal, have an aromatic, though rather heavy odour. The berries as well as other parts of the plant are employed, in domestic practice, for the same purposes as the corresponding parts of the European elder, to which this species bears a close affinity.

Sambucus nigra. Willd. *Sp. Plant.* i. 1495; Woodv. *Med. Bot.* p. 596, t. 211. The common elder of Europe differs from the American most obviously in its size, which approaches to that of a small tree. The stem is much branched towards the top, and has a rough whitish bark. The leaves are pinnate, consisting usually of five oval, pointed, serrate leaflets, four of which are in opposite pairs, and the fifth ter-

minal. The flowers are small, whitish, and in five-parted cymes. The berries are globular, and blackish-purple when ripe. A fungus growing on this plant, called *fungus sambuci*, had a century since some reputation in Europe as a refrigerant in ophthalmia, and has recently been revived as a remedy in the same disease. It was ascertained by Steckel, an apothecary of N. Germany, to have an extraordinary power, when immersed in water, of absorbing that fluid, so as to increase its weight sevenfold; and, if long immersed, it is capable of taking up from 9 to 12 times its weight. It has, besides, the property of retaining the absorbed water very adhesively. This property adapts it admirably to the local treatment of conjunctivitis; and on trial it has been found successful where the ordinary applications have proved fruitless. (*Neues Repert.*, xiii. 476, A.D. 1864.)

The *flowers* have a peculiar sweetish odour, which is strong in their recent state, but becomes feeble by drying. Their taste is bitterish. They yield their active properties to water by infusion, and when distilled give over a small proportion of volatile oil, which on cooling assumes a butyraceous consistence. Water distilled from them contains an appreciable portion of ammonia. The *berries* are nearly inodorous, but have a sweetish, acidulous taste, dependent on the presence of saccharine matter and malic acid. Their expressed juice is susceptible of fermentation, and forms a vinous liquid used in the north of Europe. It is coloured violet by alkalies, and bright red by acids; and the colouring matter is precipitated blue by acetate of lead. The *inner bark* is without smell. Its taste is at first sweetish, afterwards slightly bitter, acrid, and nauseous. Both water and alcohol extract its virtues, which are said to reside especially in the green layer between the liber and epidermis. According to Simon, the active principle of the inner bark of the root is a soft resin, which may be obtained by exhausting the powdered bark with alcohol, filtering the tincture, evaporating to the consistence of syrup, then adding ether, which dissolves the active matter, and finally evaporating to the consistence of a thick extract. Of this, twenty grains produce brisk vomiting and purging. (*Annal. der Pharm.*, xxxi. 262.) The bark, analyzed by Kramer, yielded an acid called by him *viburnic acid*, which has proved to be the *valerianic*, traces of volatile oil, albumen, resin, an acid sulphurous fat, wax, chlorophyll, tannic acid, grape sugar, gum, extractive, starch, pectin, and various alkaline and earthy salts. (*Chem. Gaz.*, May, 1846; from *Archiv. der Pharm.*)

Medical Properties and Uses. The flowers are gently excitant and sudorific, but are seldom used, except externally as a discutient, in the form of poultice, fomentation, or ointment. The berries are diaphoretic and aperient; and their inspissated juice has enjoyed some reputation as a remedy in rheumatic, gouty, eruptive, and syphilitic affections. Its dose as an alterative diaphoretic is one or two drachms, as a laxative half an ounce or more. The inner bark is a hydragogue cathartic, and in large doses emetic. It has been employed in dropsy, epilepsy, and as an alterative in various chronic diseases. An ounce may be boiled with two pints of water to a pint, and four fluidounces of the decoction given for a dose. It is also used in vinous infusion. The leaves are not without activity, and the young leaf-buds are said to be a violent and even unsafe purgative. The juice of the root has been highly recommended in dropsy as a hydragogue cathartic, sometimes acting as an emetic, in the dose of a tablespoonful, repeated every day, or less frequently if it act with violence.*

Off. Prep. Aqua Sambuci, *Br.* W.

SANGUINARIA. *U.S.*

Bloodroot.

The rhizome of Sanguinaria Canadensis. *U. S.*

SANGUINARIA. *Sex. Syst.* Polyandria Monogynia.—*Nat. Ord.* Papaveraceæ.

* Dr. B. H. Stratton, of Mount Holly, N. J., has found a syrup prepared from the berries useful as an alterative, employing it in all cases to which sarsaparilla is thought to be applicable. To prepare the syrup, he mixes the juice of the berries and sugar, in the proportion of a pint of the former to a pound of the latter, boils sufficiently, and adds to each pint of the syrup an ounce of the strongest brandy. The syrup must be kept in well-closed bottles in a cool place. The dose is from a dessertspoonful to a tablespoonful three times a day. (*N. J. Med. Reporter*, vii. 446.)

Gen. Ch. Calyx two-leaved. *Petals* eight. *Stigma* sessile, two-grooved. *Capsule* superior, oblong, one-celled, two-valved, apex attenuated. *Receptacles* two, filiform, marginal. *Nuttall.*

Sanguinaria Canadensis. Willd. *Sp. Plant.* ii. 1140; Bigelow, *Am. Med. Bot.* i. 75; Barton, *Med. Bot.* i. 31. The *bloodroot*, or, as it is sometimes called, *puccoon*, is an herbaceous or perennial plant. The root (rhizome) is horizontal, abrupt, often contorted, about as thick as the finger, two or three inches long, fleshy, of a reddish-brown colour on the outside, and brighter red within. It is furnished with numerous slender radicles, and makes offsets from the sides, which succeed the old plant. From the end of the root arise the scape and leafstalks, surrounded by the large sheaths of the bud. These spring up together, the folded leaf enveloping the flower-bud, and rolling back as the latter expands. The leaf, which stands upon a long channeled petiole, is reniform, somewhat heart-shaped, deeply lobed, smooth, yellowish-green on the upper surface, paler or glaucous on the under, and strongly marked by orange-coloured veins. The scape is erect, round, and smooth, rising from a few inches to a foot, and terminating in a single flower. The calyx is two-leaved and deciduous. The petals, varying from seven to fourteen, but usually about eight in number, are spreading, ovate, obtuse, concave, mostly white, but sometimes slightly tinged with rose or purple. The stamens are numerous with yellow filaments shorter than the corolla, and orange oblong anthers. The germ is oblong and compressed, with a sessile, persistent stigma. The capsule is oblong, acute at both ends, two-valved, and contains numerous oval, reddish-brown seeds. The whole plant is pervaded by an orange-coloured sap, which flows from every part when broken, but is of the deepest colour in the root.

The bloodroot is one of the earliest and most beautiful spring flowers of North America. It grows abundantly throughout the whole United States, delighting in loose, rich soils, and shady situations, and flowering in March and April. After the fall of the flower, the leaves continue to grow, and, by the middle of summer, have become so large as to give the plant an entirely different aspect. Except the seeds, all parts of the plant are active; but the root only is officinal.

This, when dried, is in pieces from one to three inches long, from a quarter to half an inch or more in thickness, flattened, much wrinkled and twisted, often furnished with abrupt offsets and many short fibres, of a reddish-brown colour externally, with a spongy uneven fracture, the surface of which is at first bright-orange, but becomes of a dull-brown by long exposure. The colour of the powder is a brownish orange-red. Sanguinaria has a faint narcotic odour, and a bitterish very acrid taste, the pungency of which remains long in the mouth and fauces. It yields its virtues to water and alcohol. The late Dr. Dana, of New York, obtained from it a peculiar alkaline principle, denominated by him *sanguinarina*, upon which the acrimony, and perhaps the medical virtues of the root depend. It may be procured, according to Dana, by infusing the finely powdered root in hot water or diluted muriatic or acetic acid, precipitating with water of ammonia, collecting the precipitated matter, boiling it in water with pure animal charcoal, filtering off the water, treating the residue left upon the filter with alcohol, and finally evaporating the alcoholic solution. (*Ann. Lyc. of Nat. Hist., New York*, ii. 250.) It may also be conveniently procured by a process similar to that employed by Probst for obtaining chelerythrin from celandine. This consists in forming a strong ethereal tincture of the root, passing through this muriatic acid gas, drying the precipitated muriate, which is insoluble in ether, dissolving it in hot water, filtering, precipitating by ammonia, drying the precipitate, dissolving it in ether, decolorizing by animal charcoal, precipitating by means of muriatic acid gas, and decomposing the muriate as before. (*Chem. Gaz.*, i. 145.) Dr. James Schiel, of St. Louis, Missouri, who has determined the identity of sanguinarina with chelerythrin, gives the following as the simplest process of preparing either alkaloid. Digest the root with water strongly acidulated with sulphuric acid, precipitate with ammonia, dry the precipitate, dissolve it in ether, treat with animal charcoal, filter, and precipitate with sulphuric acid dissolved in ether. A pure sulphate is thus obtained, which may be decomposed in the ordinary method, to obtain the alkaloid. (*Silliman's Journ.*, Sept. 1855.) Sanguinarina is a white pearly substance, of an

acrid taste, very sparingly soluble in water, soluble in ether, and very soluble in alcohol. With the acids it forms salts soluble in water, all of which have some shade of red, crimson, or scarlet, and form beautiful red solutions. They are acrid and pungent to the taste, particularly the muriate and acetate. From these facts it would appear that the red colour and acrid properties of the bloodroot may be owing to the presence of some native salt of sanguinarina, which is decomposed by ammonia in the separation of the organic alkali. The formula of sanguinarina is $C_{37}H_{16}NO_8$. A second alkaloid has been extracted from bloodroot by Riegel, and is considered by him as analogous to the *porphyroxin* found by Merck in opium.* (*Chem. Gaz.*, iv. 198.) Mr. E. S. Wayne, of Cincinnati, has discovered a third alkaloid, which he found in the ether, after the precipitation of the sulphate of sanguinarina in the process of Dr. Schiel. It is pale-red, tasteless, insoluble in water, soluble in alcohol and ether, and unites with muriatic and sulphuric acids to form crystallizable compounds, of a deep-red colour. (*Am. Journ. of Pharm.*, xxviii. 522.) Dr. Gibb proposes for this principle the name of *puccin*. According to that writer, bloodroot contains, besides the three alkaloids referred to, chelidonic acid, fecula, sugar, albumen, resin, fixed oil, gum, extractive, and lignin. (*Pharm. Journ.*, March, 1860, p. 461.) The virtues of the root are said to be rapidly deteriorated by time. Mr. Thos. M. Newbold has extracted from sanguinaria an organic acid, which, though agreeing with chelidonic acid in some of its characteristics, differs in others, and must, therefore, be considered a distinct principle. According to Mr. Newbold, it is a non-volatile liquid; and he proposes for it the name of *sanguinarinic acid*. (*Am. Journ. of Pharm.*, Nov. 1866, p. 496.) Mr. Ernest Pierpoint, in a chemical examination of the root, succeeded in isolating the two alkaloids sanguinarina and puccina; and, besides, obtained a third, in the form of crystals, but not in sufficient quantity to be enabled to give its characteristic properties. (*Am. Journ. of Pharm.*, Aug. 1872, p. 349.)

Medical Properties and Uses. Sanguinaria is an acrid emetic, with stimulant narcotic powers. In small doses it excites the stomach, and accelerates the circulation; more largely given, produces nausea and consequent depression of the pulse; and in the full dose occasions active vomiting. It is also expectorant, and is said to be emmenagogue. The effects of an overdose are violent emesis, a burning sensation in the stomach, tormenting thirst, faintness, vertigo, dimness of vision, and alarming prostration. Four persons lost their lives at Bellevue Hospital, New York, in consequence of drinking largely of tincture of bloodroot, which they mistook for ardent spirit. (*Am. Journ. of Med. Sci.*, N. S., ii. 506.) Snuffed up the nostrils, bloodroot excites much irritation, attended with sneezing. Upon fungous surfaces it acts as an escharotic. It has been given in typhoid pneumonia, catarrh, pertussis, croup, phthisis pulmonalis, hydrothorax, scarlatina, rheumatism, jaundice, dyspepsia, amenorrhœa, dysmenorrhœa, and other affections, either as an emetic, nauseant, alterative, or emmenagogue; and its virtues are highly praised by many judicious practitioners. Dr. Mothershead, of Indianapolis, speaks in the strongest terms of its efficacy as an excitant to the liver, given in alterative doses. (See *Wood's Quart. Retrosp.*, ii. 80.)

The dose with a view to its emetic operation is from ten to twenty grains, given in powder or pill. The latter form is preferable, in consequence of the great irritation of throat produced by the powder when swallowed. For other purposes the dose is from one to five grains, repeated more or less frequently according to the effect desired. The medicine is sometimes given in infusion or decoction, in the

* This alkaloid was obtained by treating the root with water acidulated with acetic acid, precipitating the sanguinarina by ammonia, neutralizing the "wash-water" by acetic acid, precipitating by infusion of galls, digesting the precipitate previously washed and dried in an alcoholic solution of potassa, passing carbonic acid through the solution, and distilling off the alcohol. The residue was exhausted with water, the liquid evaporated, and what remained extracted by ether, which yielded it, on evaporation, in the form of a dirty-white crystalline mass. By dissolving this in alcohol, decolorizing with animal charcoal, and crystallizing, it was obtained in colourless tabular crystals, without taste or smell, very sparingly soluble in water, more readily soluble in alcohol, and forming with the acids colourless, bitter, crystallizable salts, soluble in water. (*Chem. Gaz.*, iv. 198.) Dr. Geo. D. Gibb, of London, who has made a partial analysis of the root, denies the identity of this principle with porphyroxin. (*Pharm. Journ.*, March, 1860, p. 46.) It awaits further investigation, and a proper name. (*Note to the twelfth edition.*)

proportion of half an ounce to the pint. The emetic dose of this preparation is from half a fluidounce to a fluidounce. The tincture is officinal.* A fluid extract may be prepared in the same manner as the officinal fluid extract of ergot. (See *Extractum Ergotæ Fluidum.*) One fluidrachm represents the virtues of sixty grains of the root; and the emetic dose, therefore, would be from ten to twenty minims. An infusion in vinegar has been employed advantageously as a local application, in obstinate cutaneous affections; and Dr. R. G. Jennings has found it more efficient as a gargle, in the sorethroat of scarlatina, than any other that he has employed. (*Stethoscope*, ii. 182.) It has been used also in diphtheria. Dr. Stephens, of Ceres, New York, has found the powder useful as an errhine, in coryza, combined with cloves and camphor. (*N. Y. Journ. of Med.*, N. S., iv. 358.) Mixed with chloride of zinc, and made into a paste with flour and water, it has been used by Dr. J. W. Fell as a local remedy in cancer, with asserted success.

In reference to the effects of sanguinarina, the late Dr. Wm. Tully found it, in large doses, to produce vertigo, dilatation of the pupil, a haggard expression of face, nausea, coldness of the extremities, cold sweats, and diminished frequency with irregularity of the pulse. The late Prof. R. P. Thomas, of Philadelphia, who experimented with it on himself and others, in medicinal doses, using both the alkaloid and its salts, gave the following statement of its powers. In doses varying from one-twelfth to one-eighth of a grain, it acted as an expectorant, without disturbing the stomach. One-sixth or one-fourth of a grain, given every two or three hours, generally produced nausea, and sometimes vomited. Half a grain in solution, given at intervals of ten minutes, almost invariably vomited after the second or third dose. Under the influence of one-eighth or one-sixth of a grain, given every three hours, for two days or more, the pulse was generally reduced from five to fifteen beats in the minute. He found no alterative effect, and none of any kind directly upon the liver. (*Proceedings of the Am. Med. Assoc.*, A.D. 1863, p. 219.)

Off. Prep. Acetum Sanguinariæ, *U. S.;* Tinctura Sanguinariæ, *U. S.* W.

SANTALUM. *U. S.*

Red Saunders.

The wood of Pterocarpus santalinus. *U. S.*

Off. Syn. PTEROCARPI LIGNUM. *Red Sandal-Wood.* The wood of Pterocarpus santalinus *Linn.* From Ceylon. *Br.*

Santal rouge, *Fr.;* Santelholz, *Germ.*

PTEROCARPUS. *Sex. Syst.* Diadelphia Decandria.—*Nat. Ord.* Fabaceæ or Leguminosæ.

Gen. Ch. Calyx five-toothed. *Legume* falcated, leafy, varicose, girted by a wing, not gaping. *Seeds* solitary. *Willd.*

Pterocarpus santalinus. Willd. *Sp. Plant.* iii. 906; Woodv. *Med. Bot.* p. 430, t. 156. This is a large tree, with alternate branches, and petiolate ternate leaves, each simple leaf being ovate, blunt, somewhat notched at the apex, entire, veined, smooth on the upper surface, and hoary beneath. The flowers are yellow in axillary spikes, and have a papilionaceous corolla, of which the *vexillum* is obcordate, erect, somewhat reflexed at the sides, toothed and waved, the *alæ* spreading with their edges apparently toothed, and the *carina* oblong, short, and somewhat inflated. The tree is a native of India, attaining the highest perfection in mountainous districts, and inhabiting especially the mountains of Coromandel and Ceylon. Its wood is the officinal *red saunders*, though there is reason to believe that the product of other trees is sold by the same name.

The wood comes in roundish or angular billets, internally of a blood-red colour,

*Mr. T. S. Wiegand proposes the following formula for *a syrup of bloodroot.* Take of the root in coarse powder ℥viij, acetic acid f℥iv, water Ov, sugar ℔ij. Add to the powder two fluidounces of the acetic acid mixed with a pint of the water, macerate for three days, transfer to a percolator, and displace with the remainder of the water mixed with the remainder of the acetic acid. Evaporate the infusion obtained, by means of a water-bath, to eighteen fluidounces, then add the sugar, and form a syrup, straining if necessary. From one to two fluidrachms should operate as an emetic. (*Am. Journ. of Pharm.*, xxvi. 108.)—*Note to the eleventh edition.*

externally brown from exposure, compact, heavy, and fibrous. It is kept in the shops in the state of small chips, raspings, or coarse powder.

Red saunders has little smell or taste. It imparts a red colour to alcohol, ether, and alkaline solutions, but not to water; and a test is thus afforded by which it may be distinguished from some other colouring woods. The alcoholic tincture produces a deep-violet precipitate with sulphate of iron, a scarlet with bichloride of mercury, and a violet with the soluble salts of lead. The colouring principle, which was separated by Pelletier, and called by him *santalin*, is of a resinous character, scarcely soluble in cold water, more so in boiling water, very soluble in alcohol, ether, acetic acid, and alkaline solutions, but slightly in the fixed and volatile oils, with the exception of those of lavender and rosemary, which readily dissolve it. It is precipitated when acids are added to the infusion of the wood, prepared with an alkaline solution. Weyermann and Hœfferly have found it to possess acid properties. For an analysis of red sandal wood by Mr. H. Dussance, New Lebanon, New York, the reader is referred to the *Am. Journ. of Pharm.* (Jan. 1860, p. 6). The wood has no medical virtues, and is employed solely for the purpose of imparting colour.

Off. Prep. Spiritus Lavandulæ Compositus, *U. S.;* Tinct. Lavandulæ Comp., *Br*

W.

SANTONICA. *U. S., Br.*

Santonica. Levant Wormseed.

The unexpanded flowers of Artemisia Cina (Willkomm, *Botanische Zeitung*, 1872, No. 9). *U. S.* The unexpanded flower-heads of an undetermined species of Artemisia. Imported from Russia. *Br.*

European Wormseed. Santonici Semen. Semen Cynæ. Semen Contra. This product, though discarded from the Dublin Pharmacopœia of 1850, has been recognised in the British Pharmacopœia, as well as in our own. It was formerly ascribed by the Dublin College, in accordance with the general belief at one time, to *Artemisia Santonica* or *Tartarian southernwood;* but upon insufficient grounds. European wormseed is of two kinds; one called the Aleppo, Alexandria, or Levant wormseed, the other Barbary wormseed. The former is supposed to be the product of *Artemisia Contra*, which grows in Persia, Asia Minor, and other parts of the East. It consists in fact not of the seeds, but of the small globular unexpanded flowers of the plant, mixed with their broken peduncles, and with minute, obtuse, smooth leaves. It has a greenish colour, a very strong aromatic odour increased by friction, and a very bitter disagreeable taste. The Barbary wormseed is thought by some to be derived from *Artemisia Judaica*, by others from the *A. glomerata* of Sieber, both of which grow in Palestine and Arabia. It consists of broken peduncles, having the calyx sometimes attached to their extremity. The calyx is also sometimes separate, consisting of very small linear obtuse leaflets. The flowers are wanting, or in the shape of minute globular buds. All these parts are covered with a whitish down, which serves to distinguish this variety from the wormseed of the Levant. It is, moreover, lighter and more coloured than the latter. Its smell and taste are the same. It is the former variety which is recognised by the two Pharmacopœias. The British gives the following description of the medicine. "Flower heads rather more than a line in length and nearly half a line in breadth, fusiform, blunt at each end, pale greenish-brown, smooth; resembling seeds in appearance, but consisting of imbricated involucral scales with a green midrib, enclosing four or five tubular flowers; odour strong, taste bitter, camphoraceous, flower-heads not round or hairy."

Wormseed contains a volatile oil and a resinous extractive matter, to which its virtues have been ascribed. But it probably owes its efficiency, in a greater degree, to a peculiar principle called *santonin*. This is crystallizable, colourless, tasteless but leaving a slight sense of acrimony in the mouth, inodorous, soluble in ether and alcohol, and nearly insoluble in water. Its alcoholic solution has a decided bitterness. Though neuter in its action upon test-paper, it combines with the alkalies to form

soluble and crystallizable salts. Having been adopted by the U. S. and Br. Pharmacopœias, with processes for its preparation, it will be treated of more fully in the *second part* of this work. (See *Santoninum.*)

The two kinds of wormseed above described have long been celebrated as a vermifuge; and the title of *semen contra*, by which they are designated in many works on pharmacy, originated in their anthelmintic property. Their influence on the system is not very striking. A curious effect, however, is recorded as having resulted from a large dose of wormseed, which was ascribed to the santonin. Several individuals of a family who had taken the remedy as a vermifuge, along with the expected results, were affected with a change in the perception of colours, red being converted into orange, and blue into green. (*Ann. de Thérap.*, A.D. 1852, p. 234.) Santonica may be given in powder or infusion. The dose in substance is from ten to thirty grains, which should be repeated morning and evening for several days, and then followed by a brisk cathartic. It is little used in this country, having given place to the seeds of *Chenopodium anthelminticum*, which are universally known among us by the name of wormseed. In Europe it has been superseded, to a considerable extent, by santonin, which is much employed.

Off. Prep. Santoninum. W.

SAPO. *U. S.*

Soap.

Soap made with soda and olive oil. *U. S.*

Off. Syn. SAPO DURUS. *Hard Soap.* Soap made with olive oil and soda. *Br.*
Savon blanc, *Fr.;* Oel-sodaseife, *Germ.;* Sapone duro, *Ital.;* Xabon, *Span.*

SAPO MOLLIS. *Br.*

Soft Soap.

Soap made with olive oil and potash. *Br.*
Savon mou, Savon vert, Savon à base de potasse, *Fr.;* Schmierseife, Kaliseife, *Germ.*

Soaps embrace all those compounds which result from the reaction of salifiable bases with fats and oils. Fats and oils, as has been explained under the titles *Adeps* and *Olea*, consist generally of three principles, two solid, differing in fusibility, called *stearin* and *margarin*, and one liquid, called *olein*, of which there are two varieties. Stearin is found most abundantly in fats which are firm and solid, as suet and tallow; margarin in human fat; and olein in the oils. When the fats and oils undergo *saponification* by reaction with a salifiable base, these three principles are decomposed into oily acids peculiar to each, discovered by Chevreul, and called stearic, margaric, and oleic acids, which unite with the base to form the soap, and into a sweet principle not saponifiable, called glycerin, which is set free. Hence it follows that stearin is a stearate, margarin a margarate, and olein an oleate of glycerin, and that the fats and oils are mixtures of these three oily salts. Hence, also, it is obvious that soaps are mixed stearates, margarates, and oleates of various bases. *Stearic acid* is a firm white solid, like wax, fusible at 167°, greasy to the touch, pulverizable, soluble in alcohol, very soluble in ether, but insoluble in water. In the impure state it is used as a substitute for wax in making candles. *Margaric acid* has the appearance of fat, and is fusible at 140°. *Oleic acid* is an oily liquid, insoluble in water, soluble in alcohol and ether, lighter than water, crystallizable in needles a little below 32°, and having a slight smell and pungent taste. *Glycerin* will be described under a separate head. (See *Glycerina.*)

Soaps are divided into the soluble and insoluble. The soluble soaps are combinations of the oily acids with soda, potassa, and ammonia; the insoluble consist of the same acids united with earths and metallic oxides. It is the soluble soaps only that are detergent, and to which the name *soap* is usually applied. Several of the insoluble soaps are employed in pharmacy; as, for example, the soap of the protoxide of lead, or lead plaster, and the soap of lime, or lime liniment. (See *Emplastrum Plumbi* and *Linimentum Calcis.*) The two officinal soaps, here described, are of the

soluble kind. One is a soda soap, made with olive oil (Castile soap), the other a potassa soap (soft soap). The soap of ammonia is noticed elsewhere. (See *Linimentum Ammoniæ.*)

The consistency of the fixed alkaline soaps depends partly on the nature of the oil or fat, and partly on the alkali present. Soaps are harder the more stearate and margarate they contain, and softer when the oleate predominates; and, as it respects the alkali present, they are harder when formed with soda, and softer when containing potassa. Hence it is that of pure soaps, considered as salts, stearate of sodium is the hardest and least soluble, and oleate of potassium the softest and most soluble.

Preparation. The following is an outline of the process for making soap. The oil or fat is boiled with a solution of caustic alkali, until the whole forms a thick mass, which can be drawn out into long clear threads. After the soap is completely formed, the next step is to separate it from the excess of alkali, the glycerin, and redundant water. This is effected by adding common salt, or a very strong akaline lye, in either of which the soap is insoluble. The same end may be attained by boiling down the solution until the excess of alkali forms a strong alkaline solution, which acts the same part in separating the soap as the addition of a similar solution. As soon as the soap is completely separated, it rises to the surface; and, when it has ceased to froth in boiling, it is ladled out into wooden frames to congeal, after which it is cut into bars by means of a wire. The soap, as first separated, is called *grain soap.* It may be purified by dissolving it in an alkaline lye, and separating it by common salt. During this process the impurities subside, and the soap combines with more water; and hence it becomes weaker, although purer and whiter. If the grain soap is not purified it forms *marbled soap;* the coloured streaks arising principally from an insoluble soap of oxidized iron. Sometimes the marbled appearance is produced by adding to the soap, as soon as it is completely separated, a fresh portion of lye, and immediately afterwards a solution of sulphate of iron. The black oxide of iron is precipitated, and gives rise to dark-coloured streaks, which, by exposure to the air, become red in consequence of the conversion of the black into the sesquioxide of iron. For an account of the process of Mr. R. A. Tilghman, of this city, patented in 1854, for manufacturing soap by subjecting a mixture of fatty matters and a solution of carbonated alkali to a high temperature under pressure, see the *Am. Journ. of Pharm.* (xxvii. 121).

The officinal *soap* (Sapo, *U. S.;* Sapo Durus, *Br.*) is an olive oil soda soap, made on the same general plan as that just explained.

Common Soap (Sapo Vulgaris, *U. S.* 1850) is also a soda soap; but, instead of olive oil, it contains concrete animal oil. This soap corresponds with the white soap of northern European countries and of the United States, and is formed usually from barilla and tallow. In Scotland it is manufactured from kelp and tallow. It was introduced into the list of the U.S. Pharmacopœia as the only proper soap for making opodeldoc; but, as this preparation was discarded, this variety of soap was dismissed along with it.

Soft Soap (Sapo Mollis, *Br.*) is prepared on the same general principles as hard soap; potash being employed as the alkali, and a fatty matter rich in olein, as the oil. The French soft soap is made with the seed oils, such as rape-seed, hemp-seed, &c.; the Scotch and Irish, with fish-oil and some tallow; and our own with refuse fat and grease. A lye of wood-ashes is the form of potash usually employed. In forming this soap it is necessary that it should continue dissolved in the alkaline solution, instead of being separated from it. Hence soft soap is a soap of potassa, completely dissolved in the solution of its alkali, which is consequently present in excess. A soap of potassa is sometimes made with a view to its conversion into a soda soap. This is effected by the addition of an equivalent quantity of common salt, which, by double composition, generates a soap of soda, and chloride of potassium in solution. After this change is effected, a further addition of salt separates the soda soap formed. Soft soap is said to be largely adulterated in France with starch, which very much improves its appearance. The fraud may be instantly detected by means of the microscope, which will reveal the starch granules. (*Journ. de Pharm.*, 4e sér., v. 179.)

Besides the officinal soaps of the U. S. and Br. Pharmacopœias, there are many other varieties, more or less used for medicinal or economical purposes. The officinal soap of the French Codex (1837), called *amygdaline soap* (*almond oil soap*), is formed of caustic soda and almond oil, and is directed to be kept for two months exposed to the air, before being used. *Starkey's soap*, also officinal in the Codex, is prepared by uniting, by trituration, equal parts of carbonate of potassium, oil of turpentine, and Venice turpentine. *Beef's marrow soap* is a fine animal oil soap, also included in the French standard of pharmacy. *Windsor soap* is a scented soda soap, made of one part of olive oil and nine parts of tallow. *Eau de luce* (*aqua luciæ*) is a kind of liquid soap, formed by mixing a tincture of oil of amber and balsam of Gilead with water of ammonia. *Transparent soap* is prepared by saponifying kidney fat with soda free from foreign salts, drying the resulting soap, dissolving it in alcohol, filtering and evaporating the solution, and running it into moulds when sufficiently concentrated. The soap is yellow or yellowish-brown, and preserves its transparency after desiccation. *Palm soap* is prepared from soda and palm oil, to which tallow is added to increase its firmness. If it be wanted white, the palm oil may be bleached by heat, bichromate of potassium with sulphuric acid, chlorine, or exposure to the sun. This soap has a yellowish colour, and the agreeable odour of violets derived from the oil. *Soap Balls* are prepared by dissolving soap in a little water, and then forming it with starch into a mass of the proper consistence. *Common yellow soap* (*rosin soap*) derives its peculiarities from an admixture of rosin and a little palm oil with the tallow employed; the oil being added to improve its colour. Silicate of sodium has, to some extent, been substituted for rosin, as more economical. (*Am. Journ. of Pharm.*, Sept. 1863, p. 466.) Large quantities of lard oil (nearly pure olein) are manufactured into soap.*

All the varieties of soap, except a few of the fancy sort, and the olive oil soaps, are manufactured in the United States. The latter, which are chiefly used for medicinal purposes, are imported from France.

Properties. Soap, whatever may be its variety, has the same general properties. Its aspect and consistence are familiar to every one. Its smell is peculiar, and taste slightly alkaline. It is somewhat heavier than water, and therefore sinks in that liquid. Exposed to heat it quickly fuses, swells up, and is decomposed. It is soluble in water, and more readily in hot than in cold. Potassa soaps and those containing oleic acid are far more soluble than the soda soaps, especially those in which the stearates and margarates predominate. Acids, added to an aqueous solution of soap, combine with the alkali, and set free the oily acids, which, being diffused through the water, give it a milky appearance. Its decomposition is also produced by metallic salts, which invariably give rise to insoluble soaps. Soap is soluble in cold, and abundantly in boiling alcohol. This solution constitutes the *tincture of soap*, and forms a very convenient test for discovering lime in natural waters. As the tincture sometimes gelatinizes, it is proposed by M. Bjorklund to remedy this inconvenience by employing soap in the nascent state, that is, containing a large proportion of water. (*Journ. de Pharm.*, 4e sér., ii. 179, A.D. 1865.) The efficacy of soap as a detergent depends upon its power of rendering grease and other soiling substances soluble in water, and therefore capable of being removed by washing. The chief adulterations in soap are lime, gypsum, heavy spar, steatite, and pipe-clay. When adulterated with these substances, it will not be entirely soluble in alcohol. According to Dr. Riegel glue is an occasional adulteration in Spanish soap, discoverable also by its insolubility in alcohol. The same impurity is sometimes found in other soaps.†

Olive oil soda soap (Sapo), otherwise called *Castile* or *Spanish soap*, is a hard

* Upon the supposition that the detergent property of soap depends exclusively on the alkali it contains, and is consequently proportionate to the quantity of that ingredient, a mode of estimating the relative value of soaps has been suggested by R. Graeger, based on the equivalent of the fatty constituent; those soaps being the strongest, of which the acid has the lowest combining number. (See *Am. Journ. of Pharm.*, July, 1861, p. 355.)

† For a mode of estimating the impurities in soap by the volumetric method, by which the character of any sample of soap may be hastily ascertained, with sufficient accuracy for ordinary purposes, see a paper, by M. Pons, in the *Journ. de Pharm. et de Chim.* (4e sér., i. 290.)—*Note to the thirteenth edition.*

soap, and is presented under two principal varieties, the white and the marbled. *White Castile soap*, when good, is of a pale grayish-white colour, incapable of giving an oily stain to paper, devoid of rancid odour or strong alkaline qualities, and entirely soluble both in water and alcohol. It should not feel greasy, nor grow moist, but, on the contrary, should become dry by exposure to the air, without exhibiting any saline efflorescence. This variety of soap contains about 21 per cent. of water. Sometimes it contains a larger proportion of water, with which the soap is made to combine by the manufacturer, with the fraudulent intention of increasing its weight. Soap, thus adulterated, is known by its unusual whiteness, and by its suffering a great loss of weight in a dry air. The proportion of water may be ascertained by introducing the soap into a saturated solution of chloride of sodium, and boiling; when the soap, nearly free from water, concretes into a solid mass. *Marbled Castile soap* is harder, more alkaline, and more constant in its composition than the other variety. It contains about 14 per cent. of water. Having less water than the white Castile, it is a stronger and more economical soap; but at the same time less pure. The impurity arises from the veins of marbling, consisting of ferruginous matter, as already explained. Soap made with animal fat, with the probable addition of silicate of sodium, has been sold for Castile soap. (*Am. Journ. of Pharm.*, March, 1864, p. 102.)

Animal oil soda soap (Sapo Vulgaris) is a hard soap, of a white colour, inclining to yellow. It is made from tallow and caustic soda. This soap possesses the same general properties as the olive oil soda soap.

Soft soap (Sapo Mollis), as made in this country, is semi-fluid, slippery, capable of being poured from one vessel to another, and of a dirty-brownish-yellow colour. This soap always contains an excess of alkali, which causes it to act more powerfully as a detergent than hard soap. It also contains the glycerin of the fatty matters, which is always separated from hard soap. In the Br. Pharmacopœia it is directed to be made from olive oil and potash; but Dr. Pereira states that he has not been able to meet with it in England. That made in France has a greenish colour and the consistence of soft ointment, and is composed of hempseed oil and potash. It is called, in the French Codex, *savon vert*. Sometimes it is manufactured from the dregs of olive oil.

Incompatibles. Soap is decomposed by all the acids, earths, and earthy and metallic salts. Acids combine with the alkali, and set free the oily acids of the soap; the earths unite with the oily acids and separate the alkali; while the earthy and metallic salts give rise, by double decomposition, to an insoluble soap of their base, and a saline combination between their acid and the alkali of the soap. Hard waters, in consequence of their containing salts of lime, decompose and curdle soap. They may be rendered soft, and fit for washing, by adding sufficient carbonate of sodium or of potassium to precipitate all the lime.

Composition. It has been already explained that soap consists of certain oily acids, united with an alkali. As olive oil is a compound of margarin and olein, so the officinal "soap" is a mixed margarate and oleate of sodium. The former officinal "common soap" is principally a stearate of sodium; and "soft soap," as defined in the Br. Pharmacopœia, is a mixed margarate and oleate of potassium. The most important soaps have the following composition in the hundred parts. *Marseilles white soap*,—soda 10·24, margaric acid 9·20, oleic acid 59·20, water 21·36. (*Braconnot.*) *Castile soap*, very dry,—soda 9·0, oily acids 76·5, water 14·5. (*Ure.*) *Glasgow soft soap*,—potassa 9·0, oily acids 43·7, water 47·3. (*Ure.*) *French soft soap*,—potassa 9·5, oily acids 44, water 46·5. (*Thenard.*) Most soaps, it is perceived, contain a large proportion of water.

Medical Properties. Soap possesses the properties of a laxative, antacid, and antilithic. It is seldom given alone, but frequently in combination with rhubarb, the astringency of which it has a tendency to correct. Thus combined, it is often administered in dyspepsia, attended with constipation and torpor of the liver. As it is readily decomposed by the weakest acids, which combine with the alkali, it often proves useful in acidity of the stomach, and has been recommended as a remedy in the uric acid diathesis; but it possesses no power to dissolve calculi, as was once

supposed. Externally, soap is a stimulating discutient, and as such has been used by friction in sprains and bruises. The late Dr. A. T. Thomson found much benefit to result from rubbing the tumid abdomen of children in mesenteric fever, morning and evening, with a strong lather of soap. For the cure of itch, Dr. Schubert recommends a mixture of soft soap and salt, in the proportion of eight ounces of the former to four of the latter, dissolved in a quart of water. With this solution, previously warmed, the patient is to be rubbed, night and morning, until a cure is effected, which generally takes place in three days. M. Thenard recommends a solution of soap as an infallible remedy against the bug (*punaise*, Fr.), which, as well as the egg, is destroyed by a hot solution, made by boiling together one part of soap with fifty parts of water. (*Journ. de Pharm.*, 3e sér., xxviii. 280.) In constipation of the bowels, particularly when arising from hardened feces in the rectum, a strong solution of soap, especially of soft soap, forms a useful enema. When the latter is used, two tablespoonfuls may be dissolved in a pint of warm water. In pharmacy, soap is frequently employed for the purpose of giving a proper consistence to pills; but care must be taken not to associate it with a substance which may be decomposed by it. It is also an ingredient in some liniments and plasters. In toxicology it is used as a counter-poison for the mineral acids, and should always be resorted to, in poisoning by these agents, without a moment's delay, and its use continued until magnesia, chalk, or the bicarbonate of sodium or of potassium can be obtained. The mode of administration, in these cases, is to give a teacupful of a solution of soap, made by dissolving it in four times its weight of water, every three or four minutes, until the patient has taken as much as he can swallow. The dose of soap is from five grains to half a drachm, given in the form of pill.

Off. Prep. of Hard Soap. Emplastrum Cerati Saponis, *Br.;* Emplastrum Resinæ, *Br.;* Empl. Saponis; Extractum Colocynthidis Compositum; Linimentum Potassii Iodidi cum Sapone, *Br.;* Linimentum Saponis; Linimentum Terebinthinæ, *Br.;* Pilulæ Aloës, *U. S.;* Pil. Aloës Barbadensis, *Br.;* Pil. Aloës et Assafœtidæ; Pil. Aloës Socotrinæ, *Br.;* Pil. Assafœtidæ, *U. S.;* Pil. Cambogiæ Composita, *Br.;* Pil. Opii, *U. S.;* Pil. Rhei, *U. S.;* Pil. Rhei Comp., *Br.;* Pil. Saponis Comp.; Pil. Scillæ Comp.

Off. Prep. of Soft Soap. Linimentum Terebinthinæ, *Br.* B.

SARSAPARILLA. *U. S.*

Sarsaparilla.

The root of Smilax officinalis (*Humboldt and Bonpland*), and of other species of Smilax. *U. S.*

Off. Syn. SARSÆ RADIX. *Jamaica Sarsaparilla.* The dried root of Smilax officinalis. *Humb. and Bonpl.* Native of Central America, imported from Jamaica. *Br.*

Salsepareille, *Fr.;* Sarsaparille, *Germ.;* Salsapariglia, *Ital.;* Zarzaparilla, *Span.*

SMILAX. *Sex. Syst.* Dioecia Hexandria.—*Nat. Ord.* Smilaceæ.

Gen. Ch. MALE. *Calyx* six-leaved. *Corolla* none. FEMALE. *Calyx* six-leaved, *Corolla* none. *Styles* three. *Berry* three-celled. *Seeds* two. *Willd.*

Formerly, *Smilax Sarsaparilla* was admitted by most of the standard authorities as the source of this drug; but it is probable that none of the sarsaparilla of the shops was ever obtained from it. *S. Sarsaparilla* is a native of the United States; and the medicine has never, within our knowledge, been collected in this country. It is not among the eleven species of *Smilax* described by Humboldt, Bonpland, and Kunth, who indicate *S. officinalis*, *S. syphilitica*, and *S. Cumanensis*, especially the first, as the probable sources of the drug exported from Mexico and the Spanish Main. In the present state of our knowledge, it is impossible to decide with certainty from what species the several commercial varieties of the drug are respectively derived. This much is certain, that they do not proceed from the same plant. Of the many species belonging to this genus, few possess any medicinal power; and Hancock states that of the six or eight which he found growing in the woods of Guiana, only one presented in any degree the sensible properties of the genuine sarsaparilla, the rest being insipid and inert. The root (rhizome) of *Smilax China*,

a native of China and Japan, has been employed under the name of *China Root* for similar purposes with the officinal sarsaparilla. As it occurs in commerce, it is in pieces from three to eight inches long and an inch or two thick, usually somewhat flattened, more or less knotty, often branched, of a brownish or grayish-brown colour externally, whitish or of a light flesh-colour internally, without odour, and of a taste flat at first, but afterwards very slightly bitterish and somewhat acrid, like that of sarsaparilla. The root of *Smilax aspera* is said to be employed in the south of Europe as a substitute for sarsaparilla; but it has little reputation. The East India Sarsaparilla, which was at one time referred to this species of smilax, is the product of *Hemidesmus Indicus.* (See *Hemidesmus.*) We shall briefly describe S. Sarsaparilla, on account of its former officinal rank, and afterwards such other species as are believed to yield any portion of the drug. All of them are climbing or trailing plants, with prickly stems; a character expressed in the name of the medicine, which is derived from two Spanish words (*zarza parilla*), signifying a small thorny vine.

Smilax Sarsaparilla. Willd. *Sp. Plant.* iv. 776; Woodv. *Med. Bot.* p. 161, t. 62. The stem of this plant is long, slender, shrubby, angular, and beset with prickles. The leaves are unarmed, ovate-lanceolate with about five nerves, somewhat glaucous beneath, and supported alternately upon footstalks, at the bases of which are long tendrils. The flowers usually stand, three or four together, upon a common peduncle, which is longer than the leafstalk. This species is indigenous, growing in swamps and hedges in the Middle and Southern States.

S. officinalis. Humb. and Bonpl. *Plant. Æquinoct.* i. 271. In this species the stem is twining, angular, smooth, and prickly; the young shoots are unarmed; the leaves ovate-oblong, acute, cordiform, five or seven-nerved, coriaceous, smooth, twelve inches long and four or five broad, with footstalks an inch long, smooth, and furnished with tendrils. The young leaves are lanceolate-oblong, acuminate, and three-nerved. According to Humboldt, the plant abounds on the river Magdalena, in New Granada. Large quantities of the root are sent down the river to Mompox and Carthagena.

S. syphilitica. Willd. *Sp. Plant.* iv. 780. The stem is round and smooth; armed at the joints with from two to four thick, straight prickles; and furnished with oblong-lanceolate, acuminate, three-nerved, coriaceous, shining leaves, which are a foot in length, and terminate by a long point. The plant was seen by Humboldt and Bonpland in New Granada, upon the banks of the river Cassiquiare, and by Martius in Brazil, at Yupura and near the Rio Negro. It has been supposed to yield the Brazilian sarsaparilla.

S. papyracea. Poiret, *Encyc. Méth.* iv. 467. This is an under-shrub with a compressed stem, angular below, and furnished with spines at the angles. Its leaves are elliptical, acuminate, and three-nerved. It inhabits Cayenne and Brazil, chiefly upon the banks of the Amazon and its tributaries, and is thought to yield the variety of sarsaparilla denominated Brazilian. (*Am. Journ. of Pharm.*, xv. 277.) A particular description of a specimen of Smilax, supposed to belong to this species, is given by Professor Bentley in the *London Pharm. Journ.* (x. 470). It was obtained from Guatemala, and was the source of a variety of commercial sarsaparilla, recently introduced into the market, which Professor Bentley proposes to name Guatemala sarsaparilla.

S. medica. Schlechtendahl, *Linnæa*, vi. 47; Carson, *Illust. of Med. Bot.* ii. 51, pl. 95. This species has an angular stem, armed with straight prickles at the joints, and a few hooked ones in the intervals. The leaves are smooth, bright-green on both sides, shortly acuminate, five-nerved, with the veins prominent beneath. They vary much in form, the lower being cordate, auriculate-hastate; the upper cordate-ovate. In the old leaves, the petiole and midrib are armed with straight subulate prickles. The inflorescence is an umbel of from eight to twelve flowers, with a smooth axillary peduncle, and pedicels about three lines long. Schiede found this plant on the eastern declivity of the Mexican Andes, where the root is collected to be taken to Vera Cruz.

The medicinal species of Smilax grow in Mexico, Guatemala, and the warm latitudes of South America. The roots are very long and slender, and originate in

great numbers from a common head or rhizome, from which the stems of the plant rise. The whole root with the rhizome is usually dug up, and as brought into market exhibits not unfrequently portions of the stems attached, sometimes several inches in length. The sarsaparilla of commerce comes from different sources, and is divided into varieties according to the place of collection or shipment.

Honduras Sarsaparilla is the variety most used in this country. It is brought from the bay of Honduras, and comes in bundles two or three feet long, composed of several roots folded lengthwise, and secured in a compact form by a few circular turns. These are packed in bales imperfectly covered with skins, each bale containing one hundred pounds or more. The roots are usually connected at one extremity in large numbers in a common head, to which portions of the stems are also attached. In some bundles are many small fibres either lying loose, or still adhering to the roots. The colour of the roots externally is a dirty-grayish or reddish-brown; and the cortical portion beneath the epidermis often appears amylaceous when broken.

The *Jamaica* or *red sarsaparilla* of foreign writers is little known by that name in the United States. The island of Jamaica is merely its channel of exportation to Europe; and it is probably derived originally from Central America. It does not materially differ in properties from Honduras sarsaparilla; its chief peculiarity being the reddish colour of the epidermis, which is also sometimes found in that variety. It is said also to yield a larger proportion of extract, and to contain less starch. As found in commerce, it is in bundles from twelve to eighteen inches long, by four or five in thickness, consisting of long slender roots folded up, with numerous radical fibres attached.

Considerable quantities of the drug are imported from the Mexican ports of Vera Cruz and Tampico. The *Vera Cruz sarsaparilla* comes in large, rather loose bales, weighing about two hundred pounds, bound with cords or leather thongs, and usually containing the roots folded upon themselves, and separately packed. These, as in the Honduras sarsaparilla, consist of a head or caudex with numerous long radicles, which, however, are somewhat smaller than in that variety, and have a thinner bark. They are often also much soiled with earth. This variety was formerly little esteemed; but, from the acrid taste which it possesses, it is probably not inferior in real virtues to the other kinds. It is probably derived from Smilax medica.

Another variety is the *Caracas sarsaparilla*, brought in large quantities from La Guayra. It is in oblong packages, of about one hundred pounds, surrounded with broad strips of hide, which are connected laterally with thongs of the same material, leaving much of the root exposed. The roots, as in the last variety, are separately packed, but more closely and carefully. The radicles are often very amylaceous internally, in this respect resembling the following.

The *Brazilian*, or, as it is sometimes called in Europe, the *Lisbon sarsaparilla*, has been less used in the United States than in Europe, where it has commanded a higher price. Within a few years, however, it has been imported in considerable quantities. It comes from the ports of Para and Maranham, in cylindrical bundles of from three to five feet in length, by about a foot in thickness, bound about by close circular turns of a very flexible stem, and consisting of unfolded roots, destitute of caudex (rhizome) and stems, and having few radical fibres. It is the variety of which Hancock speaks as celebrated throughout South America by the name of *sarsa of the Rio Negro*, and is considered as the most valuable variety of the drug. It is distinguished by the amylaceous character of its interior structure, and has considerable acrimony. It was said by Martius to be derived from Smilax syphilitica; but Dr. Hancock considers that portion of it which comes from the Rio Negro, and is shipped at Para, as the product of an undescribed species, certainly not S. syphilitica. According to Richard, it has been ascertained to be the product of the S. papyracea of Poiret. (See *Am. Journ. of Pharm.*, xv. 277.)

The variety described by Professor Bentley under the name of *Guatemala sarsaparilla* was collected in the province of Sacatapeques, about ninety miles from the sea. It is in cylindrical bundles about two feet eight inches long by four inches in diameter, composed of separate roots, arranged in parallel order, without rootstalk, and bound together by a few turns of the flexible stem of a monocotyledonous

plant. The bundles resemble the Brazilian in arrangement, but are much less compact. It is amylaceous, has considerable acrimony, and is probably one of the most efficient varieties. Professor Bentley ascribes it to S. papyracea. For a particular description of the root, the reader is referred to the *Pharmaceutical Journ.* (xii. 472).

Much sarsaparilla has been imported into England from Lima, Valparaiso, and other places on the Pacific coast of South America. It is described by Pereira as bearing a close resemblance to Jamaica sarsaparilla, but yielding a smaller proportion of extract. It is in bundles of about three feet long and nine inches thick, consisting of the roots folded with their heads or rhizomes attached. The epidermis is brown or grayish-brown. Sometimes roots of a light-clay colour are found in the bundles.

In a memoir read by Dr. Berthold Seeman before the London Linnæan Society, the author stated that, after careful examination, he was convinced that the commercial varieties of sarsaparilla, called Brazilian, Jamaica, and Guatemala sarsaparilla, are all the product of one species of Smilax, the *S. officinalis* of Humboldt and Bonpland, and moreover, that the *S. medica* of Schlechtendahl, and the *S. papyracea* of Poiret, are identical with that species. (*Pharm. Journ.*, Feb. 1854, p. 385.)

Properties. The dried sarsaparilla roots are several feet in length, about the thickness of a goose-quill, cylindrical, more or less wrinkled longitudinally, flexible, and composed of a thick exterior cortical portion, covered with a thin easily separable epidermis, of an inner layer of ligneous fibre, and of a central pith. The epidermis is of various colours, generally ash-coloured, grayish-brown, or reddish-brown, and sometimes very dark. The cortical portion is in some specimens whitish, in others brown, and not unfrequently of a pink or rosy hue. It is occasionally white, brittle, and almost powdery like starch. The woody part is usually very thin, and composed of longitudinal fibres, which allow the root to be split with facility through its whole length. The central medulla often abounds in starch.

Sarsaparilla in its ordinary state is nearly or quite inodorous, but in decoction acquires a decided and peculiar smell. To the taste it is mucilaginous and very slightly bitter, and, when chewed for some time, produces a disagreeable acrid impression, which remains long in the mouth and fauces. The root is efficient in proportion as it possesses this acrimony, which is said by some authors to be confined to the cortical portion; while the ligneous fibre and medullary matter are insipid and inert. Hancock avers that all parts are equally acrid and efficacious. The truth is probably between the two extremes; and, as in most medicinal roots, it must be admitted that the bark is more powerful than the interior portions, while these are not wholly inactive. The virtues of the root are communicated to water cold or hot, but are impaired by long boiling. They are extracted also by diluted alcohol. According to Hancock, the whole of the active matter is not extracted by water. He observes in his paper upon sarsaparilla, published in the *London Medico-Botanical Transactions*, when speaking of the sarsaparilla from Para and the Rio Negro, "after exhausting half a pound of this sort by two digestions, boiling, and pressure, I added to the dregs half a pint of proof spirit, and digested this with a gentle heat for a few hours in a close vessel, then affusing hot water to the amount of that taken off from the first boiling, and pressing again, I procured by the last operation about four pints of an infusion which possessed the acrid properties of the sarsa in a much higher degree even than that obtained by the first decoction with simple water." It appears that in South America it is the custom to prepare sarsaparilla by digestion in wine or spirit, or by infusion in water with additions which may produce the vinous fermentation, and thus add alcohol to the menstruum. The same result, as to the superior efficacy of alcohol as a solvent of the acrid principle of sarsaparilla, has been obtained by the French experimentalists. It has been suggested that sarsaparilla, the virtues of which are admitted to be impaired by long boiling, might also be injured by the degree of heat applied in the water or steam bath. But the contrary appears to have been proved by the experiments of Mr. J. F. Judge, of Cincinnati. (*Pharm. Journ.*, July, 1874, p. 48; from *Proceed. of Am. Pharm. Soc.*)

According to M. Thubeuf, sarsaparilla contains, 1. a peculiar crystalline substance, which is probably the active principle of the root, 2. a colouring substance, 3.

resin, 4. starch, 5. lignin, 6. a thick, aromatic fixed oil, 7. a waxy substance, and 8 chloride and nitrate of potassium. It is said also to contain a minute proportion of volatile oil, and Batka found gum, bassorin, albumen, gluten and gliadine, lactic and acetic acids, and various salts. The proportion of starch is large. Chatin found iodine in Honduras sarsaparilla; but Dr. Winckler, not having succeeded in detecting this principle in any one root, thinks it probable that the specimen examined by Chatin had been exposed to sea-water. (*Pharm. Cent. Blatt*, May 7, 1852.)

Sarsaparillin. (Smilacin. Pariglin. Salseparine. Parillinic acid.) The crystalline principle in which the virtues of sarsaparilla reside should be called *sarsaparillin.* It was first discovered by Dr. Palotta, who described it in 1824 under the name of *pariglin.* Subsequently, M. Folchi supposed that he had found another principle which he called *smilacin.* In 1831, M. Thubeuf announced the discovery of a new substance in sarsaparilla which he named *salseparine*, from the French name of the root. Finally, Batka, a German chemist, towards the end of 1833, published an account of a principle which he had discovered in the root, and which, under the impression that it possessed acid properties, he called *parillinic acid.* M. Poggiale, however, has shown that these substances are identical, though procured by different processes. The following is the process of M. Thubeuf. The root is treated with hot alcohol till deprived of taste. The tincture is submitted to distillation, and seven-eighths of the alcohol drawn off. The remainder is treated with animal charcoal, and filtered at the end of twenty-four or forty-eight hours. The sarsaparillin is deposited in the form of a granular powder. This is dissolved in a fresh portion of alcohol, and crystallized. The alcoholic mother-liquors may be deprived of that portion of the principle which they retain by evaporating to dryness, dissolving the product in water, filtering, again evaporating to dryness, redissolving in alcohol, and crystallizing. *Sarsaparillin* is white, inodorous, almost tasteless in the solid state, but bitter, acrid, and nauseous when dissolved in alcohol or water. It is very slightly soluble in cold water, but more readily in boiling water, which deposits it on cooling. It is very soluble in alcohol, especially at the boiling temperature. Ether and the volatile oils also dissolve it. Its aqueous solution has the property of frothing very much by agitation. M. Beral states that he has procured it pure by distilling, by means of a salt-water bath, a tincture of sarsaparilla prepared with very dilute alcohol. In that case it must be volatile, and we can understand why sarsaparilla suffers in decoction. (See *Am. Journ. of Pharm.*, xii. 245.) The solutions of sarsaparillin are without acid or alkaline reaction. Batka erred in considering it an acid. M. Poggiale found it both in the cortical and medullary part of the root, but most largely in the former. Palotta gave it internally in doses varying from two to thirteen grains, and found it to produce nausea, and to diminish the force of the circulation. It is probably the principle upon which sarsaparilla depends chiefly, if not exclusively, for its remedial powers.

The sarsaparilla of the shops is apt to be nearly if not quite inert, either from age, or from having been obtained from inferior species of Smilax. This inequality of the medicine, with the improper modes of preparing it long in vogue, has probably contributed to its variable reputation. The only criterion of good sarsaparilla to be relied on is the taste. If it leave a decidedly acrid impression in the mouth after having been chewed for a short time, it may be considered efficient; if otherwise, it is probably inert.

Medical Properties and Uses. Few medicines have undergone greater changes of reputation. About the middle of the sixteenth century it was introduced into Europe as a remedy for the venereal complaint, in which it had been found very useful in the recent Spanish settlements in the West Indies. After a time it fell into disrepute, and was little employed till about a century ago, when it was again brought into notice by Sir William Fordyce and others, as a useful adjuvant and corrigent of mercury in lues venerea. Since that period very different opinions have been entertained of it. Some, among whom was Dr. Cullen, considered it wholly inert; others, on the contrary, have had the most unbounded confidence in its powers. The probable cause of much of this discrepancy has been already mentioned. Experience, both among regular practitioners and empirics, would seem to have placed

its efficacy beyond reasonable doubt. Its most extensive and useful application is to the treatment of secondary syphilis and syphiloid diseases, and that shattered state of the system which sometimes follows the imprudent use of mercury in these affections. It is also employed, though with less obvious benefit, in chronic rheumatism, scrofulous affections, certain cutaneous diseases, and other depraved conditions of health. Its mode of action is less evident than its ultimate effects. It is said to increase the perspiration and urine; but, allowing it to do so, the effect is too slight to explain its remedial influence; and even that which is produced has been ascribed by some to the medicines with which it is generally associated, or the liquid in which it is exhibited. In this ignorance of its precise *modus operandi* we call it an alterative, as those medicines are named which change existing morbid actions, without obvious influence over any of the functions.

Sarsaparilla may be given in powder, in the dose of half a drachm three or four times a day. It is, however, more conveniently administered in the form of infusion, decoction, syrup, or fluid extract. (See *these preparations* in *Part II.*) A beer made by fermenting an infusion of the drug with molasses, is said to be a popular remedy in South America.* The smoke of sarsaparilla has been highly recommended in asthma. (*Journ. de Pharm.*, xviii. 221.)

Off. Prep. Decoctum Sarsæ, *Br.;* Decoct. Sarsæ Compositum, *Br.;* Decoct. Sarsaparillæ Comp., *U. S.;* Extractum Sarsaparillæ Fluidum, *U. S.;* Extract. Sarsaparillæ Fluid. Comp., *U. S.;* Extract. Sarsæ Liquidum, *Br.;* Syrupus Sarsaparillæ Comp., *U. S.* W.

SASSAFRAS. *U. S.*

Sassafras.

The bark of the root of Sassafras officinale (Nees, *Laurin.*). *U. S.*

SASSAFRAS MEDULLA. *U. S.*

Sassafras Pith.

The pith of the stems of Sassafras officinale (Nees, *Laurin.*). *U. S.*

Off. Syn. SASSAFRAS RADIX. The dried root of Sassafras officinale. Nees, *Laurineæ.* From North America. *Br.*

Sassafras, *Fr., Germ.:* Sassafras, Sassafrasso, *Ital.;* Sassafras. *Span.*

In the new distribution of the species composing the genus Laurus of Linnæus, the sassafras tree has been made the type of a distinct genus, denominated *Sassafras*, which is recognised by the U. S. and Br. Pharmacopœias.

Sassafras. *Sex. Syst.* Enneandria Monogynia.—*Nat. Ord.* Lauraceæ.

Gen. Ch. Dicœcious. *Calyx* six-parted, membranous; segments equal, permanent at the base. Males. *Fertile stamens* nine, in three rows, the three inner with double stalked distinct glands at the base. *Anthers* linear, four-celled, all looking inwards. Females, with as many sterile stamens as the males or fewer; the inner often confluent. *Fruit* succulent, placed on the thick fleshy apex of the peduncle, and seated in the torn unchanged calyx. (*Lindley.*)

Sassafras officinale. Nees, *Laurin.* 488.—*Laurus Sassafras.* Willd. *Sp. Plant.* ii. 485; Bigelow, *Am. Med. Bot.* iii. 142; Michaux, *N. Am. Sylv.* ii. 144. This is an indigenous tree of middling size, rising in favourable situations from thirty to fifty feet, with a trunk about a foot in diameter. In the southern States it is sometimes larger, and in the Northern parts of New England is little more than a shrub. The bark of the stem and large branches is rough, deeply furrowed, and grayish;

* The following is a formula recommended by Hancock. "Take of Rio Negro sarsa, bruised, 2lb.; bark of guaiac, powdered, 8oz.; raspings of guaiac wood, anise seeds, and liquorice root, each 4oz.; mezereon, *bark of the root*, 2oz.; treacle [molasses], 2lb.; and a dozen bruised cloves; pour upon these ingredients about four gallons of boiling water, and shake the vessel thrice a day. When fermentation has well begun, it is fit for use, and may be taken in the dose of a small tumblerful twice or thrice a day." This formula is worthy of attention; but the bark of guaiacum, which is not kept in the shops, might be omitted, or replaced by the wood.

that of the extreme branches or twigs is smooth and beautifully green. The leaves, which are alternate, petiolate, and downy when young, vary much in their form and size even upon the same tree. Some are oval and entire, others have a lobe on one side; but the greater number are three-lobed. Their mean length is four or five inches. The flowers, which are frequently diœcious, and appear before the leaves, are small, of a pale greenish-yellow colour, and disposed in racemes which arise from the branches below the leaves, and have linear bractes at their base. The corolla is divided into six oblong segments. The male flowers have nine stamens; the hermaphrodite, which are on a different plant, have only six, with a simple style. The fruit is an oval drupe, about as large as a pea, of a deep-blue colour when ripe, and supported on a red pedicle, enlarged at the extremity into a cup for its reception.

The sassafras is common throughout the United States, and extends into Mexico. It is said also to grow in Brazil and Cochin-China; but the plants observed in these countries are probably not of the same species. In the United States the sassafras is found both in woods and open places, and is apt to spring up in the neighbourhood of cultivation, and in neglected or abandoned fields. In Pennsylvania and New York, it blooms in the beginning of May, but much earlier at the South. The fresh flowers have a slighly fragrant odour, and almost all parts of the plant are more or less aromatic. The root is directed by the British Pharmacopœia; the bark of the root, and the pith of the twigs or extreme branches, by that of the U. States. The best time for collecting the pith is after the occurrence of frost in autumn; and the same is the case also with the bark of the root. The root is exported, and is the part chiefly used in the British pharmacy. It consists of a brownish-white wood, covered with a spongy bark divisible into layers. The latter portion is by far the most active, and is usually kept separate in our shops.

1. *Sassafras Pith.* This is in slender cylindrical pieces, very light and spongy, with a mucilaginous taste, and in a slight degree the characteristic flavour of the sassafras. It abounds in a gummy matter, which it readily imparts to water, forming a limpid mucilage, which, though ropy and viscid, has much less tenacity than that of gum arabic, and will not answer as a substitute in the suspension of insoluble substances. It differs also from solutions of ordinary gum, in remaining limpid when added to alcohol. This mucilage is much employed as a soothing application in inflammation of the eyes; and forms an agreeable and useful drink in dysenteric, catarrhal, and nephritic diseases. It may be prepared by adding a drachm of the pith to a pint of boiling water.

2. *Bark of Sassafras Root.* As found in the shops, this is usually in small irregular fragments, sometimes invested with a brownish epidermis, sometimes partially or wholly freed from it, of a reddish or rusty cinnamon hue, very brittle, and presenting when freshly broken a lighter colour than that of the exposed surfaces. The living bark is nearly white, but becomes coloured, on exposure, immediately after collection. Its odour is highly fragrant, its taste sweetish and gratefully aromatic. These properties are extracted by water and alcohol. They reside in a volatile oil, which is obtained by distillation. (See *Oleum Sassafras.*) According to Dr. Reinsch, the bark contains a heavy and light volatile oil, camphorous matter, fatty matter, resin, wax, a peculiar principle resembling tannic acid called *sassafrid*, tannic acid, gum, albumen, starch, red colouring matter, lignin, and salts. The sassafrid bears some analogy to cinchonic red, and like it appears to be a derivative of the tannin, which exists in much larger proportion in the fresh than in that long kept. (Procter, *Am. Journ. of Pharm.*, Nov. 1866, p. 490.)

Medical Properties and Uses. The bark of sassafras root is stimulant, and perhaps diaphoretic; though its possession of any peculiar tendency to the skin, independently of its mere excitant property, is very doubtful. It is used almost exclusively as an adjuvant to other more efficient medicines, the flavour of which it improves; while it renders them more cordial to the stomach. The complaints for which it has been particularly recommended are chronic rheumatism, cutaneous eruptions, and scorbutic and syphiloid affections. As a remedy in lues venerea, in which it formerly had a high reputation, it is now considered as in itself wholly inefficient. It is most conveniently administered in the form of infusion. The oil may also be given.

Off. Prep. of the Pith. Mucilago Sassafras, *U. S.*

Off. Prep. of the Bark of the Root, or of the Root. Decoctum Sarsæ Compositum, *Br.;* Decoct. Sarsaparillæ Comp., *U. S.;* Extractum Sarsaparillæ Fluidum Comp., *U. S.;* Oleum Sassafras, *U. S.* W.

SCAMMONIÆ RADIX. *Br.*

Scammony Root.

The dried Root of Convolvulus Scammonia. *Linn.* From Syria and Asia Minor. *Br.*

SCAMMONIUM. *U. S., Br.*

Scammony.

A resinous exudation from the root of Convolvulus Scammonia. *U. S.* A gum-resin obtained by incision from the living root of Convolvulus Scammonia (*Linn.*), chiefly from Asia Minor. *Br.*

Scammonée, *Fr.;* Scammonium, *Germ.;* Scamonea, *Ital.;* Escamonea, *Span.*

Convolvulus. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Convolvulaceæ.

Gen. Ch. Corolla campanulate. *Style* one. *Stigmas* two, linear-cylindrical, often revolute. *Ovary* two-celled, four-seeded. *Capsule* two-celled. (*Lindley.*)

Convolvulus Scammonia. Willd. *Sp. Plant.* i. 845; Woodv. *Med. Bot.* p. 243, t. 86; Carson, *Illust. of Med. Bot.* ii. 14, pl. 62. This species of Convolvulus has a perennial, tapering root, from three to four feet long, from nine to twelve inches in circumference, branching towards its lower extremity, covered with a light-gray bark, and containing a milky juice. The stems are numerous, slender, and twining, extending sometimes fifteen or twenty feet upon the ground, or on neighbouring plants, and furnished with smooth, bright-green, arrow-shaped leaves, which stand alternately upon long footstalks. The flowers are placed in pairs, or three together, upon the peduncles, which are round, axillary, solitary, and of nearly twice the length of the leaf. The plant is a native of Syria, Anatolia, and certain islands of the Archipelago. No part is medicinal except the root, which was found by Dr. Russel to be a mild cathartic. It is recognised in the Br. Pharmacopœia, being used for the extraction of resin.* (See *Scammoniæ Resina* in *Part II.*) Scammony is the concrete juice of the fresh root.

Scammony is collected, according to Russel, in the following manner. In the month of June, the earth is cleared away from about the root, the top of which is cut off obliquely about two inches from the origin of the stems. The milky juice which exudes is collected in shells, or other convenient receptacle, placed at the most depending part of the cut surface. A few drachms only are collected from each root. The juice from several plants is put into any convenient vessel, and concretes by time. In this state it constitutes genuine scammony, but is very seldom exported. It is generally prepared for the market by admixture, while it is yet soft, with the expressed juice of the stalks and leaves, with wheat flour, chalk, ashes, fine sand, &c.; and it has been supposed that scammony sometimes consists wholly or in great part of the expressed juice of the root, evaporated to dryness by exposure to the sun, or by artificial heat. According to Landerer, the roots from which the juice has been collected are in some places boiled with water in copper vessels, and the extract

* Not having had an opportunity of examining the root of the scammony plant, we give the following description by Dr. Otto Borg, Professor in Berlin, contained in Buchner's *Neues Repertorium* of 1864 (xiii. No. 10, p. 448).

The dried root, as it occurs in commerce, is in cylindrical pieces a foot or more in length, about three-fourths of an inch thick, of a pure brown externally, wrinkled in drying, with here and there slender branches, with a head at top, and at the lower end with the cut surface coarsely fibrous; the head being sometimes provided with remains of the stems from half a line to two lines thick. The surface when the root is cut transversely is roundish or rarely elliptical, and pale-brown within. The bark of the root is thin, of a dirty whiteness with dark resinous points. The wood consists of compressed, generally separate, pale-brown, coarsely porous, usually subdivided fibres, parted by a parenchyma similar to the bark. (*Note to the thirteenth edition.*)

added to the juice, not so much with the purpose of adulteration, as under the impression that it favourably modifies the action of the drug. Scammony is exported chiefly from Smyrna, though small quantities are said to be sent out of the country at Alexandretta, the seaport of Aleppo. Dr. Pereira was informed by a merchant who had resided in Smyrna, that it is brought upon camels in a soft state into that city, and afterwards adulterated by individuals called scammony makers. The adulteration appears to be conducted in conformity with a certain understood scale, more or less foreign matter being added according to the price. The materials employed are chiefly chalk and some kind of flour or meal. Very little comparatively is exported perfectly pure. We obtain scammony either directly from Smyrna, or indirectly through some of the Mediterranean ports.*

The name of *Aleppo scammony* was formerly given to the better kinds of the drug, and of *Smyrna scammony* to those of inferior quality; the distinction having probably originated in some difference in the character of the scammony obtained at these two places. But no such difference now exists; as scammony is brought from Smyrna of every degree of purity. It has been customary, in this country, to designate the genuine drug of whatever quality as Aleppo scammony; while the name of Smyrna scammony has been given to a spurious article manufactured in the south of France, and to other factitious substitutes. It is quite time that these terms should be altogether abandoned. We shall treat of the drug under the heads of genuine and factitious scammony.

Genuine Scammony. This is sent into commerce in drums or boxes, and is either in irregular lumps, in large solid masses of the shape of the containing vessel into which it appears to have been introduced while yet soft, or in circular, flattish or plano-convex cakes. It seldom reaches us in an unmixed state. Formerly small

* An interesting account of the collection and preparation of scammony in Anatolia, in the vicinity of Smyrna, has been communicated by Mr. S. H. Maltass to the *London Pharmaceutical Journ. and Trans.* (xiii. 264). The juice is collected in the same manner as described by Russel in reference to Syria. The product, however, of each plant is somewhat less. In some districts, according to Maltass, ten plants produce only a drachm of scammony; in others the average from each root is a drachm; and in a good soil a plant four years old will yield two drachms. The juice received in the shells is mixed with another portion scraped from the cut surface of the root; and this mixture is the pure or *lachryma scammony*. Only a small quantity of this is taken to Smyrna; the greater part being adulterated by the peasants before it reaches the markets. Sometimes the juice is worked up with a decoction of the roots, in which case it is black, heavier than the preceding, and not so easily broken. Sometimes they add a calcareous earth, in a proportion varying from 10 to 150 per cent. The kind thus prepared is usually kept for some time in Smyrna, and is apt to ferment, so as to become porous and lose its gloss. It is in irregular lumps, and is the kind usually sold in London as *lachryma scammony*. Another kind sold in London in rough lumps, and probably under the same name, is prepared in the interior of the country by mixing the juice with wheat starch, ashes, earthy matters, gum arabic or tragacanth, and sometimes wax, yelk of egg, pounded scammony roots and leaves, flour, or resin. A kind much used in Great Britain is prepared by the Jews in Smyrna, and is in the form of cakes as described in the text. It is of two qualities. The *first quality* is prepared by mixing *skilip* (which is an inferior kind of scammony prepared at Aujora, and consists of from 30 to 40 per cent. of juice and 60 to 70 of starch) with 60 per cent. of inferior scammony from the neighbourhood of Smyrna; the *second quality*, by mixing *skilip* with about 30 per cent. of the latter kind, and adding about 10 per cent. of gum arabic and black-lead. The *first quality* contains about 50 per cent. of resin, the *second* about 30 per cent. For an account of specimens of scammony sent by Mr. Maltass from Smyrna, see a paper by Mr. D. Hanbury in the *Pharm. Journ.* (xiii. 268).—*Note to the tenth edition.*

Prof. Ch. Boulier, of Algiers, gives the following account of the collection of scammony in the northwestern parts of Anatolia. The plant is not cultivated, but grows wild in rocky places covered with brushwood. At the flowering period, about the end of June and beginning of July, the peasants go forth in search of localities among the mountains where it is most abundant, and, having satisfied themselves on this point, return home, provide themselves with the requisite implements, and set out for the place of collection. Clearing away the brushwood and stems, the peasant digs deeply around the root, then cuts off the top obliquely, and affixes a muscle-shell to the root so as to receive the juice as it flows from the dependent part. He then passes on to other plants upon which he operates in like manner. After a time he returns upon his steps, and empties the shells successively into a tinned copper vessel. Next day he goes over the same ground, and scrapes by a knife from the cut surface the juice which has in the mean time flowed out, and partially concreted. This he mixes with that previously collected, and, when his vessel is full, takes it to some neighbouring market, where it is bought up, and sent to the wholesale druggists at Constantinople and Smyrna. The juice reaches the market in a pasty state, and whitish like cheese except where exposed to the air. It is in these centres of trade, or on its way from the collectors, that the drug undergoes the various sophistications to which it is subjected; the peasant himself being honest, and seldom disposed to adulterate. (*Ibid.*, April, 1860, p. 521.)—*Note to the twelfth edition.*

portions of pure scammony were occasionally to be met with in Europe, contained in the shells in which the juice was collected and dried. This variety, denominated *scammony in shells*, is now scarcely to be found. The pure drug is called *virgin scammony*. It is in irregular pieces, often covered with a whitish-gray powder, friable and easily broken into small fragments between the fingers, with a shining grayish-green fracture soon passing into greenish-black, and exhibiting under the microscope minute air-cells, and numerous gray semi-transparent splinters.* It is easily pulverized, affording a pale ash-gray powder. When rubbed with water it readily forms a milky emulsion. It has a rather strong, peculiar odour, compared to that of old cheese. The taste is feeble at first, and afterwards somewhat acrid, but without bitterness. It gives no evidence, when the requisite tests are applied, of the presence of starch or carbonate of calcium, leaves but a slight residue when burned, and yields about 80 per cent. of its weight to ether. Considerable quantities of what is called virgin scammony have been imported into this country since the drug-law went into operation; but, though some specimens are tolerably pure, on the whole, the drug falls far short of the proper standard. Dr. E. R. Squibb examined many specimens, and found the proportion of resin to vary from 25 to 79·7 per cent.; only two or three, out of more than 30 examined, approaching the latter degree of purity within 10 per cent. (*Am. Journ. of Pharm.*, Jan. 1863, p. 51.)†

The form of scammony chiefly found in our markets is that in circular cakes. These are sometimes flattish on both sides, but generally somewhat convex on one side and flat on the other, as if dried in a saucer, or other shallow vessel. They are from four to six inches in diameter, and from half an inch to an inch and a half, or even two inches thick in the centre. As found in the retail shops, they are often in fragments. They are hard and heavy, with a faintly shining roughish fracture; and when broken exhibit in general a structure very finely porous, sometimes almost compact, and in a very few instances cavernous. Their colour externally is a dark-ash or dark-olive, or slate colour approaching to black; internally somewhat lighter and grayish, with an occasional tinge of green or yellow, but deepening by exposure. The small fragments are sometimes slightly translucent at the edges. The mass, though hard, is pulverizable without great difficulty, and affords a light-gray powder. It imparts to water with which it is triturated a greenish milky appearance. The smell is rather disagreeable, and similar to that of the pure drug. The taste, very slight at first, becomes feebly bitterish and acrid. This kind of scammony is never quite pure, and much of it is considerably adulterated. In some of the cakes carbonate of calcium is the chief impurity; in others the adulterating substance is probably meal, as evidences of the presence of starch and lignin are afforded; and in others again both these substances are found. Christison discovered in the chalky specimens from 15 to 38 per cent. of carbonate of calcium; in the amylaceous, from 13 to 42 per cent. of impurity. It was probably to the flat, dark-coloured, compact, difficultly pulverizable, and more impure cakes that the name of *Smyrna scammony* was formerly given. These have been erroneously ascribed by some to *Periploca Secamone*, a plant growing in Egypt.‡

* According to Maltass, the purest scammony has a reddish-black fracture, unless it has been mixed with water in its preparation, in which case it is black and very glossy. (*Pharm. Journ.*, xiii. 266.)

† Dr. Squibb gives the following description of the drug recently imported as *virgin scammony*. "It generally occurs in soldered square tin boxes, containing 25 to 28 pounds each. Occasionally, however, it is in round wooden boxes or drums of a similar capacity. The scammony is in irregular, rough and fissured masses of various sizes, sometimes porous, but commonly solid, hard, and semi-resinous, having a tough dull fracture. It is of a very dark grayish-green colour internally, often nearly black, but more of an ash colour externally. It is rarely dry enough to be pulverulent, yet still more rarely too moist to be rubbed into coarse powder, and it generally loses 6 per cent. in drying sufficiently to make a fine powder." (*Am. Journ. of Pharm.*, Jan. 1863, p. 49.)—*Note to the twelfth edition.*

‡ Dr. Pereira, in his work on Materia Medica, describes as follows the varieties of scammony as they exist in the London market.

1. *Virgin Scammony. Pure Scammony. Lachryma Scammony.* The description of this corresponds with that of pure scammony given in the text. In addition, the following particulars may be mentioned. The whitish powder often found upon the surface effervesces with muriatic acid, and consists of chalk, in which the lumps have probably been rolled. The sp. gr. of the masses is 1·210. In the same pieces it sometimes happens that certain portions are shining and black, while

Scammony is ranked among the gum-resins. It is partially dissolved by water, much more largely by alcohol and ether, and almost entirely, when pure, by boiling diluted alcohol. Its active ingredient is resin, which constitutes from 80 to 90 per cent. of pure dry scammony. (See *Resina Scammonii.*) The gum-resin has been analyzed by various chemists, but the results are uncertain; as the character of the specimens examined is insufficiently determined by the terms Aleppo and Smyrna scammony, employed to designate them. Thus, Bouillon-Lagrange and Vogel obtained, from 100 parts of Aleppo scammony, 60 of resin, 3 of gum, 2 of extractive, and 35 of insoluble matter; from the same quantity of Smyrna scammony, 29 parts of resin, 8 of gum, 5 of extractive, and 58 of vegetable remains and earthy substances. It is obvious that both the specimens upon which they operated were very impure. Marquart found in pure scammony (*scammony in shells*) 81·25 per cent. of resin, 3·00 of gum with salts, 0·75 of wax, 4·50 of extractive, 1·75 of starchy envelopes, bassorin, and gluten, 1·50 of albumen and lignin, 3·75 of ferruginous alumina, chalk, and carbonate of magnesium, and 3·50 of sand. Christison found different specimens of pure scammony to contain, in 100 parts, from 77 to 83 parts of resin, from 6 to 8 of gum, from 3·2 to 5 of lignin and sand, and from 7·2 to 12·6 of water, with occasionally a little starch, probably derived accidentally from the root, and not in sufficient quantity to cause a cold decoction of the gum-resin to give a blue colour with iodine. Mr. Hanbury, of London, found 91·1 per cent. of resin in the purest scammony in shells; and Mr. B. W. Bull, of New York, 86·88 per cent. in a specimen in irregular lumps, received from Constantinople as Aleppo Scammony. (*N. Y. Journ. of Pharm.*, June, 1852.) As already stated, scammony is seldom quite pure as found in our shops. Much of it contains not more than 50 per cent. of the resin, some not more than 42 per cent., and the worst varieties as little as 10 per cent., or even less.* Sometimes the cakes are of good quality on the outside, and inferior within. (Bull, *N. Y. Journ. of Pharm.*, i. 7.) It has been sug-

others are dull-grayish. Virgin scammony readily takes fire, and burns with a yellowish flame. This variety is now much more abundant in the shops of London than formerly.

2. *Scammony of second quality.* This is called *seconds* in commerce. It is in two forms. 1. In *irregular pieces.* This in external appearance, brittleness, odour, and taste, resembles virgin scammony; but is distinguished by its greater sp. gr., which is 1·463, by its dull, very slightly shining fracture, and its grayish colour. The freshly broken surface effervesces with muriatic acid, but the cold decoction does not give a blue colour with iodine. It therefore contains chalk, but not fecula. 2. In *large irregular masses.* This has the form of the drum or box in which it was imported, and into which it was probably introduced while soft. It has a dull grayish fracture, and the sp. gr. 1·359. It exhibits, with the appropriate tests, evidence of the presence both of chalk and fecula. It is sometimes found of a soft or cheesy consistence.

3. *Scammony of third quality.* This is called *thirds* in commerce. It is in circular, flat cakes, about five inches in diameter and one inch thick. The cakes are dense, heavy, and more difficult to break than the preceding varieties. The fracture is sometimes resinous and shining, sometimes dull, and exhibits air cavities, and numerous white specks, which consist of chalk. The colour is grayish or grayish-black. The sp. gr. varies from 1·276 to 1·543. Both chalk and flour are detected by tests. In five different cakes, the quantity of chalk employed in the adulteration was stated by the importer to be, in 100 parts of the cakes respectively, 13·07, 23·1, 25·0, 31·05, and 37·54, numbers which correspond very closely, in the two extremes, with the results obtained by Christison. This is the variety of scammony referred to in the text as the one chiefly used in the United States.

A valuable paper by Dr. Carson, on the varieties of scammony imported into this country, was published in the *Am. Journ. of Pharm.* (xx. i.), to which the reader is referred. Besides the kinds described in the text, namely the virgin scammony, and those which are adulterated with chalk or meal or both, Dr. Carson describes two, under the names of *gummy* and *black gummy* scammony, in which the chief adulteration appears to be tragacanth, or some analogous substance, which is associated in the dark variety with bone-black. They afforded from 6 to 13 per cent. of resin. They are in circular cakes, hard, compact, of difficult pulverization, and viscid when moistened. (*Note to the eighth edition.*)

* The following table is given by Dr. Christison as the result of his examination of different specimens of impure commercial scammony.

	Calcareous.			Amylaceous.		Calcareo-amylaceous.
Resin	64·6	56·6	43·3	37·0	62·0	42·4
Gum	6·8	5·0	8·2	9·0	7·2	7·8
Chalk	17·6	25·0	31·6	—	—	18·6
Fecula	—	1·4	4·0	20·0	10·4	13·2
Lignin and sand	5·2	7·1	7·8	22·2	13·4	9·4
Water	6·4	5·2	6.4	12·0	7·5	10·4
	100·6	100·3	101·3	100·2	100·5	101·8

gested, in this uncertainty as to the strength of the scammony of the shops, whether it might not be best to abandon its internal use altogether, and to employ only the resin, which is of uniform strength. Indeed, the resin has been officinally substituted for the gum-resin in that important preparation, the compound extract of colocynth.

In the U. S. Pharmacopœia it is directed that 75 per cent. of the drug should be soluble in ether, in the British from 80 to 90 per cent. Both require that it should not effervesce with muriatic acid, and that water heated with it should not give a blue colour with tincture of iodine; the former test indicating the absence of chalk, the latter of farinaceous matters.

Factitious Scammony. Montpellier Scammony. Much spurious scammony is manufactured in the south of France, said by Guibourt to be made from the expressed juice of *Cynanchum Monspeliacum*, incorporated with various resins, and other purgative substances. M. Thorel, however, a pharmaceutist of Avallon, denies that this plant is employed in its preparation. (*Journ. de Pharm.*, xx. 107.) It has been occasionally imported into the United States, and sold as Smyrna scammony. It is usually in flat semicircular cakes, four or five inches in diameter, and six or eight lines thick, blackish both externally and within, very hard, compact, rather heavy, of a somewhat shining and resinous fracture, a feeble balsamic odour wholly different from that of genuine scammony, and a very bitter nauseous taste. When rubbed with the moistened finger it becomes dark-gray, unctuous, and tenacious. We have seen another substance sold as Smyrna scammony, which was obviously spurious, consisting of blackish, circular, flat cakes, or fragments of such cakes, rather more than half an inch thick, very light, penetrated with small holes, as if worm-eaten, and when broken exhibiting an irregular, cellular, spongy texture. Dr. Pereira described a factitious substance sold as *Smyrna scammony*, which was in circular flat cakes about half an inch thick, blackish, and of a slaty aspect, breaking with difficulty, of a dull black fracture, and of the sp. gr. 1·412. Moistened and rubbed it had the smell of guaiac, which could also be detected by chemical tests.

Medical Properties and Uses. Scammony is an energetic cathartic, apt to occasion griping, and sometimes operating with harshness. It was known to the ancient Greek physicians, and was much employed by the Arabians, who not only gave it as a purgative, but also applied it externally for the cure of various cutaneous diseases. It may be used in all cases of torpid bowels, when a powerful impression is desired; but, on account of its occasional violence, it is seldom administered, except in combination with other cathartics, the action of which it promotes, while its own harshness is mitigated. It should be given in emulsion with mucilage, sugar, almonds, liquorice, or other demulcent; and its disposition to gripe may be counteracted by the addition of an aromatic. The dose is from five to fifteen grains of pure scammony, from ten to thirty of that commonly found in the market.

Off. Prep. of the Root. Scammoniæ Resina, *Br.*

Off. Prep. of Scammony. Confectio Scammonii, *Br.;* Pilula Colocynthidis Comp., *Br.;* Pulvis Scammonii Comp., *Br.;* Resina Scammonii, *U. S.* W.

SCILLA. *U. S., Br.*

Squill.

The bulb of Scilla maritima. *U. S.* The sliced and dried bulb of Urginea Scilla. *Steinheil.* From the Mediterranean coast. *Br.*

Scille, *Fr.;* Meerzwiebel, *Germ.;* Scilla, *Ital.;* Cebolla albarrana, *Span.*

Scilla. *Sex. Syst.* Hexandria Monogynia.—*Nat. Ord.* Liliaceæ.

Gen. Ch. Corolla six-petaled, spreading, deciduous. *Filaments* thread-like. *Willd.*

Scilla maritima. Willd. *Sp. Plant.* ii. 125; Woodv. *Med. Bot.* p. 745, t. 255.—*Squilla maritima.* Lindley, *Flor. Med.* p. 591; Carson, *Illust. of Med. Bot.* ii. 46, pl. 89. This is a perennial plant, with fibrous roots proceeding from the bottom of a large bulb, which sends forth several long, lanceolate, pointed, somewhat undulated, shining, deep-green leaves. From the midst of the leaves a round, smooth, succu-

lent flower-stem rises, from one to three feet high, terminating in a long, close spike of whitish flowers. These are destitute of calyx, and stand on purplish peduncles, at the base of each of which is a linear, twisted, deciduous floral leaf. The squill grows on the sea-coast of Spain, France, Italy, Greece, and the other countries bordering on the Mediterranean. The bulb is the officinal portion. It is generally dried for use; but is sometimes imported into this country in the recent state packed in sand.

Properties. The fresh bulb is pear-shaped, usually larger than a man's fist, sometimes as large as the head of a child, and consists of fleshy scales attenuated at their edges, closely applied over each other, and invested by exterior scales so thin and dry as to appear to constitute a membranous coat. There are two varieties, distinguished as the *red* and *white squill.* In the former, the exterior coating is of a deep reddish-brown colour, and the inner scales have a whitish rosy or very light pink epidermis, with a yellowish-white parenchyma; in the latter, the whole bulb is white. They do not differ in medicinal virtue. The bulb abounds in a viscid, very acrid juice, which causes it to inflame and even excoriate the skin when much handled. By drying, this acrimony is very much diminished, with little loss of medicinal power. The bulb loses about four-fifths of its weight in the process. Vogel found 100 parts of fresh squill to be reduced to 18 by desiccation. The process is somewhat difficult, in consequence of the abundance and viscidity of the juice. The bulb is cut into thin transverse slices, and the pieces dried separately by artificial or solar heat. The outer and central scales are rejected, the former being dry and destitute of activity, the latter too fleshy and mucilaginous.

Dried squill, as found in our shops, is in irregular oblong pieces, often more or less contorted, of a dull yellowish-white colour with a reddish or rosy tint, sometimes entirely white, slightly diaphanous, brittle and pulverizable when perfectly dry, but often flexible from the presence of moisture, for which they have a great affinity. Occasionally a parcel will be found consisting of vertical slices, some of which adhere together at the base. The odour is very feeble, the taste bitter, nauseous, and acrid.

The virtues of squill are extracted by water, alcohol, and vinegar. It was analyzed by Vogel; and, more recently (A.D. 1856), by M. J. H. Marais, who found, in 100 parts, 30 of mucilage, 15 of sugar, 8 of tannin, 10 of a red, acid colouring matter, 2 of a yellow, acid, odorous colouring matter, 1 of fatty matter, 1 of *scillitin*, 5 of salts, and traces of iodine. (*Journ. de Pharm.*, Fév. 1857, p. 127.) Examined by the microscope, the bulb is seen to be pervaded by innumerable minute acicular crystals, consisting of the salts of squill, chiefly, according to M. Marais, carbonate of calcium, with a little chloride of calcium. (*Ibid.*) Water distilled from it had neither taste nor smell, and was drunk by Vogel to the amount of six ounces without effect. The acrid principle, therefore, is not volatile. The substance named *scillitin* by Vogel was soluble in water, alcohol, and vinegar; but was considered by M. Tilloy, of Dijon, to be a compound of the proper active principle of squill with gum and uncrystallizable sugar. The *scillitin*, obtained by the latter experimenter, was insoluble in water and dilute acids, soluble in alcohol, exceedingly acrid and bitter, and very powerful in its influence on the system. A single grain produced the death of a strong dog. The process of Tilloy may be seen in former editions of this work. The scillitin obtained by him was still impure. Labourdais believed that he had obtained it in an isolated state by means of animal charcoal. A decoction of squill was first treated with acetate of lead to separate the viscid matters, was then filtered and agitated in the cold with purified animal charcoal in fine powder, and afterwards allowed to rest. The charcoal gradually subsided, carrying with it the bitter and colouring principles. The liquid being decanted, the solid matter was dried, and treated with hot alcohol, which acquired an insupportable bitterness. The alcohol, being distilled off, left a milky liquid, which was allowed to evaporate spontaneously. The scillitin thus procured was solid, uncrystallized, easily decomposable by heat, almost caustic to the taste, not deliquescent, neuter, but slightly soluble in water, to which, however, it imparted a very great bitterness, very soluble in alcohol, and dissolved, but at the same time decomposed by concentrated sulphuric and nitric acids, imparting to the former a purple colour, instantly becoming black. (*Ann. de Thérap.*, 1849, p. 145.) L. F. Bley succeeded in obtaining scillitin, by the process of La-

bourdais, in long flexible needle-shaped crystals, by simply allowing the last alcoholic solution to evaporate spontaneously. (*Arch. der Pharm.*, lxi. 141.) Landerer obtained a crystalline principle from fresh squill, by treating the bruised bulb with dilute sulphuric acid, concentrating the solution, neutralizing it with lime, drying the precipitate, exhausting this with alcohol, and evaporating the tincture, which, on cooling, deposited the substance in question in prismatic crystals. It was bitter, but not acrid, insoluble in water or the volatile oils, slightly soluble in alcohol, and, according to Landerer, capable of neutralizing the acids. (*Christison's Dispensatory.*) Wittstein inferred from his experiments that the bitterness and acrimony of squill reside in distinct principles. (See *Pharm. Journ.*, x. 359.) By a more recent analysis, Tilloy was induced to believe that there were two active principles in squill; one a resinoid substance very acrid and poisonous, soluble in alcohol and not in ether, the other a very bitter principle, yellow, and soluble in water and alcohol. The acrid principle, in the dose of about three-quarters of a grain, killed a dog. The bitter principle is much less powerful. Both are contained in the matters extracted from squill by means of animal charcoal. (*Journ. de Pharm.*, xxiii. 410.)

M. Marais obtained results somewhat different from those of his predecessors. The *scillitin* procured by him is uncrystallizable, hygrometric but not deliquescent, insoluble in water, and very soluble in alcohol and ether, even cold. It is in minute semitransparent spangles, of a pale-yellow colour, and of an intense, pungent bitterness, which is increased by the presence of water. Sulphuric acid dissolves it, producing a colour precisely similar to that which the same acid causes with cod-liver oil. Nitric acid also dissolves it, causing a bright-red colour, which rapidly disappears. Muriatic acid has no effect on it. The hydrated alkalies disengage ammonia, showing that it contains nitrogen. Ammonia and potassa do not dissolve it, but remove its bitterness. Tannic acid gives with it a pale-yellow precipitate. It approaches the alkaloids in character; as it has an alkaline reaction, combines with acetic acid, and contains nitrogen. In its effects on the system, it resembles the acrid narcotics, proving fatal in the dose of three-quarters of a grain. It first vomits and purges violently, then acts as a narcotic, and finally paralyzes the heart. In fatal doses it occasions violent inflammation of the alimentary canal. Applied endermically, it acts much more rapidly than by the mouth, and now almost exclusively as a narcotic. A vigorous dog was killed in twenty-two minutes by six-tenths of a grain applied in this way. M. Marais obtains it by making a concentrated tincture of dry squill with alcohol of 0·56, precipitating with milk of lime, shaking the whole with ether, decanting the supernatant liquid, washing the magma with a fresh portion of ether till wholly deprived of bitterness, uniting the liquors, and distilling until there remains in the retort only alcohol with the scillitin and a little fatty matter. This is then evaporated as quickly as possible with a gentle heat, and the residue treated with alcohol of 0·90, which dissolves the scillitin, and leaves the fatty matter. The alcoholic solution, evaporated to dryness, yields the scillitin, which is to be immediately enclosed in a well-stopped bottle. (*Ibid.*, xxi. 128, Fév. 1857.)

When kept in a dry place, squill retains its virtues for a long time; but if exposed to moisture it soon becomes mouldy.

Medical Properties and Uses. Squill is expectorant, diuretic, and in large doses emetic and purgative. In overdoses it has been known to occasion hypercatharsis, strangury, bloody urine, and fatal inflammation of the stomach and bowels. The Greek physicians employed it as a medicine; and it has retained to the present period a deserved popularity. As an expectorant, it is used both in cases of deficient and of superabundant secretion from the bronchial mucous membrane; in the former case usually combined with tartar emetic or ipecacuanha, in the latter frequently with the stimulant expectorants. In both instances, it operates by stimulating the vessels of the lungs; and, where the inflammatory action in this organ is considerable, as in pneumonia and severe catarrh, the use of squill should be preceded by depletory measures. In dropsical diseases it is very much employed, especially in connection with calomel, which is supposed to excite absorption, while the squill increases the secretory action of the kidneys. It is thought to succeed best in these complaints, in the absence of general inflammatory excitement. A remarkable case

of greatly enlarged spleen, which was entirely removed under the use of fifteen drops of tincture of squill, given five times a day, and operating as a diuretic, is recorded by Dr. Hennigké in the Medical Gazette of Strasburg. The cure was effected in three weeks. (*Ann. de Thérap.*, 1867, p. 91.) On account of its great uncertainty and occasional harshness, it is very seldom prescribed as an emetic, except in infantile croup or catarrh, in which it is usually given in the form of syrup or oxymel. When given in substance it is most conveniently administered in the form of pill. The dose, as a diuretic or expectorant, is one or two grains repeated two or three times a day, and gradually increased till it produces slight nausea, or evinces its action upon the kidneys or lungs. From six to twelve grains will generally vomit. The vinegar and syrup of squill are officinal, and are much used. An *acetic extract* has been prepared by Mr. F. D. Niblett, by digesting a pound of squill with three fluidounces of acetic acid and a pint of distilled water, with a gentle heat, for forty-eight hours, then expressing, and, without filtration, evaporating to a proper consistence. One grain is equal to about three of the powder. (*Pharm. Journ.*, xii. 133.)

Off. Prep. Acetum Scillæ; Pilula Ipecacuanhæ cum Scilla, *Br.;* Pilulæ Scillæ Comp.; Syrupus Scillæ Comp., *U. S.;* Tinctura Scillæ. W.

SCOPARIUS. *U. S.*

Broom. Broom-Tops. Br.

The tops of Sarothamæ Scoparius (*Wimmer*). *U. S.*

Off. Syn. SCOPARII CACUMINA. *Broom Tops.* The fresh and dried tops of Sarothamnus Scoparius. *Wimmer.* From indigenous plants. *Br.*

Genêt à balais, *Fr.;* Gemeine Besenginster, *Germ.;* Scoparia, *Ital.;* Retama, *Span.*

CYTISUS. *Sex. Syst.* Diadelphia Decandria.—*Nat. Ord.* Fabaceæ or Leguminosæ.

Gen. Ch. Calyx bilabiate, upper lip generally entire, lower somewhat three-toothed. *Vexillum* ovate, broad. *Carina* very obtuse, enclosing the stamens and pistils. *Stamens* monadelphous. *Legume* plano-compressed, many-seeded, not glandular. (*De Cand.*)

Cytisus Scoparius. De Cand. *Prodrom.* ii. 154.—*Spartium Scoparium.* Willd. *Sp. Plant.* iii. 933; Woodv. *Med. Bot.* p. 413, t. 150. This is a common European shrub, cultivated in our gardens, from three to eight feet high, with numerous straight, pentangular, bright-green, very flexible branches, and small, oblong, downy leaves, usually ternate, but on the upper part of the plant sometimes simple. The flowers are numerous, papilionaceous, large, showy, of a golden-yellow colour, and solitary upon short axillary peduncles. The seeds are contained in a compressed legume, which is hairy at the sutures.

The whole plant has a bitter nauseous taste, and, when bruised, a strong peculiar odour. The tops of the branches are the officinal portion; but the seeds also are used, and, while they possess similar virtues, have the advantage of keeping better. Water and alcohol extract their active properties. According to Cadet de Gassicourt, the flowers contain volatile oil, fatty matter, wax, chlorophyll, yellow colouring matter, tannin, a sweet substance, mucilage, osmazome, albumen, and lignin. Dr. Stenhouse has separated from them two principles, one of which, called *scoparin*, he believes to be the diuretic principle, and the other, named *spartein*, to be narcotic. The former is in stellate crystals, easily dissolved by boiling water and alcohol, and is obtained by purifying a yellow gelatinous substance deposited upon the evaporation of the decoction. It may be given in the dose of four or five grains. The latter was obtained by distillation from the mother-waters of the scoparin. It is a colourless liquid, having a peculiar bitter taste, and all the properties of a volatile organic base. It appears to have narcotic properties. But we need more definite information on the subject. (*Annuaire de Thérap.*, 1853, p. 153.)

Medical Properties and Uses. Broom is diuretic and cathartic, and in large doses emetic, and has been employed with great advantage in dropsical complaints, in which it was recommended by Mead, Cullen, and others. Cullen prescribed it in the form of decoction, made by boiling half an ounce of the fresh tops in a pint of

water down to half a pint, of which he gave a fluidounce every hour till it operated by stool or urine. It is a domestic remedy in Great Britain, but is seldom used in this country. The seeds may be given in powder, in the dose of ten or fifteen grains.

Off. Prep. Decoctum Scoparii, *Br.;* Succus Scoparii, *Br.* W.

SCUTELLARIA. *U. S. Secondary.*

Scullcap.

The herb of Scutellaria lateriflora. *U. S.*

Scutellaria. *Sex. Syst.* Didynamia Gymnospermia.—*Nat. Ord.* Labiatæ.

Gen. Ch. Calyx bilabiate; lips entire; mouth closed by a helmet-shaped lid after the corolla falls. *Corolla* bilabiate, upper lip vaulted, lower dilated, convex; tube of the corolla bent.

Several species of Scutellaria have attracted attention. *Scutellaria galericulata*, or common *European scullcap*, which also grows wild in this country, has a feeble, somewhat alliaceous odour, and a bitterish taste. It has been employed in intermittents, and externally in old ulcers. Dr. R. W. Evans, of Canada West, has found it useful in epilepsy; but to effect a cure it must be continued, he says, for five or six months. He makes an infusion with two ounces of the herb and eight ounces of water, and gives a fluidounce every eight hours, doubling the quantity after a week. (See *Am. Journ. of Med. Sci.*, xvii. 495.) Another indigenous species, the *S. integrifolia*, of which *S. hyssopifolia*, Linn., is considered by some as a variety, is intensely bitter, and might probably be found useful as a tonic. S. lateriflora is the only officinal species.

Scutellaria lateriflora. Willd. *Sp. Plant.* iii. 172; Gray, *Manual of the Bot. of North. U. S.*, p. 315. This is an indigenous perennial herb, with a stem erect, much branched, quadrangular, smooth, and one or two feet high. The leaves are ovate, acute, dentate, subcordate upon the stem, opposite, and supported upon long petioles. The flowers are small, of a pale-blue colour, and disposed in long, lateral, leafy racemes. The tube of the corolla is elongated, the upper lip concave and entire, the lower three-lobed. The plant grows in moist places by the sides of ditches and ponds in all parts of the Union.

To the senses scullcap does not indicate, by any peculiar taste or smell, the possession of medicinal virtues. It is even destitute of the aromatic properties which are found in many of the labiate plants. When taken internally, it produces no very obvious effects. Notwithstanding this apparent inertness, it obtained, at one period, extraordinary credit throughout the United States, as a preventive of hydrophobia, and was even thought to be useful in the disease itself. A strong infusion of the plant was given in the dose of a teacupful, repeated several times a day, and continued for three or four months after the bite was received; while the herb itself was applied to the wound. Strong testimony was adduced in favour of its prophylactic powers; but it has already shared the fate, which in this case is no doubt deserved, of numerous other specifics against hydrophobia, which have been brought into temporary popularity, only to be speedily abandoned. Nevertheless, it is thought by some practitioners to have valuable therapeutic properties; and Drs. Ariel Hunton and C. H. Cleaveland, of Vermont, speak in strong terms of its efficacy as a nervine. They have employed it in neuralgic and convulsive affections, chorea, delirium tremens, and nervous exhaustion from fatigue or over-excitement, and have found it highly advantageous. Dr. Cleaveland says that he prefers it to all other nervines or antispasmodics, except where an immediate effect is desirable. He prefers the form of infusion, which he prepares by adding half an ounce of the dried leaves to a teacupful of water, and allows the patient to drink *ad libitum*. (*Am. Journ. of Pharm.*, xxiii. 370; also *N. J. Med. Reporter*, v. 13.) These views are confirmed, by the statement of Dr. D. C. Leavenworth, of New Haven, Conn., who has employed it with great advantage in diseases requiring a combined nervine and tonic influence, as in low forms of fever, in the nervous diseases of women, in epilepsy, and debilitated system from masturbation, or excessive mercurial action, &c. (*Med. and Surg. Reporter*, March 19, 1870, p. 230.)

Two preparations are now used; one called *scutellarine*, though erroneously, as it has no claim to be considered a pure proximate principle, the other a *fluid extract*. The so-called scutellarine is prepared by mixing a concentrated tincture with water, precipitating by alum, and then washing and drying. Dr. Cleaveland gives it in a dose varying from one to three or four grains, and finds very happy effects from it in quieting nervous disorders. (*N. J. Med. Reporter*, viii. 121.) The fluid extract, prepared by the Messrs. Tilden, is used in the dose of one or two fluidrachms. Dr. Joseph Bates, of New Lebanon, N. Y., speaks highly of it as a nervine. (*Boston Med. and S. Journ.*, lii. 337.) W.

SENEGA. *U. S.*

Seneka.

The root of Polygala Senega. *U. S.*

Off. Syn. SENEGÆ RADIX. *Senega Root.* The dried root of Polygala Senega *Linn.* From North America. *Br.*

Polygale de Virginie, *Fr.;* Klapperschlangenwurzel, *Germ.;* Poligala Virginiana, *Ital.*

POLYGALA. *Sex. Syst.* Diadelphia Octandria. — *Nat. Ord.* Polygalaceæ.

Gen. Ch. Calyx five-leaved, with two leaflets wing-shaped and coloured. *Legume* obcordate, two-celled. *Willd.*

Besides *P. Senega*, two other species have attracted some attention in Europe—*P. amara* and *P. vulgaris*—as remedies in chronic pectoral affections; but as they are not natives of this country, and never used by practitioners here, they do not merit particular notice.

Polygala Senega. Willd. *Sp. Plant.* iii. 894; Bigelow, *Am. Med. Bot.* ii. 97; Barton, *Med. Bot.* ii. 111. This unostentatious plant has a perennial branching root, from which several erect, simple, smooth, round, leafy stems annually rise, from nine inches to a foot in height. The stems are occasionally tinged with red or purple below, but are green near the top. The leaves are alternate or scattered, lanceolate, pointed, smooth, bright-green on the upper surface, paler beneath, and sessile or supported on very short footstalks. The flowers are small and white, and form a close spike at the summit of the stem. The calyx is their most conspicuous part. It consists of five leaflets, two of which are wing-shaped, white, and larger than the others. The corolla is small and closed. The capsules are small, much compressed, obcordate, two-valved and two-celled, with two oblong-ovate, blackish seeds, pointed at one end.

This species of Polygala, commonly called *Seneka snakeroot*, grows wild in all parts of the United States, but most abundantly in the southern and western sections, where the root is collected for sale. It is brought into market in bales weighing from fifty to four hundred pounds.

Properties. As the root occurs in commerce, it is of various sizes, from that of a straw to that of the little finger, presenting a thick knotty head, which exhibits traces of the numerous stems. It is tapering, branched, variously twisted, often marked with crowded annular protuberances, and with a projecting keel-like line, extending along its whole length. The epidermis is corrugated, transversely cracked, of a yellowish-brown colour in the young roots, and brownish-gray in the old. In the smaller branches the colour is a lighter yellow. The bark is hard and resinous, and contains the active principles of the root. The central portion is ligneous, white, and quite inert, and should be rejected in the preparation of the powder. The colour of this is gray. The odour of seneka is peculiar, strong in the fresh root, but faint in the dried. The taste is at first sweetish and mucilaginous, but after chewing becomes somewhat pungent and acrid, leaving a peculiar irritating sensation in the fauces. These properties, as well as the medical virtues of the root, are extracted by boiling water and by alcohol. Diluted alcohol is an excellent solvent. The root has been analyzed by Gehlen, Peschier of Geneva, Feneulle of Cambray, Dulon D'Astafort, Folchi, and Trommsdorff, and more recently by M. Quevenne. The *senegin* of Gehlen, though supposed at one time to be the active principle, has been ascertained to be a complex substance, and to have no just claim to the rank assigned to it. From a

comparison of the results obtained by the above-mentioned chemists, it would appear that seneka contains, 1. a peculiar acrid principle, which M. Quevenne considers to be an acid, and has named *polygalic acid;* 2. a yellow colouring matter, of a bitter taste, insoluble or nearly so in water, but soluble in ether and alcohol; 3. a volatile principle considered by some as an essential oil, but thought by Quevenne to possess acid properties, and named by him *virgineic acid;* 4. pectic acid or pectin; 5. tannic acid of the variety which precipitates iron green; 6. gum; 7. albumen; 8. cerin; 9. fixed oil; 10. woody fibre; and 11. saline and earthy substances, as the carbonates, sulphates, and phosphates of calcium and potassium, chloride of potassium, alumina, magnesia, silica, and iron. The virtues of seneka appear to reside chiefly, if not exclusively, in the acrid principle which M. Quevenne called polygalic acid, and which he considered closely analogous to saponin. He obtained it pure by the following process. Powdered seneka is exhausted by alcohol of 33°, and so much of the alcohol is distilled off as to bring the resulting tincture to the consistence of syrup. The residue is treated with ether, in order to remove the fatty matter. The liquid upon standing deposits a precipitate, which is separated by filtration, and is then mixed with water. To the turbid solution thus formed alcohol is added, which facilitates the production of a white precipitate, consisting chiefly of polygalic acid. The liquid is allowed to stand for several days, that the precipitate may be fully formed. The supernatant liquid being decanted, the precipitate is drained upon a filter, and, being removed while yet moist, is dissolved by the aid of heat in alcohol of 36°. The solution is boiled with purified animal charcoal, and filtered while hot. Upon cooling it deposits the principle in question in a state of purity. Thus obtained, polygalic acid is a white powder, inodorous, and of a taste at first slight, but soon becoming pungent and acrid, and producing a very painful sensation in the throat. It is fixed, unalterable in the air, inflammable, soluble in water slowly when cold and rapidly with the aid of heat, soluble in all proportions in boiling absolute alcohol, which deposits most of it on cooling, quite insoluble in ether and in the fixed and volatile oils, and possessed of the properties of reddening litmus and neutralizing the alkalies. Its constituents are carbon, hydrogen, and oxygen. M. Quevenne found it, when given to dogs, to occasion vomiting, and much embarrassment in respiration, and in large quantities to destroy life. Dissection exhibited evidences of inflammation of the lungs; and frothy mucus was found in the stomach, œsophagus, and superior portion of the trachea, showing the tendency of this substance to increase the mucous secretion, and explaining in part the beneficial influence of seneka in croup. (*Journ. de Pharm.*, xxii. 449, and xxiii. 227.) M. Bolley confirms the opinion of Quevenne as to the strong analogy between *polygalic acid* or *senegin* and saponin, if not their absolute identity, and considers them both as glucosides, resolvable by muriatic acid into glucose and a peculiar substance called *sapogenin.* He represents the composition of senegin by the formula $C_{36}H_{24}O_{30}$. (See *Am. Journ. of Pharm.*, xxvii. 45.)

From the experiments of M. Quevenne, it also appears that seneka yields its virtues to water, cold or hot, and to boiling alcohol; and that the extracts obtained by means of these liquids have the sensible properties of the root. But, under the influence of heat, a portion of the acrid principle unites with the colouring matter and coagulated albumen, and thus becomes insoluble in water; and the decoction, therefore, is not so strong as the infusion, if time is allowed, in the formation of the latter, for the full action of the menstruum. In forming an aqueous extract, the infusion should be prepared by percolation; as it is thus most concentrated, and consequently requires less heat in its evaporation. In preparing an infusion of seneka, the temperature of the water, according to M. Quevenne, should not exceed 104° F.

The roots of *Panax quinquefolium* or ginseng are frequently mixed with the seneka, but are easily distinguishable by their shape and taste. Another root has been occasionally observed in parcels of seneka, supposed to be that of Gillenia trifoliata. This would be readily distinguished by its colour and shape (see *Gillenia*), and by its bitter taste without acrimony. One of the most characteristic marks of seneka is the projecting line running the whole length of the root, and appearing as though a thread were placed beneath the bark, and, being attached at the upper end, were drawn at the lower, so as to give the root a contorted shape.

Medical Properties and Uses. Seneka is a stimulating expectorant and diuretic, and in large doses emetic and cathartic. It appears indeed to excite more or less all the secretions, proving occasionally diaphoretic and emmenagogue, and increasing the flow of saliva. Its action, however, is especially directed to the lungs; and its expectorant virtues are those for which it is chiefly employed. It was introduced into practice about a century ago by Dr. Tennant, of Virginia, who recommended it as a cure for the bite of the rattlesnake, and in various pectoral complaints. As an expectorant it is employed in cases not attended with acute inflammatory action, or in which the inflammation has been in great measure subdued. It is peculiarly useful in chronic catarrhal affections, the secondary stages of croup, and in peripneumonia notha after sufficient depletion. By Dr. Archer, of Maryland, it was recommended in the early stages of croup; but is now seldom given, unless in combination with squill and an antimonial, as in the *Syrupus Scillæ Compositus.* Employed so as to purge and vomit, it has proved useful in rheumatism; and some cases of dropsy are said to have been cured by it. It has also been recommended in amenorrhœa.

The dose of powdered senèka is from ten to twenty grains; but the medicine is more frequently administered in decoction. (See *Decoctum Senegæ.*) A syrup and alcoholic extract are officinal. The dose of the former is one or two fluidrachms, of the latter from one to three grains. A tincture is directed in the Br. Pharmacopœia. Polygalic acid may be employed in the dose of from the fourth of a grain to a grain, and may be administered either in pill or powder, or dissolved in hot water, with the addition, in any of its forms, of gum and sugar to obtund its acrimony. A formula for its preparation, by Professor Procter, has been published in the *Am. Journ. of Pharm.*, March, 1860, p. 150.

Off. Prep. Decoctum Senegæ, *U. S.;* Extractum Senegæ, *U. S.;* Infusum Senegæ, *Br.;* Syrupus Scillæ Compositus, *U. S.;* Syrupus Senegæ, *U. S.;* Tinctura Senegæ, *Br.* W.

SENNA. *U. S.*

Senna.

The leaflets of Cassia acutifolia (*Delile*), of Cassia obovata (*De Candolle*), and of Cassia elongata (Lemaire, *Journ. de Pharm.*, vii. 345). *U. S.*

Off. Syn. SENNA ALEXANDRINA. *Alexandrian Senna.* The leaflets of Cassia lanceolata *Lamarck;* and Cassia obovata *Colladon.* Imported from Alexandria; carefully freed from the flower pods, and leafstalks of the same, and from the flowers and fruit of Solenostemma Argel *Hayne.* SENNA INDICA. *Tinnivelly Senna.* The leaflets of Cassia elongata *Lemaire.* From plants cultivated in Southern India. *Br.*

Séné, *Fr.;* Sennesblätter, *Germ.;* Senna, *Ital., Port.;* Sen, *Span.*

Cassia. See CASSIA FISTULA.

The plants which yield senna belong to the genus Cassia, of which several species contribute to furnish the drug. These were confounded together by Linnæus in a single species, which he named Cassia Senna. Since his time the subject has been more thoroughly investigated, especially by Delile, who accompanied the French expedition to Egypt, and had an opportunity of examining the plant in its native country. Botanists at present distinguish at least three species, C. acutifolia, C. obovata, and C. elongata, as the source of commercial senna; and it is probable that two others, *C. lanceolata* of Forskhal and *C. Æthiopica* of Guibourt, contribute towards it. The first three are recognised by the U. S. Pharmacopœia.

1. *Cassia acutifolia.* Delile, *Flore d'Egypte*, lxxv. tab. 27, f. 1.—*C. lanceolata.* De Candolle; Carson, *Illust. of Med. Bot.* i. 34, pl. 27. This is described as a small undershrub, two or three feet high, with a straight, woody, branching, whitish stem; but, according to Landerer, the senna plant attains the height of eight or ten feet in the African deserts. The leaves are alternate and pinnate, with glandless footstalks, and two small narrow pointed stipules at the base. The leaflets, of which from four to six pairs belong to each leaf, are almost sessile, oval-lanceolate, acute, oblique at

their base, nerved, from half an inch to an inch long, and of a yellowish-green colour. The flowers are yellow, and in axillary spikes. The fruit is a flat, elliptical, obtuse, membranous, smooth, grayish-brown, bivalvular legume, about an inch long and half an inch broad, scarcely if at all curved, and divided into six or seven cells, each containing a hard, heart-shaped, ash-coloured seed. C. acutifolia grows wild in great abundance in Upper Egypt, Nubia, Sennaar, and other parts of Africa. This species furnishes the greater part of the variety known in commerce by the name of Alexandria senna.

2. *Cassia obovata.* Colladon, *Monographie des Casses;* De Cand. *Prodrom.* ii. 492; Carson, *Illust. of Med. Bot.* i. 35, pl. 28. The stem of this species is rather shorter than that of C. acutifolia, rising to the height of only a foot and a half. The leaves have from five to seven pairs of leaflets, which are obovate, very obtuse, sometimes mucronate, in other respects similar to those of the preceding species. The flowers are in axillary spikes, of which the peduncles are longer than the leaves of the plant. The legumes are very much compressed, curved almost into the kidney form, of a greenish-brown colour, and covered with a very short down, which is perceptible only by the aid of a magnifying glass. They contain from eight to ten seeds. The *C. obtusata* of Hayne, with obovate, truncated, emarginate leaflets, is probably a mere variety of this species. The plant, which according to Merat is annual, grows wild in Syria, Egypt, and Senegambia; and is said to have been cultivated successfully in Italy, Spain, and the West Indies. At present it grows wild so abundantly in some parts of Jamaica as to have suggested, to a resident of the island, the propriety of cultivating it for the English and American markets. (*Pharm. Journ. and Trans.*, Sept. 1867, p. 143.) It yields the variety of senna called in Europe Aleppo senna, and contributes to the Alexandrian.

3. *Cassia elongata.* Lemaire, *Journ. de Pharm.* vii. 345; Fée, *Journ. de Chim. Méd.* vi. 232; Carson, *Illust. of Med. Bot.* i. 36, pl. 29. This name was conferred by M. Lemaire upon the plant from which the India senna of commerce is derived. The botanical description was completed by M. Fée, from dried specimens of the leaves and fruit found by him in unassorted parcels of this variety of senna. Dr. Wallich afterwards succeeded in raising the plant from seeds found in a parcel of senna taken to Calcutta from Arabia; and it has been described by Dr. Royle, Wight & Arnott, and Dr. Lindley. As usually grown, it is annual; but with care it may be made to live through the year, and then assumes the character of an undershrub. It has an erect, smooth stem, and pinnate leaves, with from four to eight pairs of leaflets. These are nearly sessile, lanceolate, obscurely mucronate, oblique at the base, smooth above and somewhat downy beneath, with the veins turned inwards so as to form a wavy line immediately within the edge of the leaflet. The most striking character of the leaflet is its length, which varies from an inch to twenty lines. The petioles are without glands; the stipules minute, spreading, and semi-hastate. The flowers are bright-yellow, and arranged in axillary and terminal racemes, rather longer than the leaves. The legume is oblong, membranous, tapering abruptly at the base, rounded at the apex, and an inch and a half long by somewhat more than half an inch broad. This plant is a native of the southern parts of Arabia. It has been said also to grow in the interior of India, and is at present cultivated at Tinnevelly for medical use.

Besides the three officinal species above described, the *C. lanceolata* of Forskhal, found by that author growing in the deserts of Arabia, is admitted by Lindley and others as a distinct species. Some difference, however, of opinion exists upon this point. De Candolle considered it a variety of the C. acutifolia of Delile, from which it differs chiefly in having leaflets with glandular petioles; and, as Forskhal's description preceded that of Delile, he designated the species by the name of C. lanceolata. Forskhal's plant has been supposed by some to be the source of the India or Mocha senna; but the leaflets in this variety are much longer than those of C. lanceolata, from which the plant differs also in having no gland on the petiole. Niebuhr informs us that he found the Alexandria senna growing in the Arabian territory of *Abuarish*, whence it is taken by the Arabs to Mecca and Jedda. This is probably the C. lanceolata of Forskhal. It is highly probable that this species is the source

of a variety of senna which has been brought to this market under the name of Mecca senna.*

Cassia Æthiopica of Guibourt (*C. ovata* of Merat), formerly confounded with C. acutifolia, is considered by Dr. Lindley as undoubtedly a distinct species. It grows in Nubia, Fezzan to the south of Tripoli, and probably, according to Guibourt, throughout Ethiopia. It is from this plant that the *Tripoli senna* of commerce is derived.

Commercial History. Several varieties of this valuable drug are known in commerce. Of these, four have been received in America, the Alexandria, the Tripoli, the India, and the Mecca senna.

1. *Alexandria Senna.* Though the name of this variety is derived from the Egyptian port at which it is shipped, it is in fact gathered very far in the interior. The Alexandria senna does not consist exclusively of the product of one species of Cassia. The history of its preparation is not destitute of interest. The senna plants of Upper Egypt yield two crops annually, one in spring and the other in autumn. They are gathered chiefly in the country beyond Sienne. The natives cut the plants, and, having dried them in the sun, strip off the leaves and pods, which they pack in bales, and send to Boulac, in the vicinity of Cairo, the great entrepot for this article of Egyptian commerce. This senna from Upper Egypt, consisting chiefly though not exclusively of the product of C. acutifolia, was here formerly mixed with the leaflets of C. obovata, brought from other parts of Egypt, and even from Syria, with the leaves of *Cynanchum oleæfolium* (*C. Argel* of Delile), known commonly by the name of *argel* or *arguel*, and sometimes with those of *Tephrosia Apollinea* of De Candolle, a leguminous plant growing in Egypt and Nubia. According to M. Royer, the proportions in which the three chief constituents of this mixture were added together, were five parts of C. acutifolia, three of C. obovata, and two of Cynanchum. Thus prepared, the senna was again packed in bales, and transmitted to Alexandria. But at present there is no such uniformity in the constitution of Alexandria senna; and, though the three chief ingredients may still sometimes be found in it, they are not in the same fixed proportions; and not unfrequently the Cynanchum leaves are wholly wanting. This variety of senna is often called in French pharmaceutic works *séné de la palthe*, a name derived from an impost formerly laid upon it by the Ottoman Porte.

A parcel of Alexandria senna, as it was formerly brought to market, consisted of the following ingredients: — 1. The leaflets of C. acutifolia, characterized by their acute form, and their length, almost always less than an inch; 2. the leaflets of C. obovata, known by their rounded very obtuse summit, which is sometimes furnished with a small projecting point, and by their gradual diminution in breadth towards their base; 3. the pods, broken leafstalks, flowers, and fine fragments of other parts of one or both of these species; 4. the leaves of Cynanchum oleæfolium, which are distinguishable by their length, almost always more than an inch, their greater thickness and firmness, the absence of any visible lateral nerves on their under surface, their somewhat lighter colour, and the regularity of their base. In this last character they strikingly differ from the genuine senna leaflets, which, from whatever species derived, are always marked by obliquity at their base, one side being inserted in the petiole at a point somewhat lower than the other, and at a different angle. Discrimination between this and the other ingredients is of some importance, as the Cynanchum must be considered an adulteration. It is said by the French writers to

* The following are the botanical characters of this and the next-mentioned species.

1. *C. lanceolata.* Forskhal; Lindley, *Flor. Med.* p. 259. "Leaflets in four or five pairs, never more; oblong, and either acute or obtuse, not at all ovate or lanceolate, and perfectly free from downiness even when young; the petioles have constantly a small round brown gland, a little above the base. The pods are erect, oblong, tapering to the base, obtuse, turgid, mucronate, rather falcate, especially when young, at which time they are sparingly covered with coarse scattered hairs." (*Lindley.*)

2. *C. Æthiopica,* Guibourt, *Hist. Ab. des Drogues, &c.* ii. 219; Lindley, *Flor. Med.* p. 259. The plant is about eighteen inches high. The footstalks have a gland at the base, and another between each pair of leaflets. There are from three to five pairs of leaflets, which are pubescent, oval-lanceolate, from seven to nine lines in length, and three or four in breadth, rather shorter and less acute than those of C. acutifolia. The legume is flat, smooth, not reniform, rounded, about an inch long, with from three to five seeds.

produce hypercatharsis and much irritation of the bowels; but was found by Christison and Mayer to occasion griping and protracted nausea, with little purgation. The flowers and fruit of the Cynanchum were also often present, the former white, and in small corymbs, the latter an ovoid follicle rather larger than an orange seed. Besides the above constituents of Alexandria senna, it occasionally contained leaflets of genuine senna, much longer than those of the acutifolia or obovata, equalling in this respect the Cynanchum, which they also somewhat resembled in form. They were distinguishable, however, by their greater thinness, the distinctness of their lateral nerves, and the irregularity of their base. The leaflets and fruit of *Tephrosia Apollinea*, which have been an occasional impurity in this variety of senna, may be distinguished, the former by their downy surface, their obovate-oblong, emarginate shape, their parallel unbranched lateral nerves, and by being usually folded longitudinally; the latter, by its dimensions, being from an inch to an inch and a half long, and only two lines broad. As now imported, Alexandria senna is often quite free from the leaves of Cynanchum, and may have few or none of the leaflets of obovate senna. It is probably brought directly to Alexandria from Upper Egypt, without having undergone intermixture at Boulac or other intervening place. In Europe, this senna is said to have been sometimes adulterated with the leaflets of *Collutea arborescens* or bladder senna, and the leaves of *Coriaria myrtifolia*, a plant of Southern Europe, said to be astringent and even poisonous. An account of the former of these plants is given in *Part III.* The leaflets of the Coriaria are ovate-lanceolate, grayish-green with a bluish tint, and are readily known, when not too much broken up, by their strongly marked midrib, and two lateral nerves running from the base nearly to the summit. They are chemically distinguished by giving a whitish precipitate with solution of gelatin, and a bluish-black one with the salts of sesquioxide of iron, proving the presence of tannin. Their poisonous properties are denied by Peschier. According to Bouchardat, they are closely analogous to strychnia in their effects. Another addition to Alexandria senna has been detected by M. Lacroix, of Macon, in France, in the leaves of the *Globularia Turbith* (*Globularia alypura*, Linn.), which seem to have taken the place of the *Colutea arborescens*, because more closely resembling the senna leaflet. The leaves of the Globularia are spatulate, much enlarged towards the upper end, rounded at the extremity, but always terminating in a short sharp point. Besides, they are brown, thick, firm, and hard to the touch; while those of the Colutea are green, very thin, and soft. They have an acrid, very bitter taste, but are without nauseous odour. They are asserted to be cathartic, but milder than senna, and capable of being substituted for it in twice the dose. (*Journ. de Pharm.*, 4e sér., i. 413.) According to Prof. Bentley, the adulteration of Alexandria senna with argel, though for some time suspended, has of late years been resumed, and is now practised to a considerable extent, at least in relation to the drug as it reaches the English market. (*Pharm. Journ.*, April, 1861, p. 497.)

2. *Tripoli Senna.* Genuine Tripoli senna consists in general exclusively of the leaflets of one species of Cassia, formerly considered as a variety of *C. acutifolia*, but now admitted to be distinct, and named *C. Æthiopica*. The leaflets, however, are much broken up; and it is probably on this account that the variety is usually less esteemed than the Alexandrian. The aspect given to it by this state of comminution, and by the uniformity of its constitution, enables the eye at once to distinguish it from the other varieties of senna. The leaflets, moreover, are shorter, less acute, thinner, and more fragile than those of C. acutifolia in Alexandria senna; and their nerves are much less distinct. The general opinion at one time was, that it was brought from Sennaar and Nubia to Tripoli in caravans; but it is reasonably asked by M. Fée, how it could be afforded at a cheaper price than the Alexandrian, if thus brought on the backs of camels a distance of eight hundred leagues through the desert. It is probably collected at Fezzan, immediately south of Tripoli.

3. *India senna.* This variety is in Europe sometimes called *Mocha senna*, probably because obtained originally from that port. It derives its name of India senna from the route by which it reaches us. Though produced in Arabia, it is brought to this country and Europe from Calcutta, Bombay, and possibly other ports of Hindostan.

It consists of the leaflets of Cassia elongata, with some of the leafstalks and pods intermixed. The eye is at once struck by the great length and comparative narrowness of the leaflets, so that the variety may be readily distinguished. The pike-like shape of the leaflet has given rise to the name of *séne de la pique*, by which it is known in French pharmacy. Many of the leaflets have a yellowish, dark-brown, or blackish colour, probably from exposure after collection; and the variety has commonly in mass a characteristic dull tawny hue. It is generally considered inferior in purgative power. Leaflets of a senna resembling the Indian were brought by Dr. Livingstone from Southern Africa, where the plant grows abundantly. (Bentley, *Pharm. Journ.*, xvii. 499.)

A variety of India senna has reached this country, which is the produce of Hindostan, being cultivated at Tinnevelly, and probably other places in the south of the Peninsula. The plant was originally raised from seeds obtained from the Red Sea, and is the same as that from which the common India senna is derived. The drug is exported from Madras to England, where it is known by the name of *Tinnevelly senna*. It is a fine unmixed variety, consisting of unbroken leaflets, from one to two or more inches long, and sometimes half an inch in their greatest breadth, thin, flexible, and of a fine green colour. Mr. T. B. Groves, however, states as the result of his experiments, that Tinnevelly senna contains much less of the active principle than the Alexandrian; the latter yielding half as much again as the former. (*Pharm. Journ. and Trans.*, Oct. 1868, p. 202.)

4. *Mecca senna.* After the publication of the fifth edition of this Dispensatory, a variety of senna was imported under the name of *Mecca senna*, consisting of the leaflets, pods, broken stems, and petioles of a single species of Cassia. The leaflets were oblong-lanceolate, on the average longer and narrower than those of C. acutifolia, and shorter than those of C. elongata. The variety in mass had a yellowish or tawny hue, more like that of India than that of Alexandria senna. May it not have been the product of the C. lanceolata of Forskhal? We might infer so from the name, and from the character of the leaflet. Landerer, however, speaks of a valuable variety of senna, characterized by the large size of the leaflets, and sold under the name of Mecca senna, which he says comes from the interior of Africa.

Commercial senna is prepared for use by picking out the leaflets, and rejecting the leafstalks, the small fragments, and the leaves of other plants. The pods are also rejected by some apothecaries; but they possess considerable cathartic power, though said to be milder than the leaves.

Properties. The odour of senna is faint and sickly; the taste slightly bitter, sweetish, and nauseous. Water and diluted alcohol extract its active principles. Pure alcohol extracts them but imperfectly. (Bley and Diesel, *Pharm. Central Blatt*, Feb. 1849, p. 126.) The leaves are said to yield about one-third of their weight to boiling water. The infusion is of a deep reddish-brown colour, and has the odour and taste of the leaves. When exposed to the air for a short time, it deposits a yellowish insoluble precipitate, supposed to result from the union of extractive matter with oxygen. The nature of this precipitate, however, is not well understood. Decoction also produces some change in the principles of senna, by which its medicinal virtues have been supposed to be impaired; but some experiments of B. Heerlein would seem to show that this opinion is incorrect. An extract prepared by boiling down an infusion, redissolving the residue, and again boiling down to a solid consistence, was found to operate actively in a dose equivalent to a drachm of the leaves. (*Pharm. Cent. Blatt*, 1851, p. 909.) To diluted alcohol it imparts the same reddish-brown colour as to water; but rectified alcohol and ether, digested upon the powdered leaves, become of a deep-olive green. The analysis of senna by MM. Lassaigne and Feneulle furnished the following results. The leaves contain—1. a peculiar principle called cathartin; 2. chlorophyll, or the green colouring matter of leaves; 3. a fixed oil; 4. a small quantity of volatile oil; 5. albumen; 6. a yellow colouring matter; 7. mucilage; 8. salts of the vegetable acids, viz., malate and tartrate of calcium and acetate of potassium; and 9. mineral salts. The pods are composed of the same principles, with the exception of chlorophyll, the place of which is supplied by a peculiar colouring matter. (*Journ. de Pharm.*, vii. 548, and ix. 58.) *Cathartin* was thought to be the

active principle of senna; but upon trial it has proved to possess little power; and it is now believed to be a complex body, consisting, according to Bley and Diesel, of a mixture of resinous and extractive matter. It is an uncrystallizable substance, having a peculiar smell, a bitter, nauseous taste, and a reddish-yellow colour; is soluble in every proportion in water and alcohol, but insoluble in ether; and in its dry state attracts moisture from the air. It is prepared in the following manner. To a filtered decoction of senna the solution of acetate of lead is added; and the precipitate which forms is separated. A stream of hydrosulphuric acid is then made to pass through the liquor in order to precipitate the lead, and the sulphuret produced is removed by filtration. The liquid is now evaporated to the consistence of an extract; the product is treated with rectified alcohol; and the alcoholic solution is evaporated. To the extract thus obtained sulphuric acid diluted with alcohol is added, in order to decompose the acetate of potassium which it contains; the sulphate of potassium is separated by filtration; the excess of sulphuric acid by acetate of lead; the excess of acetate of lead by hydrosulphuric acid; and the sulphuret of lead by another filtration. The liquid being now evaporated yields cathartin. This substance must not be confounded with a purgative principle, also called cathartin, which exists in Rhamnus catharticus.* Bley and Diesel found in senna a peculiar yellow resin which they named *chrysoretin*, a brown resin and brown extractive which they could not fully separate, pectin, gummy extractive, chlorophyll, fatty matter, and various salts. (*Pharm. Cent. Blatt*, Feb. 1849, p. 126.) M. Batka, besides the components enumerated by MM. Lassaigne and Feneulle, found chrysophanic acid, previously discovered by Martius, legumin (instead of albumen), gum, sugar, *sennacrin* (instead of cathartin, without bitterness), *sennaretin*, magnesia and soda, and the sennatannic, oxalic, carbonic, silicic, phosphoric, sulphuric, and muriatic acids. (*Journ. de Pharm.*, 4e sér., i. 136.)

At length there is good reason to believe that the real active principle of senna has been isolated. The substance obtained by Mr. Robert Rau, of Bethlehem, Pa., and believed by him to be the purgative ingredient, has not withstood the test of subsequent investigation. (*Am. Journ. of Pharm.*, May, 1866, p. 193.) Mr. Thos. B. Groves, of London, was on the point of isolating the principle, when its existence was announced by Dragendorf and Kubly, to whom the credit of the discovery belongs, and who have named it *cathartic acid*. It appears to be a glucoside, and has an extraordinarily complex composition, containing sulphur as well as nitrogen; and its formula is stated as $C_{180}H_{96}N_2SO_{82}$. This accounts for its great facility of decomposition, and the great difficulty of its discovery. It is insoluble in water, strong alcohol, and ether, but its saline compounds with the alkalies and earth are readily dissolved. Its ammonia salt is precipitated by the salts of silver, tin, mercury, copper, and lead; but tannin, the antimonial salts, and the yellow and red prussiates have no effect on it. Alkalies with heat decompose it; and, boiled with a mineral acid, it separates into a variety of glucose and a peculiar acid called the *cathartogenic*. It is prepared by partially precipitating with alcohol a watery infusion of senna, concentrating to a syrupy consistence *in vacuo*, filtering, treating the filtrate with a large proportion of absolute alcohol, and repeatedly dissolving in water, and precipitating by alcohol the precipitate thus obtained. It is purified by submitting it, dissolved in moderately strong muriatic acid, to dialysis on a diaphragm of parchment paper; cathartic acid having strong collodial properties. Mr. Groves found that cathartate of ammonium purged moderately in the dose of $3\frac{3}{4}$ grains, with considerable griping; and that of certain mixed cathartates $7\frac{1}{2}$ grains purged violently with much griping and sickness, and continued to act through most of a day. He considers 4 grains as a fair dose. It should be given in connection with an aromatic and a saline cathartic. The cathartate of magnesium is soluble. The salts of this acid in watery solution are decomposed and rendered inert by long exposure to heat in contact with the air.

* M. E. Bourgoin has examined cathartin with peculiar care, and states as the result of his investigations, that it is a complicated substance containing at least three distinct principles; viz., chrysophanic acid, a glucose with a right-handed rotary power, and a peculiar substance now first discovered, which M. Bourgoin proposes to name *chrysophanine*. Of the mode of isolating these principles, and of their properties, the author gives an account in the *Journal de Pharmacie* (Janv. 1872, p. 25), to which the reader is especially referred. (See also *Pharm. Journ.*, March, 1872, p. 723.)—*Note to the fourteenth edition.*

(Groves, *Pharm. Journ. and Trans.*, Oct. 1868, pp. 200–1.) The same chemists found chrysophanic acid in small proportions, two substances called respectively *sennacrol* and *sennapicrin*, and a peculiar non-fermentable saccharine principle, with the formula $C_{42}H_{44}O_{38}$, which they have named *catharto-mannite*. (*Journ. de Pharm.*, 4e sér., v. 475.)

Some recent results of experiments on the properties of senna which more particularly concern the pharmaceutist, are noted in a paper contained in the *Journ. de Pharmacie* (Janv. 1874, p. 80), and require to be stated here, because they tend to fix certain points which are left undetermined in the above statement. An extract made by evaporating in the air a watery infusion of senna possesses but partially the purgative properties of the leaves. If the extract be redissolved in a large quantity of water, and the solution be again evaporated, the extract now obtained will be quite inert. It follows that a prolonged decoction of senna destroys its cathartic powers. The presence of an alkali in the decoction increases the rapidity of the destruction. An infusion of senna in lime-water, heated to the boiling point, and then deprived of lime by a stream of carbonic acid, becomes inert. An infusion of senna, made to boil after the addition of caustic potassa, and then neutralized by an acid, is also inert. The mineral acids destroy the purgative powers of senna, but less energetically than the alkalies; the vegetable acids exercise the same power but feebly. Concentrated alcohol does not dissolve the active principle, which is soluble in cold water. It was Heerlein who first determined the complete want of purgative power in the pure alcoholic extract of senna. Nevertheless, this extract possesses, in a high degree, the odour and taste of senna; and, taken internally, without purging, imparts a deep yellow colour to the urine, which the alkalies change to red. The leaves exhausted by alcohol, have all their purgative effect, but lose the power of affecting the urine so that an alkaline solution shall colour it red. These facts prove that chrysophanic acid is not the purgative principle of senna. The fact that alcohol removes the odour and taste of senna, without affecting its purgative action, may sometimes be advantageously applied in cases in which the taste of senna is extremely offensive.

Incompatibles. Many substances produce precipitates with the infusion of senna; but it does not follow that they are all medicinally incompatible; as they may remove ingredients which have no therapeutical effect, and leave the active principles untouched. Cathartin is precipitated by infusion of galls and solution of subacetate of lead. Acetate of lead and tartarized antimony, which disturb the infusion, have no effect upon the solution of this substance.

Medical Properties and Uses. Senna was first used as a medicine by the Arabians. It was noticed in their writings so early as the ninth century; and the name itself is Arabic. It is a prompt, efficient, and very safe purgative, well calculated for fevers and febrile complaints, and other cases in which a decided but not violent impression is desired. A disadvantage is that it is apt to produce severe griping. This effect, however, may be obviated by combining with the senna some aromatic, and some one of the alkaline salts, especially bitartrate of potassium, tartrate of potassium, or sulphate of magnesium. The explanation which attributes the griping property to the oxidized extractive, and its prevention by the saline substances to their influence in promoting the solubility of that principle, is not satisfactory. The purgative effect of senna is considerably increased by combination with bitters; a fact noticed by Cullen, and abundantly confirmed by subsequent experience. The decoction of guaiac is said to exert a similar influence. Senna yields one or more of its principles to the urine; as, from twenty to thirty minutes after it has been taken, this secretion acquires the property of being reddened by ammonia. (*Journ. de Pharm.*, Août, 1863, p. 161.) The dose of senna in powder is from half a drachm to two drachms; but its bulk renders it of inconvenient administration; and it is not often prescribed in this state. Besides, the powder is said to undergo decomposition, and to become mouldy on exposure to a damp air. The form of infusion is almost universally preferred. (See *Infusum Sennæ.*) The medicine is also used in the forms of confection, fluid extract, syrup, and tincture, all of which are officinal.

Senna taken by nurses is said to purge sucking infants, and an infusion injected into the veins operates as a cathartic.

In the officinal preparations, "Tinnevelly senna may be used in place of Alexandria senna." *Br.*

Off. Prep. Confectio Sennæ; Extractum Sennæ Fluidum, *U. S.;* Infusum Sennæ; Mistura Sennæ Composita, *Br.;* Syrupus Sarsaparillæ Compositus, *U. S.;* Syrupus Sennæ, *Br.;* Tinctura Rhei et Sennæ, *U. S.;* Tinctura Sennæ, *Br.* W.

SERPENTARIA. *U.S.*

Serpentaria. Virginia Snakeroot.

The root of Aristolochia Serpentaria, of Aristolochia reticulata, and of other species of Aristolochia. *U. S.*

Off. Syn. SERPENTARIÆ RADIX. *Serpentary Root.* The dried rhizome of Aristolochia Serpentaria *Linn. Br.*

Serpentaire de Virginie, *Fr.;* Virginianische Schlangenwurzel, *Germ.;* Serpentaria Virginiana, *Ital., Span.*

ARISTOLOCHIA. *Sex. Syst.* Gynandria Hexandria.—*Nat. Ord.* Aristolochiaceæ. *Gen. Ch. Calyx* none. *Corolla* one-petaled, ligulate, ventricose at the base. *Capsules* six-celled, many-seeded, inferior. *Willd.*

Many species of Aristolochia have been employed in medicine. The roots of all of them are tonic and stimulant; and their supposed possession of emmenagogue properties has given origin to the name of the genus. *A. Clematitis*, *A. longa*, *A. rotunda*, and *A. Pistolochia* are still retained in many officinal catalogues of the continent of Europe, where they are indigenous. The root of *A. Clematitis* is very long, cylindrical, as thick as a goosequill or thicker, variously contorted, beset with the remains of the stems and radicles, of a grayish-brown colour, a strong peculiar odour, and an acrid bitter taste; that of *A. longa* is spindle-shaped, from a few inches to a foot in length, of the thickness of the thumb or thicker, fleshy, very brittle, grayish externally, brownish-yellow within, bitter, and of a strong disagreeable odour when fresh; that of *A. rotunda* is tuberous, roundish, heavy, fleshy, brownish on the exterior, grayish-yellow internally, and similar to the preceding in odour and taste; that of *A. Pistolochia* consists of numerous slender yellowish or brownish fibres, attached to a common head, and possessed of an agreeable aromatic odour, with a taste bitter and somewhat acrid. Many species of Aristolochia growing in the West Indies, Mexico, and South America, have attracted attention for their medicinal properties; and some, like our own snakeroot, have acquired the reputation of antidotes for the bites of serpents. In the East Indies, *A. Indica* is employed for similar purposes with the European and American species; and the Arabians are said by Forskhal to use the leaves of *A. sempervirens* as a counter-poison. We have in the United States six species, of which four—*A. Serpentaria*, *A. hirsuta*, *A. hastata*, and *A. reticulata*—contribute to furnish the snakeroot of the shops.

Aristolochia Serpentaria. Willd. *Sp. Plant.* iv. 159; Bigelow, *Am. Med. Bot.* iii. 82; Barton, *Med. Bot.* ii. 41. This species of Aristolochia is an herbaceous plant, with a perennial root, which consists of numerous slender fibres proceeding from a short horizontal caudex. Several stems often rise from the same root. They are about eight or ten inches in height, slender, round, flexuose, jointed at irregular distances, and frequently reddish or purple at the base. The leaves are oblong-cordate, acuminate, entire, of a pale yellowish-green colour, and supported on short petioles at the joints of the stem. The flowers proceed from the joints near the root, and stand singly on long, slender, round, jointed peduncles, which are sometimes furnished with one or two small scales, and bend downwards so as nearly to bury the flower in the earth or decayed leaves. There is no calyx. The corolla is purple, monopetalous, tubular, swelling at the base, contracted and curved in the middle, and terminating in a labiate border with lanceolate lips. The anthers—six or twelve in number—are sessile, attached to the under part of the stigma, which is roundish, divided into six parts, and supported by a short fleshy style upon an oblong, angular, hairy, inferior germ. The fruit is a hexangular, six-celled capsule, containing several small flat seeds.

The plant grows in rich shady woods, throughout the Middle, Southern, and Western States, abounding in the valley of the Ohio, and in the mountainous regions of our interior. It flowers in May and June. The root is collected in Western Pennsylvania and Virginia, in Ohio, Indiana, and Kentucky, and is brought eastward chiefly by the routes of Wheeling and Pittsburg. As it reaches Philadelphia, it is usually in bales containing about one hundred pounds, and is often mixed with the leaves and stems of the plant, and with dirt from which it has not been properly cleaned at the time of collection.

A. hirsuta. Muhlenberg, *Catalogue*, p. 81; Bridges, *Am. Journ. of Pharm.*, xiv. 121. In Muhlenberg's Catalogue this species was named without being described; and botanists, supposing from the name that it was identical with *A. tomentosa*, generally confounded the two plants. But they are entirely distinct. A description of *A. hirsuta* in the handwriting of Muhlenberg, and a labelled specimen of the plant, in the possession of the Academy of Natural Sciences of this city, have been found to correspond with a dried specimen received by the author from Virginia. *A. tomentosa* is a climbing plant, growing in Louisiana on the banks of the Mississippi, and ascending to the summit of the highest trees. A plant in the garden of the author has a thick, creeping root, entirely different in shape from that of the officinal species, though possessed of an analogous odour. *A. hirsuta* has a root like that of *A. Serpentaria*, consisting of a knotty caudex, sending out numerous slender simple fibres, sometimes six inches in length. From this arise several jointed, flexuose, pubescent stems, less than a foot high, with one or two pubescent bractes, and several large roundish-cordate leaves, of which the lower are obtuse, the upper abruptly acuminate, and all pubescent on both sides and at the margin. From the joints near the root originate from one to three solitary peduncles, each bearing three or four leafy bractes and one flower. The peduncles, bractes, and corolla are all hairy. This species grows in Virginia, and perhaps other parts of the Western and Southern States. It probably contributes to afford the serpentaria of commerce; as its leaves have been found in bales of the drug.

A. hastata. Nuttall, *Gen. of N. Am. Plants*, p. 200.—*A. sagittata.* Muhl. *Catal.* This species, if indeed it can be considered a distinct species, differs from A. Serpentaria in having hastate, acute, somewhat cordate leaves, and the lip of the corolla ovate. It flourishes on the banks of the Mississippi, in the Carolinas, and elsewhere. Its root scarcely differs from that of the officinal plant, and is frequently mixed with it, as proved by the presence of the characteristic leaves of *A. hastata* in the parcels brought into market.

A. reticulata. Nuttall; Bridges, *Am. Journ. of Pharm.*, xvi. 118; Carson, *Illust. of Med. Bot.* ii. 32, pl. 77. This plant was probably first observed by Mr. Nuttall; as a specimen labelled "*A. reticulata*, Red river," in the handwriting of that botanist, is contained in the Herbarium of the Academy of Natural Sciences of Philadelphia. From this specimen, as well as from others found in parcels of the drug brought into market, a description was drawn up by Dr. Robert Bridges, and published in the *Am. Journ. of Pharmacy.* From a root, similar to that of *A. Serpentaria*, numerous short, slender, round, flexuose, jointed stems arise, usually simple, but sometimes branched near the root. The older stems are slightly villous, the young densely pubescent. The leaves, which stand on very short villous petioles, are round or oblong-cordate, obtuse, reticulate, very prominently veined, and villous on both sides, especially upon the veins. From the lower joints of the stem four or five hairy, jointed peduncles proceed, which bear small leafy villous bractes at the joints, and several flowers on short pedicels. The flowers are small, purplish, and densely pubescent, especially at the base end on the germ. The hexangular capsule is deeply sulcate. This species grows in Louisiana, Texas, Arkansas, and the Indian Territory west of that State.

Bales of a new variety of serpentaria were some years since brought to Philadelphia, which is certainly the product of this species; as specimens of all parts of the plant have been found in the bales, and the roots, which differ somewhat from those before known, are homogeneous in character. One of these bales was brought from New Orleans, and was said to have come down the Red river, and to have been col-

lected by the Indians. The chief difference between this and ordinary Virginia snakeroot is in the size of the radicles, which are much thicker and less interlaced in the new variety. Each root has usually a considerable portion of one or more stems attached to the caudex. The colour is yellowish. The odour and taste are scarcely if at all distinguishable from those of common serpentaria; and there is no doubt that the root is equally effectual as a medicine. From a chemical examination by Mr. T. S. Wiegand, it appears to have the same constituents, and to differ only in containing a rather larger proportion of gum, extractive, and volatile oil.

Properties. Virginia snakeroot as found in the shops, is in tufts of long, slender, frequently interlaced, and brittle fibres, attached to a short, contorted, knotty head or caudex. The colour, which in the recent root is yellowish, becomes brown by time. That of the powder is grayish. The smell is strong, aromatic, and camphorous; the taste warm, very bitter, and also camphorous. The root yields all its virtues to water and alcohol, producing with the former a yellowish-brown infusion, with the latter a bright-greenish tincture, rendered turbid by the addition of water. Chevallier found in the root volatile oil, a yellow bitter principle soluble in water and alcohol, resin, gum, starch, albumen, lignin, and various salts. Bucholz obtained from 1000 parts, 5 of a green, fragrant volatile oil, 28·5 of a yellowish-green resin, 17 of extractive matter, 181 of gummy extract, 624 of lignin, and 144·5 of water. The active ingredients are probably the volatile oil, and the yellow bitter principle of Chevallier, which that chemist considers analogous to the bitter principle of quassia. The volatile oil passes over with water in distillation, rendering the liquid milky, and impregnating it with the odour of the root. Dr. Bigelow states that the liquid, on standing, deposits small crystals of camphor.

The roots of *Spigelia Marilandica* are sometimes found associated with serpentaria. They may be distinguished by the absence of the bitter taste, and, when the stem and foliage are attached, by the peculiar character of these parts. (See *Spigelia.*) We have seen the young roots of *Polygala Senega* mixed with serpentaria. Independently of their difference in odour and taste, they may be distinguished by being simple, and by a projecting line running from one end to the other of the root. Another adulteration has been detected by Mr. P. S. Milleman, of Chicago, who found, in a parcel from one of their drug-houses, a large quantity of "golden seal."* The rhizomes, with rootlets attached, were from a quarter of an inch to an inch in length, and rarely more than one-eighth of an inch in diameter; and averaged over two ounces to the pound of serpentaria. (*Am. Journ. of Pharm.*, Nov. 1874, p. 516.)

Medical Properties and Uses. Serpentaria is a stimulant tonic, acting also as a diaphoretic or diuretic, according to the mode of its application. Too largely taken, it occasions nausea, griping pains in the bowels, sometimes vomiting and dysenteric tenesmus. It is adapted to the treatment of typhoid fevers, whether idiopathic or symptomatic, when the system begins to feel the necessity for support, but is unable to bear active stimulation. In exanthematous diseases in which the eruption is tardy or has receded, and the grade of action is low, it is thought to be useful by promoting the cutaneous affection. It has also been highly recommended in intermittent fevers; and, though itself generally inadequate to the cure, often proves serviceable as an adjunct to Peruvian bark or sulphate of quinia. With the same remedies it is frequently associated in the treatment of typhous diseases. It is sometimes given in dyspepsia, and is employed as a gargle in malignant sorethroat.

The dose of the powdered root is from ten to thirty grains; but the infusion is almost always preferred. (See *Infusum Serpentariæ.*) The decoction or extract would be an improper form; as the volatile oil, upon which the virtues of the medicine partly depend, is dissipated by boiling. There is, however, an officinal fluid extract, which is an efficient preparation.

Off. Prep. Extractum Serpentariæ Fluidum, *U. S.;* Infusum Serpentariæ; Tinctura Cinchonæ Composita; Tinctura Serpentariæ. W.

* Hydrastis Canadensis, among other common names, as *yellow-root, orange-root,* and *yellow puccoon,* has also, in some localities, that of *Golden Seal,* and is probably the plant referred to in the text by that name. See Dr. Porcher's Work on the Resources of the Southern States, in which *Golden Seal* is given as one of the titles of the plant.—(*Note to the fourteenth edition.*)

SESAMUM. *U.S. Secondary.*

Benne.

SESAMI FOLIUM. *Pharm.*, 1860. *U.S.*
The leaves of Sesamum Indicum, and of Sesamum orientale. *U.S.*

OLEUM SESAMI. *U.S. Secondary.*

Benne Oil.

The fixed oil of the seed of Sesamum Indicum, and of Sesamum orientale. *U.S.*
Sesame, *Fr.;* Sesam, *Germ.;* Sesamo, *Ital.;* Anjonjoli, *Span.*

SESAMUM. *Sex. Syst.* Didynamia Angiospermia.—*Nat. Ord.* Bignoniæ, *Juss.* Pedaliaceæ, *R. Brown, Lindley.*

Gen. Ch. Calyx five-parted. *Corolla* bell-shaped, five-cleft, with the lower lobe largest. *Stamens* five, the fifth a rudiment. *Stigma* lanceolate. *Capsule* four-celled. *Willd.*

Sesamum orientale. Willd. *Sp. Plant.* iii. 358; Rheed. *Hort. Malab.* ix. 54. "Leaves ovate-oblong, entire."

Sesamum Indicum. Willd. *Sp. Plant.* iii. 359; Curtis, *Bot. Mag.* vol. xli. t. 1688. "Leaves ovate-lanceolate, the inferior three-lobed, the superior undivided. Stem erect." There is reason to believe that this species is the one chiefly cultivated in our Southern States. At least we have found plants, raised in Philadelphia from seeds obtained from Georgia, to have its specific character, as given by Willdenow.

The benne plant of our Southern States is annual, with a branching stem four or five feet high, and bearing opposite, petiolate leaves, varying considerably in their shape. Those on the upper part of the plant are ovate-lanceolate, irregularly serrate, and pointed; those near the base three-lobed and sometimes ternate; and lobed leaves are not uncommon at all distances from the ground. The flowers are reddish-white, and stand solitarily upon short peduncles in the axils of the leaves. The fruit is an oblong capsule, with small, oval, yellowish seeds.

These two species of Sesamum are natives of the East Indies, and have been cultivated from time immemorial in various parts of Asia and Africa. From the latter continent it is supposed that seeds were brought by the negroes to the United States, where, as well as in the West Indies, one or both species are now cultivated to a considerable extent. The plant above described will grow vigorously in the gardens so far north as Philadelphia, though it does not usually ripen its seeds in this vicinity.

The seeds are employed as food by the negroes, who parch them over the fire, boil them in broths, make them into puddings, and prepare them in various other modes. By expression they yield a fixed oil, which, as well as the leaves, has been introduced into the secondary catalogue of the U. S. Pharmacopœia. M. Berjot obtained 53 per cent. of the oil by means of bisulphide of carbon.

1. *Benne Leaves.* These abound in a gummy matter, which they readily impart to water, forming a rich, bland mucilage, much used in the Southern States as a drink in various complaints to which demulcents are applicable; as in cholera infantum, diarrhœa, dysentery, catarrh, and affections of the urinary passages. The remedy has attracted attention also in the North, and has been employed with favourable results in Philadelphia. One or two fresh leaves of full size, stirred about in half a pint of cool water, will soon render it sufficiently viscid. If dried, they should be introduced into hot water. The leaves also serve for the preparation of emollient cataplasms.

2. *Benne Oil.* This is inodorous, of a bland, sweetish taste, and will keep long without becoming rancid. It bears some resemblance to olive oil in its properties, and may be used for similar purposes. It is not a drying oil. At 55° F., it has the sp. gr. 0·919; and its point of congelation is 23° F. It is temporarily rendered green

by a mixture of sulphuric and nitric acids; a property by which it may be detected when used to adulterate olive or almond oil. (Fluckiger, *Journ. de Pharm.*, 4e sér., v. 157; from *Schweitzer Wochenschrift für Pharm.*, 1866, No. 37.) It was known to the ancient Persians and Egyptians, and is highly esteemed by the modern Arabs and other people of the East, both as food, and as an external application to promote softness of the skin. Like olive oil, it is laxative in large doses. W.

SEVUM. *U.S.*

Suet.

The prepared suet of Ovis Aries. *U. S.*

Off. Syn. SEVUM PRÆPARATUM. *Prepared Suet.* The internal Fat of the abdomen of the sheep, Ovis Aries *Linn.*, purified by melting and straining. *Br.*

Suiff, Graisse de mouton, *Fr.;* Hammelstalg, *Germ.;* Grasse duro, *Ital.;* Sebo, *Span.*

Suet is the fat of the sheep, taken chiefly from about the kidneys. It is prepared by cutting the fat into pieces, melting it with a moderate heat, and straining it through linen or flannel. In order to avoid too great a heat, the crude suet is sometimes purified by boiling it in a little water.

Mutton suet is of a firmer consistence, and requires a higher temperature for its fusion than any other animal fat. It is very white, sometimes brittle, inodorous, of a bland taste, insoluble in water, and nearly so in alcohol. Boiling alcohol, however, dissolves it, and deposits it upon cooling. It consists, according to Chevreul, of stearin, olein, and a small proportion of hircin. The two first-mentioned principles are described under the *Fixed Oils* (page 607). *Hircin* is a liquid like olein, from which it differs in being much more soluble in alcohol, and in yielding *hircic acid* by saponification.

Suet acquires by time an unpleasant smell, and becomes unfit for pharmaceutic purposes. It is employed to give a proper consistence to ointments, cerates, and plasters, and sometimes as a dressing to blisters.

Off. Prep. Ceratum Resinæ Compositum, *U. S.;* Emplastrum Cantharidis, *Br.;* Unguentum Hydrargyri; Unguentum Picis Liquidæ, *U. S.* W.

SIMARUBA. *U.S. Secondary.*

Simaruba.

The bark of the root of Simaruba officinalis. *U. S.*

Ecorce de simarouba, *Fr.;* Simarubarinde, *Germ.;* Corteccia di simaruba, *Ital.;* Corteza de simaruba, *Span.*

QUASSIA. See QUASSIA.

Quassia Simaruba. Willd. *Sp. Plant.* ii. 568; Woodv. *Med. Bot.* p. 569, t. 203. —*Simaruba officinalis.* De Cand. *Prodrom.* i. 733.—*S. amara*, Aublet; Lindley, *Flor. Med.* p. 207. As this plant is unisexual, it belongs to the genus Simaruba of De Candolle and Lindley, those only being placed by these botanists in the genus Quassia which are hermaphrodite. But, as the Linnæan arrangement was adhered to in the case of Quassia excelsa, we continue to adhere to it in relation to this plant. (See *Quassia.*) It is a tree of considerable height and thickness, having alternate branches, with a bark which in the old tree is black and somewhat furrowed, in the young is smooth, gray, and marked here and there with broad yellow spots. The leaves are alternate and abruptly pinnate, with a naked petiole, to which the leaflets are alternately attached by short footstalks. The leaflets are nearly elliptical, on the upper surface smooth and deep-green, on the under whitish. The flowers are yellow, and in long axillary panicles. In some descriptions they are stated to be monœcious, in others dicœcious. According to Dr. Wright, the female flowers are never found in Jamaica on the same tree with the male. The number of stamens is ten.

The tree is found in the West Indies and Guyana. In Jamaica it is called the *mountain damson.* *Simaruba amara* of Aublet, which grows in Guyana, and has generally been considered identical with *Q. Simaruba*, is believed by Hayne to be a

distinct species; the Jamaica plant having diœcious, while this has monœcious flowers. The bark of the root is the part employed; the wood itself being nearly tasteless and inert.

Simaruba bark is in long pieces, some inches in breadth, folded lengthwise, light, flexible, tenacious, very fibrous, externally of a light brownish-yellow colour, rough, warty, and marked with transverse ridges, internally of a pale yellow. It is without smell, and of a bitter taste. It readily imparts its virtues, at ordinary temperatures, to water and alcohol. The infusion is at least equally bitter with the decoction, which becomes turbid as it cools. Its constituents, according to M. Morin, are a bitter principle identical with *quassin*, a resinous matter, a volatile oil having the odour of benzoin, malic acid, gallic acid in very minute proportion, an ammoniacal salt, malate and oxalate of calcium, some mineral salts, oxide of iron, silica, ulmin, and lignin.

Medical Properties and Uses. Simaruba possesses the same tonic properties as other simple bitters, and may be employed for the same purposes. In large doses it is said to purge and vomit. It was introduced into France in 1713 from Guyana, where it had previously been used as a remedy for dysentery. In the treatment of this disease and of obstinate diarrhœa, it afterwards obtained much credit in Europe; but Cullen was right in denying to it any specific control over these complaints. It operates simply as a tonic; and, though occasionally beneficial in relaxed and debilitated states of the alimentary canal, would do much harm if indiscriminately prescribed in dysenteric cases. On account of its difficult pulverization, it is seldom given in substance. The best mode of administration is by infusion. The dose is from a scruple to a drachm. W.

SINAPIS ALBA. *U.S.*

White Mustard.

The seed of Sinapis alba. *U.S.*

SINAPIS NIGRA. *U.S.*

Black Mustard.

The seed of Sinapis nigra. *U. S.*

Off. Syn. SINAPIS. *Mustard.* The seeds of Sinapis nigra *Linn.*, and Sinapis alba *Linn.;* also the seeds reduced to powder, mixed. *Br.*

Moutarde, *Fr.;* Senfsamen, *Germ.;* Senapa, *Ital.;* Mostaza, *Span.*

OLEUM SINAPIS. *Br.*

Oil of Mustard.

The oil distilled with water from the seeds of Black Mustard, Sinapis nigra *Linn.*, after the expression of the fixed oil. *Br.*

SINAPIS. *Sex. Syst.* Tetradynamia Siliquosa.—*Nat. Ord.* Brasicaceæ or Cruciferæ.

Gen. Ch. Calyx spreading. *Corolla* with straight claws. *Glands* between the shorter stamens and pistil, and between the longer stamens and calyx. *Willd.*

Sinapis nigra. Willd. *Sp. Plant.* iii. 555; Woodv. *Med. Bot.* p. 403, t. 146. Common or black mustard is an annual plant, with a stem three or four feet in height, divided and subdivided into numerous spreading branches. The leaves are petiolate and variously shaped. Those near the root are large, rough, lyrate-pinnate, and unequally toothed; those higher on the stem are smooth, and less lobed; and the uppermost are entire, narrow, smooth, and dependent. The flowers are small, yellow, with a coloured calyx, and stand closely together upon peduncles at the upper part of the branches. The pods are smooth, erect, nearly parallel with the branches, quadrangular, furnished with a short beak, and occupied by numerous seeds.

Sinapis alba. Willd. *Sp. Plant.* iii. 555; Smith, *Flor. Brit.* 721. The white mustard is also annual. It is rather smaller than the preceding species. The lower leaves are deeply pinnatifid, the upper sublyrate, and all irregularly toothed, rugged, with stiff hairs on both sides and pale-green. The flowers are in racemes, with yellow petals, and linear, green calycine leaflets. The pods are spreading, bristly, rugged, roundish, swelling in the position of the seeds, ribbed, and provided with a very long ensiform beak.

Both plants are natives of Europe and cultivated in our gardens; and *S. nigra* has become naturalized in some parts of this country. Their flowers appear in June. The seeds are kept in the shops, both whole and in the state of very fine powder, as prepared by the manufacturers for the table.

Black mustard seeds are small, globular, of a deep-brown colour, slightly rugose on the surface, and internally yellow. In the entire state they are inodorous, but have a distinct smell in powder, and, when rubbed with water or vinegar, exhale a strong pungent odour, sufficient in some instances to excite a flow of tears. Their taste is bitterish, hot, and pungent, but not permanent. *White mustard seeds* are much larger, of a yellowish colour, and less pungent taste. Both afford a yellow powder, which has a somewhat unctuous appearance, and cakes when compressed. This is commonly called *flour of mustard*, or simply *mustard*, and is prepared by crushing and pounding the seeds, and then sifting them; the purest flour being obtained by a second sifting. Both the black and the white seeds are used in its preparation. It is often adulterated with wheat flour coloured by turmeric, to which red pepper is added to render the mixture sufficiently hot. The skin of white mustard seeds contains a mucilaginous substance, which is extracted by boiling water. When bruised or powdered, both kinds impart their active properties wholly to water, but in a very slight degree to alcohol. They yield upon pressure a fixed oil, called *oil of mustard*, of a greenish-yellow colour, little smell, and a mild not unpleasant taste; and the portion which remains is even more pungent than the unpressed seeds. The fixed oil of mustard yields, upon saponification, a peculiar acid, for which the name of *erucic acid* has been proposed. (*Chem. Gaz.*, vii. 163.)

The oil-cake, remaining after the expression of the oil, is said to have been sold in England as a substitute for other oil-cakes, as that from flax seed, rape seed, and cotton seed, used as food for cattle, for which the mustard oil-cake is altogether unsuitable, on account of its highly irritant properties. (Prof. Attfield, *Pharm. Journ.*, March, 1869, p. 520.)

It has been long known that black mustard seeds yield by distillation with water a very pungent volatile oil, containing sulphur. Guibourt conjectured, and Robiquet and Boutron proved, that this oil does not pre-exist in the seeds, but is produced by the action of water. Hence the absence or very slight degree of odour in the seeds when bruised in a dry state, and their pungency when water is added. It seemed reasonable to suppose that the reaction in this case was similar to that exercised by water upon bitter almonds (see *Amygdala Amara*); and this has been proved to be the fact by the experiments of Simon, Bussy, Boutron, and Frémy. According to M. Bussy, there are two peculiar principles in black mustard seeds, one named by him *myronic acid*, existing in the seeds in the state of *myronate of potassium;* the other *myrosyne*, closely analogous in character to the albuminous constituent of almonds called *emulsin*. When water is added to black mustard seed, the myrosyne, acting the part of a ferment, determines a reaction between the water and myronate of potassium, which results in the production of the volatile oil. The same thing happens when any one of the myronates is brought into contact with water and myrosyne. The presence of the last-mentioned principle is essential. Like emulsin, it becomes inoperative when coagulated by heat, alcohol, or the acids; and, if black mustard seeds be subjected to either of these agencies previously to the addition of water, they will yield no volatile oil. The myrosyne, however, sometimes partially recovers its power by continued contact with water. This substance is found also in white mustard seeds, but without myronate of potassium. If, therefore, white mustard seeds be added to the black in which the myrosyne has been coagulated, the volatile oil will be generated on the application of water. Though closely analogous to emulsin,

myrosyne is yet distinct, as its place cannot be supplied by emulsin with the same effect. (*Journ. de Pharm.*, xxvi. 39.) Simon obtained results somewhat different from those of M. Bussy. The former chemist succeeded in procuring a peculiar crystalline principle from the seeds which he called *sinapisin*, and which, upon contact with water and the albuminous principle of the seeds, emitted the odour of the oil of mustard. Dr. S. von Thielau asserts that, though the volatile oil is produced by the reaction between myrosyne and some principle existing in black mustard, yet this principle is not myronate of potassium, the existence of the so-called myronic acid being fabulous. (See *Am. Journ. of Pharm.*, Nov. 1858, p. 540.) MM. Ludwig and Lange, however, have found myronic acid in abundance in black mustard seeds. They have also found along with it another substance, apparently the acid salt of a nitrogeno-sulphur alkaloid, which likewise yields the volatile oil of mustard with myrosyne. (*Journ. de Pharm.*, Mars, 1861, p. 236.)

A new principle has been extracted by Dr. Will from white mustard seed, with the aid of alcohol. It has been named *sinalbin*, and has the formula $C_{30}H_{44}N_2S_2O_{16}$. It is decomposed, like the myronate of potassium, into sulphocyanate of acrinyl and other products; an albuminoid substance being formed at the same time. "The sulphocyanate of acrinyl (C_8H_7NSO) is a very active principle, oily, insoluble in water, not volatile. It may be obtained by causing ether to act on the product of the decomposition of sinalbin. Treated by an alkali and then neutralized by an acid, it colours the perchloride of iron red." (*Journ. de Pharm.*, Avril, 1872, p. 327.)

Oleum Sinapis. The *volatile oil of mustard* is usually obtained from seeds which have been deprived of their fixed oil by pressure. It is a colourless or pale-yellow liquid, rather heavier than water, of an exceedingly pungent odour, of an acrid burning taste, and of the sp. gr. 1·015. It boils at about 298°; is slightly soluble in water, and readily so in alcohol and ether; with alkaline solutions yields sulphocyanides; and consists, according to M. Löwig and Dr. Will, of nitrogen, carbon, hydrogen, and sulphur; its formula being $NC_8H_5S_2$. Dr. Will considers it a sulphocyanide of *allyl* (C_6H_5), the compound radical of oil of garlic, which is considered a sulphuret of allyl.* (*Chem. Gaz.*, Nos. 62 and 64.) It is the principle upon which black mustard seeds depend for their activity. According to Zeller, the seeds yield from 0·33 to 0·63 per cent. of the oil. As it is often adulterated with other oils, a test has been proposed consisting of concentrated sulphuric acid, 50 drops of which are to be mixed with 5 drops of the suspected oil in a small glass tube. If the oil is pure, little change of colour is produced; but if any adulterating oil be present, a red or brown colour will soon appear. Rectified oil of petroleum is the only exception, as the colour of this is not affected by the acid; but it would be recognized by its insolubility in sulphuric acid. (See *Am. Journ. of Pharm.*, July, 1865, p. 285.) Adulteration with alcohol is readily detected by its much lower boiling point, which also enables it to be separated by distillation. The volatile oil of mustard has recently been employed as a substitute for the mustard plaster. For this purpose one part may be mixed with sixty parts of alcohol, and the mixture applied sprinkled not too thickly on piline. It acts speedily and efficiently. (*Pharm. Journ. and Trans.*, July, 1865, p. 34.)

White mustard seeds do not yield volatile oil when treated with water; but an acrid fixed principle is developed, which renders these seeds applicable to the same purposes as the other variety. MM. Robiquet and Boutron, who ascertained this fact, concluded that the acrid principle resulted from the reaction of water upon *sulphosinapisin*, discovered in the seeds by MM. Henry, jun., and Garot. Their reason for this belief was that mustard, which had been deprived of this ingredient, was incapable of developing the acrid principle. The myrosyne is equally essential to the change here, as to that which occurs in black mustard; and the reaction equally fails, if this principle be previously rendered inert by heat, alcohol, or the acids.

* Volatile oil of mustard has been produced artificially, by MM. Berthelot and S. de Luca, by treating iodide of propionyl, identical with allyl (C_6H_5I) with sulphocyanuret of potassium. The iodine unites with potassium, and the liberated radical (C_6H_5) combines with the sulphocyanogen (NC_2S_2) to form volatile oil of mustard ($NC_8H_5S_2$). Iodide of propionyl is procured by treating glycerin with iodide of phosphorus, and differs from volatile oil of garlic (sulphuret of allyl), only in containing iodine instead of sulphur. (*Journ. de Pharm.*, Août, 1855, p. 124.)

MM. Boutron and Frémy state that not only the acrid principle of white mustard, but hydrosulphocyanic acid also results from the reaction above explained; and this observation renders still closer the analogy between the changes that take place, upon contact with water, in mustard seeds and bitter almonds. (*Journ. de Pharm.*, xxvi. 50.)*

From the foregoing account of the chemical relations of mustard, it is obvious

* As some may desire to push these investigations further, we give the properties of these peculiar principles, and the modes of procuring them.

Myronic acid is a fixed inodorous substance, of a bitter and sour taste, and acid reaction. When obtained separate from its bases, it forms a colourless solution; which by evaporation becomes of a thick consistence like molasses, without crystallizing. It is soluble in water and alcohol, but not in ether; and forms soluble salts with the alkalies, baryta, lime, and the oxides of lead and silver, all of which yield volatile oil of mustard, when mixed with an aqueous solution of myrosyne. It contains sulphur, besides nitrogen, carbon, hydrogen, and oxygen. It is obtained from the myronate of potassium by adding to 100 parts of that salt 38 parts of crystallized tartaric acid, concentrating the solution by evaporation, and then adding weak alcohol, which precipitates the bitartrate of potassium, and retains the myronic acid in solution. To obtain *myronate of potassium* from black mustard seeds, the powder, having been dried at 212°, and deprived of its fixed oil by pressure, is treated with strong alcohol in a displacement apparatus, and, when thus nearly exhausted of everything soluble in that liquid, is pressed and treated with water. The aqueous solution is evaporated, and, before it is too much concentrated, weak alcohol is added, which precipitates a glutinous matter. The solution being then carefully evaporated, deposits crystals of myronate of potassium, which may be obtained very pure and white by washing the mass with diluted alcohol. This salt is easily crystallizable in fine, large, transparent crystals, is unalterable in the air, very soluble in water, insoluble in pure alcohol, and of a bitter taste. MM. Ludwig and Lange, who procured the myronate of potassium, by a process essentially the same as that of M. Bussy, in the quantity of 1 part from 500 parts of black mustard, give its composition as represented by the formula $KO,NC_{20}H_{19}S_4O_{18}$. (*Journ. de Pharm.*, Juin, 1861, p. 432.)

Myrosyne, when dry, has the character of an albuminous substance. It is soluble in water, forming a viscid solution which froths when agitated, and is coagulated by heat, alcohol, and the acids. It is obtained by treating white mustard seed with cold water, filtering the solution, evaporating it by heat not exceeding 100°, and, when it is of the consistence of syrup, carefully adding alcohol, which causes a precipitate easily separable by decantation. If this be dissolved in water, and the solution evaporated as before, myrosyne is obtained, though not entirely pure. (*Journ. de Pharm.*, xxvi. 39.)

The *sinapisin* of Simon is in brilliant, white scaly crystals, sublimable by heat, soluble in alcohol, ether, and the fixed and volatile oils, but insoluble in acids and alkalies. To obtain it he exhausted black mustard seed with strong alcohol, distilled off the greater part of the alcohol, treated the residue several times with four or five times its weight of ether, from the ethereal solutions distilled off all the ether, treated the extract again with a smaller quantity of ether so as to leave behind insoluble substances, and repeated this process until the extract formed a perfectly clear solution without residue. The extract was then dissolved in cold strong alcohol, and the solution, having been decolorized with animal charcoal, was allowed to evaporate in the air. Simon obtained from 55 pounds of the seeds only 80 grains of crystallized sinapisin. (*Annal. der Pharm.*, xxvi. 291.)

Sulpho-sinapisin, the peculiar ingredient of white mustard seed, is white, crystallizable, inodorous, bitter, and soluble in alcohol and water, forming a yellow solution. It was at first thought by MM. Henry and Garot to be an acid, but they afterwards ascertained that it was neuter. It consists of nitrogen, carbon, hydrogen, sulphur, and oxygen. It may be obtained from white mustard seeds, previously deprived of the fixed oil by expression, by boiling them in water, evaporating the decoction to the consistence of honey, mixing the residue with 6 or 8 times its volume of anhydrous alcohol which precipitates various substances, then distilling off the alcohol, and setting aside the syrupy residue to crystallize. The crystals may be purified by repeated solution and crystallization in alcohol. (Berzelius, *Traité de Chimie.*) This principle, which has also been called *sinapin*, is considered by L. von Babo and Hirschbrunn to be the sulphocyanide of an alkaloid, to which they propose to confine the name of *sinapin*, and for which they give the formula $C_{32}H_{26}NO_{12}$. The *sulphocyanide of sinapin* is obtained from the seeds, already so far exhausted by cold alcohol as to yield only a pale-yellow colour to that liquid by boiling them in alcohol of the sp. gr. 0·833, evaporating the liquor, and crystallizing. It has an appearance like that of crystallized sulphate of quinia, is soluble with difficulty in cold water and alcohol, but readily in both liquids when hot, and is nearly insoluble in ether. When boiled with alkalies, it yields an acid called *sinapic acid*. It is difficult to separate the organic base sinapin from it, because this is decomposed by alkalies. It does not appear that sulphocyanide of sinapin yields with synaptase the acrid principle developed in white mustard seeds by water; but the authors state that another substance rich in sulphur has been ascertained by Simon to exist in white mustard seeds, which plays an important part in the production of the pungent matter. (See *Chem. Gaz.*, March 1, 1853, p. 81.)—*Notes to former editions.*

A practical application of the principles developed in the foregoing paragraphs has been suggested by M. Lebaigue, who proposes applying to one sheet of paper a concentrated solution of *myronate of potassium*, and to a second a concentrated solution of *myrosyne*, and drying them. When used the leaves are to be moistened and applied to the surface, one over the other. Volatile oil of mustard is formed by the reaction of the two principles, and the effects of a sinapism are obtained. (*Journ. de Pharm.*, Août, 1868, p. 118.)—*Note to the thirteenth edition.*

that admixture with alcohol or the acids, or the application of a boiling heat, can only have the effect of impairing its medical virtues, and that the best vehicle, whether for external or internal use, is water at common temperatures.

Medical Properties and Uses. Mustard seeds swallowed whole operate as a laxative, and have acquired some reputation as a remedy in dyspepsia, and other complaints attended with torpid bowels and deficient excitement. The white seeds are preferred, and are taken in the dose of a tablespoonful once or twice a day, mixed with molasses, or previously softened and rendered mucilaginous by immersion in hot water. They probably act in some measure by mechanically stimulating the bowels. The bruised seeds or powder, in the quantity of a large teaspoonful, operate as an emetic. Mustard in this state is applicable to cases of great torpor of stomach, especially that resulting from narcotic poisons. It rouses the gastric susceptibility, and facilitates the action of other emetics. In smaller quantities it is useful as a safe stimulant of the digestive organs; and, as it is frequently determined to the kidneys, has been beneficially employed in dropsy. It has been highly recommended as a remedy in obstinate hiccough, given in the form of infusion, made in the proportion of a teaspoonful to four fluidrachms of boiling water. It is stated by Dr. Januariz, in the *Siglo Medico*, to have been employed successfully in several obstinate cases. (*Am. Journ. of Med. Sci.*, April, 1870, p. 544.) Whey, made by boiling half an ounce of the bruised seeds or powder in a pint of milk and straining, is a convenient form for administration. It may be given in the dose of a wineglassful repeated several times a day. But mustard is most valuable as a rubefacient. Mixed with water in the form of a cataplasm, and applied to the skin, it very soon produces redness with burning pain, which in less than an hour usually becomes insupportable. When a speedy impression is not desired, especially when the sinapism is applied to the extremities, the powder should be diluted with an equal portion of rye meal or wheat flour. Care should be taken not to allow the application to continue too long, as vesication with obstinate ulceration, and even sphacelus, may result. This caution is particularly necessary when the patient is insensible, and the degree of pain can afford no criterion of the sufficiency of the action. The volatile oil, which is powerfully rubefacient, and capable of producing speedy vesication, has been considerably used in Germany. For external application as a rubefacient, 30 drops may be dissolved in a fluidounce of alcohol, or 6 or 8 drops in a fluidrachm of almond or olive oil. To form a *sinapism* it has been recommended to mix 20 drops of the volatile oil with 3·5 drachms of glycerin and 5 drachms of starch. (See *Am. Journ. of Pharm.*, Nov. 1861, p. 569.) It has been given internally in colic, two drops being incorporated with a six-ounce mixture, and half a fluidounce given for a dose. (*Ibid.*, xi. 9.) In overdoses it is highly poisonous, producing gastro-enteric inflammation, and probably perverting the vital processes by pervading the whole system. Its odour is perceptible in the blood, and it is said to impart the smell of horseradish to the urine. A *spirit of mustard* may be prepared by macerating, for two hours, 250 parts of powdered black mustard with 500 parts of cold water, then adding 120 parts of alcohol of 86 per cent., and distilling over 120 parts of spirit. Though not so precise in composition as the alcoholic solution of the oil, it is more economical. (*Ann. de Thérap.*, 1864, p. 126.)*

* *Rigollot's and Rueff's Mustard-papers.* In consequence of the various inconveniences attendant upon the application of ordinary mustard cataplasms, *mustard-papers* have been contrived by M. Rigollot, in France, and Herr Rueff, in Germany, which aim to obviate these inconveniences.

1. *Rigollot's Mustard-paper* is prepared in the following manner. To a leaf of paper, sufficiently stiff, a layer of the flour of mustard, a millimeter in thickness, is attached by means of a solution of caoutchouc in the sulphide of carbon or a volatile oil. The solvent evaporates, leaving the flour of mustard entangled in a net of fibres adhering to the paper, and permeable by water as would be the meshes of a sieve. All that is necessary, when it is used, is to steep the mustard-paper, for 12 or 15 seconds, in water cold or warm, before applying it to the skin. Ninety grains of flour of mustard, employed in this method, are sufficient to redden strongly a surface of about four inches square. Mustard has its rubefacient power increased by depriving it of its fixed oil, which may be done by pressure, or by sulphide of carbon, which M. Rigollot prefers, while it keeps much better than that which retains its fixed oil. (*Journ. de Pharm.*, Oct. 1867, p. 269.)

2. *Rueff Mustard-paper.* This appears to have been prepared in the interests of the shop; for the mode of preparing it is not given in the highly laudatory notice of it contained in Buchner's *Neues Repertorium* (A.D. 1868, xvii. 182). It differs from Rigollot's preparation, is kept in well-

Off. Prep. of Mustard. Cataplasma Sinapis, *Br.;* Charta Sinapis, *U.S.;* Oleum Sinapis, *Br.*

Off. Prep. of Oil of Mustard. Linimentum Sinapis Compositum, *Br.* W.

SODIUM.

Sodium.

Sodium, *Fr.;* Natrium, Natronmetall, *Germ.;* Sodio, *Ital., Span.*

Sodium is a peculiar metal, forming the radical of the alkali soda. It was discovered by Sir H. Davy in 1807, who obtained it in small quantity by decomposing the alkali by the agency of galvanic electricity. It was afterwards procured in much larger quantities by Gay-Lussac and Thenard, by bringing the alkali in contact with iron turnings heated to whiteness. The iron became oxidized, and the metallic radical of the soda was liberated. Since the discovery of a mode for obtaining aluminium in bars, by Deville, in 1854, the process for procuring sodium, which is the decomposing agent, has been very much improved and cheapened. (See *page* 106.) Sodium is now obtained on a large scale by igniting an intimate mixture of dry carbonate of soda, coal, and chalk.

Sodium is a soft, malleable, sectile solid, of a silver-white colour. It possesses the metallic lustre in a high degree, when protected from the action of the air, by which it is quickly tarnished and oxidized. Its sp. gr. is 0·97, fusing point about 200°, equivalent number 23·3, and symbol Na. Its chemical affinities resemble those of potassium, but are less energetic. Like potassium it has a strong attraction for oxygen. When thrown upon cold water it instantly fuses into a globule without inflaming, and traverses the surface in different directions with rapidity; on hot water it inflames. In both cases the water is decomposed, hydrogen is liberated, and a solution of soda generated. Like potassium also, if exposed with a bright surface to the air, it undergoes a slow combustion, which renders it luminous in the dark. It combines also with a larger proportion of oxygen than exists in soda, forming a *teroxide.* This oxide is always formed when the metal is burned in the open air.

Sodium is a constituent of a number of important medicinal preparations, and is briefly described in this place as an introduction to these compounds. Its protoxide only is salifiable, constituting the alkali soda, which, united to acids, gives rise to a numerous class of compounds, called salts of soda. These are characterized by communicating to the blowpipe flame a rich yellow colour, and by not being precipitable by any reagent, except the metantimoniate of potassium. (See *page* 731.) Protoxide of sodium (*dry soda*) consists of one eq. of sodium 23·3, and one of oxygen 8 = 31·3. United with one eq. of water 9, it forms hydrate of soda (*caustic soda*), weighing 40·3. It appears that the salts of sodium, long theoretically presumed to be isomorphous with those of lithium, have recently been proved to be so by a comparison of the crystals of the hyposulphites of the two alkalies. (*Journ. de Pharm.*, 4e sér., iv. 72.)

The officinal combinations containing sodium are caustic soda, chloride of sodium, the solutions of soda and chlorinated soda, the acetate, arseniate, borate, carbonate, bicarbonate, phosphate, sulphate, sulphite, and valerianate of sodium, and the tartrate of potassium and sodium. The description of some of these combinations will immediately follow; and the remainder will be noticed, under their respective titles, in *Part II.* B.

SODII ACETAS. *U.S.*

Acetate of Sodium.

Off. Syn. SODÆ ACETAS. *Acetate of Soda.* $NaO,C_4H_3O_3+6HO$. *Br.*

Terra foliata tartari, *Lat.;* Acétate de soude, *Fr.;* Essigsaures Natron, *Germ.;* Acetato di soda, *Ital.*

closed stiff paper capsules, and retains its excellent properties unchanged. When to be used as a sinapism, all that is necessary is to cut off a piece of the required size, and, having dipped it for a few seconds in lukewarm water, to apply it to the skin with some pressure, and, if needful, to confine it with a bandage. It is stated, in the communication concerning it, that it is likely to supersede mustard as a cataplasm. (*Note to the thirteenth edition.*)

Acetate of sodium, being obtained on a large scale from the manufacturing chemist is properly placed in the catalogues of the Materia Medica of the U. S. and Br. Pharmacopœias.

Acetate of sodium is prepared by the manufacture of crude pyroligneous acid, for the purpose of being decomposed, so as to yield the officinal acetic acid, by the action of sulphuric acid. The steps of the process by which it is made from the crude acid have been given under the head of *Acidum Aceticum* (*page* 19).

Properties, &c. Acetate of sodium is a white salt, crystallizing in long striated prisms, and possessing a sharp, bitterish, not disagreeable taste. Exposed to a dry air it effloresces slowly, and loses about 40 per cent. of its weight. It is soluble in about 3 parts of cold water, and in 24 of alcohol. Subjected to heat, it undergoes first the aqueous and then the igneous fusion, and is finally decomposed; the residue being a mixture of carbonate of sodium and charcoal. By the addition of sulphuric acid it is decomposed, the acetic acid being liberated, known by its acetous odour, and sulphate of sodium formed. The salt should be perfectly neutral to test paper, and not precipitated by chloride of barium, nitrate of silver, or bichloride of platinum. The non-action of these tests shows the absence of sulphates, chlorides, and the salts of potassa. For the proper action of the nitrate of silver test, the solution should be dilute; as, if it be strong, there will be a crystalline precipitate of acetate of silver, which dissolves on the addition of water. Acetate of sodium, when crystallized, consists of one eq. of acetic acid 51, one of soda 31·3, and six of water 54 = 136·3.

Medical Properties and Uses. Acetate of sodium is diuretic, and possesses generally the same medical properties as acetate of potassium, to which article the reader is referred. It is, however, more convenient for exhibition than the latter salt, as it is not deliquescent. The dose is from a scruple to two drachms. It is employed principally to yield acetic acid by the action of sulphuric acid.

In prescribing this salt, the fact, first noticed by M. Violette, should not be forgotten, that a mixture of equal parts of it and nitrate of potassium, if heated, explodes with great violence. (*New Remed.*, April, 1873, p. 347.)

Pharm. Uses. In preparing Ferri Arsenias, *Br.;* Ferri Phosphas, *Br.;* Syrupus Ferri Phosphatis, *Br.*

Off. Prep. Acidum Aceticum Glaciale, *Br.* 1864. B.

SODII BICARBONAS VENALIS. *U.S.*

Commercial Bicarbonate of Sodium.

This substance was, in the former editions of our Pharmacopœia, placed among the *Preparations*, with the name of Sodæ Bicarbonas. In the late revision, that article was divided into two; one, as here headed, referring to a more or less impure form of the Bicarbonate as it usually circulates in the commerce of this country; the second, which concerns a purer form, being retained among the Preparations, with the title of Sodii Bicarbonas. With this, we consider the British article under the same title. The following is the mode of preparing the salt, now called *the commercial bicarbonate*, given in the U. S. Pharm. of 1860.

"Take of Carbonate of Soda *a convenient quantity.* Put the Carbonate, previously broken in pieces, into a wooden box, having a horizontal partition near the bottom pierced with numerous small holes, and a cover which can be tightly fitted on. To a bottle having two tubulures, and half filled with water, adapt two tubes, the first passing from an apparatus for generating carbonic acid, through one tubulure, to a point below the surface of the water in the bottle; the second reaching from the other tubulure to an opening near the bottom of the box, beneath the partition. Then lute all the joints, and cause a stream of carbonic acid to pass through the water into the box until the Carbonate is fully saturated. Lastly, remove the product from the box, and, having dried it, rub it into powder. Carbonic acid may be obtained from Marble by the addition of dilute Sulphuric Acid." *U.S.*

The object of this process was to unite the soda with an additional equivalent of carbonic acid, whereby it becomes converted into the bicarbonate.

The process adopted in the U. S. Pharmacopœia, since 1840, is that which has been practised for many years in the United States, and was described in 1830 by Dr. Franklin R. Smith, in the first volume of the Journal of the Philadelphia College of Pharmacy. This process is attributed to Dr. Smith by Soubeiran, who characterizes it as the best that can be employed. It was adopted in the French Codex on its revision of 1837. A stream of carbonic acid, freed from any accompanying impurity by passing through water in the intervening bottle, is conducted into a suitable vessel, containing the crystallized carbonate placed on a diaphragm, pierced with numerous holes. As the bicarbonate combines with much less water of crystallization than is contained in the carbonate, it follows that, during the progress of the saturation of the carbonate, a considerable quantity of water is liberated. This water would finally dissolve a portion of the bicarbonate formed, were it not for the pierced diaphragm, through which it is allowed to drain off holding in solution a part of the carbonate. When the saturation is completed, the pieces of crystals, still supported on the diaphragm, are found to have retained their original form, but to have become opaque and of a porous texture. The necessary carbonic acid for forming the bicarbonate may be economically obtained from other processes in which this acid is evolved; as, for example, from the process for making tartaric acid, in which tartrate of calcium is formed from cream of tartar by the addition of carbonate of calcium.

We are informed that much bicarbonate of sodium is now prepared in breweries, in the same manner as bicarbonate of potassium or sal aëratus, by placing the carbonate in suitable vessels over the fermenting beer in the vats, so as to be constantly immersed in an atmosphere of carbonic acid. It is sold under the same name as the analogous salt of potassa; but is sometimes distinguished as the *soda sal aëratus*.

Properties, &c. As obtained by the foregoing formula, bicarbonate of sodium is in opaque, porous masses, made up of numerous aggregated crystalline grains, having a snow-white colour. For the convenience of the apothecary these masses are reduced to powder. Bicarbonate of sodium is permanent in the air, and slightly alkaline to the taste and to turmeric paper. It is soluble in thirteen parts of cold water. When the solution is exposed to heat, the salt gradually parts with carbonic acid, and, at the temperature of 212°, is converted into sesquicarbonate. At a red heat, the water of crystallization and the second equivalent of carbonic acid, amounting together to 37 per cent., are expelled, and the anhydrous carbonate is left. More or less carbonate of sodium is always present in the commercial Bicarbonate. Its presence may be known by a decided alkaline taste and reaction, by a cold solution of the salt yielding a precipitate with sulphate of magnesium, and by a solution in 40 parts of water, affording, without agitation, an orange-coloured or reddish-brown precipitate with corrosive sublimate. The pure bicarbonate is not precipitated by bichloride of platinum, nor, when treated with nitric acid in excess, by chloride of barium or nitrate of silver. The non-action of these tests shows the absence of salts of potassa, and of sulphates and chlorides. The incompatibles of this salt are the same as those elsewhere mentioned of the carbonate, except sulphate of magnesium in the cold, which decomposes the carbonate, but not the bicarbonate.

Medical Properties. This salt has the general medical properties of the carbonate; but, from its mild taste and less irritating qualities, proves more acceptable to the palate and stomach. It is often resorted to in calculous cases, characterized by excess of uric acid. The continued use of the carbonate, in these cases, is liable to induce phosphatic deposit, after the removal of the uric acid. According to D'Arcet, who made the observation at the springs of Vichy, this objection does not apply to the bicarbonate, especially when taken in carbonic acid water; for this salt, by its superabundant acid, has the power of maintaining the phosphates in solution, even after the alkali has caused the uric acid to disappear. The same remark is applicable to the bicarbonate of potassium. Bicarbonate of sodium has been given in infantile croup, with apparent advantage in promoting the expulsion of the false membrane, in the dose of a grain every five minutes, dissolved in milk and water. Dr. Lemaire has proposed it as an antiphlogistic remedy in the treatment of pneumonia, membranous angina, and croup, supposing it to act on the principle of removing from the blood the excess of fibrin, which exists in that liquid in inflammation. Its utility in

membranous angina has been confirmed by M. Marchal (de Calvi). According to M. Jeannel, the use of bicarbonate of sodium lessens the sugar in the urine of diabetic patients. The dose for an adult is from ten grains to a drachm, and is taken most conveniently in a glass of carbonic acid water. When given in angina, fifteen grains may be administered every half hour in a tablespoonful of water. This salt is principally consumed in making soda and Seidlitz powders.

Pharm. Uses. In the preparation of Aqua Acidi Carbonici, *U. S.*

Off. Prep. Sodii Carbonas, *U. S.* B.

SODII BORAS. *U. S.*

Borate of Sodium.

Off. Syn. BORAX. *Borax.* $NaO,2BO_3+10HO$. *Br.*

Borate de soude, Borax, *Fr.;* Boraxsaures Natron, Borax, *Germ.;* Borace, *Ital.;* Borax, *Span.;* Boorak, *Arab.*

Borax was known to the ancients; but its chemical nature was first ascertained by Geoffroy in 1732. It exists native, and may be obtained by artificial means. It occurs in several localities in Europe, in Peru, and in beds, associated with borate of calcium, in the district of Iquique, in the Republic of Ecuador. This mineral (*tinkalzite*) which has become an article of commerce, and is considerably used as a substitute for borax, contains, according to T. L. Phillipson, 34 per cent. of water, 11·95 of soda, 14·45 of lime, 34·71 of boracic acid, 1·34 of chlorine, 1·10 of sulphuric acid, 0·60 of silica, and 2 of sand; and may be considered as a compound essentially of one eq. of crystallized borate of sodium and two of borate of calcium, more two eqs. of water. (*Chem. News*, Oct. 5, 1861, p. 183.) It is said also to contain usually some iodine and bromine. (*G. Sims.*) Borax is found abundantly in certain lakes of Thibet and Persia, from which it is obtained by spontaneous evaporation. The impure borax, called in commerce *tincal* or *crude borax*, concretes on the borders of these lakes. As thus obtained it is in the form of crystalline masses which are sometimes colourless, sometimes yellowish or greenish, and always covered with an earthy coating, greasy to the touch, and having the odour of soap. The greasy appearance is derived from a fatty matter, saponified by soda. The tincal is transferred to the seaports of India, especially Calcutta, from which it is exported to this country in chests. Besides Indian tincal, there is another commercial variety of borax which comes from China, and which is partially refined. Both varieties require to be purified before being used in medicine or the arts.

A new and abundant source of borax has recently been developed within the limits of the United States. The existence of a borax lake in California was first made known by Dr. J. A. Veatch, who visited it in September, 1856, and, upon examining its waters, found borax among its constituents. The borax lake is a small offset of a large sheet of water, called *Clear Lake*, which is situated in the midst of a volcanic region, about 36 miles from the Pacific, and about 100 miles north of San Francisco. The smaller lakelet is separated from the larger by a low ridge of volcanic materials loosely massed together. It is of variable dimensions according to the season, being sometimes dry, at others filled with water to the extent of about a mile in length, and half a mile in breadth. In September, 1863, the water, being analyzed by Mr. T. E. Moore, was found to contain in a gallon 2401·56 grains of solid matter, of which about one-half was common salt, one-quarter carbonate, and the remainder chiefly borate of sodium, equivalent to 535·08 grains of the crystallized biborate to the gallon. The borax, being the least soluble of the saline constituents, from time to time, as the water becomes saturated, crystallizes out, and being deposited at the bottom of the lake, has accumulated there in large quantities. The crystals of borax, from the minutest speck up to a diameter of two or three inches, intermixed with blue mud, form a layer at the bottom of the lake of variable thickness, but 18 inches in one place that was examined. This deposit forms an apparently inexhaustible supply of borax, for as fast as removed in one place it is deposited in another by crystallization from the water, which, supplied from the volcanic regions around, promises to continue furnishing the borax for an indefinite period. Already

the lake has supplied large quantities of borax to commerce. Iron coffer dams are sunk to the bottom of the lake, the water pumped out, and the mixed mud and crystals removed. The crystals are picked out, and the earth, which is strongly impregnated with borax, is lixiviated, and the solution thus obtained evaporated in boilers till crystals form. At the last accounts 4000 pounds of the salt are collected daily, and it is said that the quantity will be greatly increased on the completion of the works. (Prof. J. D. Whitney, *Silliman's Journ.*, March, 1866; and D. J. Macgowan, *Am. Journ. of Pharm.*, March, 1867, p. 155.)

Purification. The method of refining borax was originally possessed as a secret by the Venetians and Dutch, but is now practised in several European countries. The process pursued in France, as reported by Robiquet and Marchand, is as follows. The tincal is placed in a large wooden vessel, and covered to the depth of three or four inches with water; in which state it is allowed to remain for five or six hours, being agitated from time to time. Slacked lime is now added, in the proportion of 1 part to 400 of the impure salt; and the whole, being thoroughly mixed, is allowed to remain at rest till the succeeding day. The salt is next separated by means of a sieve, the crystals being crumbled between the hands, and placed so as to drain. The object of this treatment is to separate the soapy matter, with which the lime forms an insoluble soap; and at the same time sulphate and chloride of sodium are removed, with only a minute loss of the borax. The borax being drained is next dissolved, by the assistance of heat, in two and a half times its weight of water, and the solution treated with one-fiftieth of its weight of chloride of calcium, in order to complete the separation of the soapy matter; after which it is strained through a coarse bag. The liquor is then concentrated by heat, and run into wooden vessels, lined with lead, having the shape of an inverted quadrangular pyramid. If care be taken that the cooling proceed very gradually, distinct crystals will be obtained, such as are found in commerce; otherwise, crystalline crusts will be formed. The Chinese borax is purified in a similar manner; but, being less impure than the common tincal, does not require to be washed.

Preparation of Artificial Borax. Large quantities of borax are now made by the direct combination of *native boracic acid* with soda. The acid is found abundantly in the crater of Vulcano, one of the Lipari Islands; but principally in a volcanic region of Tuscany, occupying a space of ten or twelve miles. Within this region are found numerous hillocks and fissures, the latter of which emit hot aqueous vapour, containing boracic acid and certain gases. Around one or several of these fissures, a circular basin of masonry is built, which is filled with water, and called a lagoon. By the jets of vapour, constantly breaking through it, the water becomes gradually impregnated with boracic acid, and heated. A series of such lagoons are made to communicate with each other on the declivity of a hill, and the lowest to discharge itself into a reservoir, where the solution is allowed to rest, and deposit mechanical impurities. From this reservoir the solution is made to pass into leaden evaporating pans, heated by the natural vapour, where it receives sufficient concentration to fit it for being conducted into wooden tubs, where it is allowed to cool and crystallize. The crude acid, thus obtained, contains, on an average, 84 per cent. of boracic acid; the impurities consisting chiefly of alum, the double sulphate of ammonium and magnesium, and sulphate of calcium. The product of the Tuscany lagoons in 1855 was over 1800 tons. (A. Péchiney-Rangot, *Journ. de Pharm.*, xxviii. 358.) The crude acid is converted into borax by dissolving it to saturation in a solution of carbonate of sodium, heated by steam; and the liquor, after boiling, is allowed to stand for ten or twelve hours. It is then drawn off into wooden vessels lined with lead, where it crystallizes. The impure crystals, thus obtained, are refined by dissolving them in water heated by steam, adding carbonate of sodium to the solution, and crystallizing. The merit of introducing the process for obtaining artificial borax belongs to Cartier and Payen, who succeeded in establishing its manufacture in France. According to Dr. Veatch, boracic acid exists in the sea-water on the coast of California.

Another method of neutralizing the Italian boracic acid is now in practice in England. Instead of combining the acid and alkali in solution, the manufacturer mixes the acid in a solid state with a proper proportion of soda ash, and exposes the

mixture to the heat of a reverberatory furnace; provision being made for the collection of a large quantity of ammonia, which is always present in the crude acid, and escapes during the process. The remaining operations are similar to those performed in the preparation of carbonate of sodium from the cake. (*Am. Journ. of Pharm.*, July, 1867, p. 339; from the *Druggists' Circular*, Feb. 1867.)

Properties. Borax is a white salt, generally crystallized in flattened hexahedral prisms, terminated by triangular pyramids, and possessing a sweetish, feebly alkaline taste, and an alkaline reaction. It dissolves in twelve times its weight of cold, and twice its weight of boiling water. Exposed to the air it effloresces slowly, and the surface of the crystals becomes covered with a white powder. Subjected to a moderate heat it undergoes the aqueous fusion, swells considerably, and finally becomes a dry porous mass, with loss of half its weight. Above a red heat it melts into a limpid liquid, which, after cooling, concretes into a transparent solid, called *glass of borax*, much used as a flux in assays with the blowpipe. Borax has been found, in the English market, adulterated to the extent of 20 per cent. with phosphate of sodium. This may be detected by exposing the suspected borax to the heat of a drying room for a few hours, when the phosphate, if present, will effloresce, and may be picked out.

Borax has the property of rendering cream of tartar very soluble in water, and forms a combination with it called *soluble cream of tartar*, which is sometimes used in medicine. This preparation is made by boiling 6 parts of cream of tartar and 2 of borax in 16 of water for five minutes, allowing the solution to cool, and then filtering to separate some tartrate of calcium. Soluble cream of tartar attracts moisture from the air, and is soluble in its own weight of cold, and half its weight of boiling water. A similar preparation may be made by substituting boracic acid for the borax. *Boracic acid soluble cream of tartar* was directed by the French Codex of 1837, and was made by the following formula. Four hundred parts of cream of tartar and 100 of the acid are dissolved in a silver basin, at the boiling temperature, in 2400 parts of water. The solution is kept boiling until the greater part of the water is consumed. The fire is then moderated, and the solution continually stirred while the evaporation proceeds. When the matter has become very thick, it is removed by portions, which are flattened in the hand, completely dried by the heat of a stove, powdered, and kept in well-stopped bottles. This form of soluble cream of tartar is more soluble than that made with borax. According to M. E. Robiquet, in order to obtain soluble cream of tartar, made with boracic acid, of good quality, it is necessary to use a large quantity of water, and to boil for a long time. By proceeding thus, the boracic acid undergoes a molecular modification, equivalent to a change from the crystallized to the vitreous condition, and a preparation, readily and totally soluble in cold water, is ensured. The product should not be powdered, but kept in large grains. (*Journ. de Pharm.*, xxi. 197.)

Composition. Borax consists of two eqs. of boracic acid 69·8, and one of soda 31·3 = 101·1. It ordinarily crystallizes in prisms, and contains ten eqs. of water (*prismatic borax*); but a variety of the salt exists, which crystallizes in octohedrons, and contains only five eqs. of water (*octohedral borax*). The latter is obtained in the artificial production of borax, by crystallizing from a concentrated solution at a temperature between 174° and 133°. When a solution of borax is evaporated at 212°, the salt is left as a transparent, amorphous, brittle mass, containing four eqs. of water. (*Schweitzer.*) In composition borax is a *biborate*, though sometimes called a subborate on account of its possessing an alkaline reaction.

Boracic acid may be obtained artificially by decomposing a hot saturated solution of borax with sulphuric acid, which unites with the soda to form sulphate of sodium, and sets free the acid. As thus obtained it is in white, shining, scaly crystals, characterized by the property of imparting a light-green colour to the flame of burning alcohol. Boracic acid consists of one eq. of boron 10·9, and three of oxygen 24 = 34·9.*

* *Reactions of Boracic Acid.* From the researches of M. C. Tissier, it appears that boracic acid, in boiling solution, is capable of dissolving the protoxides of calcium, magnesium, manganese, iron, cobalt, nickel, zinc, and cadmium, but not those of copper, lead, or tin, nor the sesquioxides of aluminium, chrome, or iron. In other words, it dissolves the protoxides of all the metals which decompose water in the presence of acids, and is without action on those of other metals, as well

Boron is a non-metallic element, which, like carbon, exists in three allotropic states, called amorphous, graphitoidal, and crystallized boron, representing severally charcoal, graphite, and diamond. Crystallized boron is very brilliant, and of different colours, from garnet-red to a nearly colourless honey-yellow. Its density is 2·68, and hardness very great. Wöhler and Deville distinguish three varieties of crystals, containing from 2 to 4 per cent. of carbon; and one specimen, in addition to carbon, about 7 per cent. of aluminium. The hardest variety was as hard as diamond. (See *Chem. Gaz.*, Aug. 1, 1857, p. 281.)*

From the experiments of M. Dumas and M. Schnatzles, it appears that borax has the property of destroying the microscopic vegetable and animal organisms, upon which fermentation and putrefaction depend, and consequently of preventing these processes, or of suspending and altogether arresting them, when already begun. Thus, a strong solution of borax added to a saccharine solution containing yeast, prevents alcoholic fermentation, by destroying the vitality of the yeast plant; and in a similar manner, in meats and other putrescible food, in great measure prevents putrefaction by destroying the infusoria and other microscopic bodies which occasion or support the process. (*Pharm. Jour.*, April, 1874, p. 846.)

Medical Properties. Borax is a mild refrigerant and diuretic. It is supposed also to exercise a specific influence over the uterus, promoting menstruation, facilitating parturition, and favouring the expulsion of the placenta. Dr. Binswanger denies its specific power of exciting uterine contractions, or promoting menstruation. Nevertheless, Dr. Daniel Stahl, of Indiana, has found it useful in dysmenorrhœa, occurring in sanguineous constitutions, venesection being premised. He gives it in doses of about nine grains every two hours, in a tablespoonful of flaxseed tea, for two days before the time of the expected return of the menses. Virey deemed it aphrodisiac; and, according to Dr. J. C. Hubbard, it is eminently so when used in the form of enema. Binswanger considers borax as the best remedy that can be used in nephritic and calculous complaints, dependent on an excess of uric acid. It probably acts in such cases as an alkali, the soda of the salt neutralizing the uric acid occurring in the urinary passages, and the boracic acid being set free. The dose is from thirty to forty grains. In infantile diarrhœa, unattended by lesions of the intestinal mucous membrane, M. Bouchut has found borax peculiarly efficacious, given in the form of enema, made by dissolving from two to five drachms in four fluidounces of water. Dr. Corson, of Orange, N. J., has tried a mixture of borax and nitre, with great success, in the sudden attacks of hoarseness from cold, so apt to interfere with speakers and singers in the performance of their duties. Sometimes borax alone, in a piece about as large as a pea, introduced into the mouth about ten minutes before singing or speaking, and allowed slowly to dissolve, will check the hoarseness so as to allow the operator to proceed; but the effect is increased by the use of nitrate of potassium, of which a piece as large as a pea is given to the speaker on the eve of the day on which he is to speak, in a glassful of warm water, and swallowed on getting into bed. (*Lancet*, March 31, 1873, p. 738; from *N. Y. Med. Jour.*) Cream of tartar is conveniently rendered more soluble by borax or boracic acid, when it is desirable to administer it in large quantities. Externally the solution of borax is used as a wash in scaly eruptions. A solution, formed by dissolving a drachm of the salt in two fluidounces of distilled vinegar, has been found, both by Dr. Abercrombie and Dr. Christison, an excellent lotion for ringworm of the scalp. Borax has been employed with good effect by Dr. Brinton in an inveterate case of cracked tongue, applied as a lotion, made by dissolving two scruples of borax in an ounce of glycerin and four fluidounces of water. This salt is very much used as a detergent in aphthous affections of the mouth in children. When employed for this purpose, it is generally applied in powder, either mixed with sugar in the proportions of one part to seven, or rubbed up with honey. (See *Mel Boracis.*) M. Yemens has succeeded in curing the most obstinate cases of *pruritus*

as on all the higher oxides, such as sesquioxides and binoxides. It dissolves only one of the insoluble metallic sulphurets, namely, the sulphuret of manganese. (*Journ. de Pharm.*, Juillet, 1858, p. 98.)

* Boracic acid is said to be obtained from a mineral denominated *boron atrocalcite*, consisting of borate of sodium and calcium, which is found abundantly in the State of Nevada, U. S. A. (*Journ. le Pharm.*, Avril, 1874, p. 157.)

urethræ and *vaginæ* by the use of borax with the aid of galvanism. He introduces grooved metal bougies smeared with a mixture of 1 part of borax and 3 of lard; and, if this does not succeed he passes a current of induced electricity through the parts affected by pushing the bougie into the bladder, and then connecting the instrument with one pole of a galvanic battery, and the nape of the neck with the other. (*New Remedies*, July, 1874, p. 211.)

Borax is used in the arts for soldering metals, its effect being to keep the surfaces free from oxidation. It is said also to have come into use, in some places, in washing clothes, as a substitute for soap, which it resembles in its effects, while it does not disturb the colours. It is used in very small proportion. (*Neues Repertorium*, A. D. 1864, xiii. 423.)

Off. Prep. Glycerinum Boracis, *Br.;* Mel Boracis, *Br.;* Mel Sodii Boratis, *U. S.* B.

SODII CARBONAS. *U. S.*

Carbonate of Sodium.

Off. Syn. SODÆ CARBONAS. *Carbonate of Soda.* $NaO,CO_2 + 10HO$. *Br.* Carbonate de soude, *Fr.;* Einfach Kohlensaures Natron, *Germ.;* Carbonato di soda, *Ital.;* Carbonato de soda, *Span.*

In the U. S. Pharmacopœia this salt has always been placed in the list of the Materia Medica; the crystallized carbonate of sodium, obtained on a large scale by the manufacturing chemist, being sufficiently pure, without further preparation, for medicinal use; and the same position is given to it in the British Pharmacopœia.

Before entering upon the consideration of the carbonate of sodium, we shall speak generally of the sources of the alkali soda. These may be divided into the natural and artificial. The natural sources are the minerals of native soda, and certain marine plants which yield the alkali in their ashes; the artificial are certain salts which furnish it by chemical decomposition.

Native soda, sometimes called *natron*, is found chiefly in Hungary, Egypt, and South America, and exists, in these countries, either in the earth of the surface, which often exhibits a saline efflorescence, or in solution in small lakes, from which it is extracted by taking advantage of the drying up of the water during the heats of summer. The native soda from Egypt, called *trona*, is a *sesquicarbonate;* while that from South America is less carbonated. Native soda, in the form of sesquicarbonate, has been found in a soda lake in the territory of the Nizam, in Hindostan. Dr. Barth, in his *Travels in Africa*, states that natron is largely collected on the shores of Lake Tsad, and in some other localities in Negroland or Central Africa. (*Am. ed.*, 1857, i. 312, and ii. 63–8.) A similar product exists abundantly in low places along the sea-coast of Arabia, near Aden. (R. Haines, *Pharm. Journ.*, July, 1863.)

Impure soda, derived from the ashes of plants growing on the surface or borders of the sea, is called barilla or kelp, according to the character of the plants incinerated. Barilla is obtained from several vegetables, principally belonging to the genera *Salsola*, *Salicornia*, and *Chenopodium*. In Spain, Sicily, and some other countries, these plants are cultivated for the purpose of yielding soda by their combustion. When ripe, they are cut down, dried, and burnt in heaps. The ashes form a semi-fused, hard, and compact saline mass, which is broken up into fragments by means of pickaxes, and thrown into commerce. Kelp, called *varec* in France, is procured by the incineration of various kinds of sea-weeds, principally the algæ and fuci, which grow on the rocky coasts of many countries. The Orkneys and Hebrides, and the rocky coasts of Wales, Scotland, and Ireland furnish large quantities of these weeds. The plants are fermented in heaps, then dried, and afterwards burnt to ashes in ovens roughly made of brick or stone, and built in the ground. The alkali in the ashes melts, and forms the whole into one solid mass. When cold, it is broken up with iron instruments into large heavy masses, in which state it is found in commerce. About twenty-four tons of sea-weeds produce one of kelp.

Barilla, when of good quality, is in hard, dry, porous, sonorous, grayish-blue masses, which become covered with a saline efflorescence on exposure. It possesses

a peculiar odour and an alkaline taste. *Spanish barilla* contains from 25 to 40 per cent. of carbonated alkali; the residue being made up of sulphate of sodium, sulphuret and chloride of sodium, carbonate of calcium, alumina, silica, oxidized iron, and a small portion of charcoal which has escaped combustion. Before the introduction of artificial soda, barilla formed the source of the crystallized carbonate employed in medicine. At present it is principally used in the manufacture of soap.

Kelp is in hard, vesicular masses, of a dark-gray, bluish, or greenish colour, sulphurous odour, and acrid, caustic taste. It is still less pure than barilla, containing only from 5 to 8 per cent. of carbonated soda; the rest being made up of a large proportion of the sulphates of sodium and potassium, and the chlorides of potassium and sodium, a small quantity of iodide of sodium, and insoluble and colouring matters. Large quantities of kelp were formerly manufactured in Great Britain and the neighbouring islands, particularly the Orkneys; but the demand and production have greatly fallen off, since the introduction of artificial soda at a comparatively low price. At present kelp is used principally in the manufacture of iodine. (See *Iodinium.*)

Artificial Soda. This is made from common salt by two steps; first, by converting the salt by sulphuric acid into sulphate of sodium, and, secondly, by decomposing the sulphate by carbonate of calcium and charcoal at a high temperature, so as to yield carbonate of sodium. The sulphate, first dried, is mixed with its own weight of ground limestone, and half its weight of small coal, ground and sifted; and the whole is heated in a reverberatory furnace, where it fuses, and forms a black mass called *black ash, soda ball*, or *British barilla.* The coal, at the temperature employed, converts the sulphate of sodium into sulphuret of sodium. This reacts with the limestone, so as to form sulphuret of calcium and carbonate of sodium (NaS and $CaO,CO_2 = CaS$ and NaO,CO_2). If this compound were digested in water, sulphuret of sodium and carbonate of calcium would be reproduced. To prevent this result a large excess of lime is used, which gives rise to the formation of an oxysulphuret of calcium ($3CaS,CaO$), which is insoluble in water, and without action on carbonate of sodium. British barilla contains about 36 per cent. of alkali, imperfectly carbonated on account of the high heat used; the remainder being principally oxysulphuret of calcium, caustic lime, and coaly matter. It is next digested in warm water, which takes up the alkali and other soluble matters, and leaves the insoluble impurities, called *soda waste*, which is now largely utilized in the manufacture of hyposulphite of sodium. (*Chem. News*, Sept. 28, 1861, p. 174.) The solution is evaporated to dryness, and the mass obtained is calcined with one-fourth of its weight of sawdust, in order to convert the alkali fully into carbonate, by means of the carbonic acid resulting from the combustion of the sawdust. The product is redissolved in water, and the solution evaporated to dryness. The alkali, in this stage of its purification, contains about 50 per cent. of carbonate of sodium, and is called *soda-ash.* It is brought to the state of crystallized carbonate of sodium, by dissolving it in water, straining the solution, evaporating it to a pellicle, and setting it aside to crystallize. On the subject of the products of the soda manufacture, see an elaborate paper by John Brown, Esq., in the *Philos. Mag.* for Jan. 1849.

The process here described, for obtaining soda from common salt, was discovered in 1784 by Leblanc; and the first manufactory for procuring it on a large scale was established in 1790, near Paris, by Leblanc and Dizé. The process is pursued on an immense scale in Great Britain, especially at Liverpool and Glasgow, and produces soda at so small a cost, that barilla and kelp are nearly superseded as sources of the alkali.

A new process for manufacturing artificial soda from sulphate of sodium has been proposed by M. Emile Kopp, and has been successfully carried into operation on a large scale, near Manchester, England. It consists in decomposing the sulphate by sesquioxide of iron and coal. The advantages claimed for this process are that the whole of the sulphur of the sulphate may be recovered, instead of being lost in the waste oxysulphuret of calcium of the old process, and that it is more independent of the skill of the workmen. (See *Journ. de Pharm.*, Nov. 1856, p. 360.)

Mr. A. G. Hunter, of Rockcliff Hall, near Flint, has made a discovery which bids fair materially to modify Leblanc's method of preparing carbonate of sodium. It is

known that caustic baryta will decompose sulphate of sodium, uniting with the acid, and leaving caustic soda in solution. But baryta is so costly as to render this property practically nugatory. Mr. Hunter's discovery consists in the fact, that caustic lime has the same effect, if aided by a pressure considerably exceeding that of the atmosphere, brought to bear on the solution of the sulphate of sodium, after the addition of the lime. The caustic soda thus obtained in solution may be converted into the carbonate by direct union with carbonic acid. (*Am. Journ. of Pharm.*, March, 1866, p. 172.)

Since the date of the publication of the last edition of this work, a process has been put in practice, and given so much satisfaction in its results as to be likely to rival, if not to supersede the hitherto unequalled process of Leblanc. It is designated as the *ammonia* process, and is based on the fact, that, when bicarbonate of ammonium is added to a strong solution of chloride of sodium, a double decomposition takes place, resulting in the production of bicarbonate of sodium, which subsides, and chloride of ammonium, which remains in solution. From the latter, if deemed advisable, the ammonia may be withdrawn by the action of lime, and serve in the renewal of the operation. The bicarbonate of sodium is reduced by heat to the carbonate, and the carbonic acid thus obtained serves to convert the ammonia into the bicarbonate of ammonia necessary in the proceeding.

The reaction between the bicarbonate of ammonium and common salt, upon which the process was founded, had been noticed by M. Turck as much as thirty years before it was carried into practical operation, with advantageous results. At present, according to M. Hofmann, it is the only process which threatens a serious competition with that of Leblanc; and already it has been adopted by some of the largest factories of soda in Great Britain, and various parts of the continent of Europe. The advantages of this method are that the common salt is directly transformed into carbonate of sodium, that in the precipitation sodium is the only metal thrown down and that the preparation is therefore remarkably pure, that it is entirely exempt from the compounds of sulphur, that the amount of product is very large, that the apparatus used in the process is very simple, and that there is a great saving of fuel and of labour, and, finally, that no unwholesome gases are diffused in the atmosphere, interfering with the health of the workmen and the community. An objectionable point in the process is the loss of the chlorine of the common salt, which, in the reproduction of the ammonia, becomes useless chloride of calcium.*

In reference to the foregoing process, MM. Schloesing and Rolland have observed that, in the double decomposition between bicarbonate of ammonium and chloride of sodium, a certain portion only, about two-thirds, undergoes the change. This is explained by M. Bauer, who finds that the reaction is limited by another in an inverse direction. Thus, if bicarbonate of ammonium and chloride of sodium yield bicarbonate of sodium and chloride of ammonium (hydrochlorate of ammonia); these, put together, inversely yield bicarbonate of ammonium and chloride of sodium. An equilibrium is thus established, and the mixture preserves a constant composition, at the point where the two reactions take place at the same time. (*J. de Pharm. et de Chim.*, Sept. 1874, p. 255.)

Another source of this carbonate has lately been found in *cryolite*, a mineral existing in great abundance on the coast of Greenland, and largely imported into this country by a manufacturing company, which enjoys to a certain extent a monopoly of the mineral under the Danish authorities. Cryolite consists mainly of a double fluoride of aluminium and sodium, containing in 100 parts 13 of aluminium, 34 of sodium, and 53 of fluorine. Carbonate of sodium is obtained by boiling cryolite with lime, whereby the fluoride of calcium is formed, which, being insoluble, is deposited, while alumina and soda are combined in solution. The soda is converted into carbonate by passing carbonic acid through the solution; and the alumina, separated from the soda, becomes insoluble, and is deposited. (*Am. Journ. of Pharm.*, Jan. 1868, p. 71.) Cryolite is also largely used in Denmark and Germany in the preparation of carbonate of sodium and of alumina, the latter of which is employed in

* The above account is abbreviated from an article in the *Journal de Pharmacie*, Mai, 1874, p. 401.

the manufacture of alum and aluminium. The cryolite is mixed thoroughly with chalk, in the state of powder, and the mixture is calcined. The fluorine combines with the calcium of the lime, which gives its oxygen to the sodium and aluminium, converting them into soda and alumina. The soda is extracted by lixiviation, and carbonic acid passed through the solution. The carbonate of sodium thus formed is obtained by evaporation and crystallization. (*Ibid.*, May, 1863, pp. 244 and 255.)*

The different kinds of impure carbonate of sodium, whether barilla, kelp, or soda-ash, being exceedingly variable in composition, it is important to have a ready method of determining the quantity of real carbonated alkali which they contain. The mode in which this is done, by means of an instrument called an alkalimeter, has been already explained. (See *page* 731.) These various forms of carbonated soda are largely consumed in dyeing and bleaching, and in the manufacture of soap and glass. In reference to "the English commercial test," see *Am. Journ. of Pharm.*, Sept. 1870, p. 447.

The following are descriptions of the different grades of artificial soda, known under the names of British barilla, soda-ash, and carbonate of soda.

British barilla, so called to distinguish it from Spanish barilla, which has its source in the ashes of maritime plants, is a blackish-brown substance, becoming darker by exposure to the air. When broken it exhibits an imperfect metallic lustre, and a close striated texture. Its taste is hepatic and caustic. By exposure to a moist atmosphere, it becomes covered with a yellow efflorescence, and quickly falls to powder, with disengagement of heat and sulphuretted hydrogen; at the same time increasing in weight by the absorption of carbonic acid and water.

Soda-ash is in white or gray compact masses, and contains about half its weight of foreign salts, consisting principally of chloride of sodium and sulphate of sodium.

Carbonate of soda (carbonate of sodium) is a colourless salt, possessing a disagreeable taste and alkaline reaction, and crystallizing usually in large oblique rhombic prisms, which speedily effloresce when exposed to the air. When heated it undergoes the aqueous fusion; and, if the heat be continued, it dries and finally suffers the igneous fusion. Of the crystallized salt, 100 parts of water dissolve 60 at 57°, 833 at 97°, its temperature of maximum solubility, and 445 at 219°, or the boiling point of the solution. (*Payen.*) This salt presents other anomalies in solubility, as ascertained by M. Henri Lœwel. Carbonate of sodium is insoluble in alcohol. The most usual impurities in it are sulphate of sodium and common salt, which may be detected by converting it into a nitrate, and testing separate portions of this severally with chloride of barium and nitrate of silver.† Common salt is seldom entirely absent, but good specimens are free from sulphate of sodium. When badly prepared, it is liable to contain sulphuret of sodium, which may be detected by the production of the smell of sulphuretted hydrogen upon dissolving the salt in water. Carbonate of sodium is incompatible with acids which decompose it with effervescence, acidulous salts, lime-water, muriate of ammonium, and earthy and metallic salts. It consists of one eq. of carbonic acid 22, and one of soda $31{\cdot}3 = 53{\cdot}3$. When fully crystallized it contains ten eqs. of water 90, giving as the number representing the crystallized salt 143·3. It is thus perceived that this salt, when perfectly crystallized, contains nearly two-thirds of its weight of water; but the quantity actually present in it, as found in the shops, is

* *Cryolite.* Besides the preparation of carbonate of sodium, cryolite is employed for other important purposes. Its only known locality, at least in large amount, is Greenland, where it is found on the south-west coast, near Cape Farewell, existing in beds, of which one is said to be 80 feet thick and 300 long. It is said that the manufacturing company referred to in the text, the "Pennsylvania Salt Company," imported in 1865 and 1866 thirteen cargoes, amounting to 9000 tons, into Philadelphia, and in the year 1867, were expected to import 8000 tons. It is a handsome mineral, hard, brittle, and translucent, sometimes almost transparent, but generally of a frosty whiteness which has probably suggested its name of *cryolite* or *kryolite*, from the Greek κρυος, frost. Though homogeneous in great degree, it exhibits here and there in its substance dark spots, sometimes mere specks, sometimes of considerable size, which appear to be crystalline centres of substances mixed with it at the time of solidification, such as galena, sulphuret of lead, carbonate of iron, copper and iron pyrites, &c. It is employed in the making of soap, in the preparation of sulphate of aluminium, and in the formation of a beautiful variety of glass, which is made by melting one part of it with from two to four parts of pure silex. (Evan T. Ellis, *Proceed. of Am. Pharm. Association*, 1867.)—*Note to the thirteenth edition.*

† For a method of determining the precise quantity of the sulphate in a special case, see *Journ. de Pharm.*, Août, 1873, p. 124.

variable, being dependent on the extent to which it may have undergone efflorescence. "The precipitate produced with its solution by chloride of barium is wholly soluble in nitric acid" (*U. S. Ph.*), proving the absence of a sulphate. To obtain pure carbonate of sodium for the purpose of a test, Dr. J. Lawrence Smith, of Louisville, Ky., recommends that oxalate of sodium should be prepared from the common carbonate, and then decomposed by heat. (*Am. Journ. of Pharm.*, Jan. 1875, p. 38.)*

Medical Properties and Uses. Carbonate of sodium is antacid, antilithic, and resolvent. It is given principally in diseases attended with acidity of the stomach; such as gout, uric acid gravel, and certain forms of dyspepsia. It is more frequently exhibited than carbonate of potassium; as, from its less acrid taste, it is more easily taken. It has also been recommended in hooping-cough, scrofula, and bronchocele. In the latter disease, Dr. Peschier, of Geneva, considered it more efficacious than iodine. It is also employed with advantage, internally and externally, in skin diseases, especially those of a papulous and scaly character. A lotion suitable for these cases may be formed by dissolving from two to three drachms of the carbonate in a pint of water. For a bath, from eight to sixteen ounces of the salt may be dissolved in the necessary quantity of water. A suitable ointment may be made by mixing from eight to sixty grains with an ounce of lard, according to the character of the affection. Carbonate of sodium is given in doses of from ten grains to half a drachm, either in powder, or dissolved in some bitter infusion. In consequence of the variable state in which it exists in the shops, as to the amount of water of crystallization which it contains, the dose cannot be indicated with precision. It is on this account that the salt is most conveniently administered in the dried state, which admits of its being given in the pilular form. (See *Sodii Carbonas Exsiccata.*) When taken in an overdose, it acts as a corrosive poison. The best antidotes are the fixed oils, acetic acid, and lemon-juice.

Pharm. Uses. In preparing Aluminii Sulphas, *U. S.;* Antimonii Oxidum, *Br.;* Antimonii Oxysulphuretum, *U. S.;* Bismuthi Subnitras, *U. S.;* Cadmii Sulphas, *U. S.*

Off. Prep. Bismuthi Subcarbonas, *U. S.;* Calcii Carbonas Præcipitata; Ferri Subcarbonas, *U. S.;* Liquor Sodæ; Liquor Sodæ Chloratæ, *Br.;* Liquor Sodæ Chlorinatæ, *U. S.;* Magnesiæ Carbonas, *Br.;* Magnesiæ Carbonas Levis, *Br.;* Pilula Ferri Carbonatis, *U. S.;* Pil. Ferri Compositæ, *U. S.;* Potassii et Sodii Tartras, *U. S.;* Soda Tartarata, *Br.;* Sodæ Bicarbonas, *Br.;* Sodæ Carbonas Exsiccata, *Br.;* Sodii Carbonas Exsiccata, *U. S.;* Sodæ Phosphas, *Br.;* Sodii Phosphas, *U. S;* Zinci Carbonas, *Br.;* Zinci Carbonas Precipitata, *U. S.* B.

SODII CHLORIDUM. *U. S., Br.*

Chloride of Sodium. Common Salt.

Muriate of soda, Sea salt, Common salt; Chlorure de sodium, Hydro-chlorate de soude, Sel marin, *Fr.;* Chlornatrium, Kochsalz, *Germ.;* Salt, *Dan., Swed.;* Chloruro di sodio, Sal commune, *Ital.;* Sal, *Span.*

This mineral production, so necessary to mankind, is universally distributed over the globe, and is the most abundant of the native soluble salts. Most animals have an instinctive relish for it; and, from its frequent presence in the solids and fluids of the animal economy, it may be supposed to perform an important part in assimilation and nutrition.

* Dr. Smith gives the following particular description of the method employed by him; 63 grammes of oxalic acid and 143 grammes of ordinary carbonate of sodium are dissolved, with heat, in 200 cubic centimetres of distilled water, the solution is distilled, filtered if necessary, and, when it cools, the solution of oxalic acid, just hot enough to prevent crystallization, is added by degrees, with stirring. It is expected that the solution, when completed, shall have a slight alkaline reaction. Shortly after the operation is finished, the oxalate of sodium will be in great measure precipitated. The whole is then allowed to stand till completely cool; the supernatant liquid is decanted, a little distilled water added, and the lumps of crystals that may have formed are broken up by a stirrer, thrown on a six-inch filter over a Bunsen aspirator, washed with about half a litre of distilled water, and allowed to dry. The quantity of dry oxalate produced is 30 grammes. In this state it may be kept in a dry bottle till wanted for use in forming carbonate of sodium. It is then projected, little by little, into a platinum capsule, over a good-sized Bunsen burner. After being strongly heated, the oxalate is changed by the decomposition of the oxalic acid into the carbonate, and, if the heat be high enough to fuse the salt, about 23 grammes of the fused carbonate will be obtained. Fused or not, this is dissolved in water, filtered, evaporated to dryness, dehydrated over a naked flame, and granulated by stirring while hot. (*Am. Journ. of Pharm.*, Jan. 1875, p. 31.)—*Note to the fourteenth edition.*

Natural State. Common salt exists in nature, either in the solid state or in solution. In the solid state, called *rock salt*, *fossil salt*, and *sal gemmæ*, it is often found forming extensive beds, and even entire mountains, from which it is extracted in blocks or masses by mining operations. Its geological position is very constant, occurring almost invariably in secondary formations, associated with clay and gypsum. In solution it occurs in certain springs and lakes, and in the waters of the ocean. The principal salt mines are found in Poland, Hungary, and Russia; in various parts of Germany, particularly the Tyrol; in Cheshire, England; in Spain; in various parts of Asia and Africa; in the island of St. Domingo;* and in Peru, and other countries of South America. With the exception of a remarkable bed of rock salt in the island of Petite Anse, in Vermillion Bay, on the coast of Louisiana, there are in the United States no salt mines east of the Rocky Mountains; but there are numerous salt springs, which either flow naturally, or are produced artificially by sinking wells to various depths in places where salt is known to exist.† These are found principally in Missouri, Kentucky, Illinois, Ohio, Michigan, Pennsylvania, Virginia, and New York. In the last-mentioned State the springs are the most productive; the chief ones being situated at Salina, Montezuma, and Galen. In Virginia an important salt region exists, extending fifteen miles on both sides of the Great Kanawha River. Rock salt is always transparent or translucent; but it often exhibits various colours, such as red, yellow, brown, violet, blue, &c., which are supposed to be derived from iron and manganese.

Extraction. Mines of salt are worked in two ways. When the salt is pure it is merely dug out in blocks and thrown into commerce. When impure it is dissolved in water, and extracted afterwards from the solution by evaporation. When the salt is naturally in solution, the mode of extraction depends upon the strength of the brine, and the temperature of the place where it is found. When the water contains from 14 to 15 per cent. of the salt, it is extracted by evaporation in large iron boilers. If, however, it contains only 2, 3, 4, or 5 per cent., the salt is obtained in a different manner. If the climate is warm it is procured by spontaneous evaporation, effected by the heat of the sun; if temperate, by a peculiar mode of evaporation to be mentioned presently, and the subsequent application of artificial heat.

Sea-water is a weak saline solution, containing 2·7 per cent. of common salt, which is extracted by the agency of solar heat in warm countries. Salt thus obtained is called *bay salt*. The extraction is conducted in Europe principally on the shores of the Mediterranean, the waters of which are salter than those of the open ocean. The mode in which it is performed is by letting the sea-water into shallow dikes, lined with clay, and capable, after having been filled, of being shut off from the sea. In this situation the heat of the sun gradually concentrates the water, and the salt is deposited. In temperate climates, weak brines are first concentrated in buildings called *graduation houses*. These are rough wooden structures open on the sides, ten or eleven yards high, five or six wide, and three or four hundred long, and containing an oblong pile of brushwood somewhat smaller than the building itself. The brine is pumped up into troughs full of holes, placed above the brushwood, upon which it is allowed to fall; and in its descent becomes minutely divided. This operation, by greatly increasing the surface of the brine, promotes its evaporation; and, being repeated several times, the solution is at last brought to the requisite degree of strength to permit of its final concentration in iron boilers by artificial heat.

Properties. Chloride of sodium is white, without odour, and of a peculiar taste called saline. It is usually crystallized in cubes; but by hasty evaporation it often assumes the form of hollow quadrangular pyramids. When pure it undergoes no change in the air; but, when contaminated with chloride of magnesium, as not un-

* This deposit is on the south side of the island, and is said to form a mountain 6 miles long, from half a mile to a mile broad, and from 400 to 500 feet high. The salt in its crude state contains 96·79 per cent. of pure chloride of sodium. (*Am. Journ. of Pharm.*, Sept. 1865, p. 395; from *Am. Druggists' Circular.*)—*Note to the thirteenth edition.*

† *Rock salt in Nevada.* In an extract from a letter dated at Virginia City, in the new State of Nevada, adjoining California, published in one of our daily papers (*North American and United States Gaz.*, Nov. 2, 1864), it is said that, near Carson River, in that State, a basin of common salt had been discovered, five miles square in extent, and fourteen feet in thickness. The salt is said to be very pure, hard, and as clear as crystal, and capable of being mined with great facility. (*Note to the twelfth edition.*)

frequently happens, it is deliquescent. Water at 54° F. dissolves 36 per cent. of this salt, and at the boiling temperature, 40 per cent. (*Fehling*). It is but sparingly soluble in alcohol. One hundred parts of this liquid (sp. gr. 0·815) dissolve, at the temperature of 59°, only 0·174 parts of common salt. (*R. Wagner.*) Exposed to a gradually increasing heat, it first decrepitates from the presence of interstitial moisture, next melts, and finally volatilizes in white fumes with but partial decomposition. (Mulder, *Journ. de Pharm. et de Chim.*, 4e éd., iii. 390.) It is decomposed by several of the acids, particularly the sulphuric and nitric, which disengage vapours of muriatic acid; by carbonate of potassium with the assistance of heat; and by the nitrates of silver and protoxide of mercury. In contact with iron, in the presence of air and moisture, it undergoes decomposition. (*Chem. News*, June, 1869, p. 298.) "Its solution yields no precipitate with carbonate of sodium, chloride of barium, or ferrocyanide of potassium." (*U. S. Ph.*) It is decomposed by steam excessively heated, with the escape of hydrochloric acid and an alkaline residue. (*Chem. News*, June 4, 1875, p. 243.)

Several varieties of common salt are distinguished in commerce; as *stoved salt*, *fishery salt*, *bay salt*, &c.; but they are characterized by the size and compactness of the grains, rather than by any difference in composition.

Composition. Common salt, in its pure state, consists of one eq. of chlorine 35·5, and one of sodium 23·3 = 58·8. It contains no water of crystallization. When in solution it is by some supposed to become muriate of soda, in consequence of the decomposition of water, the hydrogen and oxygen of which are alleged to convert the chlorine and sodium into muriatic acid and soda. The common salt of commerce, besides pure chloride of sodium, contains, generally speaking, insoluble matter, and usually more or less of the sulphates of calcium and magnesium, and chlorides of calcium and magnesium. When pure it is not precipitated by carbonate of sodium, chloride of barium, or ferrocyanide of potassium. Chloride of calcium is generally present in very small amount; but the chloride of magnesium sometimes amounts to 28 parts in 1000. Sulphate of calcium is usually present; constituting variously from 1 to 23½ parts in 1000; and sulphate of magnesium is sometimes present and sometimes absent. To separate the earths, a boiling solution of carbonate of sodium must be added, as long as any precipitate is formed. The earths will fall as carbonates, and must be separated by filtration, and the sulphate of sodium and chloride of sodium, resulting from the double decomposition, will remain in solution. The sulphate of sodium may then be decomposed by the cautious addition of chloride of barium, which will generate chloride of sodium and insoluble sulphate of baryta.

Medical Properties, &c. Chloride of sodium, in small doses, acts as a stimulant tonic and anthelmintic; in larger ones as a purgative and emetic. It certainly promotes digestion, and the almost universal animal appetency for it proves it to be a salutary stimulus in health. From the experiments of Prof. Buckheim, it appears that common salt quickly passes into the blood, and is thrown off in greater part, in six hours, by the kidneys. The portion not found in the urine and feces is probably appropriated to the uses of the economy. According to the experiments of M. Plouviez, made upon himself, at intervals, during twenty-five months, a saline regimen has the effect of increasing the weight and strength of the body. He began with a teaspoonful daily, which he increased to a tablespoonful, continuing to take this dose for a period of three or four months. The regimen appeared to produce plethora. The blood, analyzed while under the full effects of the salt, was found to contain more of the corpuscles and salts, but less of the albumen and water.

Common salt has been used with good effect by a number of practitioners as a remedy in intermittent fever. This practice is said to have been long followed in Hungary. In 1850 it was brought to the notice of the profession by M. Scelle-Mondezert, of Charenton, on whose results M. Piorry reported favourably. Since then the power of common salt as an antiperiodic has been attested by Dr. Lattimore of New York, Dr. Hutchinson of Brooklyn, Dr. Moroschkin of Russia, and others. In some cases, observed by M. Piorry, the spleen rapidly diminished in size. It is not alleged to be equal to quinia; but, while it cures many cases, it has the merit of cheapness. The dose is from eight to twelve drachms, given in divided doses

during the apyrexia. It is best administered in mucilage of slippery elm, or in coffee.

On the sudden occurrence of hæmoptysis, common salt is usefully resorted to as a styptic, in the dose of a teaspoonful, taken dry, and often proves successful in stopping the flow of blood. Externally applied in solution it is stimulant, and may be used either locally or generally. Locally, it is sometimes employed as a fomentation in sprains and bruises; and as a general external application it forms the salt-water bath, a valuable remedy as a tonic and excitant in depraved conditions of the system, especially when occurring in children. A pound of salt, dissolved in four gallons of water, forms a solution of about the strength of sea-water, and suitable for a bath. The dose, as a tonic, is from ten grains to a drachm; as a cathartic, from two drachms to half an ounce. In doses of from half an ounce to an ounce, dissolved in four or five times its weight of water, it frequently proves a prompt and efficient emetic, invigorating rather than depressing the powers of the system. It is frequently used as a clyster, in the quantity of from one to two tablespoonfuls in a pint of water.

The uses of common salt in domestic economy as a condiment and antiseptic are well known. In pharmacy it is employed to prepare chlorine, muriatic acid, chloride of ammonium, calomel, and corrosive sublimate. It is also used to form sulphate of sodium, with a view to its conversion into carbonate of sodium.

Off. Prep. Acidum Hydrochloricum, *Br.;* Hydrargyri Chloridum Corrosivum, *U. S.;* Hydrargyri Chloridum Mite, *U. S.;* Hydrargyri Perchloridum, *Br.;* Hydrargyri Subchloridum, *Br.* B.

SODII HYPOPHOSPHIS. *U. S.*

Hypophosphite of Sodium.

"A white salt, crystallizing in tables, which have a pearly lustre. It is very deliquescent, very soluble in water and absolute alcohol, and insoluble in ether. It evolves, at a red heat, spontaneously inflammable phosphuretted hydrogen." *U. S.*

Hypophosphite of sodium is prepared by mixing solutions of hypophosphite of calcium and crystallized carbonate of sodium, in the proportion of 6 ounces of the former dissolved in 4 pints of water, to 10 of the latter in one and a half pints. Double decomposition takes place, with the formation of carbonate of calcium and hypophosphite of sodium, of which the latter is held in solution, and the former precipitated. After filtration to separate the carbonate of calcium, the solution is evaporated to a pellicle, and then stirred constantly till the salt granulates, the heat being continued. If required quite pure, the granulated salt is dissolved in officinal alcohol; and the liquid, having been evaporated to a syrupy consistence, is set aside to crystallize.

Sometimes the hypophosphite of sodium explodes with violence during the evaporation of its solution. This was ascribed to the use of too high a heat; but the same accident has occurred when the heat was applied by means of a water-bath. (See *Am. Journ. of Pharm.*, Jan. 1860, p. 87.) In a communication of Mr. Tuson to the *Chemical News* (No. 31, p. 46), it is stated that, though he had superintended the manufacture of large quantities of the hypophosphites of calcium and of sodium, he had never witnessed anything like an explosion; but the heat employed in evaporation had never approached 212°; and this is probably the true explanation. Caution, therefore, should be observed to evaporate at a low temperature. Hypophosphite of sodium crystallizes in rectangular tables of a pearly lustre, deliquesces on exposure, and is soluble both in water and alcohol. Its formula is $NaO,2HO,PO$.

Attention has been called to the hypophosphites as a class, in consequence of their recommendation by Dr. Churchill, of Paris, in the treatment of phthisis, in which they are thought to be useful by furnishing phosphorus to the tissues. A paper on their mode of preparation and qualities was communicated by Prof. Procter to the *American Journal of Pharmacy* (March, 1858, p. 118), to which we are indebted for much of what follows on the chemistry of the subject. Hypophosphorous acid consists of one eq. of phosphorus and one of oxygen, and always contains two or three eqs. of water. It has a strong affinity for oxygen, and acts therefore as a powerful deoxidizing agent, and carries this property as well as water with it into composi-

tion. When heated it is resolved into phosphuretted hydrogen and phosphoric acid. Its salts are generally soluble in water and deliquescent, and many of them are soluble in alcohol. They are converted into phosphates by heat, with the escape of phosphuretted hydrogen; and some of them are explosive. Hypophosphite of calcium is white, of a somewhat pearly lustre, and crystallizes in flattened prisms. It has a nauseous bitter taste. It is soluble in 6 parts of cold water, little more so in boiling water, and slightly soluble in diluted, but insoluble in officinal alcohol. Its solubility is increased by the addition of hypophosphorous acid. When heated, it loses no water at the temperature of 300° or less; but at a red heat it decrepitates, giving off water, and a phosphuretted hydrogen, which is spontaneously inflammable, and leaving about 80 per cent. of a reddish substance behind. *U. S.* Its formula is $CaO,2HO,PO$.

As the soluble salts of mercury and silver are reduced by the hypophosphites, they are of course incompatible with hypophosphite of sodium in prescriptions. With the hypophosphite of calcium, all the soluble sulphates and carbonates produce precipitates. As the hypophosphites are insoluble in cod-liver oil, they should be dissolved in syrup before being added to the oil. Prof. Procter prepares a *syrup of hypophosphite of calcium* by dissolving a troyounce of the salt in 9·5 fluidounces of water, then adding 12 troyounces of sugar and dissolving with a gentle heat, and finally adding half a fluidounce of the fluid extract of vanilla. The dose of the syrup is from one to four fluidrachms, three times a day. A compound syrup is prepared by the same writer, containing the hypophosphites of calcium, sodium, potassium, and iron, with hypophosphorous acid, a formula for which will be found in the same communication to which reference has been made above.

The author does not wish to be understood as recommending these remedies in consumption. The weight of testimony appears to him to be opposed to the first favourable impressions; and, though some cases may have seemed to be benefited, yet great care must be taken not to allow a reliance on the hypophosphites to interfere with the use of remedies known to be efficient, as cod-liver oil and supporting measures generally. But though of doubtful efficacy in phthisis, the hypophosphites may be valuable remedies in other affections, and would seem to be indicated in cases in which there may be defect of nutrition of the nerve centres, of which phosphorus forms an important constituent; and Dr. J. D. Brown, of the Albany City Hospital, has found them highly useful in diseases attended with the loss of nerve power, and in many of the complaints of infancy connected with the scrofulous diathesis, and defect in the osseous system. (*Boston Med. and Surg. Journ.*, lxxiii. 412, Dec. 21, 1865.) The dose of either of the hypophosphites may be from ten to thirty grains, three times a day. W.

SODII HYPOSULPHIS. *U.S.*

Hyposulphite of Sodium.

Off. Syn. Hyposulphite of Soda crystallized, $NaO,S_2O_2+5HO=124$. *Ar. Appendix.*

This salt was introduced into the British Pharmacopœia as a test, and for the formation of the *Volumetric Solution of Hyposulphite of Soda*. It is readily prepared, according to Walchner, by mixing a pound of dry carbonate of sodium, in fine powder, with five ounces of sulphur, heating the mixture gradually in a porcelain vessel until the sulphur melts, and stirring the agglutinated mass, still kept hot, in order that every portion of it may come in contact with the air. The sulphuret of sodium, first formed, is thus converted into sulphite of sodium. This is dissolved in water, and the filtered solution, being boiled with sulphur, becomes one of hyposulphite of sodium, from which, after filtration and concentration, the salt is deposited in crystals. It may be obtained also by digesting the solution of sulphite of sodium, at a high temperature but short of ebullition, with finely divided sulphur. The sulphurous acid (SO_2) takes an additional eq. of sulphur, becoming hyposulphurous (*dithionous*) acid (S_2O_2), which combines with the soda to form the hyposulphite (NaO,S_2O_2). This acid exists only in combination; and its salts were formerly considered simply as sulphuretted sulphites.

Properties. Hyposulphite of sodium is in large colourless transparent crystals, of a

mild, saline, sulphurous taste, freely soluble in water, and insoluble in alcohol. Its solution dissolves chloride of silver and all other insoluble compounds of that metal, except the sulphuret, and that resulting from the decomposition of a silver salt by light. Though without action on iodide of potassium, it dissolves iodine, decomposes iodic acid with the liberation of iodine, and destroys the blue colour of iodide of starch. (*Brande and Taylor.*) In dissolving iodine it forms with it iodide of sodium and tetrathionate of sodium; as represented by the formula $2(NaO,S_2O_2)+I=NaI+NaO,S_4O_5$. It dissolves also sulphate and iodide of lead, and sulphate of calcium much more freely than water. (*Journ. de Pharm.*, Avril, 1864, p. 363.) Its relations to iodine render it valuable as a means of estimating the quantity of free iodine, for which purpose it is used in the Br. Pharmacopœia, in the form of a *volumetric solution*. In consequence of its peculiar solvent properties, it is much used in photography. The daguerreotypists employ it for the purpose of dissolving the sensitive coating of iodide of silver from the plate, after the action of the light, and thus fixing the image already formed. For an account of the several tests of this salt, the reader is referred to the *Chemical News* (December 12, 1863, p. 283). One of the most delicate is that of iodine and starch. The blue colour produced by the mixture of very small quantities of these two substances in solution is instantly discharged by a solution containing a trace of the hyposulphite. Mr. M. Carey Lea has discovered a new test in ruthenium. When a solution of a salt of this metal, made alkaline with ammonia, is boiled with the hyposulphite, it gradually becomes rose-coloured, and ultimately of a rich carmine, which in strong solution becomes almost black; and then, if diluted, the shade is magnificent, rivalling the aniline red in richness. (*Am. Journ. of Sci. and Arts*, Sept. 1867, p. 222.) The U. S. Pharmacopœia gives the following characteristics; "It is soluble in one and a half parts of water, at 60°, and insoluble in alcohol. Its solution dissolves chloride and oxide of silver, and discharges the colour of solution of iodide of starch, and of the solution of iodine. Sulphuric acid added to its solution, gives rise to the odour of burning sulphur, and causes a white precipitate of sulphur" (p. 51).

Medical Properties. Hyposulphite of sodium has recently come into use, in consequence of its extraordinary powers in destroying the life of the lower organic beings, such as have been found, through microscopic investigation, to infest various parts of the human system, and are sometimes the cause of troublesome, if not serious disease. When taken internally it appears to have deoxidizing powers, probably through the passage of the hyposulphurous into sulphuric acid. It has been found, in its action on the urine, to diminish urea and increase uric acid, to increase the sulphates, and to cause the presence of sugar and oxalic acid in the urine. (Kletzinsky, *Ann. de Thérap.*, A. D. 1860, p. 109.) The use of this salt has been suggested, by Dr. G. Polli, in various diseases supposed to be dependent on the presence of substances in the blood which act as ferments. Along with its destructive action on microscopic fungi, it has an extraordinary power of arresting fermentation; and with those who believe that this process is essentially connected with organic growths, the two properties may be considered identical. The theory is plausible, and to a certain extent is supported by the experiments of Dr. Polli. Low febrile and malignant diseases, purulent infections, and the contagious exanthemata are included in the category referred to; and the medicine might very properly be tried in these affections, in connection with the ordinary remedies. Many reports have been made of its favourable influence in diseases denominated zymotic. In the U. States it has been used with much success in malarial fevers. Among others, Dr. W. H. Baxter, of Moscow, Iowa, seems to have been peculiarly successful, having given the remedy exclusively in more than 100 cases of intermittent and remittent fever, without a single failure. (*Am. J. of Med. Sci.*, Oct. 1866, p. 584.) Dr. Wm. A. Corwin, U. S. N., states that, smallpox having broken out in the ship to which he belonged, while in the Japanese port of Yokohama, he had an opportunity of treating that disease under favourable circumstances, and, having employed the hyposulphite of sodium as a prominent remedy, had every reason to be satisfied of its favourable effects. He gave the salt in drachm doses, confining it to the febrile stage, and treated the eruptive stage by a simple supporting

method. The good effects were manifest after the first dose; the fever in general subsiding, the eruption being tardily or incompletely developed, and the bowels relaxed with watery stools. "What I particularly wish to be noted," says the doctor, "is that in direct proportion to the early and free use of the remedy, really harmless for evil while so potent for good, was the disease ameliorated, and its average duration shortened, and this in an epidemic of more than usual severity." (*Medical Record*, No. 132, Aug. 15, 1871, p. 267.) With a view to its poisonous influence on the sarcina ventriculi which attends yeasty vomiting, it has been employed in that complaint; and, as a local application, it may be used in all the parasitic affections of the skin and mouth. It may be given in the dose of from ten to twenty grains three times a day, simply dissolved in water, or in the form of syrup. For external use a drachm may be dissolved in a fluidounce of water. As the effects of this salt proceed from its acid constituent, other hyposulphites may be employed for the same purposes; and *hyposulphite of calcium* has been recommended. For the mode of preparing the latter salt, the reader is referred to an article in the *Am. Journ. of Pharm.* for May, 1863 (p. 223). W.

SODII NITRAS. *U.S.*

Nitrate of Sodium.

Off. Syn. SODÆ NITRAS, *Nitrate of Soda.* NaO,NO_5. A native salt, purified by crystallization from water. *Br.*

This salt, called also *cubic nitre*, which has been recognised as officinal, because necessary in the preparation of the *arseniate of sodium*, must now be treated in this part of the Dispensatory, which embraces all the strictly officinal medicines recognised as such in the U. S. or British Pharmacopœias. We, therefore, bring hither the following article by the late Dr. Bache from the *third part* of the work, where it has long held a place.

Nitrate of sodium is imported from S. America, where it is found naturally in the desert of Atacama and elsewhere in Peru, forming beds of vast extent. Attempts were made between 1820 and 1830 to export it to England and the United States; but the cargoes were unsalable. Soon afterwards, however, its value became known; so that at present large quantities are exported from Peru, being consumed in the manufacture of sulphuric and nitric acids, and as a fertilizer. The salt has been found also largely in Brazil, in the Province of Bahia, near the river San Francisco. (*Am. Journ. of Pharm.*, Nov. 1861, p. 502.) For a particular account of the nitrate of sodium deposits of Peru, in a commercial point of view, see *Ibid.*, March, 1862, p. 263.

The crude salt, as it comes from Peru, is in saline lumps, rather soft and friable, and damp on the surface. It is distinguished into varieties according to its colour and state of aggregation, as *white compact*, *yellow*, *gray compact*, *gray crystalline*, *white crystalline*, and varies very much in purity, containing from 85 to only 20 per cent. of the pure salt. Some of the varieties contain iodine. The impurities consist of common salt, sulphate and carbonate of sodium, and chloride of calcium. Occasionally borate of calcium, associated with borate of sodium, is found under the beds of the nitrate.

Arrangements have been made for treating the crude nitrate, so as to deliver it to commerce in a state of great purity. Exposure of the mineral to an open fire, which seems to have been first employed, has been entirely superseded by mechanical methods aided by steam, to prepare it for the subsequent steps of solution, crystallization, and desiccation. The Peruvian nitre, prepared by the "Nitre Association of Tarapaca," the province in which the mineral exists, never contains more than 0·5 or 0·667 per cent. of impurities. It is white, pearly, dry, and light; and does not require to be refined for the practical uses to which it is applied. (Thiercelin, *Journ. de Pharm.*, Juin, 1868, p. 439.)

Nitrate of sodium, when pure, is a white salt, crystallizing in rhomboidal prisms, and having a sharp, cooling, and bitter taste. It attracts moisture slightly from the air, and dissolves in about twice its weight of water, at 60°. Like nitrate of potassium, it deflagrates when thrown on the fire; but is distinguished by giving rise to an orange-yellow flame, and by the rhomboidal shape of its crystals, those of nitre being

long six-sided prisms. According to the Br. Pharmacopœia, it evolves ruddy fumes when warmed in a test tube with sulphuric acid and copper wire. "The solution gives no precipitate with nitrate of silver, chloride of barium" (*Br.*), or bichloride of platinum (*U. S.*), indicating the absence of chlorides, carbonates, and sulphates, as also of potassium. "If 100 grains of it be heated with 73 grains of officinal sulphuric acid, and the mixture be kept at a red heat until the salt ceases to lose weight, the residue will weigh 83·5 grains" (*U. S.*).

Medical Uses. This salt has been praised as a remedy in dysentery by two German physicians, Drs. Velsen and Meyer, given in the quantity of from half an ounce to an ounce in the course of the day, dissolved in gum-water, or other mucilaginous liquid. It has been used with success in the same disease by Dr. Rademacher, of Vienna, who recommends it in a number of other diseases having nothing in common. (*Ann. de Thérap.*, 1854.) Dr. J. B. Brown also bears very emphatic testimony to the value of nitrate of sodium as a speedy and safe remedy in dysentery and dysenteric diarrhœa. (*Charleston Med. Journ.*, May, 1854, p. 398; from *North-Western Med. and Surg. Journ.*)

Off. Prep. Sodæ Arsenias, *Br.;* Sodii Arsenias, *U. S.* B.

SODII SULPHAS. *U. S.*

Sulphate of Sodium.

Off. Syn. SODÆ SULPHAS. *Sulphate of Soda.* NaO,SO_3+10HO. *Br.*

Vitriolated soda, Glauber's salt; Sulfate de soude, *Fr.;* Schwefelsaures Natron, Glaubersalz, *Germ.;* Sulfato di soda, *Ital.;* Sulfato de soda, Sal de Glaubero, *Span.*

Sulphate of sodium, in small quantities, is extensively diffused in nature, and is obtained artificially in several chemical operations. It exists in solution in many mineral springs, among which may be mentioned those of Cheltenham and Carlsbad; and it is found combined with sulphate of calcium, constituting a distinct mineral. Many ponds containing this salt are found in the country between Santa Fe and the head-waters of the Arkansas, and on the route to the Rocky Mountains. The water in one of these ponds forms a solution so highly concentrated that, in dry weather, the salt crystallizes on the surface to the depth of several inches, so as to have the appearance of limpid ice. (*Am. Journ. of Pharm.*, xii. 110.) A large deposit of Glauber's salt has been found in the Caucasus, not far from Tiflis. It is about 10 feet below the surface, and was penetrated 5 feet, and probably extended much deeper. There are, besides, in the same region, various lakelets containing the same salt in solution. (*New Remedies*, Oct. 1872, p. 151.) As an artificial product, it is formed in the processes for obtaining muriatic acid and chlorine, and in the preparation of muriate of ammonium from sulphate of ammonium and common salt. It may also be procured from sea-water, in which its ingredients are present.

Immense quantities of sulphate of sodium are made by decomposing common salt by sulphuric acid, in the manufacture of soda-ash and carbonate of sodium; and, so far from the generated muriatic acid being a product of value, its absorption in a convenient way, so as to avoid the nuisance of its escape into the atmosphere in a gaseous state, is an object of importance to the manufacturer. (See *Acidum Muriaticum.*) MM. Thomas, Dellisse, and Boucard have proposed a new process for preparing sulphate of sodium, by double decomposition between chloride of sodium and sulphate of iron. This process avoids the production of muriatic acid vapours, and is said to furnish a cheap salt.

The residue of the process for obtaining chlorine, by the action of sulphuric acid and deutoxide of manganese on common salt, is a mixture of sulphate of sodium and sulphate of protoxide of manganese. (See *Chlorinii Liquor.*) Large quantities of this residue are formed in manufacturing chlorinated lime (bleaching salt); and the sulphate of sodium in it, roughly purified, supplies a part of the consumption of this salt in making soda-ash and carbonate of sodium.

The process for obtaining muriate of ammonium from sulphate of ammonium and common salt, forms another source of sulphate of sodium. By double decomposition, sulphate of sodium and muriate of ammonium are formed; and by exposing the

mixed salts to heat, the muriate of ammonium sublimes, and the sulphate of sodium remains behind. (See *Ammonii Chloridum.*)

In some of the Northern States, a portion of Glauber's salt is procured from sea-water in the winter. The circumstances under which it is formed have been explained by Mr. D. B. Smith, of this city. The constituents of several salts exist in sea-water, and the binary order in which these constituents will precipitate, upon evaporation, depends on the temperature. During the prevalence of rigorous cold, sulphate of sodium is the least soluble salt which can be formed out of the acids and bases present, and consequently separates in the form of crystals.

Properties. Sulphate of sodium is a colourless salt, possessing a cooling, nauseous, bitter taste, and crystallizing with great facility in six-sided striated prisms. When recently prepared, it is beautifully transparent; but by exposure to the air it effloresces, and the crystals become covered with an opaque white powder. By long exposure it undergoes complete efflorescence, and falls into powder with loss of more than half its weight. It is soluble in three times its weight of cold water, and in its own weight of boiling water, but is insoluble in alcohol. A supersaturated solution of sulphate of sodium will remain without crystallizing at ordinary temperatures, even though containing several times the weight of the salt that will be dissolved at the same degree of heat. (*Gay-Lussac.*) But the solution instantly forms into a crystalline mass upon adding to it a fragment of the same salt crystallized, or other substances that have been exposed to the air, or upon abruptly placing it in contact with the air. M. D. Gernez appears to have proved that in each instance the cause of crystallization is the same, namely sulphate of sodium containing 10 eqs. of water; and where the crystal itself is not added, the result is owing to sulphate of sodium existing in the air. (See *Am. Journ. of Pharm.*, Sept. 1865, p. 379.) Subjected to heat, it dissolves in its water of crystallization, then dries, and afterwards, by the application of a red heat, melts, with the loss of 55½ per cent. of its weight. M. Coppet has ascertained that there are two varieties of the anhydrous sulphate; one in which the salt is deprived of its water at ordinary temperature, the other in which the desiccation is effected at a heat above that of 33° C. The two differ in their relation to the crystallization of the salt; the former causing immediate crystallization when thrown into a supersaturated solution, the second not. (*Journ. de Pharm.*, Juillet, 1874, p. 36.) Occasionally it contains an excess of acid or alkali, which may be discovered by litmus or turmeric paper. Common salt may be detected by sulphate of silver; a salt of iron by ferrocyanide of potassium or tincture of galls. This salt is not subject to adulteration. It is incompatible with carbonate of potassium, chloride of calcium, the salts of baryta, acetate and subacetate of lead, and with nitrate of silver if the solutions are strong. With chloride of barium, it yields a white precipitate, sulphate of barium, insoluble in nitric acid. It consists of one eq. of sulphuric acid 40, one of soda 31·3, and ten of water 90 = 161·3.

Medical Properties and Uses. Sulphate of sodium, in doses of from half an ounce to an ounce, is an efficient cathartic; in smaller doses, an aperient and diuretic. When in an effloresced state, the dose must be reduced one-half, on account of its having lost about one-half of its weight in water. Prof. Buckheim has ascertained, by experiment, that the ingestion of this salt causes an increase of sulphates in the urine, especially if its purgative action be delayed or prevented by other medicines. These results were not affected by the quantity of water taken with the salt. Sulphate of sodium is much less used than formerly, having been almost entirely superseded by sulphate of magnesium, which is less disagreeable to take. Its nauseous taste, however, may be disguised by the admixture of a little lemon-juice or cream of tartar, or the addition of a few drops of sulphuric acid. It is an ingredient in the artificial Cheltenham salt. (See *Part* III.) A new application of sulphate of sodium has recently been made by M. D. de Luca, of Naples, who has found it remarkably efficient in removing stains or opacity of the cornea, which he supposes it to do by its property of dissolving albumen, which in a coagulated state is the frequent cause of the opacity. He employed at first a cold saturated solution of the salt, but, not finding it to act with the desired rapidity, he substituted the powdered crystals, letting fall pinches of the powder on the globe of the eye; the head being placed horizontally. Under

this treatment the stains of the cornea begin to disappear in a few days. The application may be made twice a day. The patient experiences an agreeable feeling of coolness, as the salt dissolves in the liquids of the eye. (*Journ. de Pharm. et de Chim.*, Sept. 1867, p. 188.) The only use of sulphate of sodium in the arts is to make carbonate of sodium, and as an ingredient in some kinds of glass. It has no officinal preparations. B.

SODII SULPHIS. *U.S.*

Sulphite of Sodium.

This salt was first adopted as officinal in the fourth edition of the U. S. Pharmacopœia. It may be prepared by passing sulphurous acid into a solution of carbonate of sodium, and evaporating out of contact of the air. The sulphurous acid unites with the soda of the carbonate, to form the sulphite of sodium, and the carbonic acid escapes. After sufficient concentration, the solution is allowed to cool, and the salt crystallizes.

Properties. Sulphite of sodium is in the form of white, prismatic, efflorescent crystals, soluble in four parts of cold, and less than their weight of boiling water. It has a sulphurous taste, and a feeble alkaline reaction. Sulphuric acid added to the solution gives rise to a smell of burning sulphur, owing to the escape of sulphurous acid; and the liquid remains transparent, indicating the absence of lime. Sulphite of sodium consists of one eq. of soda, one of sulphurous acid, and three of water ($NaO, SO_2 + 3HO$). The salt should be kept in bottles well stopped; as it gradually changes on exposure into sulphate of sodium.

Medical Uses. Sulphite of sodium has been used in cases of yeasty vomiting with remarkable success. The matter vomited in these cases has a yeasty appearance on the surface, and is generally found to contain, when examined by the microscope, two microscopic fungi, called sarcina ventriculi and torula cerevisiæ. The remedy was first used at the suggestion of Prof. Graham, of London, who supposed that the sulphurous acid, necessarily extricated from the salt in the stomach by the acid of the yeasty matter, would destroy the parasites. Dr. Dobie, of Edinburgh, has reported two cases of yeasty vomiting, occurring under his observation, in which the disease was immediately checked by the sulphite. In one of the cases the vomited matter contained an enormous quantity of the torula, without sarcinæ. (*Ed. Monthly Journ.*, xiv. 574.) Dr. Astrié, an Italian physician, has proposed this salt as a remedy for the constitutional effects of mercury, when used in excess, on the ground that it has the power of rendering the metal soluble. The dose of sulphite of sodium is a drachm three times a day.

Sulphite of sodium is sometimes used locally, especially in that species of aphthous sore-mouth which is attributed to a parasitic vegetable. The wash may be made of a drachm of the salt to a fluidounce of water. The acid secretions of the mouth extricate the sulphurous acid, which kills the parasite. It is said that the solution acts with surprising rapidity, a single application of it sometimes removing the disease in 24 hours. From what has been said it is evident that sulphite of sodium as a remedy is equivalent to sulphurous acid; since its employment, whether internally or externally, is always attended with the extrication of this acid. (See *Acidum Sulphurosum*, Part II.) B.

Since the experiments of Dr. Polli, referred to in *page* 860, sulphite of sodium has been employed to a considerable extent internally in reference to its antizymotic properties; the supposition being that, as it suppresses fermentation out of the body, it may have a similar effect on analogous changes presumed to occur in the blood, and thus promote a cure. It is not necessary to adopt the theory of organized agents as essential to fermentation; so that the non-discovery of such agents in the blood by the microscope cannot be admitted as evidence against the mode of operation referred to, namely as an antizymotic action. Some experiments of Mr. M. Carey Lea tend to confirm this view. (*Am. Journ. of Med. Sci.*, Jan. 1865, p. 843.) Mr. Lea found that the sulphites, though to a considerable extent changed into sulphates, and appearing as such in the urine, yet, when taken in a certain amount and for a certain

time, they in part pass unaltered, and are found as sulphites in the urine; proving incontestably that they must exist, at least to the same extent, in the blood, and may, therefore, exercise their antizymotic powers on that fluid. In a communication by Dr. W. F. Atlee (*Ibid.*, p. 82), an account is given of two cases of purulent infection of a very serious character, both of which recovered under the use of the bisulphite of sodium, in one of which 8 grains were given every two hours, in the other 20 grains as often; the bisulphite being understood to operate on the same principle as the sulphite; and both by the sulphurous acid they contain. Indeed, all the alkaline compounds of the sulphurous acids, including sulphites, bisulphites, and hyposulphites, may be considered therapeutically in the same category, all operating, as is supposed, whether generally or locally, through their antizymotic effects, with little other influence, in the doses ordinarily given, on the system or its functions, than that of the refrigerant salts. Indeed, as has been stated, they are in great measure converted into sulphates. In the choice of them, consequently, one is preferred to another from causes independent of their antizymotic character. While, therefore, in speaking of their therapeutical action, we may treat of them together, each one requires a distinct consideration as regards its sensible and physical properties, preparation, and mode of exhibition. In this way they are treated of severally in this work, each in a place corresponding with the alphabetical position and its recognition or non-recognition in the officinal catalogues. The disease in which those medicines have been recommended are purulent infection of whatever origin, malignant pustule, hospital gangrene, erysipelas and other exanthematous fevers, malarial and miasmatic fevers, and in fine all diseases which may be supposed to depend on absorbed poisons not acting on the tissues, but by a species of fermentation.* In the present state of our knowledge on this point, all conclusions not dependent on actual experience must be considered as purely speculative; and, while many cases may be adduced from the journals of highly favourable effects,† yet the opposing testimony is probably still stronger, and the tendency seems to be on the whole unfavourable. Thus, Semmola states, with much positiveness, that the results from the sulphites are completely negative in typhus, scarlatina, measles, marsh fevers, syphilis, malignant pustules, and purulent infection. (*Ann. de. Thérap.*, 1865, p. 170.) With such conflicting sentiments the practitioner will be fully justified in deciding for himself whether to employ them; for there is this extraordinary fact which may be urged in their favour, that, if they do no good, they are not likely, in the doses ordinarily used, to do much harm.

Locally applied, there seems to be no doubt that the sulphites and other substances of this class are often very useful. Besides the application to the throat or sore-mouth of infants above mentioned, they have been found extremely useful in controlling suppurative ulcers, and all suppurative affections of the mucous membranes, as of the urinary passages, the bronchial tubes, and the alimentary canal, in which there is reason to think that the local affection is sustained by zymotic influence or invisible organisms, and in which purulent infection of the blood may be produced by the same cause. They appear almost to act as specifics in such cases. At a certain stage of cancer of the womb they operate usefully in the same way, by obviating the effects of putrid fermentations. For these various purposes the sulphite of sodium may be used in solution in the proportion of one part of the salt to 10 of water, whenever it is to be used as a lotion, dressing for wounds, inhalation by the atomizer, &c. When it may be desirable to employ it as a cataplasm, it may be dissolved, in the same proportion or rather larger, in glycerin, and the solution thickened with powdered starch.

W.

* In a very severe and almost desperate case of carbuncle, sulphite of sodium appeared to act favourably from the time of its first use, and the recovery was speedy and complete. The medicine was given in the dose of a drachm or two. (Dr. J. Radcliffe, *Med. and Surg. Reporter;* from *Bost. Med. and Surg. Journ.*, Nov. 23, 1871, p. 343.)—*Note to the fourteenth edition.*

† A case of severe rattlesnake poisoning is reported by Dr. G. M. Staples, of Dubuque, Iowa, in which recovery took place under the use of bisulphite of sodium, in doses of a scruple every half hour for four hours, then every hour for six hours, then every two hours for twelve hours, and lastly every four hours. Other remedies were employed at the same time; and it is impossible to determine how much of the result was ascribable to the bisulphite. At all events, the experience in this case was sufficiently encouraging to justify the use of the same remedy in similar cases hereafter. (*Med. and Surg. Reporter*, Oct. 28, 1865, p. 279.)—*Note to the thirteenth edition.*

SOLIDAGO. *U. S. Secondary.*

Golden-rod.

The leaves and tops of Solidago odora. *U. S.*

SOLIDAGO. *Sex. Syst.* Syngenesia Superflua. — *Nat. Ord.* Compositæ Asteroideæ, *De Candolle;* Asteraceæ, *Lindley.*

Gen. Ch. Calyx imbricated, scales closed. *Radical florets* about five, yellow. *Receptacle* naked, punctate. *Pappus* simple, pilose. *Nuttall.*

This is a very abundant genus, including, according to Eaton's enumeration, upwards of sixty species belonging to this country. Of these *S. odora* only is officinal. *S. Virgaurea*, which is common to the United States and Europe, was formerly directed by the Dublin College. It is astringent, and has been supposed to possess lithontriptic virtues. The flowers of our native *S. bicolor* were chemically and pharmaceutically investigated by Mr. Adam Conrath, and the results consigned to an inaugural essay, an abstract of which will be found in the *Am. Journ. of Pharm.* (June, 1873, p. 253).

Solidago odora. Willd. *Sp. Plant.* iii. 2061; Bigelow, *Am. Med. Bot.* i. 187. *Sweet-scented golden-rod* has a perennial creeping root, and a slender, erect, pubescent stem, two or three feet high. The leaves are sessile, linear-lanceolate, entire, acute, rough at the margin, elsewhere smooth, and covered with pellucid dots. The flowers are of a deep golden-yellow colour, and are arranged in a terminal, compound, panicled raceme, the branches of which spread almost horizontally, are each accompanied by a small leaf, and support the flowers on downy pedicels, which put forth from the upper side of the peduncle, and have small linear bractes at their base. The florets of the ray are ligulate, oblong, and obtuse; those of the disk, funnel-shaped, with acute segments.

The plant grows in woods and fields throughout the United States, and is in flower from August to October. The leaves, which are the officinal portion, have a fragrant odour, and a warm, aromatic, agreeable taste. These properties depend on a volatile oil, which may be separated by distillation with water. It is of a pale greenish-yellow colour, and lighter than water.

Medical Properties and Uses. Golden-rod is aromatic, moderately stimulant and carminative, and, like other substances of the same class, diaphoretic when given in warm infusion. It may be used to relieve pain arising from flatulence, to allay nausea, and to cover the taste or correct the operation of unpleasant or irritating medicines. For these purposes it may be given in infusion. The volatile oil dissolved in alcohol is employed in the Eastern States. According to Pursh, the dried flowers are used as a pleasant and wholesome substitute for common tea. It is said that the leaves are now largely collected and dried in the Blue Mountains, in the neighbourhood of which it is largely consumed in place of the Chinese product. (*Pharm. Journ.*, Feb. 1873, p. 603.) W.

SPIGELIA. *U. S.*

Spigelia. Pinkroot.

The root of Spigelia Marilandica. *U. S.*

Spigélie du Maryland, *Fr.;* Spigelie, *Germ.;* Spigelia, *Ital.*

SPIGELIA. *Sex. Syst.* Pentandria Monogynia. — *Nat. Ord.* Gentianaceæ, *Juss.;* Spigeliaceæ, *Martius, Lindley.*

Gen. Ch. Calyx five-parted. *Corolla* funnel-shaped, border five-cleft, equal. *Capsule* didymous, two-celled, four-valved, many-seeded. *Nuttall.*

Two species of Spigelia have attracted attention as anthelmintics, *S. anthelmia* of South America and the West Indies, and *S. Marilandica* of this country. The former is an annual plant, used only in the countries where it grows; the latter is much employed both in this country and in Europe.

Spigelia Marilandica. Willd. *Sp. Plant.* i. 825; Bigelow, *Am. Med. Bot.* i. 142; Barton, *Med. Bot.* ii. 75. The *Carolina pink* is an herbaceous plant with a perennial

root, which sends off numerous fibrous branches. The stems, several of which rise from the same root, are simple, erect, four-sided, nearly smooth, and from twelve to twenty inches high. The leaves are opposite, sessile, ovate-lanceolate, acuminate, entire, and smooth, with the veins and margins slightly pubescent. Each stem terminates in a spike, which leans to one side, and supports from four to twelve flowers with very short peduncles. The calyx is persistent, with five long, subulate, slightly serrate leaves, reflexed in the ripe fruit. The corolla is funnel-shaped, and much longer than the calyx, with the tube inflated in the middle, and the border divided into five acute, spreading segments. It is of a rich carmine colour externally, paler at the base, and orange-yellow within. The edges of the segments are slightly tinged with green. The stamens, though apparently very short, and inserted into the upper part of the tube between the segments, may be traced down its internal surface to the base. The anthers are oblong, heart-shaped; the germ superior, ovate; the style about the length of the corolla, and terminating in a linear fringed stigma projecting considerably beyond it. The capsule is double, consisting of two cohering, globular, one-celled portions, with many seeds.

The plant is a native of our Southern and Southwestern States, being seldom found north of the Potomac. It grows in rich soils on the borders of woods, and flowers from May to July. The root is the only part recognised in the Pharmacopœias. The drug was formerly collected in Georgia and the neighbouring States by the Creek and Cherokee Indians, who disposed of it to the white traders. The whole plant was gathered and dried, and came to us in bales or casks. After the emigration of the Indians, the supply of spigelia from this source very much diminished, and has now nearly if not quite ceased. The consequence was for a time a great scarcity, and increase in the price of the drug; but a new source of supply was opened from the Western and Southwestern States, and it is now again plentiful. As we receive spigelia at present, it consists chiefly if not exclusively of the root, without the stem and leaves. We have been informed that most of it comes in casks or bales from St. Louis by the way of New Orleans. That contained in casks is to be preferred, as less liable to be damp and mouldy.

Properties. Pinkroot consists of numerous slender, branching, crooked, wrinkled fibres, from three to six inches long, attached to a knotty head or caudex, which exhibits traces of the stems of former years. It is brownish or yellowish-brown externally, of a faint, peculiar smell, and a sweetish, slightly bitter, not very disagreeable taste. Its virtues are extracted by boiling water. The root, analyzed by M. Feneulle, yielded a fixed and volatile oil, a small quantity of resin, a bitter substance supposed to be the active principle, a mucilaginous saccharine matter, albumen, gallic acid, the malates of potassium and calcium, &c., and woody fibre. The principle upon which the virtues of the root are thought to depend is brown, of a bitter nauseous taste, like that of the purgative matter of the leguminous plants, and, when taken internally, produces vertigo and a kind of intoxication. An analysis of the root by Dr. R. H. Stabler yielded as results, a bitter uncrystallizable principle upon which the virtues of the medicine are supposed to depend, a little volatile oil, tannic acid, inert extractive, wax, resin, lignin, and salts of soda, potassa, and lime. The active principle is acrid and bitter, soluble in water and alcohol, insoluble in ether, not volatilizable without change, uncrystallizable, neuter, and deliquescent. It was obtained by treating a decoction of the root with subacetate of lead in excess, filtering, precipitating the lead by sulphuric acid, again filtering, evaporating by means of a steam bath to a soft extract, treating this with alcohol, filtering the alcoholic solution, decolorizing with animal charcoal, and evaporating by steam as before. The residue yielded nothing to ether, and was of a reddish-brown colour. (*Proceed. of the Am. Pharm. Assoc.*, A. D. 1857.)

The stalks of the dried plant are oval below the first pair of leaves, and then become obscurely four-sided. The leaves, when good, have a fresh greenish colour, and an odour somewhat like that of tea. In taste they resemble the root, and afforded to M. Feneulle nearly the same principles. The quantity, however, of the bitter substance was less, corresponding with their inferior efficacy. This circumstance should cause their rejection from the shops; as the inequality in power of the two portions of the plant would lead to uncertainty in the result, when they are both employed.

The roots are sometimes mixed with those of other plants, particularly of a small vine which twines round the stem of the Spigelia. These are long, slender, crooked,

yellowish, thickly set with short capillary fibres, and much smaller and lighter-coloured than the pinkroot. They should be separated before the latter is used. It is said to be adulterated with a product called in the markets East Tennessee *pink* root; the botanical origin of which is unknown. (*Am. Journ. of Pharm.*, March, 1875, p. 134.) The activity of spigelia is somewhat diminished by time.

Medical Properties and Uses. Pinkroot is generally considered among the most powerful anthelmintics. In the ordinary dose it usually produces little sensible effect on the system; more largely given it acts as a cathartic, though unequal and uncertain in its operation; in overdoses it excites the circulation, and determines to the brain, giving rise to vertigo, dimness of vision, dilated pupils, spasms of the facial muscles, and sometimes even to general convulsions. Spasmodic movements of the eyelids have been observed among the most common attendants of its narcotic action. The death of two children, who expired in convulsions, was attributed by Dr. Chalmers to the influence of spigelia. The narcotic effects are said to be less apt to occur when the medicine purges, and to be altogether obviated by combining it with cathartics. The danger from its employment cannot be great; as it is in very general use in the United States, both in regular and domestic practice, and we never hear at present of serious consequences. Its effects upon the nervous system have been erroneously conjectured to depend on other roots sometimes mixed with the genuine. The vermifuge properties of spigelia were first learned from the Cherokee Indians. They were made known to the medical profession by Drs. Lining, Garden, and Chalmers, of South Carolina. The remedy has also been recommended in infantile remittents and other febrile diseases; but is entitled to little confidence in these complaints.

It may be given in substance or infusion. The dose of the powdered root, for a child three or four years old, is from ten to twenty grains, for an adult from one to two drachms, to be repeated morning and evening for several days successively, and then followed by a brisk cathartic. The practice of preceding its use by an emetic has been generally abandoned. It is frequently given in combination with calomel. The infusion, however, is a more common form of administration. (See *Infusum Spigeliæ.*) It is usually combined with senna or some other cathartic, to ensure its action on the bowels. A preparation generally kept in the shops, and much prescribed by physicians, under the name of *worm tea*, consists of pinkroot, senna, manna, and savine, mixed together, in various proportions, to suit the views of different individuals. Spigelia is also very often given in the form of fluid extract.

Off. Prep. Extract. Spigeliæ Fluidum, *U. S.;* Infusum Spigeliæ, *U. S.* W.

SPIRÆA. *U. S. Secondary.*

Hardhack.

The root of Spiræa tomentosa. *U. S.*

SPIRÆA. *Sex. Syst.* Icosandria Pentagynia.—*Nat. Ord.* Rosaceæ.

Gen. Ch. Calyx spreading, five-cleft, inferior. *Petals* five, equal, roundish. *Stamens* numerous, exserted. *Capsules* three to twelve, internally bivalve, each from one to three-seeded. *Nuttall.*

Spiræa ulmaria, queen of the meadow, or *meadow-sweet*, which is a European plant, though introduced into this country, has been found by M. Tessier, of Lyons, to possess valuable diuretic properties, united with those of a moderate tonic and astringent. All parts of it are active. M. Tessier employed it in the form of decoction, of which he gave a quart daily. For more extended observations in relation to this medicine, see Bouchardat's *Annuaire de Thérapeutique* (A. D. 1852, p. 119).

Spiræa tomentosa. Willd. *Sp. Plant.* ii. 1056; Rafinesque, *Med. Flor.* vol. ii. This is an indigenous shrub, two or three feet high, with numerous simple, erect, round, downy, and purplish stems, furnished with alternate leaves, closely set upon very short footstalks. The leaves are ovate-lanceolate, unequally serrate, somewhat pointed at both ends, dark-green on their upper surface, whitish and tomentose beneath. The flowers are beautifully red or purple, and disposed in terminal, compound, crowded spikes or racemes.

The hardhack flourishes in low grounds, from New England to Carolina, but is most abundant in the Northern States. It flowers in July and August. All parts of it are medicinal. The root, though designated in the Pharmacopœia, is, according to Dr. A. W. Ives, the least valuable portion. The taste of the plant is bitter and strongly astringent. Among its constituents are tannin, gallic acid, and bitter extractive. Water extracts its medicinal virtues.

Medical Properties and Uses. Spiræa is tonic and astringent, and may be used in diarrhœa, cholera infantum, and other complaints in which astringents are indicated. In consequence of its tonic powers it is peculiarly adapted to cases of debility; and, from the same cause, should not be given during the existence of acute inflammatory action, or febrile excitement. It is said to have been employed by the aborigines; but was first brought to the notice of the medical profession by Dr. Cogswell, of Hartford, Connecticut. It is said to be less apt to disagree with the stomach than most other astringents.

The form in which it is best administered is that of an extract, prepared by evaporating the decoction of the leaves, stems, or root, or an infusion of the same parts made by percolation. The dose is from five to fifteen grains, repeated several times a day. A decoction, prepared by boiling an ounce of the plant in a pint of water, may be given in the dose of one or two fluidounces. W.

SPIRITUS FRUMENTI. *U.S.*

Whisky.

Spirit obtained from fermented grain by distillation, and containing from 48 to 56 per cent. by volume of absolute alcohol. For medicinal use, it should be free from disagreeable odour, and not less than two years old. *U.S.*

The term *whisky* is said to have been first applied to the spirit obtained from barley, in the Highlands of Scotland, and to signify water in the language of the people of that region. (*Rees's Cyclopædia.*) In the strict sense of the word, as at present understood, and as officinally defined, it belongs to the distilled spirit from different grains, including wheat, rye, barley, and Indian corn. We have been informed that the famous Bourbon whisky, from Kentucky, is prepared from Indian corn, previously malted and kiln dried. The common whisky of this country is generally made from rye. The term, however, is sometimes extended to other forms of ardent spirit; and that resulting from the distillation of cider is frequently designated as *apple whisky*.

In the preparation of whisky, the infusion of rye or other grain is first made to undergo fermentation, by which the saccharine matter and indirectly the starch are converted into alcohol. In this state the liquid is called the *wash*. This is submitted to distillation, and the product is denominated *low wines*. By a second distillation it becomes purer and stronger, and now takes the name of raw corn spirit or whisky. Sometimes, we are informed, it is submitted to a third distillation, in order still further to purify it. By time certain chemical changes take place by which the natural impurities contained in the liquor are destroyed, and the whisky becomes mellowed, losing the disagreeable odour and taste which it is apt to have when first distilled.

There are volatile principles naturally existing in the grains, which accompany the liquor in all its changes, and give their characteristic flavour to the resulting spirit. These can scarcely be considered as impurities. But there are others, produced during the process of fermentation, which serve seriously to contaminate the product. Among these is *fusel oil* or *grain oil* (amylic alcohol), which is offensive both to the smell and taste, and from which it is very desirable that the spirit should be freed as far as possible. As this oil has a considerably higher boiling point than alcohol or even water, it is mainly left behind if the distillation be not carried too far; yet portions still rise, and to a certain extent impregnate the spirit. Minute proportions of acetic and butyric acids are often present in whisky, and valerianic acid has been detected. (*Am. Journ. of Pharm.*, Nov. 1859, p. 573.) According to Dr. A. A.

Hayes, of Boston, all new spirits, prepared with copper stills, are liable to be adulterated with that metal, which, however, is, he thinks, deposited in the process of ripening, which they undergo by time. (*Am. Journ. of Sci. and Arts*, July, 1861.)

Whisky, when recently prepared, is nearly colourless; but, when kept in casks, it gradually acquires a brownish colour, which deepens with time; and hence it may be found of various shades, from a slight yellowish-brown tint to the dark brown of brandy. Its taste and smell, when mellow by age, though peculiar, are not disagreeable. As directed by the Pharmacopœia, it should contain from 48 to 56 per cent. by volume of absolute alcohol, and its sp. gr. therefore should not exceed 0·922 at 60° F., nor be less than 0·904.*

It was introduced into the Pharmacopœia as a cheap substitute for brandy, and may be employed for all the purposes which that spirit is capable of fulfilling. Indeed, when of good quality, which can always be commanded, it is probably preferable as a medicinal agent to brandy such as is now generally sold in our markets. It is sometimes also used as antiseptic in wounds, and ulcers of feeble condition; and Dr. Suesserott, of Chambersburg, Pa., in a communication to the *Philad. Med. Times* (Sept. 5, 1874, p. 774), speaks strongly of its favourable results, from his own observation and experience. W.

SPIRITUS MYRCIÆ. *U.S.*

Spirit of Myrcia. Bay-rum.

The spirit obtained by distilling rum with the leaves of Myrcia acris. *U.S.*

This was a new officinal of the U. S. Pharmacopœia of 1860. It has been long in use as a most agreeable and refreshing perfume; and many persons, misled by the name, believed it to be prepared by distilling spirit from the leaves of the bay-tree (Laurus nobilis). It appears, however, from a paper published by Mr. John M. Maisch in the *American Journal of Pharmacy* for July, 1861, that this was an error. A leaf having been presented to him, brought from the West Indies, with the information that it was from the tree of which the leaves were used in preparing this spirit, he observed that it had precisely the characteristic odour and taste of bay-rum, and on comparing it with the leaves of a twig in the collection of the Academy of Natural Sciences of this city, brought by the late Dr. Griffiths from St. Croix, and labeled as the plant from which bay-rum was prepared, found that the two closely corresponded. From the characters of the leaf, Prof. Bridges suggested that it might belong to a plant of the family Myrtaceæ, and most probably the Myrcia acris of De Candolle. Further investigation satisfied Mr. Maisch of the correctness of this reference; and there is little room to doubt that the source of this very agreeable perfume is really the plant indicated in the Pharmacopœia.

Myrcia. *Sex. Syst.* Icosandria Monogynia. — *Nat. Ord.* Myrtaceæ.

Gen. Ch. Calyx five-parted, tube subglobose. *Petals* five. *Stamens* numerous, free. *Ovary* two or three-celled. *Berry* one or two-celled, one to three-seeded. *Seed* subglobose, smooth; cotyledons foliaceous.

Myrcia acris. Schwartz; De Cand. *Prodrom.* v. 243; Curtis's *Bot. Mag.*, 2d ser., vol. vi. pl. 3153. — *Myrtus acris.* Willd. *Sp. Plant.* p. 973. The *bayberry*, as it is sometimes called, is a tree of considerable size, with a straight stem, and a thick pyramidal summit. The young branches are green and sharply four-angled. The leaves are opposite, from 3 to 5 inches long, very coriaceous, lanceolate, obtuse, wavy, somewhat revolute at the edges, with numerous parallel nerves, reticulated on the upper surface, and sprinkled with pellucid dots. They have a very fragrant odour, and are somewhat astringent. The flowers, which are arranged in pedunculate, axillary panicles, longer than the leaves, are small, and white with a reddish tinge.

* As quantity is strictly represented by weight, all statements of proportionate quantities should be so considered unless proportion by measure is expressly indicated. The Pharmacopœia in directing the percentage of alcohol in whisky did not originally give measure as its basis of proportion, and was, therefore, to be considered as meaning by weight; and hence the specific gravities given in the text of the late edition of the Dispensatory; *i.e.* the sp. gr. representing 48 per cent. of alcohol by weight, 0·922, and that representing 56 per cent. of alcohol, as of the sp. gr. 0·904, must have been considered the right figures. (*Note to the fourteenth edition.*)

The berries are round, about as large as a pea, with 7 or 8 seeds, and of an aromatic smell and taste.

The tree is a native of Jamaica and other West India islands. The spirit is probably prepared by distilling rum from the leaves; but we are in want of precise information on the subject, and it is not impossible that the leaves of other species may also be used. Indeed, an odour of pimento which it appears to us may be sometimes detected, suggests the idea that the leaves of this tree may be at least occasionally added to those of the bayberry. A *volatile oil* is also obtained from the leaves by distillation. This is described by Mr. Maisch in the same number of the *American Journal of Pharmacy* (p. 296). It is brownish-yellow, limpid, of an aromatic odour resembling that of allspice, and a warm spicy taste. It is lighter than water, readily soluble in ether, from which alcohol precipitates it, and partially soluble in alcohol. Its alcoholic solution has a feeble acid reaction.

Bay-rum is used chiefly as a refreshing perfume in cases of nervous headache, faintness, and other nervous disorders, either held to the nostrils, or applied on soft linen to the head and forehead. It is also grateful to the feeble and convalescent patient, by being sprinkled on the bed covering, or otherwise made to impregnate the air of the chamber. W.

SPIRITUS VINI GALLICI. *U.S., Br.*

Brandy.

The spirit obtained from fermented grapes by distillation, and containing from 48 to 56 per cent. by volume of absolute alcohol. Brandy, for medicinal use, should be free from disagreeable odour, and not less than four years old. *U.S.*

Spirit of French Wine. Spirit distilled from French wine. It has a peculiar flavour, and a light sherry colour derived from the cask in which it has been kept. *Br.*

Eau de vie, *Fr.;* Branntwein, *Germ.;* Acquavite, *Ital.;* Agua ardiente, *Span.*

All liquids which have undergone the alcoholic fermentation yield an ardent spirit by distillation. (See *Alcohol*, p. 83.) When the alcoholic liquid is wine, the product of the distillation is brandy. This ardent spirit is subject to variation, according to the character of the wine from which it is distilled. The best brandy is obtained from French wines, and the kinds called Cognac and Armagnac are most esteemed. Cognac is probably the most profitable wine-producing region in the world, and has given its name to the most widely known wine. In the year 1866, 11,562,210 gallons are said to have been exported from the neighbouring sea-port town of Tounay-Charente. (*Am. Journ. of Pharm.*, Nov. 1869, p. 654.) The *catawba brandy* of Messrs. Longworth and Zimmermann, of Cincinnati, distilled from the lees of the catawba wine of Ohio, is a good brandy, but possesses the peculiar flavour of the wine. When the brandy is distilled from the marc of the catawba grape, it has an unpleasant taste, and contains a large amount of fusel oil. (E. S. Wayne, *Am. Journ. of Pharm.*, Nov. 1855, p. 498.) Considerable quantities of brandy have also been produced in California, we believe from the same grape, which, when submitted to the professional brandy-tasters of Cognac, was pronounced to be of very good quality; yet the flavour was so different, that no one could be expected to prefer it to old French brandy who had not acquired a fondness for its taste by long usage. Our Pharmacopœia formerly recognised French brandy exclusively; but in the present edition all spirits are admitted under that name, when obtained from the juice of grapes, and sufficiently strong and pure to meet the requisitions above given. Of course the brandy from catawba grape, if well prepared, is now officinal.

Brandy has an agreeable, vinous, aromatic odour, and a peculiar, well-known taste. Its sp. gr. varies from 0·902 to 0·941, and it contains on an average 53 per cent. by measure of alcohol of the density 0·825. Besides alcohol, water, and volatile oil, it contains colouring matter, tannin, œnanthic ether described under *wine*, a little acetic ether, and a little aldehyd. Brandy is distinguished by its colour into the pale and high-coloured. *Pale brandy* has a yellow colour, derived from the cask in which it is kept. *High-coloured* brandy has a deep-red colour given to it, before importation,

by burnt sugar (caramel), which is said to impart a more agreeable flavour. *Factitious brandy* is sometimes made from alcohol, deprived of fusel oil, and reduced to the proper proof by water, by adding to it acetic ether in the proportion of from half an ounce to an ounce to the gallon. The proper colour is then given by burnt sugar. The spurious liquid may be known by its leaving on evaporation a residue, containing sugar and no tannin; the absence of the latter being shown by its not striking a black colour with the salts of sesquioxide of iron. It may also be detected by the absence of aldehyd. (*Magnes Lahens.*) For modes of detecting impurities in brandy and other forms of ardent spirit, the reader is referred to an article by Mr. S. P. Duffield, of Detroit, in the *Am. Journ. of Pharm.* for March, 1862 (p. 118). See also, for remarks on the same subject, the *Journ. de Pharm.* (Août, 1875, p. 127).

Medical Properties. Brandy is esteemed cordial and stomachic, and is frequently given, in the form of toddy or milk-punch, in the sinking stages of low fevers. In the late Lond. Pharmacopœia there was an officinal preparation of it, called *Mistura Spiritus Vini Gallici*, consisting of brandy, cinnamon water, the yelks of eggs, sugar, and oil of cinnamon. This, though a convenient form for the administration of brandy, was omitted in the Br. Pharmacopœia. It has, however, been admitted into the new edition, and is now again officinal; but the oil has been omitted. If prepared with the U. S. cinnamon water, it would certainly be sufficiently flavoured without the addition of the oil. Brandy is in general most conveniently exhibited, in low fevers, mixed with milk, and flavoured with sugar; the proportions being varied to meet the demands of the case.

Off. Prep. Mistura Spiritus Vini Gallici, *Br.* B.

STATICE. *U.S.*

Marsh Rosemary.

The root of Statice Limonium, variety Caroliniana. *U.S.*

STATICE. *Sex. Syst.* Pentandria Pentagynia.—*Nat. Ord.* Plumbaginaceæ.

Gen. Ch. Calyx one-leaved, entire, plaited, scariose. *Petals* five. *Seed* one, superior. *Nuttall.*

Statice Caroliniana. Walter, *Flor. Car.* 118; Bigelow, *Am. Med. Bot.* ii. 51. This is considered by Nuttall, Torrey, and some other botanists, as a mere variety of the *Statice Limonium* of Europe. Pursh, Bigelow, and others follow Walter in considering it as a distinct species. It is an indigenous maritime plant with a perennial root, sending up annually tufts of leaves, which are obovate or cuneiform, entire, obtuse, mucronate, smooth, and on long footstalks. They differ from the leaves of *S. Limonium* in being perfectly flat on the margin, while the latter are undulated. The flower-stem is round, smooth, from a few inches to a foot or more in height, sending off near its summit numerous alternate subdividing branches, which terminate in spikes, and form altogether a loose panicle. The flowers are small, bluish-purple, erect, upon one side only of the common peduncle, with a mucronate scaly bracte at the base of each, a five-angled, five-toothed calyx, and spatulate, obtuse petals.

Marsh rosemary grows in the salt marshes along the sea-coast, from New England to Florida, and flowers in August and September. The root, which is the officinal portion, is large, spindle-shaped or branched, fleshy, compact, rough, and of a purplish-brown colour. It is bitter and extremely astringent to the taste, but without odour. Mr. Edward Parrish, of Philadelphia, found it to contain tannic acid, gum, extractive, albumen, volatile oil, resin, caoutchouc, colouring matter, lignin, and various salts, among which were common salt, and the sulphates of sodium and magnesium. The proportion of tannic acid was 12·4 per cent. (*Am. Journ. of Pharm.*, xiv. 116.)

Medical Properties and Uses. Statice is powerfully astringent, and in some parts of the United States, particularly in New England, is much employed. It may be used for all the purposes for which kino and catechu are given; but its chief popular application is to aphthous and ulcerative affections of the mouth and fauces. Dr.

Baylies, of Massachusetts, found it highly useful in cynanche maligna, both as an internal and local remedy. It is employed in the form of infusion or decoction.

W.

STILLINGIA. *U. S.*

Stillingia. Queen's-root.

The root of Stillingia sylvatica. *U. S.*

STILLINGIA. *Sex. Syst.* Monœcia Monadelphia. — *Nat. Ord.* Euphorbiaceæ.

Gen. Ch. MALE. *Involucre* hemispherical, many-flowered, or wanting. *Calyx* tubular, eroded. *Stamens* two and three, exserted. FEMALE. *Calyx* one-flowered, inferior. *Style* trifid. *Capsule* three-grained. *Nuttall.*

From the fruit of *Stillingia sebifera*, the Chinese procure a *vegetable tallow* in large quantities, which is said to be almost pure stearin, and is much used in making candles. It exists between the shell of the seeds and the outer husk; the kernel, contained within the shell, yielding a liquid oil by expression. (*Pharm. Journ.*, xii. 73.)

Stillingia sylvatica. Willd. *Sp. Plant.* iv. 588. This is an indigenous perennial plant, commonly called *Queen's delight*, with herbaceous stems, two or three feet high, and alternate, sessile, oblong or lanceolate-oblong, obtuse, serrulate leaves, tapering at the base, and accompanied with stipules. The male and female flowers are distinct upon the same plant. They are yellow, and arranged in the form of a spike, of which the upper part is occupied by the male, the lower by the female flowers. The male florets are scarcely longer than the bracteal scales. The plant grows in pine-barrens from Virginia to Florida, flowering in May and June. When wounded it emits a milky juice.

The root, which is the part used, is large, thick, and woody. A specimen presented to the writer by Dr. J. B. Holmes, of Charleston, S. C., is in long cylindrical pieces, from a third of an inch to more than an inch thick, wrinkled from drying, of a dirty yellowish-brown colour externally, and, when cut across, exhibiting an interior soft, yellowish, ligneous portion, surrounded by a pinkish-coloured bark. The odour is slight, peculiar, and somewhat oleaginous, but in the recent root is said by Dr. Frost to be strong and acrimonious. The taste is bitterish and pungent, leaving an impression of disagreeable acrimony in the mouth and fauces. It imparts its virtues to water and alcohol. Dr. Frost thinks that the active principle is somewhat volatile, and states that the root loses much of its activity when long kept. Mr. M. Saunders has obtained from the root a volatile oil, which he found to possess the odour, taste, and peculiar acrimony of the root in a high degree. He procured six and a quarter ounces from five pounds of the dried root. It had a thick consistence, which required the addition of an ounce of alcohol, to render it fit for manipulation. The substance sold in the shops of Cincinnati by this name, he believes to be factitious. (*Am. Journ. of Pharm.*, March, 1869, p. 149.)

Medical Properties and Uses. In large doses, stillingia is emetic and cathartic, in smaller doses alterative, with some influence over the secretions. It has been long popularly used in South Carolina; but was first introduced to the notice of the profession by Dr. Thomas Young Simons, in a paper published in the *American Medical Recorder* for April, 1828 (vol. xiii. p. 312), as a valuable alterative remedy in syphilitic affections, and others ordinarily requiring the use of mercury. Dr. Simons's statements have been confirmed and extended by Dr. A. Lopez, of Mobile (*N. Orleans Med. and Surg. Journ.*, iii. 40), and Dr. H. R. Frost, of Charleston, S. C. (*South. Journ. of Med. and Pharm.* for November, 1846). From the reports in its favour there seems no reason to doubt the efficacy of this medicine in secondary syphilis, scrofula, cutaneous diseases, chronic hepatic affections, and other complaints ordinarily benefited by alterative medicines. It may be given in substance, decoction, or tincture; but the two latter forms are preferable. The dose of the powder is stated at from fifteen to thirty grains. The decoction, made by slowly boiling an ounce of the bruised root in three pints of water to a pint, may be given in the quantity of one or two fluidounces three or four times a day, increased as the stomach will bear it. The dose of a tincture, made with two ounces of the root and a pint of diluted alcohol, is about a fluidrachm. Stillingia is sometimes advantageously combined with sarsaparilla and other alteratives.

W.

STRAMONII FOLIA. *U.S., Br*

Stramonium Leaves.

Syn. Stramonii Folium. *Pharm.*, 1860. *U.S.*

The leaves of Datura Stramonium. *U.S.* The dried leaves of Datura Stramonium. Collected from plants in flower. *Br.*

STRAMONII SEMEN. *U.S.*

Stramonium Seed.

The seed of Datura Stramonium. *U.S.*

Off. Syn. STRAMONII SEMINA. The ripe seeds of Datura Stramonium. *Br.* Thornapple; Stramoine, Pomme épineuse, *Fr.;* Stechapfel, *Germ.;* Stramonio, *Ital.;* Estramonio, *Span.*

DATURA. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Solanaceæ.

Gen. Ch. Corolla funnel-shaped, plaited. *Calyx* tubular, angular, deciduous. *Capsule* four-valved. *Willd.*

Datura Stramonium. Willd. *Sp. Plant.* i. 1008; Bigelow, *Am. Med. Bot.* i. 17; Woodv. *Med. Bot.* p. 197, t. 74. The *thornapple* is an annual plant, of rank and vigorous growth, usually about three feet high, but in a rich soil sometimes six feet or more. The root is large, whitish, and furnished with numerous fibres. The stem is erect, round, smooth, somewhat shining, simple below, dichotomous above, with numerous spreading branches. The leaves, which stand on short round footstalks, in the forks of the stem, are five or six inches long, of an ovate-triangular form, irregularly sinuated and toothed at the edges, unequal at the base, dark-green on the upper surface, and pale beneath. The flowers are large, axillary, solitary, and peduncled; having a tubular, pentangular, five-toothed calyx, and a funnel-shaped corolla with a long tube, and a waved plaited border, terminating in five acuminate teeth. The upper portion of the calyx falls with the deciduous parts of the flower, leaving its base, which becomes reflexed, and remains attached to the fruit. This is a large, fleshy, roundish-ovate, four-valved, four-celled capsule, thickly covered with sharp spines, and containing numerous seeds, attached to a longitudinal receptacle in the centre of each cell. It opens at the summit.

There are two varieties of this species of Datura, one with a green stem and white flowers; the other with a dark-reddish stem minutely dotted with green, and purplish flowers striped with deep purple on the inside. The latter, however, is considered by some botanists as a distinct species, being the *D. Tatula* of Linnæus. The properties of both are the same.*

It is doubtful to what country this plant originally belonged. Many European botanists refer it to North America, while we in return trace it to the old continent. Nuttall considers it as having originated in South America or Asia; and it is probable that its native country is to be found in some portion of the East. It is said to grow wild abundantly in Southern Russia, from the borders of the Black Sea eastward to Siberia. Its seeds, being retentive of life, are taken in the earth put on shipboard for ballast from one country to another, not unfrequently springing up upon the passage, and thus propagating the plant in all regions which have any commercial connection. In the United States it is found everywhere in the vicinity of cultivation, frequenting dung-heaps, the road-sides and commons, and other places where a rank soil is created by the deposited refuse of towns and villages. Its flowers appear from May to July or August, according to the latitude. Where the plant grows abundantly, its vicinity may be detected by the rank odour which it diffuses to some

* M. Naudin maintains that they are distinct species, always retaining their distinctive characters, the one of green stems and pure white flowers, the other dark-purple stems and violet-tinted flowers. The two species were crossed by M. Naudin, who obtained hybrids, which, though of twice the size of their parents, were in other respects intermediate between them; and, when these hybrids were cultivated, they showed a constant tendency to return to the original; out of a considerable number of seedlings, many being real D. Stramonium, and nearly as many D. Tatula. (See *Am. Journ. of Pharm.*, Sept. 1865, p. 341.)—*Note to the thirteenth edition.*

distance around. All parts of it are medicinal. The leaves and seeds only are now officinal; the root having been omitted in the recent revision of the U. S. Pharmacopœia. The leaves may be gathered at any time from the appearance of the flowers till the autumnal frost. In this country the plant is generally known by the name of *Jamestown weed*, derived probably from its having been first observed in the neighbourhood of that old settlement in Virginia. In Great Britain it is called *thornapple*.

1. The *fresh leaves* when bruised emit a fetid narcotic odour, which they lose upon drying. Their taste is bitter and nauseous. These properties, together with their medical virtues, are imparted to water and alcohol. Water distilled from them, though possessed of their odour in a slight degree, is destitute of their active properties. They contain, according to Promnitz, 0·58 per cent. of gum, 0·6 of extractive, 0·64 of green starch, 0·15 of albumen, 0·12 of resin, 0·23 of saline matters, 5·15 of lignin, and 91·25 of water. The leaves, if carefully dried, retain their bitter taste.

2. The *seeds* are small, kidney-shaped, flattened on the sides, of a dark-brown almost black colour, inodorous unless bruised, and of the bitter, nauseous taste of the leaves, with some degree of acrimony. They are much more energetic in their action on the system than the leaves. MM. Hirtz and Hopp inferred, from their experiments, that one part of an extract prepared from them was equal in strength to five parts of an extract prepared in precisely the same manner from the leaves (*Ann. de Thérap.*, A. D. 1862, p. 22). They were analyzed by Brandes, who found, besides a peculiar alkaline principle called *daturia*, a glutinous matter, albumen, gum, a butyraceous substance, green wax, resin insoluble in ether, fixed oil, bassorin, sugar, gummy extractive, orange-coloured extractive, and various saline and earthy substances. Chemists, however, have failed to obtain the daturia of Brandes by his own process; and Berzelius states that it has been admitted, even by that chemist himself, to be nothing more than phosphate of magnesium. (*Traité de Chimie*, vi. 319.) But Geiger and Hesse succeeded in isolating an alkaline principle, to which the same name has been given, and which Trommsdorff has repeatedly procured by their process.

As described by Geiger and Hesse, *daturia* crystallizes in colourless, inodorous, shining prisms, which, when first applied to the tongue, are bitterish, but ultimately have a flavour like that of tobacco. It is dissolved by 280 parts of cold, and 72 of boiling water, is very soluble in alcohol, and less so in ether. Mr. H. J. Waddington states that daturia, resembling atropia precisely in this respect, melts when heated, remains colourless, and sublimes in perfect crystals. (*Pharm. Journ. and Trans.*, March, 1868, p. 416.) It has been shown to have a poisonous action upon animals, and strongly dilates the pupil. Crystals of it are asserted to have been obtained from the urine of a person fatally poisoned by stramonium. (See *Am. Journ. of Med. Sci.*, xvi. 485.) It may be procured from the seeds in the same manner as *hyoscyamia* from those of Hyoscyamus niger. (See *Hyoscyamus*.) The product is exceedingly small. In the most favourable case, Trommsdorff got only $\frac{1}{30}$ of 1 per cent. According to Dr. A. Von Planta, daturia is identical with atropia, its formula being $C_{34}H_{23}NO_6$. (See *Am. Journ. of Pharm.*, xxiii. 38.) Mr. Morries obtained a poisonous empyreumatic oil by the destructive distillation of stramonium.*

* *Daturia.* The following is N. Gunther's method of preparing this alkaloid. The parts of the plant, finely powdered, are twice exhausted, at from 30° C. to 40° C., with ten times their weight of water containing about 3 per cent. of sulphuric acid. The resulting liquid is strained, and evaporated, by means of a water-bath, to a syrupy consistence. To this syrupy residue, three times its volume of alcohol are added, in order to precipitate albuminous matter, and at the same time to dissolve the new alkaloid precipitated, after which the liquid is left at rest in a warm place for 24 hours, and is then filtered, and cautiously deprived of the excess of alcohol by distillation. The acid residue is reduced by evaporation to a small volume, say from 30 to 60 grammes, and then shaken with the ether of petroleum to separate the resinous and colouring matters. After carefully decanting the ethereal layer, the watery liquid, neutralized by ammonia, is well shaken with chloroform; and this operation is repeated in order that all the alkaloid shall be dissolved. The chloroformic solutions are then once or twice shaken with water, in order to dissolve in the water the ammoniacal salts they may contain. Then, the greater part of the chloroform is withdrawn by distillation at a moderate temperature; and, lastly, the residue is submitted to spontaneous evaporation in a watch-glass. From all parts of the Datura Stramonium, the daturia is obtained in an amorphous state, which may be attributed to the fact that the separation of the amorphoid residue takes place under the influence of certain impurities. (*Annuaire de Thérap.*, A. D. 1870, p. 48.)

Physiological Properties. The following results were obtained through experiments made by

Medical Properties and Uses. Stramonium is a powerful narcotic. When taken in quantities sufficient to affect the system moderately, it usually produces more or less cerebral disturbance, indicated by vertigo, headache, dimness or perversion of vision, and confusion of thought, sometimes amounting to slight delirium or a species of intoxication. At the same time peculiar deranged sensations are experienced about the fauces, œsophagus, and trachea, increased occasionally to a feeling of suffocation, and often attended with nausea. A disposition to sleep is sometimes but not uniformly produced. The pulse is not materially affected. The bowels are rather relaxed than confined, and the secretions from the skin and kidneys not unfrequently augmented. These effects pass off in five or six hours, or in a shorter period, and no inconvenience is subsequently experienced. In poisonous doses, this narcotic produces cardialgia, excessive thirst, nausea and vomiting, a sense of strangulation, anxiety and faintness, partial or complete blindness with dilatation of the pupil, sometimes deafness, flushing and swelling of the face, headache, vertigo, delirium sometimes of a furious, sometimes of a whimsical character, tremors of the limbs, palsy, and ultimately stupor and convulsions. In a case recorded by Dr. C. B. Faust, the whole surface of the body was of a scarlet colour. (*Charleston Journ. and Rev.*, ix. 745.) From all these symptoms the patient may recover; but they have frequently terminated in death. To evacuate the stomach by emetics or the stomach-pump is the most effectual remedy. What has before been said as to the destructive effects of the caustic alkalies upon the active principle of belladonna and hyoscyamus is applicable to their influence on stramonium. (See *pages* 173 and 491.) Opium exercises the same antagonistic influence upon the operation of this poison as on that of belladonna. (See *Belladonna*, page 173.)

Though long known as a poisonous and intoxicating herb, stramonium was first introduced into regular practice by Baron Störck, of Vienna, who found some advantage from its use in mania and epilepsy. Subsequent observation has confirmed his estimate of the remedy; and numerous cases are on record in which benefit has accrued from it in these complaints. Other diseases in which it has been found beneficial are neuralgic and rheumatic affections, dysmenorrhœa, syphilitic pains, cancerous sores, and spasmodic asthma. In the last complaint it has acquired con-

MM. Oulmont and Laurent, upon daturia and hyoscyamia, with a view of determining their comparative properties. They were performed both on men and the lower animals, and the medicines were applied through the stomach or by subcutaneous injection. In the case of a man, affected with obstinate neuralgic pains of which an attack occurred on the 3d of July, four milligrammes of daturia were injected in the evening without any very appreciable result. The pains persisted, and in the following evening six milligrammes were injected. In 20 minutes the pulse had risen from 68 to 84, remaining regular, and there was slight increase of the temperature of the blood (from 36·6° C. to 37° C.). Other symptoms were moderate dilatation of the pupils, vivid thirst, dryness of the throat, slight hoarseness, no difficulty of swallowing or buzzing of the ears, but some heaviness of the head. In three hours the patient was extremely pale, with small, irregular pulse, and 96 pulsations, limbs cold and bathed in a cold sweat, pupils steadily dilated, complete loss of voice, and irregular and sighing respirations. The pulsations of the heart were intermittent; the patient no longer answered questions; the temperature of the axilla did not change after the first 20 minutes, being always 37° C. Coffee internally, and sinapisms applied here and there to the extremities, soon restored the patient. On the 5th inst., in the morning, the pulse had fallen back to 64, the cardiac intermittence continuing, and of all the serious symptoms of the evening before, nothing remained but a severe thirst and headache.

The general conclusions from the experiments were: 1. That both alkaloids affect especially the system of the great sympathetic. 2. In small doses, they diminish the capillary circulation; and in large doses determine a vascular paralysis. 3. The arterial tension is augmented by small doses; on the contrary, it is decreased by doses so large as to be poisonous; nor are these results modified by section of the pneumogastric. 4. The pulsations increase in number and diminish in bulk. 5. Hyoscyamus renders the heart's movements regular; daturia, on the contrary, often produces intermittent action, and suspensions of pulsation. Both, acting directly on the heart, diminish the frequency of the pulsations and completely arrest the action of the heart. 6. They always accelerate the respiration. 7. Neither of the alkaloids has a direct action on the nervous system, and the life of relation, sensibility and motility are not modified. In poisonous doses, the peripheric sensibility is softened. 8. These alkaloids have no action on the excitability of the striated muscles, and do not modify their structure. 9. In small doses they accelerate the intestinal movements, in large doses paralyze them. 10. The general phenomena are owing to the nervous modifications in the circulation. They disappear rapidly. The alkaloids are quickly eliminated, especially by the urine, in which they can be detected. 11. The dilatation of the pupil is owing to the excitation of the great sympathetics. 12. Feeble doses, in general, determine a slight augmentation of the temperature; strong ones diminish the central temperature. (*Annuaire de Thérap.*, A. D. 1873, pp. 22 to 26.)—*Note to the fourteenth edition.*

siderable reputation. It is employed only during the paroxysm, which it very often greatly alleviates or altogether subverts. The practice was introduced into Great Britain from the East Indies, where the natives are in the habit of smoking the dried root and lower part of the stem of *Datura ferox*, in the paroxysms of this distressing complaint. The same parts of *D. Stramonium* were substituted, and found equally effectual. To prepare the roots for use, they are quickly dried, cut into pieces, and beaten so as to loosen the texture. The dried leaves answer the same purpose. They are smoked by means of a common tobacco-pipe. These and other narcotic leaves have also been used in the shape of cigars. The smoke produces a sense of heat in the lungs, followed by copious expectoration, and attended frequently with temporary vertigo or drowsiness, and sometimes with nausea. The remedy should never be used in plethoric cases, unless preceded by ample depletion, and in no case where there is determination to the head. Dangerous and even fatal consequences have resulted from its incautious or improper use; and General Gent, who was instrumental in introducing the practice into England, is said at last to have fallen a victim to it. Stramonium has sometimes been given by the stomach in the same complaint. It is used by Dr. H. D. W. Pawling in the treatment of delirium tremens, and, as represented in the inaugural dissertation of his pupil Dr. G. W. Holstein, with great success. Dr. Pawling employs a decoction of the leaves.

Externally the medicine is used advantageously as an ointment or cataplasm in irritable ulcers, inflamed tumors, swelling of the mammæ, and painful hemorrhoidal affections. Dr. J. Y. Dortch, of North Carolina, has found it very useful in tinea capitis. (*Thesis*, Feb. 1846.) By American surgeons it is very frequently applied to the eye, in order to produce dilatation of the pupil, previously to the operation for cataract; and is found equally efficacious with belladonna. For this purpose the extract, mixed with lard, is generally rubbed over the eyelid, or a solution of it dropped into the eye.

Of the parts of the plant employed, the seeds are the most powerful. They may be given in the dose of a grain twice a day; and an extract made by evaporating the decoction, in one-quarter or half the quantity. The dose of the powdered leaves is two or three grains. The inspissated juice of the fresh leaves is more commonly prescribed than any other preparation, and may be administered in the quantity of one grain. (See *Extractum Stramonii Foliorum.*) There is also an officinal tincture, to which the reader is referred. The dose should be gradually increased till the narcotic operation becomes evident, or relief from the symptoms of the disease is obtained. Fifteen or twenty grains of the powdered leaves, and a proportionate amount of the other preparations, have often been given daily without unpleasant effects.

Daturia has been employed for obtaining the effects whether of stramonium or belladonna. M. Jobert has found it three times as strong as atropia, less apt to disturb vision than belladonna, and at the same time more constant and lasting in its operation. (*Ann. de Thérap.*, A. D. 1863, p. 28.) A. Hirschberg states that, when stramonium is smoked, as in the treatment of asthma, none of the daturia enters the system; but that the effects produced are from new alkaloids generated by the heat. (*New Remedies*, Oct. 1872, p. 154.)

Off. Prep. of the Leaves. Extractum Stramonii Foliorum, *U. S.*

Off. Prep. of the Seeds. Extractum Stramonii, *Br.;* Extractum Stramonii Seminis, *U. S.;* Tinctura Stramonii. W.

STYRAX. *U. S.*

Storax.

A balsam prepared from the bark of Liquidambar orientale. *U. S.*

Off. Syn. STYRAX PRÆPARATUS. *Prepared Storax.* A balsam, obtained from the bark of Liquidambar orientale. Purified by means of rectified spirit and straining. *Br.*

Storax, *Fr., Germ.;* Storace, *Ital.;* Estoraque, *Span.*

Until recently it was generally admitted that storax was obtained from Styrax officinale; and it has not been determined that this plant does not yield a variety of the drug; but both the U. S. and Br. Pharmacopœias now ascribe the storax in

ordinary use to Liquidambar orientale; and we shall, therefore, give a brief description of both plants.

STYRAX. See BENZOINUM.

Styrax officinale. Willd. *Sp. Plant.* ii. 623; Woodv. *Med. Bot.* p. 291, t. 101. This species of Styrax is a tree which rises from fifteen to twenty-five feet in height, sends off many branches, and is covered with a rough gray bark. The leaves are alternate, petiolate, entire, oval, pointed, bright-green on their upper surface, white with a cotton-like down upon the under, about two inches in length, and an inch and a half in breadth. The flowers are united in clusters of three or four at the extremities of the branches. They are white, and bear considerable resemblance to those of the orange. The tree is a native of Syria and other parts of the Levant, and has been naturalized in Italy, Spain, and the south of France, where, however, it does not yield balsam. This circumstance induced some naturalists to doubt whether *Styrax officinale* is the real source of storax; and, as the *Liquidambar styraciflua* of this country affords a balsam analogous to that under consideration, Bernard de Jussieu conjectured that the latter might be derived from another species of the same genus, *L. orientale* of Lamarck, which is more abundant in Syria than the *Styrax*. This conjecture has since been confirmed; and storax is now officinally referred to that plant.

LIQUIDAMBAR. *Sex. Syst.* Monœcia Polyandria.—*Nat. Ord.* Amentaceæ. *Juss.;* Balsamaceæ, *Lindley.*

Gen. Ch. MALE. *Amentum* conical, surrounded by a four-leaved involucre; *corolla* none; *filaments* numerous. FEMALE. *Amentum* globose, with a four-leaved involucre; *calyx* one-leafed, urceolate, two-flowered; *styles* two; *capsules* two, surrounded at the base by the calyx, one-celled, many-seeded.

Liquidambar orientale. Miller, *Dict.* No. 2; *Pharm. Journ.*, xvi. 462. The *oriental sweet-gum* is a tree of from twenty to forty feet high, with palmate leaves, of which each division is obscurely three-lobed. They are serrate, perfectly smooth, bright-green and shining on the upper surface, and pale on the under. The tree is a native of Asia Minor, in the southwestern parts of which it forms large forests. It yields the variety of the drug called *liquid storax.*

Accounts somewhat differ as to the mode of collecting the balsam. They agree, however, in the point, that, the outer bark having been removed, the inner bark is scraped off and submitted to pressure. According to Mr. Maltass, the bark is first pressed cold in horse-hair bags, after which hot water is thrown over them, and they are again pressed. Lieutenant Campbell states that the inner bark is first boiled with water, and, a portion of the balsam which rises having been skimmed off, is then pressed so as to extract the remainder. The residuary bark, after expression, is dried in the sun, and employed in various parts of Turkey for fumigation. It is the drug known in commerce as *Storax bark* or *Cortex Thymiamatis.* (Hanbury, *Pharm. Journ.*, xvi. 463.) The balsam is sent in casks to Constantinople, Smyrna, and other ports of the Levant.

Several kinds of storax have been described. The purest was the *storax in grains*, which was in whitish, yellowish-white, or reddish-yellow tears, about the size of a pea, opaque, soft, adhesive, and capable of uniting so as to form a mass. Another variety, formerly called *styrax calamita*, from the circumstance, as is supposed, that it was brought wrapped in the leaves of a kind of reed, consisted of dry and brittle masses, formed of yellowish agglutinated tears, in the interstices of which was a brown or reddish matter. The French call it *storax amygdaloïde.* This and the preceding variety had a pleasant odour like that of vanilla. Neither of them, however, is now found in the markets. It is possible that one or both of these varieties may have been the product of Styrax officinale; but there seems to be no certainty on this point.

A third variety, which is sometimes sold as the *styrax calamita*, is in brown or reddish-brown masses of various shapes, light, friable, yet possessing a certain degree of tenacity, and softening under the teeth. Upon exposure, it becomes covered upon the surface with a white efflorescence of benzoic acid. It evidently consists of sawdust, united either with a portion of the balsam, or with other analogous substances. As found in our shops, it is usually in the state of a coarse, soft, dark-coloured pow-

der, mingled with occasional light friable lumps of various magnitude, and containing very little of the balsam. When good, it should yield, upon pressure between hot plates, a brown resinous fluid having the odour of storax. The source of this variety is not precisely known. Mr. Hanbury states that some of it is prepared at Trieste by mixing the residue of the liquidambar bark remaining after expression, and reduced to coarse powder, with genuine liquid storax. (*Pharm. Journ.*, April, 1863, p. 438.)

A fourth variety, which, under the name of *liquid storax*, is the one commonly used, is a semi-fluid, adhesive substance, brown or almost black upon the surface exposed to the air, but of a slightly greenish-gray colour within, and of an odour somewhat like that of Peruvian balsam, though less agreeable. It is kept in jars. The source of liquid storax was till recently quite uncertain. Some supposed it to be derived by decoction from the young branches of *Liquidambar styraciflua;* but a specimen of the juice of this plant, brought from New Orleans, which we had an opportunity of inspecting, had an odour entirely distinct from that of the substance under consideration. According to Landerer, who resides in Greece, liquid storax is obtained in the islands of Cos and Rhodes from the bark and young twigs of Styrax officinale, by subjecting them to pressure. But Mr. Daniel Hanbury, in a communication to the *Pharmaceutical Journal* (xvi. 422), has shown this to be an error; none whatever of the balsam being collected in those islands. It has been stated above that liquid storax had been referred to *Liquidambar orientale;* and from specimens of the plant furnishing the balsam, collected by Mr. Maltass, and sent by him to Mr. Hanbury, there can scarcely be a doubt of the correctness of this reference.

As found in the shops, storax is usually so much adulterated as to require purification before it can be used; and, both in the U. S. and British Pharmacopœias, processes were formerly given for its preparation. But in the recent editions these processes have been abandoned; and the U. S. authorities content themselves with directing, in the Materia Medica Catalogue, "a balsam prepared from the bark;" the British, the "balsam purified by means of rectified spirit and straining." Whenever not originally pure enough for use, it should be dissolved in alcohol, the solution strained, and the alcohol distilled off to a certain extent, and then completely evaporated at a gentle heat.

Among the substances used in the adulteration of storax is turpentine. To detect it Mr. Hager employed the following method. He liquefied the resin, in a tube, by means of the water-bath; added half its volume of absolute alcohol, and favoured the solution by agitation; then treated with several volumes of benzine. This operation was twice repeated. The liquors obtained were then evaporated, in a *tared* vessel; and there was obtained, for pure storax, a residue (45 to 55 per cent.) colourless with a light blue opalescence; for that mixed with turpentine, a residue more considerably yellowish, and having the terebinthinate odour. (*Journ. de Pharm.*, Fév. 1876, p. 161.)

General Properties. Storax has a fragrant odour and aromatic taste. It melts with a moderate heat, and, when the temperature is raised, takes fire and burns with a white flame, leaving a light spongy carbonaceous residue. It imparts its odour to water, which it renders yellow and milky. Its active constituents are dissolved by alcohol and ether. Newmann obtained from 480 grains of storax 120 of watery extract; and from an equal quantity, 360 grains of alcoholic extract. Containing volatile oil and resin, and yielding benzoic or cinnamic acid by distillation, it is entitled to be ranked as a balsam. Besides oil, resin, and benzoic acid, Reinsch found in styrax calamita, gum, extractive, lignin, a matter extracted by potassa, water, and traces of ammonia. Simon found in liquid storax cinnamic acid, and a resinous substance, which he considered identical with the *styracin* of Bonastre. According to Toel, styracin is a compound of cinnamic acid with a peculiar substance which he calls *styrone*, and is in composition perfectly analogous to the natural fats. (*Chem. Gaz.*, July 2, 1849.) Strecker gives the name of styrone to a substance resulting from the action of caustic potassa on liquid storax. He states that, if this be oxidized by exposing spongy platinum moistened with it in the liquid state to the air, the odour of oil of cinnamon is perceived, evincing the production of a portion of that oil. (See *Pharm. Journ.*, xv. 180.) The volatile oil of storax, denominated *styrol*, is obtained by distilling the liquid balsam with water and carbonate of sodium, this salt being added

to retain the cinnamic acid. It is a mobile, limpid fluid, with the odour of liquid storax, and a burning taste. It has the sp. gr. 0·924, and boils at 294° F. (*Gmelin's Handbook*, xiii. 2.)

Medical Properties and Uses. This balsam is a stimulating expectorant, and was formerly recommended in phthisis, chronic catarrh, asthma, and amenorrhœa; but it is very seldom used at present, except as a constituent of the compound tincture of benzoin. It has been highly praised as a remedy in diphtheria and pseudomembranous croup. Liquid storax has been recommended in gonorrhœa and leucorrhœa as equally effectual with copaiba, and less disagreeable. From ten to twenty grains may be given twice a day, and the dose gradually increased. The same variety of storax, mixed with olive oil, has been found by Dr. H. Schultze, of Magdeburg, effectual in the cure of itch; the death of the insect resulting from a single thorough rubbing of the surface in twenty-four hours, and the eruption then subsiding spontaneously. (*Am. Journ. of Med. Sci.*, July, 1867, p. 258.)

Off. Prep. Tinctura Benzoini Composita. W.

SULPHUR LOTUM. *U.S.*

Washed Sulphur.

Sublimed sulphur, thoroughly washed with water. *U.S.*

SULPHUR SUBLIMATUM. *U.S., Br.*

Sublimed Sulphur.

Sulphur, prepared from crude or rough sulphur by sublimation. *Br.*

Brimstone; Soufre, *Fr.;* Schwefel, *Germ.;* Zolfo, *Ital.;* Azufre, *Span.*

The officinal forms of sulphur are the *sublimed*, the *washed*, and the *precipitated*. The sublimed and washed sulphur will be noticed in this place; the precipitated, in *Part* II. among the Preparations.

Natural States. Sulphur is very generally disseminated throughout the mineral kingdom, and is almost always present, in minute quantity, in animal and vegetable matter. Among vegetables, it is particularly abundant in mustard and other cruciform plants. It occurs in the earth, either native or in combination. When native it is found in masses, translucent or opaque, or in the powdery form mixed with various earthy impurities. In combination it is usually united with certain metals, as iron, lead, mercury, antimony, copper, and zinc, forming compounds called sulphurets. *Native sulphur* is most abundant in volcanic countries, and is hence called *volcanic sulphur*. The most productive mines of sulphur are found in Sicily, at Solfatara in the kingdom of Naples,* and in the Roman States. A large mine of native sulphur has been opened in California, about twenty miles from Santa Barbara, and seven from the sea-coast. (*Am. Journ. of Pharm.*, March, 1862, p. 176.) Near the borax lake in California (see *Sodii Boras*, p. 847) is an elevation, where the deposition of sulphur is constantly going on from vapours issuing from innumerable crevices in a decomposed volcanic rock, the surface of which is so far covered with the deposited matter as to give the mass the appearance of a bank of sulphur. It is called "Sulphur Banks," and will no doubt largely contribute this material to commerce in future times. (Prof. J. D. Whitney, *Ibid.*, May, 1866, pp. 237–8.) Already works are in operation for preparing the sulphur. In the year 1869 or 1870, a new place of deposit was discovered by a traveller from New York, in the Island of Saba, one of the Dutch West Indies, about 110 miles S. of St. Thomas. The sulphur is in large masses, and readily reached; so that the discoverer, with some aid from the natives, quarried two sloop-loads of the ore, which, being taken to New York, and there submitted to chemical examination, was ascertained to yield an average of more than 60 per cent. of sulphur. The island is of volcanic origin, of about 11 miles in circumfer-

* On a visit to Solfatara in 1861, one of the authors was informed that sulphur was no longer obtained from this extinct volcano; and certainly no works for its extraction were then in operation. (*Note to the twelfth edition.*)

ence, and with 200 of an English-speaking population. (*Am. Journ. of Pharm.*, Sept. 1870, p. 431; from the *Drug. Circular*, New York.) Still another locality of native sulphur was found A. D. 1872, within the Western Territories of the United States, about 900 miles west of Omaha and 30 south of the Union Pacific Railroad. It is described as forming a great hill of almost pure sulphur. This has been ascertained to be purer than the sulphur from Sicily, and will some time, probably, be largely used by the manufacturers of this country. (*New Remedies*, Oct. 1874, p. 340.)

Extraction, &c. Sulphur is obtained either from sulphur earths, or from the native sulphurets of iron and copper, called iron and copper pyrites. The sulphur earths are placed in earthen pots, set in oblong furnaces of brickwork. From the upper and lateral part of each pot, a tube proceeds obliquely downwards, which communicates with the upper part of a similar pot, situated outside the furnace, and perforated near its bottom, to allow the melted sulphur to flow into a vessel containing water, conveniently placed to receive it. Fire being applied, the sulphur rises in vapour, leaving the impurities behind, and, being condensed again, flows from the perforated pot into the vessel containing the water. Sulphur, as thus obtained, is called *crude sulphur*, and contains about one-twelfth of its weight of earthy matter. For purification it is generally melted in a cast iron vessel. When the fusion is complete, the impurities subside, and the purer sulphur is dipped out and poured into cylindrical wooden moulds, which give it the form of solid cylinders, about an inch in diameter, called in commerce *roll sulphur* or *cane brimstone*. The dregs of this process, ground to powder, constitute a very impure kind of sulphur, of a gray colour, called in the shops *sulphur vivum* or *horse brimstone*.

The above process purifies the sulphur but imperfectly. At the same time it causes a considerable loss; as the dregs just mentioned contain a large proportion of sulphur. A more eligible mode of purification consists in distilling the crude sulphur from a large cast iron still, set in brickwork over a furnace, and furnished with an iron head. The head has two lateral communications, one with a chamber of brickwork, the other with an iron receiver immersed in water, which is constantly renewed to cool it sufficiently to cause the sulphur to condense in the liquid form. When the tube between the still and receiver is shut, and that communicating with the chamber is open, the sulphur condenses on its walls in the form of an impalpable powder, and constitutes *sublimed sulphur* or *flowers of sulphur*. If, on the other hand, the communication with the chamber is closed, and that with the receiver opened, the sulphur condenses in the latter in the fused state, and, when cast in cylindrical moulds, forms the *roll sulphur* of commerce.

The extraction of sulphur from the bisulphuret of iron (iron pyrites) is performed by distilling it in stone-ware cylinders. Half the sulphur contained in the bisulphuret is volatilized by the heat, and conducted, by means of an adapter, into vessels containing water, where it condenses. The residue of the mineral is employed for making sulphate of iron, or green vitriol. In the island of Anglesea, large quantities of sulphur are obtained from copper pyrites in the process for extracting that metal. The furnaces in which the ore is roasted are connected by horizontal flues with chambers, in which the volatilized sulphur is condensed. Each chamber is furnished with a door, through which the sulphur is withdrawn once in six weeks.

A process for separating pure sulphur from the residue of the manufacture of soda, proposed by Max Schaffner, has been put in operation in most of the soda factories of the German Zollverein, and has been introduced, to a greater or less extent, in England, France, and Belgium. For a minute detail of the process, the reader may consult the *Amer. Journ. of Pharm.* (Nov. 1869, p. 545). We shall confine ourselves to an outline. The process is divided into three parts; *first*, the preparation of the *soda solution* by heaping up the soda residue in the air, whereby oxidation takes place, and polysulphurets and hyposulphites are formed, which are extracted by lixiviation; *secondly*, the solution thus obtained is decomposed, in close stone or iron vessels, by muriatic acid, which decomposes the polysulphurets, and hyposulphites, with precipitation of sulphur; and, *thirdly*, the sulphur is obtained pure by fusing it under water, with steam and a pressure of $1\frac{3}{4}$ atmosphere. Chloride of calcium remains in solution, gypsum is suspended, and the addition of a little

milk of lime neutralizes any free acid present, and with the sulphur forms sulphide of calcium, which dissolves whatever sulphide of arsenic may be present, leaving the sulphur free from impurities. This collects in the bottom of the kettle, and is drawn off into moulds. From 60 to 65 per cent. of pure sulphur is thus obtained from the soda residue.

Crude sulphur comes to this country principally from Messina, in Sicily, and the ports of Italy. Roll sulphur and the flowers are usually brought from Marseilles. Good Sicilian sulphur does not contain more than 3 per cent. of impurity, consisting chiefly of earths. Crude sulphur is employed by the manufacturers of sulphuric acid; and, as it is very variable in quality, it becomes important to ascertain its exact value. This may be done by drying a given weight of it, and submitting it to combustion. The weight of the incombustible residue, added to that lost in drying, gives the amount of impurity.

Properties. Sulphur is a non-metallic element, susceptible of several allotropic states. In its ordinary state it is a brittle solid, of a pale-yellow colour, permanent in the air, and exhibiting a crystalline texture and shining fracture. It has a slight taste, and a perceptible smell when rubbed. When pure its sp. gr. is about 2; but it varies a little in density in its different allotropic states. Occasionally, from impurity, its sp. gr. is as high as 2·35. Its eq. number is 16, and its symbol S. It is a bad conductor of heat, and becomes negatively electric by friction. The melting point of sulphur varies with its allotropic state, which is readily altered by heat. Pure sulphur melts and sublimes at 180°. (Guy, *Pharm. Journ.*, Feb. 1868, p. 375.) In ordinary sulphur, which is a mixture of the element in different allotropic states, the melting point varies from 232° to 248°. If heated above its melting point, it undergoes, in proportion to the heat applied, a progressive change, which will cause it, upon slow cooling, to solidify at a temperature lower than that at which it was melted; and, if it be remelted, it will be found to have a higher melting point than before. Melted sulphur is perfectly limpid, and of a bright-yellow colour. When sulphur is melted, and, after partial cooling, the crust formed on its surface is pierced, and the fluid portion poured out, it may be obtained in slender prismatic crystals, called prismatic sulphur. When sulphur is heated above its melting point, it becomes deeper coloured and less fluid. At 392°, it has a deep-brown colour, and is so viscid that it cannot be poured from the containing vessel. If the temperature be still further increased, the sulphur resumes its fluidity, but retains its brown colour. Finally, when the temperature reaches 752°, it boils in close vessels, forming a yellow vapour, and may be distilled. If melted sulphur, heated above 392°, is suddenly cooled by being poured out into water, it becomes a reddish-brown plastic mass, with alteration of properties, called *soft sulphur* (*viscid sulphur*), which is employed in taking impressions of medals, &c. This form of sulphur resumes the hard state, but not its original colour, after the lapse of a few days, or suddenly if heated to about 212°. Sulphur is insoluble in water, but soluble in alkaline solutions, petroleum, rectified coal naphtha, the fixed oils, oil of turpentine and other volatile oils, alcohol and ether, chloroform, and bisulphide of carbon. One of its best solvents is bisulphide of carbon, from solution in which it crystallizes generally in octohedrons, a form belonging to a different system from the prism, obtained by crystallizing melted sulphur by cooling. Hence sulphur is said to be dimorphous. M. Eugene Pelouze has observed that the oils obtained by distilling the tar from gas-works, dissolve most sulphur at a temperature near their boiling point, and, if a saturated solution at this heat were to be allowed to cool, it would deposit sulphur in a crystalline form; and M. C. Wiedmann has suggested the application of this property to extraction of sulphur from native sulphur earths and ores, and from the residue of coal gas-works. (*Am. Journ. of Pharm.*, June, 1871, p. 267.)

The allotropic states of sulphur have been studied chiefly by Brodie, Magnus and Weber, and Berthelot. These states are induced, for the most part, by heat, and are distinguished by the crystalline form of the sulphur, and by its solubility or non-solubility in bisulphide of carbon. According to the corrected determinations of Magnus and Weber, there are four allotropic states of sulphur, which they distinguish by the names of prismatic, octohedral, crummy, and insoluble sulphur. *Pris-*

matic sulphur forms the greater part of ordinary sulphur. It is soluble in bisulphide of carbon. If heated just to its point of fusion, it will have a coinciding melting and solidifying point at 248° (*B. C. Brodie.*) *Octohedral sulphur* may be obtained from freshly made soft sulphur, by acting on it with bisulphide of carbon, which dissolves it in part. This solution, by distilling off a portion of the bisulphide, yields, on cooling, octohedral sulphur. The melting point of this sulphur is 238°; but it is difficult to get it correctly, owing to the facility with which octohedral sulphur is changed by heat into the prismatic, with the effect of raising the melting point. (*B. C. Brodie.*) The solution, when no more crystals can be obtained from it, still contains sulphur, which may be separated as a cellular amorphous mass, called crummy sulphur, by the spontaneous evaporation of the solvent. *Crummy sulphur* forms from 2 to 5 per cent. of the soft sulphur; and, though obtained from its solution in bisulphide of carbon, cannot be redissolved in it, even at the boiling temperature. *Insoluble sulphur* is the name given to that part of the soft sulphur which is left undissolved by the bisulphide, amounting to between one-third and nearly one-half of the former. Mr. Brodie was unable to determine the melting point of this sulphur, but found it considerably above 248°, or the melting point of prismatic sulphur. Flowers of sulphur contain about one-third of their weight of insoluble sulphur. Crummy sulphur is either yellow or red, according as it is obtained from a soft sulphur which has been once or several times melted and poured out into water. What Magnus formerly called *red sulphur* is a red modification of crummy sulphur. Red and black sulphur are no longer considered by Magnus as allotropic states of sulphur; but rather as sulphur modified by the presence of a minute proportion of foreign matter. This opinion is founded on the discovery of Mitscherlich, confirmed by Magnus, that a number of substances, especially the fats and oils, when heated with sulphur, give it a red or black colour. Thus, one part of tallow, heated with 3000 parts of sulphur, imparts to it an intensely red colour; and the same proportion of paraffin changes it to red or black. So minute is the quantity of foreign matter, capable of producing this change, that Magnus asserts that sulphur, touched by the hands, will be coloured red by the greasy matter thereby imparted, upon being heated to 572°. *Black sulphur* forms a soft, greasy, ductile mass, which after a time solidifies, when it assumes a glassy appearance. (See *Chem. Gaz.*, May 15, 1854, and *Philos. Mag.*, Supplement, Jan. 1857.)

The physical properties of sulphur are remarkably modified by heating it in contact with a minute proportion of certain other substances. MM. Moutier have ascertained that, heated with $\frac{1}{400}$ of iodine, it becomes, on cooling, soft, plastic, and in great measure insoluble in bisulphide of carbon. The same authors found that many other substances have a similar effect on sulphur; as naphthalin, paraffin, creasote, camphor, and oil of turpentine; the quantity of the substance required varying from $\frac{1}{400}$ to $\frac{1}{600}$; and the necessary temperature being different with the substances used; camphor requiring 230° C., and naphthalin and oil of turpentine much more. After cooling, a paste is obtained, black, soft, plastic, ductile, which passes very slowly into the hard and brittle state of ordinary sulphur. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 288, A. D. 1865.)

According to M. Marès, sulphur mixed with carbonate of calcium, in the presence of the organic matters of the soil, is converted at first into sulphydric acid, then, under the influence of air and porous bodies into sulphuric acid, finally into sulphate of calcium; but Prof. Egidio Pollacer, on the contrary, thinks that sulphur, in contact with carbonate of calcium, passes very readily into sulphuric acid, and then to sulphate of calcium, independently of organic matters, and without being preliminarily changed into sulphydric acid; and this opinion he supports by several experiments. (*Journ. de Pharm.*, Oct. 1874, p. 330.)

Sulphur takes fire at about the temperature of 300°, and burns with a blue flame, combining with the oxygen of the air, and giving rise to a peculiar gaseous acid, called sulphurous acid. The combinations of sulphur are numerous, and among the most powerful agents of chemistry. It forms with oxygen four principal acids, the *hyposulphurous*, *sulphurous*, *hyposulphuric*, and *sulphuric*; with hydrogen, *sulphohydric acid* (*hydrosulphuric acid* or *suiphuretted hydrogen*); and with the metals, various

sulphurets or *sulphides.** Some of the sulphurets are analogous to acids, others to bases; and these different sulphurets, by combining with each other, form compounds, which, from their analogy to salts, are called by Berzelius *sulpho-salts.*

An extremely sensitive test of this element is a solution of molybdate of ammonia in muriatic acid, diluted with water, which is rendered blue by contact with even a trace of sulphur. (*Journ. de Pharm.*, Mai, 1862, p. 367.)

Sulphur, when obtained by roasting the native sulphurets, sometimes contains arsenic, and is thereby rendered poisonous. Sicilian sulphur, being volcanic, is not subject to this impurity. The common English roll sulphur is sometimes made from iron pyrites, and is then apt to contain orpiment (*tersulphuret of arsenic*). This impurity may be detected by heating the suspected sulphur with nitric acid. The arsenic, if present, will be converted into arsenic acid; and the nitric solution, diluted with water, neutralized with carbonate of sodium, and acidulated with muriatic acid, will give a yellow precipitate of quintosulphuret of arsenic with a stream of sulphuretted hydrogen. A precipitate may be more readily obtained from the nitric solution, if, after neutralization, sulphurous acid be added, which will convert the arsenic acid into the arsenious. This is more easily decomposed by the sulphuretted hydrogen; but the precipitate obtained will now be the tersulphuret. Sulphur, when perfectly pure, is wholly volatilized by heat, and soluble without residue in oil of turpentine. According to Dr. Playfair, a solution of nitroprusside of sodium is a delicate test for the alkaline sulphurets, producing with them a violet tint. The late Prof. Bailey, of West Point, employed the same test for detecting sulphur in any compound. The substance suspected to contain it is fused with carbonate of sodium, with the addition of carbonaceous matter if necessary. If sulphur be present it will be converted into sulphuret of sodium; and, upon the addition of a small portion of the fused mass to a drop of the nitroprusside, the characteristic violet tint will be produced.

Sublimed sulphur, usually called *flowers of sulphur* (*flores sulphuris*), is in the form of a crystalline powder of a fine yellow colour. It is always contaminated with a little sulphuric acid, which is formed at the expense of the oxygen of the air contained in the subliming chambers. Accordingly, it always reddens litmus; and, if the acid is present in considerable quantity, sometimes cakes. It may be freed from acidity by careful ablution with hot water, when it becomes the officinal washed sulphur.

Washed sulphur is placed in the list of Materia Medica of the U. S. Pharmacopœia, with an explanatory note, that it is sublimed sulphur, thoroughly washed with water. Washed sulphur has the general appearance of sublimed sulphur, and is wholly volatilized by heat. When properly prepared it does not affect litmus, and undergoes no change by exposure to the air.

Medical Properties and Uses. Sulphur is laxative, diaphoretic, and resolvent. It is supposed to be rendered soluble by the soda of the bile. M. Miahle teaches that it is carried into the circulation by the fatty matters in the alimentary canal which dissolve it. (*Med. T. and Gaz.*, June, 1868, p. 642.) It evidently passes off by the pores of the skin; as is shown by the fact that silver, worn in the pockets of patients under a course of it, becomes blackened with a coating of sulphuret. The stools which it occasions are usually solid, and it is gentle in its operation, unless it contain a good deal of acid, when it may cause griping; and the liability of the sublimed sulphur to contain acid, renders it less eligible for exhibition than the washed sulphur, from which all acidity is removed. The diseases in which sulphur is principally used are hemorrhoidal affections, atonic gout, chronic rheumatism, chronic catarrh, and asthma. It has also been given as an antiperiodic, being considered as particularly applicable to cases in which the apyrexia is incomplete. It is also much employed, both internally and externally,

* There appears also to be an acid composed of sulphur and oxygen, with a little hydrogen, associated with the sulphur as the radical. Prof. Schœnbein noticed that zinc, in an aqueous solution of sulphurous acid, assumes during the action temporarily a yellow colour, and has the power of decolorizing indigo. Schutzenberger, on investigating the subject, came to the conclusion that the phenomena were owing to the production of a new acid, which he succeeded in indicating, though with difficulty. He found the new acid to have the formula HI_2S_2O, and that it could be kept only out of contact with acids. (For particulars, see *Am. Journ. of Pharm.*, May, 1875, p. 343.)

in cutaneous affections, especially scabies, for the cure of which it is considered a specific. In these affections, as well as in chronic rheumatism, it is sometimes applied as an air bath, in the form of sulphurous acid gas, the head being protected from its effects. It has been employed with great success, by M. Lagauldrie, in diphtheric croup, given freely every hour, simply suspended in water. M. Thevenot finds it promptly effectual in the removal of diphtheric exudation, simply applied locally to the patches. (*Ann. de Thérap.*, A. D. 1867, p. 78.) Dr. Kieser recommends it highly in diphtheria, blowing the flowers, by means of a little cone of paper like a lamp-lighter, into the fauces three times a day. Usually from three to six insufflations are sufficient, in cases seen early, to remove the deposits; in neglected cases, from nine to ten are necessary. It is said also to be very useful in lead colic. (*Ibid.*, 1868, p. 108.) The external use of sulphur is strongly recommended by Dr. O'Connor, of London, in sciatica and chronic articular rheumatism. The limb affected is covered with sulphur, and bandaged with new flannel, over which sheets of wadding are wrapped. The dressing should not be taken off for several days; as its earlier removal would interfere with the absorption of the sulphur, on which its curative effect depends. (*Lancet*, Am. ed., June, 1857, p. 507.) The dose of sulphur is from one to three drachms, mixed with syrup or molasses, or taken in milk. It is often combined with bitartrate of potassium, or with magnesia.

According to M. Hannon, of Brussels, *soft sulphur*, recently prepared, possesses valuable therapeutic properties, not as a laxative, but as a stimulant to the circulation. lungs, and skin, far more active than ordinary sulphur. The dose of soft sulphur is from twenty to fifty grains, given in the form of pill. It has also been successfully employed for filling the hollows of carious teeth. (*Pharm. Journ.*, xvii. 330.)

Much sulphur is consumed in the arts, principally in the manufacture of gunpowder and sulphuric acid.

Off. Prep. of Sulphur Sublimatum. Confectio Sulphuris, *Br.;* Emplastrum Ammoniaci cum Hydrargyro; Emplastrum Hydrargyri, *Br.;* Hydrargyri Sulphuretum Rubrum, *U. S.;* Potassa Sulphurata, *Br.;* Potassii Sulphuretum, *U. S.;* Sulphur Præcipitatum; Sulphuris Iodidum; Unguentum Sulphuris. B.

SUMBUL RADIX. *Br.*

Sumbul Root.

The dried transverse sections of the root of a plant the botanical history of which is unknown. Imported from Russia and also from India. *Br.*

Under the name of *sumbul* or *jatamansi*, a root has long been used in India, Persia, and other parts of the East, as a perfume, an incense in religious ceremonies, and medicinally. It is the product of an unknown plant, supposed to be umbelliferous, and, from the character of the root, to grow in low wet places. The plant is said to inhabit no part of British India, but the regions to the north and east of it, as Nepaul, Bootan, Bucharia, &c. The root is taken northward to Russia, and reaches the rest of Europe through St. Petersburg. The physicians of Moscow and St. Petersburg were the first to employ it on the continent of Europe. Dr. Granville first introduced it to the notice of the profession in Great Britain and this country. It has also been imported into England from India, whither it was brought from a great distance in the interior.

Since the publication of the last preceding edition of this work (the 13th, A. D. 1870), it is stated that the Russians returning from their expedition into Bucharia, brought with them several roots, believed to be those of the plant supposed to produce Sumbul. These were taken to the Botanical Garden of Moscow, and one of them, which alone was in good condition, being planted, produced a plant which, at the latest accounts that we have seen, was in bloom. It is umbelliferous, and has received the name of *Sumbulus Moschatus;* but we have yet seen no botanical description of it. (*Am. Journ. of Pharm.*, Feb. 1871, p. 78; from Hager's *Ph. Centralblatte*, 1870, No. 39, 367.)

The medicine comes in transverse sections, from two to four or five inches in diameter, and from an inch to an inch and a half in length, with a dusky, light-brown, wrinkled epidermis, and an interior porous structure, consisting of coarse, irregular, easily separable fibres. The fresh cut surface of a transverse section presents, within the epidermis, an exterior white and spotted layer, and an inner yellow substance which forms the greater part of the root. Examined by means of a microscope, it exhibits translucent points which probably represent starch granules. Sumbul has a strong odour, much resembling that of musk, which it retains when long kept; and hence the name of *musk-root* sometimes attached to it. The taste, at first feebly sweetish, becomes after a time bitterish and balsamic, but not disagreeable; and a strong aroma is developed under mastication, diffusing itself with a sensation of warmth through the mouth and throat, and rendering the breath fragrant. This effect, however, is much diminished by time. That brought from India differs somewhat from the Russian, being of closer texture, more dense and firm, and of a reddish tint. (*Am. Journ. of Pharm.*, xxiv. 174; from *Pharm. Journ.*)

The root has been analyzed by Reinsch and other German chemists, and found to contain volatile oil, two balsamic resins, one soluble in alcohol, the other in ether, wax, gum, starch, a bitter substance soluble in water and alcohol, a crystallizable acid which Reinsch proposes to call *sumbulic acid*, and saline matter. The musklike odour seems to be connected with the balsamic resins, and probably depends on some principle associated with them not yet isolated. The volatile oil yielded by distilla tion has a taste like that of peppermint.

The virtues of the drug appear to be those of a nervous stimulant. It is used by the Russian physicians in low fevers of a typhous character, and in asthenic cases of dysentery and diarrhœa. It has also been employed by them with asserted success in malignant cholera. The authors, on the occasion of a visit in the summer of 1853 to St. Petersburg, were informed by Dr. Thielmann, physician to the Hospital of St. Peter and St. Paul, that he depended mainly on this remedy in the treatment of delirium tremens, having found it superior in its composing influence over that complaint even to opium. Dr. Granville recommends it in gastric spasm, hysteria, chlorosis, amenorrhœa, dysmenorrhœa, palsy of the limbs, epilepsy, and other nervous disorders. It is given in substance, infusion, decoction, and alcoholic and ethereal tincture. There seems to be no great precision in relation to the dose; but it is inferrible, from the accounts of the drug, that it may be used very much as we use valerian. The facts above stated are taken chiefly from a pamphlet by Dr. Granville, published in London, A. D. 1850.

Dr. Murawieff, of Russia, prepares the resin, which he considers as the active principle, by macerating the root first in water, and then in a solution of carbonate of sodium, washing it well with cold water, drying it, treating it with alcohol, filtering the tincture, adding a little lime and again filtering, separating the lime by sulphuric acid, agitating with animal charcoal, again filtering, distilling off nearly all the alcohol, mixing the residuum with water, driving off the remaining alcohol, and, finally, washing the precipitate with cold water, and drying it. The resin thus obtained is whitish, translucent, softening between the fingers, combustible without residue, of an acid taste, and an aromatic smell, like that of the root. Dr. Murawieff gives it in the dose of a grain or two, in the form of pill, three or four times a day, with or without opium, and has found it useful in chronic bronchitis and pneumonia slow of resolution, in the moist asthma of old, anemic, and scorbutic patients, in atonic dysentery, leucorrhœa, hypochondriasis, and hysteria. (*Dub. Quart. Journ.*, Feb. 1855, p. 252; from *Med. Zeit. Russland.*) Prof. Procter has published a formula for a fluid extract, of which the dose is from 15 minims to a fluidrachm. (*Am. Journ. of Pharm.*, xxvii. 233.)

A case is referred to in *New Remedies* (Oct. 1874, p. 309), in which a young man, having taken half an ounce of a tincture, which is an overdose, experienced narcotic symptoms, such as confusion of the head, a tendency to snore, even when awake, feelings of tingling, &c., with a strong odour of the medicine from the breath and skin, which continued for a day or two and then gradually passed off.

Off. Prep. Tinctura Sumbul, *Br.* W.

TABACUM. *U.S.*

Tobacco.

The commercial dried leaves of Nicotiana Tabacum. *U.S.*

Off. Syn. TABACI FOLIA. *Leaf Tobacco.* The dried leaves of Virginian tobacco, Nicotiana Tabacum. (*Linn.* Steph. & Church, *Med. Bot.*, plate 37.) Cultivated in America. *Br.*

Tabac, *Fr.;* Tabak, *Germ.;* Tobacco, *Ital.;* Tobaco, *Span.*

NICOTIANA. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Solanaceæ.

Gen. Ch. Corolla funnel-shaped with the border plaited. *Stamens* inclined. *Capsules* two-valved, two-celled. *Willd.*

Nicotiana Tabacum. Willd. *Sp. Plant.* i. 1014; Bigelow, *Am. Med. Bot.* ii. 171; Woodv. *Med. Bot.* p. 208, t. 77. The tobacco is an annual plant, with a large fibrous root, and an erect, round, hairy, viscid stem, which branches near the top, and rises from three to six feet in height. The leaves are numerous, alternate, sessile, and somewhat decurrent, very large, ovate-lanceolate, pointed, entire, slightly viscid, and of a pale-green colour. The lowest are often two feet long, and six inches broad. The flowers are disposed in loose terminal panicles, and are furnished with long, linear, pointed bractes at the divisions of the peduncle. The calyx is bell-shaped, hairy, somewhat viscid, and divided at its summit into five pointed segments. The tube of the corolla is twice as long as the calyx, of a greenish hue, swelling at top into an oblong cup, and ultimately expanding into a five-lobed, plaited, rose-coloured border. The whole corolla is very viscid. The filaments incline to one side, and support oblong anthers. The pistil consists of an oval germ, a slender style longer than the stamens, and a cleft stigma. The fruit is an ovate, two-valved, two-celled capsule, containing numerous reniform seeds, and opening at the summit. The leaves are the part employed. The seeds, examined by F. M. Brandt, yielded no narcotic principle, though a protein-like substance contained in them was thought, by its decomposition, to produce nicotia. (*Neues Jahrb. für Pharm.*, xxi. 42.) Prof. Procter also failed to find nicotia in the seeds. (*Proceed. of Am. Pharm. Assoc.*, 1858, p. 296.)

There is good reason to believe that this plant is a native of tropical America, where it was found by the Spaniards upon their arrival. It is at present cultivated in most parts of the world, and nowhere more abundantly than within the limits of the United States. Virginia is, perhaps, the region most celebrated for its culture. The young shoots, produced from seeds thickly sown in beds, are transplanted into the fields during the month of May, and set in rows with an interval of three or four feet between the plants. Through the whole period of its growth, the crop requires constant attention. The development of the leaves is promoted by removing the top of each plant, and thus preventing it from running into flower and seed. The harvest is in August. The ripe plants, having been cut off above their roots, are dried under cover, and then stripped of their leaves, which are tied in bundles, and packed in hogsheads. While hung up in the drying houses, they undergo a curing process, consisting in exposure to a considerable degree of heat, through which they become moist, or in other words are said to sweat, after which they are dried for packing.

Two varieties of this species are mentioned by authors, one with narrow, the other with broad leaves; but they do not differ materially in properties. Great diversity in the quality of tobacco is produced by difference of soil and mode of cultivation; and several varieties are recognised in commerce. Other species also of Nicotiana are cultivated, especially *N. rustica* and *N. paniculata*, the former of which is said to have been the first introduced into Europe, and is thought to have been cultivated by the aborigines of this country, as it is naturalized near the borders of some of our small northern lakes. The *N. quadrivalvis* of Pursh affords tobacco to the Indians of the Missouri and Columbia rivers; and *N. fruticosa*, a native of China, was probably cultivated in Asia before the discovery of this continent by Columbus. The latter species is said by Mr. John Le Conte to be that from which the best Cuba tobacco is obtained. (*Am. Journ. of Pharm.*, Sept. 1859; from *Proceed. of Acad. of Nat. Sci.*)

Properties. Tobacco, as it occurs in commerce, is of a yellowish-brown colour, a strong narcotic penetrating odour which is wanting in the fresh leaves, and a bitter, nauseous, and acrid taste. These properties are imparted to water and alcohol. They are injured by long boiling; and the extract is, therefore, relatively feeble. An elaborate analysis of tobacco was made by Vauquelin, who discovered in it, among other ingredients, an acrid, volatile, colourless liquid, slightly soluble in water, very soluble in alcohol, and supposed to be the active principle. It was separated by a complicated process, of which, however, the most important step was the distillation of tobacco juice with potassa. In the results of this distillation, Vauquelin recognised alkaline properties, which he ascribed to ammonia, but which were, in part at least, dependent upon the acrid principle alluded to. To this principle the name of *nicotin* was given; but its alkalinity was not ascertained till a subsequent period. Another substance was obtained by Hermstadt by simply distilling water from tobacco, and allowing the liquid to stand for several days. A white crystalline matter rose to the surface, which, upon being removed, was found to have the odour of tobacco, and to resemble it in effects. It was fusible, volatilizable, similar to the nicotin of Vauquelin in solubility, and without alkaline or acid properties. It was called *nicotianin* by Hermstadt, and appears to partake of the nature of volatile oils. Two German chemists, Posselt and Reimann, subsequently analyzed tobacco, and ascertained the alkaline nature of its active principle, which, however, neither they nor Vauquelin obtained in a state of purity. According to these chemists, 10,000 parts of the fresh leaves contain 6 parts of an alkaline substance, which they call *nicotin*, 1 of the *nicotianin* of Hermstadt, 287 of slightly bitter extractive, 174 of gum mixed with a little malate of calcium, 26·7 of green resin, 26 of albumen, 104·8 of a substance analogous to gluten, 51 of malic acid, 12 of malate of ammonium, 4·8 of sulphate of potassium, 6·3 of chloride of potassium, 9·5 of potassa, which was combined in the leaves with malic and nitric acids, 16·6 of phosphate of calcium, 24·2 of lime which had been combined with malic acid, 8·8 of silica, 496·9 of lignin, traces of starch, and 8828 parts of water. (Berzelius, *Traité de Chimie.*) According to M. E. Goupet, tobacco contains also a little citric acid. (*Chem. Gaz.*, Aug. 1846, p. 319.) The nicotin obtained by Vauquelin, and by Posselt and Reimann, was a colourless, volatile liquid, and, as subsequently ascertained by Henry and Boutron, was in fact an aqueous solution of the alkaline principle in connection with ammonia. It was reserved for these chemists to obtain nicotin, or *nicotia*, as it should now be called, in a state of purity. It exists in tobacco combined with an acid in excess, and in this state is not volatile.*

The following was the process employed by the Messrs. Henry and Boutron. Five hundred parts of smoking tobacco were exposed to distillation, in connection with about 6000 parts of water and 200 parts of caustic soda; the heat applied being at first very moderate, and afterwards increased to the boiling point. The product of the distillation was received in a vessel containing about 30 or 40 parts of sulphuric acid, diluted with 3 times its weight of water; and the process was continued till nearly one-half of the liquid had come over. The product, in which care was taken to preserve a slight excess of acid, was evaporated to about 100 parts, and then allowed to cool. A slight deposit which had formed was separated by filtration, an excess of caustic soda was added, and the liquor again distilled. A colourless, very volatile, acrid liquor now came over, which, being concentrated under the receiver of an air-pump, lost the ammonia which accompanied it, and assumed a syrupy consistence, and more or less of the colour of amber. In the liquid, after a few days, minute crystalline plates formed; but, in consequence of their affinity for moisture, it was difficult to isolate them. This liquid was pure nicotia. M. Debize obtains it by passing a current of steam through a mixture of tobacco and lime, contained in a cylinder, and condensing the vapour by a worm connected with the opposite extremity of the

* M. Liecke determines the proportion of nicotia in any specimen of tobacco as follows. He treats the dry leaves three times successively with water acidulated with sulphuric acid, and evaporates the liquid to the consistence of an extract. The extract is agitated with its volume of alcohol, and the tincture is filtered through paper previously washed with alcohol. It contains all the nicotia in the state of sulphate. After evaporating the alcohol, he decomposes the sulphate by caustic potassa in a distillatory apparatus of glass, which is heated gradually, by means of an oil-bath, to 260° C., and saturates the nicotia received by dilute sulphuric acid. (*Journ. de Pharm. et de Chim.*, Déc. 1867, p. 451.)—*Note to the thirteenth edition.*

cylinder from that at which the steam enters. The resulting liquid, which contains the nicotia, together with ammonia and some undetermined bases, is neutralized with sulphuric acid, then concentrated, and treated with ammonia and ether, by means of which an ethereal solution of nicotia is obtained. As this base is insoluble in solution of sulphate of ammonium, the solution of nicotia separates, and, rising to the surface, may be removed. The alkaloid may afterwards be obtained pure by rectification. (*Journ. de Pharm.*, Oct. 1860, p. 281.) For a mode of estimating the proportion of nicotia in tobacco, see *Pharm. Journ.* (December, 1873, p. 442). For an analysis of the ashes of Virginia tobacco, by MM. McD. Firby of N. Orleans, and J. A. Cahill, of Va., see *Chem. News* (Sept. 4, 1874, p. 117).

Nicotia. (*Nicotina. Nicotin.*) This is a colourless or nearly colourless fluid; of the sp. gr. 1·048; remaining liquid at 22° F.; of little smell when cold; of an exceedingly acrid burning taste, even when largely diluted; entirely volatilizable, and, in the state of vapour, very irritant to the nostrils, with an odour recalling that of tobacco;* inflammable; very soluble in water, alcohol, ether, the fixed oils, and oil of turpentine; strongly alkaline in its reaction; and capable of forming crystallizable salts with the acids. These salts are deliquescent, have a burning and acrid taste, and, like the salts of ammonia, lose a portion of their base by heat. Nicotia contains a much larger proportion of nitrogen than most of the other organic alkalies. Its formula is $N_2C_{20}H_{14}$, and combining number consequently 162. In its action on the animal system, it is one of the most virulent poisons known. A drop of it, in the state of concentrated solution, was sufficient to destroy a dog; and small birds perished at the approach of a tube containing it. In man, it is said to destroy life, in poisonous doses, in from two to five minutes. Tannin forms with it a compound of but slight solubility, and might be employed as a counter-poison. It exists in tobacco in small proportion. Henry and Boutron found different varieties of tobacco to give products varying from 3·8 to 11·28 parts in 1000. It has been found in the seeds, and in very small proportion in the root. (See *Journ. de Pharm.*, xxii. 689.) There can be little doubt that tobacco owes its activity to this alkaloid.† It has been employed as a poison. For a very interesting account of it in all its toxicological relations, the reader is referred to a memoir by Orfila, translated by Dr. Lee, and published in the *N. Y. Journ. of Med.* (N. S., ix. 112, 219, and 369). A more recent paper on the same subject, by Dr. A. S. Taylor, is contained in the *Pharmaceutical Journal* for June, 1859 (p. 620). Nicotia has the remarkable property of resisting decomposition amid the decaying tissues of the body, and was detected by Orfila in the bodies of animals destroyed by it two or three months after their death. Prof. F. F. Mayer, of New York, has concluded from his experiments, that nicotia is the active principle in all parts of the plant both before and after curing. (*Proc. Am. Pharm. Assoc.*, 1865.)

Nicotianin is probably the odorous principle of tobacco. Posselt and Reimann prepared it by distilling six pounds of the fresh leaves with twelve pounds of water, till one-half of the liquid passed over, then adding six pounds more of water, and again distilling, and repeating this process three times. The nicotianin was obtained to the amount of eleven grains, floating on the surface of the water. It was a fatty substance, having the smell of tobacco-smoke, and an aromatic somewhat bitter taste. It was volatilizable by heat, insoluble in water, soluble in alcohol and ether, and not affected by the dilute acids, but dissolved by solution of potassa. This was not ob-

* It boils at 482° F., undergoing, however, partial decomposition in the process; but, heated in a stream of hydrogen, it distils over unaltered between 212° and 392° F. (Frezenius, *Am. Journ. of Pharm.*, Jan. 1867, p. 27.)

† M. Schloesing obtained a much larger proportion that that stated above, by the following process. Tobacco is exhausted by boiling water, the infusion evaporated to a semi-solid consistence, and the extract shaken with twice its volume of alcohol of 36°. Two layers form, of which the upper contains all the nicotia. This is decanted, most of the alcohol evaporated, and alcohol anew added in order to precipitate certain matters. The extract is treated with a concentrated solution of potassa, and, after cooling, is shaken with ether, which dissolves the nicotia. To the ethereal solution powdered oxalic acid is added, which unites with the nicotia, and separates in the form of a syrupy mass. This, being washed with ether, treated with potassa, taken up by water, and distilled in a water-bath, yields the nicotia, which may be obtained pure by rectification in a current of hydrogen. (*Journ. de Pharm.*, 3e sér., xii. 157.) Orfila, in his memoir on nicotia, states that Havana tobacco yields 2 per cent. of this alkaloid, Maryland 2·3 per cent., and Virginia 6·9 per cent.

tained by Henry and Boutron. It produces sneezing when applied to the nostrils, and a grain of it swallowed by Hermstadt occasioned giddiness and nausea.

The presence of sulphuretted hydrogen and hydrocyanic acid in tobacco-smoke was thought to have been demonstrated by Dr. A. Vogel and C. Reischauer. (See *Am. Journ. of Pharm.*, Jan. 1859, p. 76.) The presence of hydrocyanic acid in the smoke was thought to be proved by the paper of Schœnbein (guaiac paper moistened with a solution of sulphate of copper), becoming blue in contact with the smoke; but MM. Péggiale and Marty have shown by experiments that the reaction of this test is not reliable, and that tobacco-smoke does not contain hydrocyanic acid. (*Journ. de Pharm.*, Mars, 1870, p. 216.)

When distilled at a temperature above that of boiling water, tobacco affords an empyreumatic oil, which Mr. Brodie proved to be a most virulent poison. A single drop, injected into the rectum of a cat, occasioned death in about five minutes, and double the quantity, administered in the same manner to a dog, was followed by the same result. This oil is of a dark-brown colour, and an acrid taste, and has a very peculiar smell, exactly resembling that of tobacco-pipes which have been much used. It has been shown to contain nicotia. (*Ann. de Chim. et de Phys.*, 3e sér., ix. 465.)

It is quite certain that tobacco leaves undergo considerable chemical changes during the processes of curing, and preparation for use. Thus, the characteristic odour of ordinary tobacco is entirely different from that of the fresh leaves, and must be owing to the generation of a new volatile principle. The proportion, too, of nicotia contained in prepared tobacco is asserted to be greater than in the fresh. It appears that a kind of fermentation takes place in the leaves, by which certain pre-existing principles are converted into nicotianin and possibly nicotia. A similar change is probably produced during the combustion of tobacco; for M. Malapert obtained, from the condensed products of a portion of common French smoking tobacco which he burned, as much as 9 per cent. of nicotia, while the proportion obtained by the ordinary process seldom exceeds 2 per cent., and the highest proportion of which we have seen any account is 6·9 per cent. (See *Am. Journ. of Pharm.*, xxvii. 119.) It has even been made a question, whether nicotia exists at all in the fresh growing leaves; but this question has been experimentally decided in the affirmative by Prof. Procter (*Proceed. of Am. Pharm. Assoc.*, 1858, p. 300); and Prof. Mayer, of N. York, has experimentally determined that the nicotia exists as largely in the plant before as after curing; indeed, he believes that it is somewhat diminished in the process, probably in part if not altogether by volatilization. (*Ibid.*, A. D. 1865.)*

* Observations and experiments of their own, had led MM. H. Vohl and Eulenberg to conclusions, in relation to tobacco, so different from those hitherto generally entertained, that it is necessary to introduce them here; but it is also necessary that they should await the result of further inquiry, before being admitted as positively true. Finding that snuff contained only from ·0392 to ·062 per cent. of nicotia, the strongest chewing tobacco a mere trace, and some specimens of this kind none at all, they concluded that the poisonous properties of tobacco could not be owing to the alkaloid; but they seem to have forgotten how extremely powerful nicotia really is; so that one part in two hundred, which would represent about the proportion above indicated, might cause death in a dog and perhaps in man, from two or three drachms of tobacco, through the nicotia alone. But, while I think that nicotia may exist in tobacco in quantities sufficient to render it highly poisonous, yet it must be admitted that the drug sometimes contains so little as hardly to be felt, and in other instances seems to be altogether destitute of it, and consequently contains other narcotic and perhaps poisonous ingredients quite independent of nicotia.

The most interesting part, however, of this communication, is the analysis of tobacco-smoke. The smoke analyzed was of strong tobacco, containing 4 per cent. of nicotine. Notwithstanding this large proportion of nicotine, none of it was found in the smoke; the authors differing from most previous observers; Zeise alone having as early as 1843 declared its non-existence. The authors ascribe the mistake of others to the existence in the smoke of certain products closely resembling nicotine in sensible and physiological properties; the nicotine bases, namely, having a high boiling point, such as parvotine.

When cigars are smoked, certain gases are given off, which, when collected and examined, proved to be oxygen, nitrogen, carbonic acid, and marsh gas. The smoke was drawn first through a potassa solution to collect acids, and then through dilute sulphuric acid to collect bases. With the potassa solution, an oily substance appeared on the surface, having an almost intolerable odour of tobacco juice, and from this was obtained by distillation at a gradually increasing temperature, at first a liquid and oily product, and at the temperature of 300°, a substance which on cooling became a laminated mass. This, on being repeatedly crystallized from ether, assumed the appearance of pearly white scales, melting between 94° and 95°, and of a higher boiling point than mercury. From these characters, as well as its percentage composition, this substance appears to be iden-

The distinguishing character of tobacco, as given in the Br. Pharmacopœia, is that, when distilled with solution of potassa, it yields an alkaline fluid, having the peculiar odour of nicotia, and giving precipitates with perchloride of platinum and tincture of galls.

Medical Properties and Uses. Tobacco unites, with the powers of a sedative narcotic, those of an emetic and diuretic; and produces these effects to a greater or less extent to whatever surface it may be applied. In addition, when snuffed up the nostrils, it excites violent sneezing and a copious secretion of mucus; when chewed, it irritates the mucous membrane of the mouth, and increases the flow of saliva; and, when injected into the rectum, it sometimes operates as a cathartic. Moderately taken, it quiets restlessness, calms mental and corporeal inquietude, and produces a state of general languor or repose, which has great charms for those habituated to the impression. In larger quantities, it gives rise to confusion of the head, vertigo, stupor, faintness, nausea, vomiting, and general depression of the nervous and circulatory functions, which, if increased, eventuates in alarming and even fatal prostration. The symptoms of its excessive action are severe retching, with the most distressing and continued nausea, great feebleness of pulse, coolness of the skin, fainting, and sometimes convulsions. It probably operates both through the medium of the nervous system, and by entering the circulation. As its local action is stimulant, we can thus account for the fact, that it excites the function of the kidneys, at the same time that it reduces the nervous and secondarily the arterial power. The experiments of Brodie lead to the inference that the function of the heart is affected by tobacco, through the medium of the nervous system; for, in a decapitated animal in which the circulation was sustained by artificial respiration, the infusion injected into the rectum did not diminish the action of the heart; while, on the contrary, this organ almost immediately ceased to contract, when an equal dose of the poison was administered to a healthy animal. Mr. Brodie observed a remarkable difference between the operation of the infusion and that of the empyreumatic oil. After death from the former the heart was found completely quiescent, while it continued to act with regularity for a considerable time after apparent death from the latter. We may infer from this fact, either that there are two poisonous principles in tobacco, or that a new narcotic product is formed during its destructive distillation. In cases of poisoning from tobacco, the indications are, after the evacuation of the poison, to support the system by external and internal stimulants, and to allay irritation of stomach by opiates.

The use of tobacco was adopted by the Spaniards from the American Indians. In the year 1560, it was introduced into France by the Ambassador of that country at the court of Lisbon, whose name — Nicot — has been perpetuated in the generic title

tical with the carbohydrate ($C_{19}H_{18}$) discovered by Kraut. The oily distillate before this, having been purified by repeated treatment with potassa and sulphuric acid, had a sp. gr. 0·8 to 0·87, and from its percentage composition (92 or 93 C., and 8 or 7 H.) appears to be a mixture of different hydrocarbons, belonging to the benzene or some analogous series. The potassa solution, after the separation of the oils, yielded, under appropriate treatment, a large amount of gas, consisting of dioxide of carbon, and cyanide and sulphide of hydrogen, consequently the statement that tobacco-smoke contains no cyanogen is a mistake.

Upon a distillation of the potassa solution after the addition of sulphuric acid, several acids were found in the distillate; viz. acetic, propionic, butyric, valerianic, and carbolic, with a portion of creasote, more doubtfully caproic, caprilic, and succinic acids.

The sulphuric acid solution now only remained for examination. From this, which had become dark-coloured and thick on standing, a *dark-brown resin* was separated. By treatment with potassa, *ammoniacal vapours* escaped, and a *brown oil* with the odour of tobacco juice floated on the surface. From the residuary liquid, after distillation, saturation with caustic potassa, and redistillation, vapours escaped which proved to be *chloride of ammonium*. After further treatment, for which we refer to the original, the oily residue was divided by fractional distillation, and a whole series of picoline bases, analogous to the aniline bases, were obtained. The identity of the following was determined by their boiling point, percentage, composition, and the composition of the double platinum salt: *pyridine*, C_5H_5N, boiling point 115° to 116°; *picoline*, C_6H_7N, boiling point 134° to 135° C.; *lutidine*, C_7H_9N, b. p. 155°; *collidine*, $C_8H_{11}N$, b. p. 171·5° (isomeric with xylidine); *parvoline*, $C_9H_{13}N$, b. p. 187° to 188° (isomeric with cumeidine); *coridine*, $C_{10}H_{15}N$, b. p. 211°; *rubidine*, $C_{11}H_{17}N$; and "probably" viridine, $C_{12}H_{19}N$, b. p. 251°. No trace of *nicotine* was to be found. The authors experimented physiologically with only a mixture, two of those boiling below 160°, and of those between 160° and 250°; and these were found, like nicotine, to cause contraction of the pupil, dyspnœa, general convulsions, and death. (H. Vohl and H. Eulenberg, *Pharm. Journ.*, Jan. 1872, p. 567.)—*Note to the fourteenth edition.*

of the plant. Sir Walter Raleigh is said to have introduced the practice of smoking into England. In the various modes of smoking, chewing, and snuffing, the drug is now largely consumed in every country on the globe. It must have properties peculiarly adapted to the propensities of our nature, to have thus surmounted the first repugnance to its odour and taste, and to have become the passion of so many millions. When employed in excess, it enfeebles digestion, produces emaciation and general debility, and lays the foundation of serious nervous disorders. The late Dr. Chapman informed us that he had met with several instances of mental disorder closely resembling delirium tremens, which resulted from its abuse, and which subsided in a few days after it had been abandoned; and Dr. Kirkbride, in the *Annual Report of the Pennsylvania Hospital for the Insane for* 1850, refers to four cases of insanity, the origin of which was ascribed to the abuse of tobacco. Among the ill effects ascribed to the habitual excessive use of tobacco, are premature gray hairs and baldness (Dr. D. B. Hoffman, *Med. Record.*, Sept. 1, 1868; from *Pacific Med. and Surg. Journ.*), and colour blindness, or the loss of sensibility of the eye to colour. (*Med. and Surg. Reporter*, April 8, 1871, p. 292.) In the form of snuff, tobacco is sometimes so much contaminated with lead, in consequence of being kept in leaden boxes, as to endanger the poisonous effects of that metal. In different kinds of snuff, Dr. A. Vogel has found from 0·014 to 1·025 per cent. of lead. (See *Am. Journ. of Pharm.*, Sept. 1864, p. 422.)

Its remedial employment is less extensive than might be inferred from the variety of its powers. The excessive and distressing nausea which it is apt to occasion. interferes with its internal use; and it is very seldom administered by the stomach. As a narcotic it is employed chiefly to produce relaxation in spasmodic affections. For this purpose the infusion or smoke of tobacco, or the leaf in substance in the shape of a suppository, is introduced into the rectum in cases of strangulated hernia, obstinate constipation from spasm of the bowels, and retention of urine from a spasmodic stricture of the urethra. A case is recorded by Dr. E. A. Hervey, of Rossville, Staten Island, N. Y., in which pleurodine, with obstinate sleeplessness, in a man previously inured to tobacco, was entirely relieved by the moderate use of smoking. (*Amer. Journ. of the Medical Sci.*, Jany. 1869, p. 99.) For a similar purpose, the powdered tobacco, or common snuff, mixed with simple cerate, as recommended by the late Dr. Godman, is sometimes applied to the throat and breast in cases of croup; and Dr. Chapman directed the smoking of a cigar in the same complaint, with decided benefit. One of the worst cases of spasm of the rima glottidis which we have seen, and which resisted powerful depletion by the lancet, yielded to the application of a tobacco cataplasm to the throat. A similar application to the abdomen is highly recommended in painter's colic, and has proved useful in hysterical convulsions. Tetanus is said to have been cured by baths made with the decoction of the fresh leaves; and an infusion of the leaves has been given internally with success in a case of poisoning by strychnia. (*Dub. Med. Press*, June 23, 1858.) The relaxation produced by smoking in a person unaccustomed to it, was very happily resorted to by Dr. Physick, in a case of obstinate and long-continued dislocation of the jaw; and the same remedy has frequently been found useful in the paroxysm of spasmodic asthma. Tobacco has been highly recommended, in the form of cataplasm, in articular gout and rheumatism; and has been employed in the same way, as well as by injection, in cases of obstinate verminose affections. As an emetic it is seldom employed, unless in the shape of a cataplasm to the epigastrium, to assist the action of internal medicines, in cases of great insensibility of stomach. As a diuretic it was used by Fowler in dropsy and dysury; but the practice is not often imitated. There is no better errhine than tobacco, for the ordinary purposes for which this class of medicines is employed. It is said that snuff, drawn into the nostrils, is an effectual remedy for maggots in the nose. (*Med. Times and Gaz.*, Feb. 1875, p. 156.) As a sialagogue, it is beneficial in rheumatism of the jaws, and often relieves toothache by its anodyne action. It is also used externally, in the shape of cataplasm, infusion, or ointment, in cases of tinea capitis, psora, and some other cutaneous affections. The empyreumatic oil mixed with simple ointment, in the proportion of twenty drops to the ounce, has been applied with advantage, by Amer-

ican practitioners, to indolent tumours and ulcers; but, in consequence of its liability to be absorbed, and to produce unpleasant effects on the system, it should be used with great caution. (See *Oleum Tabàci.*) This remark is applicable to all the modes of employing tobacco; particularly to the injection of the infusion into the rectum, which has caused death in several instances. It is even more dangerous than a proportionate quantity introduced into the stomach; as, in the latter case, the poison is more apt to be rejected. Even the external application of the leaves or powder is not without danger, especially when the cuticle is removed. A case of death is on record, occurring in a child eight years old, in consequence of the application of the expressed juice of the leaves to the head, for the cure of tinea capitis. Death has also been produced by the inhalation of the smoke.

Five or six grains of powdered tobacco will generally act as an emetic; but the remedy is not given in this shape. The infusion used in dropsy by Fowler was made in the proportion of an ounce to a pint of boiling water, and given in the dose of sixty or eighty drops. The officinal infusion, which is employed for injection, is much weaker. (See *Infusum Tabaci.*) A wine and an ointment of tobacco are directed by the U. S. Pharmacopœia.

Off. Prep. Enema Tabaci, *Br.;* Infusum Tabaci, *U. S.;* Oleum Tabaci, *U. S.;* Unguentum Tabaci, *U. S.;* Vinum Tabaci, *U. S.* W.

TAMARINDUS. *U. S., Br.*

Tamarind.

The preserved fruit of Tamarindus Indica. *U. S.* The preserved pulp of the fruit. *Br.*

Tamarins, *Fr.;* Tamarinden, *Germ.;* Tamarindi, *Ital.;* Tamarindos, *Span.*

TAMARINDUS. *Sex. Syst.* Monadelphia Triandria.—*Nat. Ord.* Fabaceæ or Leguminosæ.

Gen. Ch. Calyx four-parted. *Petals* three. *Nectary* with two short bristles under the filaments. *Legume* filled with pulp. *Willd.*

Tamarindus Indica. Willd. *Sp. Plant.* iii. 577; Woodv. *Med. Bot.* p. 448, t. 161. The tamarind tree is the only species of this genus. It rises to a great height, sends off numerous spreading branches, and has a beautiful appearance. The trunk is erect, thick, and covered with a rough, ash-coloured bark. The leaves are alternate and pinnate, composed of many pairs of opposite leaflets, which are almost sessile, entire, oblong, obtuse, unequal at their base, about half an inch long by a sixth of an inch broad, and of a yellowish-green colour. The flowers, which are in small lateral racemes, have a yellowish calyx, and yellow petals beautifully variegated with red veins. The fruit is a broad, compressed, reddish ash-coloured pod, much curved, from two to six inches long, with numerous brown, flat, quadrangular seeds, contained in cells formed by a tough membrane. Exterior to this membrane is a light-coloured acid pulpy matter, between which and the shell are several tough ligneous strings, running from the stem to the extremity of the pod, the attachment of which they serve to strengthen. The shells are fragile and easily separated.

Tamarindus Indica appears to be a native of the East and West Indies, Egypt, and Arabia, though believed by some to have been imported into America. Dr. Barth, the African traveller, found it abundant in the interior of Africa, and one of the greatest ornaments of Negroland. (*Travels in Africa*, Am. ed., 1857, i. 418.) De Candolle is doubtful whether the East and West India trees are of the same species. It is stated by writers that the pods of the former are much larger than those of the latter, and have a greater number of seeds; the East India tamarinds containing six or seven, those from the West Indies rarely more than three or four. We found, however, in a parcel of the latter in our possession, numerous pods with from eight to ten seeds, and the number generally exceeded four. The fruit is the officinal portion.

Tamarinds are brought to us chiefly, if not exclusively, from the West Indies, where they are prepared by placing the pods, previously deprived of their shell, in layers in a cask, and pouring boiling syrup over them. A better mode, sometimes

practised, is to place them in stone jars, with alternate layers of powdered sugar. They are said to be occasionally prepared in copper boilers.

Properties. Fresh tamarinds, which are sometimes, though rarely, brought to this country, have an agreeable sour taste, without any mixture of sweetness. As we usually find them, in the preserved state, they form a dark-coloured adhesive mass, consisting of syrup mixed with the pulp, membrane, strings, and seeds of the pod, and of a sweet acidulous taste. The seeds should be hard, clean, and not swollen, the strings tough and entire, and the smell without mustiness. From the analysis of Vauquelin, it appears that in 100 parts of the pulp of tamarinds, independently of the sugar added to them, there are 9·40 parts of citric acid, 1·55 of tartaric acid, 0·45 of malic acid, 3·25 of bitartrate of potassium, 4·70 of gum, 6·25 of jelly, 34·35 of parenchymatous matter, and 27·55 of water; so that the acidity is owing chiefly to citric acid. It is said that copper may sometimes be detected in preserved tamarinds, derived from the boilers in which they are occasionally prepared. Its presence may be ascertained by the reddish coat which it imparts to the blade of a knife immersed in the tamarinds.

Medical Properties and Uses. Tamarinds are laxative and refrigerant, and infused in water form a highly grateful drink in febrile diseases. Convalescents often find the pulp a pleasant addition to their diet, and useful by preserving the bowels in a loose condition. It is sometimes prescribed in connection with other mild cathartics, and is one of the ingredients in the confection of senna. Though frequently given with infusion of senna to cover its taste, it is said to weaken its purgative power; and the same observation has been made of its influence upon the resinous cathartics in general. From a drachm to an ounce or more may be taken at a dose.

Off. Prep. Confectio Sennæ. W.

TANACETUM. *U. S. Secondary.*

Tansy.

The leaves and tops of Tanacetum vulgare. *U. S.*

Tanaisie, *Fr.;* Gemeiner Rheinfarrn, Wurmkraut, *Germ.;* Tanaceto, *Ital., Span.*

TANACETUM. *Sex. Syst.* Syngenesia Superflua.—*Nat. Ord.* Compositæ-Senecionideæ, *De Candolle;* Asteraceæ, *Lindley.*

Gen. Ch. Receptacle naked. *Pappus* somewhat emarginate. *Calyx* imbricate, hemispherical. *Corolla* rays obsolete, trifid. *Willd.*

Tanacetum vulgare. Willd. *Sp. Plant.* iii. 1814; Woodv. *Med. Bot.* p. 66, t. 27. This is a perennial herbaceous plant, rising two or three feet in height. The stems are strong, erect, obscurely hexagonal, striated, often reddish, branched towards the summit, and furnished with alternate, doubly pinnatifid leaves, the divisions of which are notched or deeply serrate. The flowers are yellow, and in dense terminal corymbs. Each flower is composed of numerous florets, of which those constituting the disk are perfect and five-cleft, those of the ray very few, pistillate, and trifid. The calyx consists of small, imbricated, lanceolate leaflets, having a dry, scaly margin. The seeds are small, oblong, with five or six ribs, and crowned with a membranous pappus.

Tansy is cultivated in our gardens, and grows wild in the roads and in old fields; but was introduced from Europe, where it is indigenous. It is in flower from July to September.

There is a variety of the plant with curled leaves, which is said to be more grateful to the stomach than that above described, but has less of the peculiar sensible properties of the herb, and is probably less active.

The odour of tansy is strong, peculiar, and fragrant, but much diminished by drying; the taste is warm, bitter, somewhat acrid, and aromatic. These properties are imparted to water and alcohol. According to Peschier, the leaves contain volatile oil, fixed oil, wax or stearin, chlorophyll, yellow resin, yellow colouring matter, tannic and gallic acids, bitter extractive, gum, lignin, and a peculiar acid which he calls *tanacetic*, and which precipitates lime, baryta, oxide of lead, and oxide of copper. The medical virtues of the plant depend on the bitter extractive and volatile oil. The latter, when separated by distillation, has a greenish-yellow colour, with the flavour of the plant.

is lighter than water, and deposits camphor upon standing. The seeds contain the largest proportion of the bitter principle, and the least of volatile oil. According to Zeller, one pound of the fresh herb, in flower, yields upon an average twenty-four grains of oil. (*Cent. Blatt*, 1855, p. 206.)

Medical Properties and Uses. Tansy has the medical properties of the aromatic bitters. It has been recommended in intermittents, hysteria, amenorrhœa, and as a preventive of arthritic paroxysms; but at present it is chiefly used as an anthelmintic, and in this country is little employed, for any purpose, in regular practice. The seeds are said to be most effectual as a vermifuge. The leaves have proved, in the hands of Dr. C. Prentice Uhle, to possess extraordinary powers as a local remedy in arresting epistaxis, the simple odour being sometimes sufficient to check the hemorrhage. (*Med. and Surg. Reporter*, May 25, 1867, p. 442.) The dose of the powder is from thirty grains to a drachm two or three times a day; but the infusion is more frequently administered. A fatal case of poisoning with half an ounce of oil of tansy is recorded in the *Medical Magazine* for November, 1834. Frequent and violent clonic spasms were experienced, with much disturbance of respiration; and the action of the heart gradually became weaker till death took place from its entire suspension. No inflammation of the stomach or bowels was discovered upon dissection. (*Am. Journ. of the Med. Sci.*, xvi. 256.) Two other fatal cases have since been recorded, one in which more than a fluidounce was taken, the other only a fluidrachm. In both death followed speedily, preceded by coma and violent convulsions. In two of the three cases above referred to, the oil seems to have been taken to produce abortion, but no such effect followed in either. (*Ibid.*, xxiii. 136, and xxiv. 279.) Dr. Pendleton records a case, in which death resulted to a negress of twenty-one from a considerable quantity of strong decoction of tansy taken internally. In the *Journal de Pharmacie* (Avril, 1870, p. 321) mention is made of a girl who, having taken half an ounce of the oil with the intent to produce abortion, was seized with convulsions with foaming of the mouth, followed by profound coma, dilated pupils, frequent and feeble pulse, &c.; but in this case recovery took place after vomiting, maintained by warm drinks, sassafras, and a dose of castor oil.

Tanacetic acid may be obtained by concentrating to the consistence of honey the residue after the distillation of the tops, heating with chalk and animal charcoal, and evaporating. If the residue be stirred with water acidulated first with muriatic, and afterwards with acetic acid, coloured crystals of tanacetic acid are obtained, which are to be washed with distilled water. It has an acrid and bitter taste, is soluble in water, but insoluble in alcohol or ether, and forms crystallizable salts. It is said to have vermifuge properties similar to those of santonin, and may be given in the same dose. (*Journ. de Pharm.*, 1871, p. 337.) W.

TAPIOCA. *U.S.*

Tapioca.

The fecula of the root of Janipha Manihot. *U.S.*

Janipha. *Sex. Syst.* Monœcia Monadelphia.—*Nat. Ord.* Euphorbiaceæ.

Gen. Ch. Calyx campanulate, five-parted. *Stamens* ten, distinct, alternately shorter. *Stigmas* three, many-lobed. *Fruit* three-celled, with solitary seeds (Lindley, *Med. and Œconom. Bot.*, 82.)

Botanists have generally followed Kunth in separating this genus from Jatropha. Its name was derived from the Indian designation of another species.

Janipha Manihot. Curtis's *Bot. Mag.* 3071.—*Jatropha Manihot.* Willd. *Sp. Plant.* iv. 562. This is the *cassava* plant or manioc of the West Indies, the *mandioca* or *tapioca* of Brazil. It is a shrub about six or eight feet high, with a very large, white, fleshy, tuberous root, which often weighs thirty pounds. The stem is round, jointed, and furnished at its upper part with alternate petiolate leaves, deeply divided into three, five, or seven oval-lanceolate, very acute lobes, which are somewhat wavy upon their borders, deep-green on their upper surface, glaucous and whitish beneath. The flowers are in axillary racemes.

Janipha Manihot is a native of South America, and is cultivated extensively in the West Indies, Brazil and other parts of tropical America, and in Liberia, for the sake of its root, which is much employed as an article of food. The plant is propagated by cuttings. It is of quick growth, and the root arrives at perfection in about eight months. There are two varieties, distinguished by the names of *sweet* and *bitter*. The root of the former may be eaten with impunity; that of the latter, which is the most extensively cultivated, abounds in an acrid milky juice, which renders it highly poisonous if eaten in the recent state. By MM. Henry and Boutron-Charlard it has been ascertained that the bitter cassava owes its poisonous properties to hydrocyanic acid. (*Journ. de Pharm.*, xxii. 119.) Both varieties contain a large proportion of starch. The root is prepared for use by washing, scraping, and grating or grinding it into a pulp, which, in the bitter variety, is submitted to pressure so as to separate the deleterious juice. It is now in the state of meal or powder, which is made into bread, cakes, or puddings. As the poisonous principle is volatile, the portion which may have remained in the meal is entirely dissipated by the heat employed in cooking. The preparation denominated tapioca among us is obtained from the expressed juice. This, upon standing, deposits a powder, which, after repeated washings with cold water, is nearly pure starch. It is dried by exposure to heat, which renders it partly soluble in cold water, and enables it to assume its characteristic consistence. When dried without heat, it is pulverulent, and closely resembles the fecula of arrow-root. In Demarara, as we are told by M. Pagot, the manioc juice, after having been deprived of all injurious properties by boiling, is used as a sauce for the table. (*Pharm. Journ.*, Jan. 1873, p. 569.)

Tapioca is in irregular, hard, white, rough grains, possessing little taste, partially soluble in cold water, and affording a fine blue colour when iodine is added to its filtered solution. The partial solubility in cold water is owing to the rupture of the starch-granules by heat. Examined under the microscope, the granules appear partly broken, partly entire. The latter are muller-shaped, about the two-thousandth of an inch in diameter, more uniform in size than the granules of most other varieties of fecula, with a distinct hilum, which is surrounded by rings, and cracks in a stellate manner. *Tapioca meal*, called sometimes Brazilian arrow-root, and by the French *moussache*, is the fecula dried without heat. Its granules are identical with those already described. Being nutritious, and at the same time easy of digestion, and destitute of irritating properties, tapioca forms an excellent diet for the sick and convalescent. It is prepared for use by boiling it in water. Lemon-juice and sugar are usually grateful additions; and in low states of disease or cases of debility, it may be advantageously impregnated with wine and nutmeg or other aromatic.

A factitious tapioca is found in the shops, consisting of very small, smooth, spherical grains, and supposed to be prepared from potato starch. It is sold under the name of *pearl tapioca*. W.

TARAXACUM. *U. S.*

Dandelion.

The root, gathered in the autumn, of Taraxacum Dens-leonis (*De Cand.*). *U. S. Off. Syn.* TARAXACI RADIX. *Dandelion Root.* The fresh and dried roots of Taraxacum Dens Leonis, *D. C.;* Woodv. *Med. Bot.* (*Leontodon Taraxacum*), plate 3, gathered between September and February, from meadows and pastures in Britain. *Br.*

Pissenlit, Dent de lion, *Fr.;* Löwenzahn, *Germ.;* Tarassaco, *Ital.;* Diente de leon, *Span.*

LEONTODON. *Sex. Syst.* Syngenesia Æqualis.—*Nat. Ord.* Compositæ-Cichoraceæ, *De Candolle;* Cichoraceæ, *Lindley.*

Gen. Ch. Receptacle naked. *Calyx* double. *Seed-down* stipitate, hairy. *Willd.*

Leontodon Taraxacum. Willd. *Sp. Plant.* iii. 1544; Woodv. *Med. Bot.* p. 39, t. 16.—*Taraxacum Dens-leonis.* De Cand. *Prodrom.* vii. 145. The dandelion is an herbaceous plant, with a perennial fusiform root. The leaves, which spring immediately from the root, are long, pinnatifid, generally runcinate, with the divisions toothed, smooth, and of a fine green colour. The common name of the plant was

derived from the fancied resemblance of its leaves to the teeth of a lion. The flower-stem rises from the midst of the leaves, six inches or more in height. It is erect, simple, naked, smooth, hollow, fragile, and terminated by a large golden-coloured flower, which closes in the evening, and expands with the returning light of the sun. The calyx is smooth and double, with the outer scales bent downwards. The florets are very numerous, ligulate, and toothed at their extremities. The receptacle is convex and punctured. The seed-down is stipitate, and at the period of maturity is disposed in a spherical form, and is so light and feathery as to be easily borne away by the wind, with the seeds attached.

This species of Leontodon grows spontaneously in most parts of the globe. It is abundant in this country, adorning our grass-plats and pasture-grounds with its bright-yellow flowers, which, in moist places, show themselves with the first opening of spring, and continue to appear till near the close of summer. In India, the plant is cultivated in various parts of the country, and its root collected for use between the months of September and February. (John R. Jackson, *Pharm. Journ.*, Dec. 1871, p. 523.) All parts of the plant contain a milky bitterish juice, which exudes when they are broken or wounded. The leaves, when very young and blanched by the absence of light during their growth, are tender and not unpleasant to the taste, and are sometimes used as a salad. When older and of their natural colour, they are medicinal. The Pharmacopœias recognise only the root, which is by far the most efficacious part. It should be full grown when collected, and should be employed in the recent state, as it is then most active. It does not, however, as stated by Duncan, lose nearly all its bitterness by drying; and the root dug up in the warmer seasons might, if dried with care, be employed with propriety in the succeeding winter. The juice of the root is thin and watery in the spring; milky, bitter, and spontaneously coagulable in the latter part of summer and autumn; and sweet and less bitter in the winter when affected by the frost. The months of July, August, and September are, therefore, the proper periods for collecting it.

Mr. Henry Barton, of Brighton, England, prepares the juice from the flower-stalks by crushing and pressure, adding 25 per cent. of spirit, and after allowing it to stand for some weeks in glass bottles, filters to separate a very small quantity of deposit, and sets aside for use. According to Mr. Barton, it remains bright, and retains its characteristic taste. Though not so rich in solid constituents as the juice of the root, yet, having an equal bitterness, it is probably not less efficacious as a medicine, if it be true, as stated by Prof. Bentley, that the efficacy of the medicine does not depend solely on the amount of its solid constituents, but principally if not entirely on the bitter principle it contains. Mr. Barton states, in referring to the juice of the stem as prepared by him, that, from his own observation, and the frequent remarks of medical practitioners who had used it, he had reason to believe that, if not the best, it is certainly one of the best preparations of taraxacum. (*Am. Journ. of Pharm.*, Nov. 1872, p. 509.)

The fresh full-grown root of the dandelion is several inches in length, as thick as the little finger or thicker, round and tapering, somewhat branched, of a light-brown colour externally, whitish within, having a yellowish ligneous cord running through its centre, and abounding in a milky juice. In the dried state it is dark-brown, much shrunk, wrinkled longitudinally, brittle, and when broken presents a shining somewhat resinous fracture. A tranverse section exhibits an exterior cortical portion, thick, spongy, whitish, and marked with concentric rings, and a smaller central portion, ligneous and yellow; though in very old roots the latter is sometimes wanting. It is without smell, but has a sweetish, mucilaginous, bitterish, herbaceous taste. Its active properties are yielded to water by boiling, and do not appear to be injured in the process. The milky juice, examined by John, was found to contain bitter extractive, gum, caoutchouc, saline matters, a trace of resin, and a free acid. Besides these ingredients, starch or inulin, and saccharine matter exist in the root. Mannite, which has been found in the infusion of the root, has been demonstrated by the Messrs. Smith, of Edinburgh, not to pre-exist in the root, but to be formed by spontaneous changes consequent on exposure. A crystallizable principle has been extracted from the juice of the root by M. Pollex, who has named it *taraxacin*. It is bitter and somewhat acrid, fusible but not volatile, sparingly soluble in cold water, but

very soluble in boiling water, alcohol, and ether. It is obtained by boiling the milky juice in distilled water, filtering the concentrated liquor, and allowing it to evaporate spontaneously in a warm place. The taraxacin crystallizes, and may be purified by repeated solution and crystallization in alcohol or water. According to Vogel, the intra-cellular substance of the root consists chiefly of pectose, which is the result of a metamorphosis of the substance constituting the membrane of the cells. (*Journ. de Pharm.*, Avril, 1864, p. 362.)

The root of *Aspargia hispida* has been largely substituted for dandelion in England by the herb gatherers (*Pharm. Journ.*, xi. 107); and we are informed that a similar fraudulent substitution is not unfrequent, in this country, of the root of *Cichorium Intibus*, or *chicory*. This is distinguishable from the genuine root by its lighter colour, and greater bitterness. For a particular account of the characteristic properties of the root, by which it may be distinguished from all others, the reader is referred to an article by Mr. K. Bentley, in the *Pharmaceutical Journal* (xvi. 304).

Medical Properties and Uses. Taraxacum is slightly tonic, diuretic, and aperient, and is thought to have a specific action upon the liver, exciting it when languid to secretion, and resolving its chronic engorgements. It has been much employed in Germany, and is a popular remedy with many practitioners in this country. The diseases to which it appears to be especially applicable, are those connected with derangement of the hepatic apparatus, and of the digestive organs generally. In congestion and chronic inflammation of the liver and spleen, in cases of suspended or deficient biliary secretion, and in dropsical affections dependent on obstruction of the abdominal viscera, it appears to be capable of doing good, if employed with a due regard to the degree of excitement. Our own experience is in its favour. An irritable condition of the stomach and bowels, and the existence of acute inflammation, contra-indicate its employment. It is usually given in the form of extract or decoction, though some prefer the infusion. (See these preparations in *Part* II.) Bitartrate of potassium is sometimes added to the decoction when an aperient effect is desired; and aromatics will occasionally be found useful in correcting a tendency to griping or flatulence. The dried root is sometimes mixed, in powder, with ground coffee, the taste of which covers that of the dandelion. It is also used as a substitute for coffee, being powdered and roasted, and then prepared in the same manner.

Off. Prep. Decoctum Taraxaci, *Br.;* Extractum Taraxaci; Extractum Taraxaci Fluidum, *U. S.;* Infusum Taraxaci, *U. S.;* Succus Taraxaci, *Br.* W.

TEREBINTHINA. *U. S.*

Turpentine.

The concrete oleo-resin obtained from Pinus palustris, and from other species of Pinus. *U. S.*

Off. Syn. THUS AMERICANUM. *Common Frankincense.* The concrete turpentine of Pinus Tæda, the Frankincense pine, and Pinus palustris, the Swamp pine. From the Southern States of North America. *Br.*

TEREBINTHINA CANADENSIS. *U. S., Br.*

Canada Turpentine. Balsam of Fir.

The liquid oleo-resin obtained from Abies balsamea (Lindley, *Flor. Med.*). *U. S. Canada Balsam.* The turpentine obtained by incision from the stem of Abies balsamea, Aiton, *Hort. Kew.* Balm of Gilead Fir. Lambert, *Pinus* (*Pinus balsamea*), plate 31. From Canada. *Br.*

Térébenthine, *Fr.;* Terpentin, *Germ.;* Trementina, *Ital., Span.*

The term *turpentine* is usually applied to certain vegetable juices, liquid or concrete, which consist of resin combined with a peculiar essential oil, called *oil of turpentine*. They are generally procured from different species of pine, fir, or larch; though other trees afford products which are known by the same general title, as for instance *Pistacia Terebinthus*, which yields the Chian turpentine. Some French writers extend the name of turpentine to other juices consisting of resin and essen-

tial oil, without benzoic or cinnamic acid, as copaiba, balm of Gilead, &c. We shall describe particularly, in this place, only the turpentines which are either now officinal, or have but recently ceased to be so. A brief botanical view of the plants from which they are respectively derived, will be in accordance with the plan of this work. It is proper first to observe that the original genus Pinus of Linnæus has been divided into the three genera, Pinus, Abies, and Larix, which are now very generally recognised, though Lindley unites the two latter in his Flora Medica.

PINUS. *Sex. Syst.* Monœcia Monadelphia.—*Nat. Ord.* Pinaceæ or Coniferæ.

Gen. Ch. Flowers monœcious. MALES. *Catkins* racemose, compact, and terminal; squamose; the scales staminiferous at the apex. *Stamens* two; the *anthers* one-celled. FEMALES. *Catkins* or *cones* simple, imbricated with acuminate scales. *Ovaries* two. *Stigmas* glandular. *Scales* of the cone oblong, club-shaped, woody; umbilicato-angular at the apex. *Seeds* in pairs, covered with a sharp-pointed membrane. *Cotyledons* digitato-partite. *Leaves* two or many, in the same sheath. (*Pereira's Mat. Med.;* from *Bot. Gall.*)

1. *Pinus palustris.* Willd. *Sp. Plant.* iv. 499.—*P. Australis.* Michaux, *N. Am. Sylv.* iii. 133. "Leaves in threes, very long; stipules pinnatifid ramentaceous, persistent; strobiles subcylindrical, armed with sharp prickles."

This is a very large indigenous tree, growing in dry, sandy soils, from the southern part of Virginia to the Gulf of Mexico. Its mean elevation is sixty or seventy feet, and the diameter of its trunk about fifteen or eighteen inches for two-thirds of this height. The leaves are about a foot in length, of a brilliant green colour, and united in bunches at the ends of the branches. The names by which the tree is known in the Southern States are *long-leaved pine*, *yellow pine*, and *pitch pine;* but the first is most appropriate, as the last two are applied also to other species. This tree furnishes by far the greater proportion of the turpentine, tar, &c. consumed in the United States, or sent from this to other countries. (See *Pix Liquida.*)

2. *Pinus Tæda.* Willd. *Sp. Plant.* iv. 498; Michaux, *N. Am. Sylv.* iii. 156. "Leaves in threes, elongated, with elongated sheaths; strobiles oblong-conical, deflexed, shorter than the leaf; spines inflexed."

This is the *loblolly*, or *old field pine* of the Southern States. It is abundant in Virginia, where it occupies the lands exhausted by cultivation. It exceeds eighty feet in height, has a trunk two or three feet in diameter, and expands into a wide spreading top. The leaves are about six inches long, and of a light green colour. It yields turpentine in abundance, but less fluid than that which flows from the preceding species.

3. *Pinus sylvestris.* Willd. *Sp. Plant.* iv. 494; Woodv. *Med. Bot.* p. 1, t. 1; Michaux, *N. Am. Sylv.* iii. p. 125. "Leaves in pairs, rigid; strobiles ovate-conical, of the length of the leaves; scales echinate."

This tree, when of full size, is eighty feet high, with a trunk four or five feet in diameter. It inhabits the northern and mountainous parts of Europe. In Great Britain it is called the *wild pine* or *Scotch fir;* the latter name having been given to it from its abundance in the mountains of Scotland. It yields a considerable proportion of the common European turpentine.

In Germany a fibrous substance is prepared from the leaves of this, and other species of Pinus and Abies, called *fir-wool*, and a volatile oil is distilled from them called *fir-wool oil*, which is considerably used, both internally and locally, as a remedy for rheumatism, palsy, chronic catarrh, chronic skin diseases, &c., indeed for the same purposes generally as the oil of turpentine. (See *Am. Journ. of Pharm.*, May, 1863, p. 274.) This oil resinifies on exposure, like oil of turpentine, and varies in sp. gr. from 0·876 to 0·912, according to its source. Its dose, when it is used internally, is from fifteen to twenty drops. An extract of the leaves, denominated *fir-wool extract*, is used for similar purposes. The leaves are made also into wadding and clothing, designated as *fir-wool* from their origin, which are supposed to have some merit in the treatment of similar affections. (*Ibid.*, March, 1867, p. 178.)

Besides the pines above described, various others yield medicinal products. *Pinus maritima* (*P. Pinaster* of Aiton and Lambert), growing in the southern and maritime parts of Europe, yields much of the turpentine, pitch, and tar consumed in France, and is admitted among the officinal plants in the French Codex. From the

branches of *Pinus Pumilio*, which inhabits the mountains of eastern and south-eastern Europe, a terebinthinate juice exudes spontaneously, called *Hungarian balsam*. *Pinus Cembra*, or the *Siberian stone-pine* of the Alps and Carpathian mountains, is said to afford the product called *Carpathian balsam;* and the seeds both of that species, and of *Pinus Pinea*, or *stone-pine* of the south of Europe and north of Africa, are used in Europe in desserts, under the name of *pine nuts*. Pinus Lambertiana, of California, produces by exudation a saccharine matter which has been found to contain a peculiar sweet principle called *pinite*. (*Comptes Rendus*, Sept. 1855.) Still another species, *Pinus Sabiniana*, Dougl., indigenous in California, where it inhabits the sides of the foot-hills of the Sierra Nevada ranges, and known as the *nut-pine* or *digger pine*, because the fruit, which is an edible nut, is largely consumed by the Digger Indians, yields, on being notched, a terebinthinate exudation, which is largely distilled for the sake of its volatile oil, extensively used in California under the name of *abietine*,* and other less appropriate designations. The *Pinus rigida*, or *pitch pine* of this country, and probably others besides those mentioned, are sometimes employed in the preparation of tar.

Abies. See PIX BURGUNDICA.

Abies balsamea. Lindley, *Flor. Med.* p. 554.—*A. balsamifera*. Michaux, *N. A. Sylv.* iii. 191.—*Pinus balsamea*. Willd. *Sp. Plant.* iv. 504. "Leaves solitary, flat, emarginate or entire, glaucous beneath, somewhat pectinate, sub-erect above, recurved spreading; cones cylindrical, erect; bractes abbreviate, obovate, conspicuously mucronate, sub-serrulate."

This is the *American silver fir*, or *balm of Gilead tree*, inhabiting Canada, Nova Scotia, Maine, and the mountainous regions further south. It is an elegant tree, seldom rising more than forty feet, with a tapering trunk, and numerous branches, which diminish in length in proportion to their height, and form an almost perfect pyramid. The leaves are six or eight lines long, inserted in rows on the sides and tops of the branches, narrow, flat, rigid, bright-green on their upper surface, and of a silvery whiteness beneath. The cones are large, erect, nearly cylindrical, of a purplish colour, and covered with a resinous exudation, which gives them a glossy, rich, and beautiful appearance. It is from this tree that the *Canada balsam* is obtained.

Several other species of Abies are officinal. *Abies excelsa* of Europe, and *A. Canadensis* of the United States, have already been described as the sources respectively of Burgundy and Canada pitch. (See *Pix Burgundica* and *Pix Canadensis*.) The *A. Picea* (*Abies pectinata* of De Candolle, *A. taxifolia* of the French Codex, *Pinus Picea* of Linnæus), or *European silver fir*, growing in the mountainous regions of Switzerland, Germany, and Siberia, yields the *Strasburg turpentine*, which is much used in some parts of Europe. By the distillation of its cones with water, it also affords a variety of oil of turpentine called in France *essence de templine*. The *Abies*

* *Abietine*, &c.—This is an extremely volatile carbo-hydrogen, obtained by distillation from the exuded juice or turpentine of a species of Pinus, and, in regard to its origin, analogous to the oil of turpentine, but differing essentially from the ordinary oils thus designated. The crude oil, brought from its place of production, after the first distillation from the resinous juice, as usually found in the markets of San Francisco, is a colourless, limpid fluid, which may be obtained quite pure by a single additional distillation. It is homogeneous, as different portions into which it may be separated have the same sp. gr., 0·694 at 16·5° C., and the same boiling point, 101° C. It has a strong, penetrating odour, somewhat resembling that of the oil of orange. It is lighter than absolute alcohol or ether; and is highly inflammable, burning with a brilliant white flame and without smoke. In water it is almost insoluble, but is dissolved in five parts, by measure, of 95 per cent. alcohol. Poured on the hands, it evaporates rapidly, giving a sensation of coldness. Dry muriatic acid, passed through it for ten hours, did not affect it. Nitric acid of the sp. gr. 1·43 produces no effect on it when cold; but, at the point of ebullition, a moderate reaction takes place, with escape of nitrous acid fumes. It dissolves iodine, producing a rich purple, and bromine freely with an orange red. For other reactions, the reader is referred to the paper from which this abstract is taken. It is a singular and important fact that abietine is a powerful solvent of the volatile as well as of the fixed oils, with the exception of castor oil, which, on the other hand, will dissolve nearly two-thirds its volume of the abietine. The same is the case with the balsam of Peru and Canada balsam. Its vapour is powerfully anæsthetic when inhaled, and is very destructive to the lower forms of vegetable and animal life. In California it is said to be chiefly used for removing grease and paint from cotton and woollen fabrics. Possessing, as it does, such strong and diversified properties, it is, no doubt, susceptible of many useful applications. (*Amer. Journ. of Pharm.*, March, 1872, p. 97; from a communication by Mr. Wm. Wenzel, to the Calif. Pharm. Soc., Dec. 13, 1871.)—*Note to the fourteenth edition.*

nigra (*Pinus nigra*), or *black spruce* of this country, yields a product, which, though not recognised by the Pharmacopœia, is considerably employed. The substance alluded to is the *essence of spruce*, prepared from the young branches by boiling them in water and evaporating the decoction. It is a thick liquid, having the colour and consistence of molasses, with a bitterish, acidulous, astringent taste. It is used in the preparation of the beverage commonly known by the name of *spruce beer*, which is a pleasant and wholesome drink in summer, and useful in long sea-voyages as a preventive of scurvy.*

LARIX. *Sex. Syst.* Monœcia Monadelphia.—*Nat. Ord.* Pinaceæ or Coniferæ.

Gen. Ch. As in Abies, except that the *cotyledons* are simple, and never lobed; the *cones* lateral; the *leaves*, when first expanding, in tufted fascicles, becoming somewhat solitary by the elongation of the new branch. (*Pereira's Mat. Med.*; from *Bot. Gall.*)

Larix Europæa. De Cand. *Flor. Fr.* 2064.—*Abies Larix.* Lamb. *Illust.* t. 785, f. 2.—*Pinus Larix.* Willd. *Sp. Plant.* iv. 503; Woodv. *Med. Bot.* p. 7, t. 4. "Leaves fascicled, deciduous; cones ovate-oblong; margins of the scales reflexed, lacerated; bractes panduriform."

The *European larch* is a large tree, inhabiting the mountains of Siberia, Switzerland, Germany, and the east of France. It yields the *Venice turpentine* of commerce, and a peculiar sweetish substance called in France *Briançon manna*, which exudes spontaneously, and concretes upon its bark. When the larch forests of Russia take fire, a juice exudes from the trunk during their combustion, which concretes, and is called *Orenburgh gum.* It is wholly soluble in water.†

PISTACIA. See MASTICHE.

Pistacia Terebinthus. Willd. *Sp. Plant.* iv. 752; Woodv. *Med. Bot.* p. 29, t. 12. This is a small tree with numerous spreading branches, bearing alternate, pinnate leaves, which consist of three or four pairs of ovate-lanceolate, entire, acute, smooth, and shining leaflets, with an odd one at the end. The male and female flowers are diœcious, small, and in branching racemes. It is a native of Barbary and Greece, and flourishes in the islands of Cyprus and Chio, the latter of which has given its name to the *Chian turpentine* obtained from the tree. A gall, produced upon this plant by the puncture of an insect, has been used in Eastern Europe in pectoral affections.

We shall treat of the several varieties of turpentine under distinct heads.

1. White Turpentine.

Térébenthine de Boston, *Fr.*

The *common American* or *white turpentine* (*Terebinthina, U. S.*). *Off. Syn.* THUS AMERICANUM. *Common Frankincense.* The concrete turpentine of Pinus Tæda,

* The following is the formula. Take of essence of spruce *half a pint*; pimento bruised, ginger bruised, hops, each, *four ounces*; water *three gallons.* Boil for five or ten minutes; then strain, and add of warm water *eleven gallons*; yeast *a pint*; molasses *six pints.* Mix, and allow the mixture to ferment for twenty-four hours.

† *Coniferin.* This name has been given to a principle recently discovered by M. Hartig in the cambium of several of the Coniferæ. The species in which it has been found are *Pinus Strobus* and *P. Cembra, Abies excelsa* and *A. pectinata*, and *Larix Europæa*; and it probably exists in many others. It is obtained by removing the outer bark, scraping the cambium from the surface of the wood, subjecting this to pressure, boiling the viscid juice to coagulate the albumen, filtering, and evaporating the filtered liquid to one-fifth of its volume. The coniferin is deposited in crystals. The mother-water is very sweet, and contains a saccharine substance closely allied to cane sugar. The crystals are purified by dissolving them in water, decolorizing by animal charcoal, and finally crystallizing from weak alcohol. Coniferin was chemically examined by M. W. Kubel with the following results.

Coniferin is closely allied to salicin, being like it a glucoside. It crystallizes in slender needles, of a silky lustre, containing water of crystallization, which they lose at 212° F., and gradually part with by efflorescence on exposure. It melts at 333° F., and at a higher temperature becomes brown, and ultimately carbonizes with an odour of caramel. It is but slightly soluble in cold water, which takes up only 0·51 per cent., but is readily dissolved by boiling water. It is scarcely soluble in absolute alcohol, and not at all in ether. The watery solution is slightly bitter, deviates the plane of polarization to the left, gives no precipitate with acetate or subacetate of lead, and is not discoloured by chloride of iron. It presents a characteristic reaction. With concentrated sulphuric acid it becomes of a deep-violet, and, on the addition of a little water, gives a precipitate which colours the liquid of a deep indigo blue. It is sufficient to touch with sulphuric acid a fresh cut surface of a branch of one of the Coniferæ, to ascertain the existence of coniferin. (See *Am. Journ. of Pharm.*, May, 1867, p. 261; originally from *Journ. für Prakt. Chem.*, xcvii. 243.)—*Note to the thirteenth edition.*

Linn., the Frankincense Pine, and Pinus palustris, *Miller's Dict*, the Swamp Pine, Lambert, *Pinus*, plates 10, 19, and 20. From the Southern States of N. America. *Br.*

In former times, large quantities were collected in New England; but the turpentine trees of that section of the Union are said to be nearly exhausted; and our commerce has been until recently almost exclusively supplied from North Carolina, and the south-eastern parts of Virginia. Within a few years, however, attention has been turned to the collection of this valuable product in Georgia and Florida; and there is no doubt that, in time, an abundant supply will be derived from the vast pine forests which occupy the southern portion of our country bordering on the Gulf of Mexico. The following is the process for obtaining the turpentine as described by Michaux. During the winter, excavations of the capacity of about three pints are made in the trunk of the tree three or four inches from the ground. Into these the juice begins to flow about the middle of March, and continues to flow throughout the warm season, slowly at first, rapidly in the middle of summer, and more slowly again in the autumn. The liquid is removed from these excavations as they fill, and transferred into casks, where it gradually thickens, and ultimately acquires a soft solid consistence. Very large quantities are thus annually procured, sufficient not only to supply the consumption of this country, but also to furnish a valuable export.*

White turpentine, as found in our shops, is yellowish-white, of a peculiar somewhat aromatic odour, and a warm, pungent, bitterish taste. It is somewhat translucent, and of a consistence varying with the temperature. In the middle of summer, it is almost semi-fluid and very adhesive, though brittle; in the winter, it is often so firm and hard as to be incapable of being made into pills without heat. Exposed to the air it ultimately becomes perfectly hard and dry. In the recent state it affords about 17 per cent. of volatile oil. It is apt to contain small pieces of bark, wood, or other impurity.

2. Common European Turpentine.

Térébenthine de Bordeaux, Térébenthine commune, *Fr.*; Gemeiner Terpentin, *Germ.*; Trementina comune, *Ital.*; Trementina comun, *Span.*

This is the *Terebinthina Vulgaris* of the former London Pharmacopœia. It is furnished by several species of pine; but chiefly by *P. sylvestris* and *P. maritima*. From the latter tree it is obtained largely in the maritime districts of the southwest of France, especially in the department of the Landes, and is exported from Bordeaux. Hence it is called in commerce *Bordeaux turpentine*. It is procured by making incisions into the trunk, or removing portions of the bark, and receiving the juice which flows out in small troughs, or in holes dug at the foot of the tree. It is purified by heating, and filtering it through straw, or by exposing it to the sun in a barrel, through holes in the bottom of which the melted turpentine escapes. Thus prepared it is whitish, turbid, thickish, and separates, upon standing, into two parts; one liquid and transparent, the other of a consistence and appearance like those of thickened honey. As found in European commerce it often consists wholly of this latter portion. It speedily hardens on exposure to the air in thin layers. The most liquid specimens are completely solidified by the addition of one part of magnesia to thirty-two of the turpentine. (*Journ. de Pharm.*, xxv. 499.) It is scarcely ever given internally, but furnishes large quantities of oil of turpentine and resin. We do not import it into this country. The substance which the French call *galipot* or *barras*, is that portion of the turpentine which concretes upon the trunk of the tree when wounded, and is removed during the winter. (*Thenard.*) This, when purified by melting with water and straining, takes the name of *yellow* or *white pitch*, or *Burgundy pitch*. When turpentine, whether the European or American, has been deprived of its oil by distillation, the resin which remains is called *rosin*, and sometimes *colophony*, from the Ionian city of Colophon, where it was formerly prepared. It is the officinal resin (*resina*), and is sometimes called yellow resin (*resina flava*). White resin (*resina alba*) is prepared by incorporating this, while in fusion, with a certain proportion of water. (See *Resina*, page 758.) Tar (*pix liquida*) is the turpentine

* A particular and interesting account of the mode of collecting turpentine, distilling the oil, and preparing tar, practised in North Carolina, is contained in Olmsted's *Journey in the Sea-board Southern States*, N. Y., 1856, p. 339.

extracted from the wood by slow combustion, and chemically altered by heat. Common pitch (*pix nigra*, or *resina nigra*) is the solid residue left after the evaporation by boiling of the liquid parts of tar.

3. Canada Turpentine.

Canada balsam, Balsam of fir; Baume de Canada, *Fr.;* Canadischer Balsam, Canadischer Terpentin, *Germ.;* Trementina del Canada, *Ital.*

Canada Turpentine (*Terebinthina Canadensis*, U. S., Br.) is the product of *Abies balsamea*, and is collected in Canada and the State of Maine. It is procured by breaking the vesicles which naturally form upon the trunk and branches, and receiving their liquid contents in a bottle. When fresh, it is colourless or slightly yellowish, transparent, of the consistence of thin honey, very tenacious, of a strong, agreeable odour, and a bitterish, somewhat acrid taste. By time and exposure it becomes thicker and more yellow, and finally solid. It is usually brought into market in bottles, and is kept in the shops under the name of *Canada balsam* or *balsam of fir*. In Europe, it is sometimes called *balm of Gilead*, from its supposed resemblance to that celebrated medicine. The term *balsam*, as at present understood, is improperly applied to it; as it contains no benzoic nor cinnamic acid, and is in fact a true turpentine, consisting chiefly of resin and volatile oil. Bonastre obtained, from 100 parts of Canada turpentine, 18·6 parts of volatile oil, 40·0 of resin easily dissolved by alcohol, 33·4 of sub-resin of difficult solubility in that fluid, 4·0 of caoutchouc similar to sub-resin, and 4·9 of bitter extractive and salts, besides traces of acetic acid. There is reason to believe that *Strasburg turpentine* is sometimes sold for it in the shops.

4. Venice Turpentine.

Térébenthine de mélèze, Térébenthine de Venise, *Fr.;* Venetianischer Terpentin, *Germ.;* Trementina di Venezia, *Ital.;* Trementina de Venecia, *Span.*

This turpentine was named from the circumstance that it was formerly an extensive article of Venetian commerce. It is procured in Switzerland, and the French province of Dauphiny, from the *Larix Europæa* or larch, which grows abundantly upon the Alps and the Jura mountains. The peasants bore holes into the trunk about two feet from the ground, and conduct the juice by means of wooden gutters into small tubs, placed at a convenient distance. It is afterwards purified by filtration through a leather sieve. Genuine Venice turpentine is a viscid liquid, of the consistence of honey, flowing with difficulty, cloudy or imperfectly transparent, yellowish or slightly greenish, of a strong not disagreeable odour, and a warm, bitterish, and acrid taste. It does not readily concrete on exposure, is not solidified by one-sixteenth of magnesia, and is entirely soluble in alcohol. (Guibourt, *Journ. de Pharm.*, xxv. 500.) What is sold under the name of Venice turpentine, in our shops, is usually quite brown, and is said to be a factitious substance, prepared by dissolving rosin in oil of turpentine. Dr. A. T. Thomson states that much of the Venice turpentine of the shops of London is obtained from America. It is probably the same preparation as that which passes under the name in this country.

5. Chian Turpentine.

Térébenthine de Chio, *Fr.;* Cyprischer Terpentin, *Germ.;* Trementina Cipria, *Ital.*

This variety of turpentine is collected chiefly in the island of Chio or Scio, by incisions made during the summer in the bark of *Pistacia Terebinthus*. The juice, flowing from the wounds, falls upon smooth stones placed at the foot of the tree, from which it is scraped with small sticks, and allowed to drop into bottles. The annual product of each tree is very small; and the turpentine, therefore, commands a high price even in the place where it is procured. Very little of it reaches this country. It is said to be frequently adulterated with the other turpentines. It is a thick, tenacious liquid, of a greenish-yellow colour, a peculiar penetrating odour more agreeable than that of the other substances of the same class, and a mild taste without bitterness or acrimony. It leaves a glutinous residue when treated with strong alcohol. (*Guibourt.*) On exposure to the air it speedily thickens, and ultimately becomes concrete and hard, in consequence of the loss of its volatile oil.

Besides the turpentines mentioned, various others are noticed in books on materia medica, though not found in the shops of this country. There are the *Strasburg turpentine*, much used in France, and obtained from the *Abies Picea* (*Abies pectinata* of De Candolle), or European silver fir, which grows on the mountains of Switzerland and Germany, and bears a close resemblance, as well in its appearance as its product, to *Abies balsamea* of Canada; the *Damarra turpentine*, which speedily concretes into a very hard resin, and is derived from the *Pinus Damarra* of Lambert. the *Agathis Damarra* of Richard, growing in the East India Islands; the *cowrie* or *cowdie* resin, procured by incision from another species of Damarra (*D. australis*) in New Zealand; and the *Dombeya turpentine*, a glutinous, milky-looking fluid, of a strong odour and taste, derived from *Dombeya excelsa*, the *Araucaria Dombeyi* of Richard, which inhabits Chili, and is said to be identical with the Norfolk Island pine. These, with one or two other turpentines scarcely known, or having a doubtful claim to the title, are all that belong properly to this class of vegetable products.*

General Properties. The turpentines resemble each other in odour and taste. though distinguished by shades of difference. Liquid at first, they become thick and gradually solid by exposure, in consequence partly of the volatilization, partly of the oxidation of their essential oil. They are rendered more liquid or softened by heat. and at a high temperature take fire, burning with a white flame and much smoke. Water extracts only a minute proportion of their volatile oil. They are almost wholly soluble in alcohol and ether, and readily unite with the fixed oils. They yield by distillation a volatile oil, called *oil of turpentine;* the residue consisting exclusively of resin. (See *Oleum Terebinthinæ* and *Resina.*) A minute proportion of succinic or acetic acid passes over with the oil. From the experiments of M. Faure, of Bordeaux, it appears that some of the liquid turpentines, like copaiba, may be solidified by the addition of magnesia. (*Journ. de Chim. Méd.*, 1830, p. 94.) According to M. Thierry, the same result is obtained by the addition of one part of hydrate of lime to thirty-two parts of common European turpentine. (*Journ. de Pharm.*, 3e sér., i. 315.)

Medical Properties and Uses. The effects of the turpentines upon the system are dependent entirely on their volatile oil. They are stimulant, diuretic, anthelmintic. and in large doses laxative. When taken internally, or applied to the skin, they communicate a violet odour to the urine, and, if continued for some time, produce an irritation of the mucous membrane of the urinary passages, amounting frequently to strangury. The last effect is less apt to be experienced when they operate upon the bowels. Externally applied they act as rubefacients. Their medical virtues were known to the ancients. At present they are less used than formerly, having been superseded by their volatile oil. They are, however, occasionally prescribed in leucorrhœa, gleet, and other chronic diseases of the urinary passages; in piles and chronic inflammation or ulceration of the bowels; in chronic catarrhal affections; and in various forms of rheumatism, especially sciatica and lumbago. A case is recorded in the *London Lancet*, in which an aggravated and dangerous form of pyæmia, in a man who had been affected with a severe injury in the hand, was relieved and ultimately cured by turpentine, after failure with other remedies, and from a seemingly almost desperate state. The remedy was given in emulsion with eggs, and repeated every four hours. (*Med. and Surg. Reporter*, Feb. 28, 1874, p. 191.) The white turpentine is usually employed in this country. They may be given in the shape of pill made with powdered liquorice root; in emulsion with gum arabic or yelk of egg, loaf sugar, and water; or in electuary formed with sugar or honey. Their dose is from a scruple to a drachm. In the quantity of half an ounce or an ounce, triturated with the yelk of an egg, and mixed with half a pint of mucilaginous liquid, they form an excellent injection in cases of ascarides, and of constipation with flatulence.

* The product of *Abies picea*, referred to in the text as *Strasburg turpentine*, is, according to Guibourt, nearly as liquid as olive oil, at first turbid and whitish, but becoming by filtration or long standing transparent and almost colourless, of an agreeable odour, analogous to that of the citron, and of a taste moderately acrid and bitter. It dries quickly in the air, is solidified by a sixteenth of magnesia, and is not entirely soluble in alcohol. It is procured by incisions into the vesicles which form upon the surface of the tree, beneath the outer bark. Guibourt states that this is the true *Venice turpentine*, while that described in the text, and generally recognised by authors as Venice turpentine, is in fact the *Strasburg*. (*Journ. de Pharm.*, xxv. 487.)

The vapour of turpentine, employed as a vapour-bath, has been highly recommended in obstinate chronic rheumatism. According to M. A. Chevandier, it is borne well for about twenty-five minutes, at a temperature of from 140° to 160° F., producing acceleration of the pulse, and copious sweating, sometimes accompanied with a confluent eruption. (*Arch. Gén.*, 4e sér., xxviii. 80.)

Off. Prep. of Turpentine. Ceratum Resinæ Compositum, *U.S.;* Emplastrum Galbani Comp., *U.S. Of White Turpentine.* (*Thus Americanum, Frankincense, Br.*) Emplastrum Picis, *Br. Of Canada Turpentine.* Charta Cantharidis, *U.S.;* Charta Epispastica, *Br.;* Collodium Flexile. W.

TESTA. *U.S.*

Oyster-shell.

The shell of Ostrea edulis. *U.S.*

Ecailles des huîtres, *Fr.;* Austerschalen, *Germ.;* Gusci della ostriche, *Ital.;* Cascaras, *Span.*

The common oyster is the *Ostrea edulis* of naturalists, an animal belonging to the division *Mollusca*, class *Acephala*, order *Testacea*, and family *Ostracea*. It is found in many parts of the world, and is particularly abundant on our own coast, and in the bays of our large rivers. It consists of a soft pulpy portion, comprising the vital organs of the animal enclosed in a hard bivalve shell, of the nature of mother-of-pearl. The flesh of the oyster forms a very digestible and nutritious article of food, particularly suited to convalescents; but the shell only is officinal.

Properties. Oyster-shells are too familiarly known to require description. They are made up, like other mother-of-pearl shells, of alternate layers of earthy and animal matter, the latter being of the nature of coagulated albumen. According to the analysis of Bucholz and Brandes, their constituents are carbonate of calcium 98·6, phosphate of calcium 1·2, animal matter 0·5, alumina (accidental) 0·2 = 100·5. Thus it appears that the animal matter is present in but small amount. When calcined or burnt, the animal matter and carbonic acid are dissipated, and the shells are converted into a species of lime, called *oyster-shell lime.*

Some credit has recently been claimed, on the basis of one or two favourable cases, for the efficiency of oyster-shell, taken internally and applied locally, in the treatment of cancer. The shells having been baked for three nights in a slow oven, the white part is scraped out, powdered, and taken in the quantity that will lie on an English shilling piece, once or twice daily, in a little warm water or tea; the treatment to be suspended for a day or two if it disturb the system. The powder may be applied, made into an ointment with cream, lard, or butter, without salt. The treatment must be continued three or four months before its effects are to be expected. The theory of the operation is that the blood-vessels supplying the tumor undergo calcareous degeneration. (Dr. P. Hood, *Lancet*, Oct. 1867, p. 484.)

Pharmaceutical Uses. Oyster-shells must be reduced to an impalpable powder, before they are fit for medical use. Thus prepared they form *Testa Præparata*, under which head their medicinal properties are noted.

Off. Prep. Testa Præparata, *U.S.* B.

TORMENTILLA. *U.S. Secondary.*

Tormentil.

The rhizome of Potentilla Tormentilla (*De Candolle*). *U.S.*

Tormentille, *Fr.;* Tormentillwurzel, *Germ.;* Tormentilla, *Ital.;* Tormentila, *Span.*

POTENTILLA. *Sex. Syst.* Icosandria Polygynia.—*Nat. Ord.* Rosaceæ.

Gen. Ch. Calyx with a concave tube, a four or five-cleft limb, and four or five bractlets. *Petals* four or five. *Stamens* numerous. *Carpels* numerous, with a lateral style, on a procumbent, persistent, capitate, juiceless receptacle. *Seed* appended. Herbs or undershrubs, with compound leaves, stipules adnate to the petiole, and white, yellow, rarely red flowers. (*De Candolle.*)

Several other species, besides the one here recognised by our Pharmacopœia, were occasionally employed in medicine; but, possessing no peculiar virtues not found in

tormentil, and in less degree probably than in that, have been abandoned. For a brief account of these species, the reader is referred to a paper by Prof. J. M. Maisch, in the *Am. Journ. of Pharm.* (March, 1875, p. 109). In the same paper, Mr. Maisch calls attention to a communication of Dr. Wm. Hauser, of Barton, Ga., speaking very strongly in favour of the Potentilla Canadensis, or common trefoil, an indigenous species, as a sudorific, and under some circumstances as a diuretic. Dr. Edwin Le Roy Anthony has cured gonorrhœa with it. But the most extraordinary powers possessed by it are those exerted in the cure of puerperal peritonitis. Dr. Hauser states that, in a large practice of twenty years, he does not remember having once failed with it in this disease. Dr. Hauser employs the whole plant in strong decoction, and gives the patient large draughts, as hot as it can be drank, every half-hour or oftener. It produces copious perspiration, soon after which the patient recovers.

Potentilla Tormentilla. Sibthorp, *Fl. Ox.* 162; Lindley, *Flor. Med.* 225.— *Tormentilla erecta.* Willd. *Sp. Plant.* ii. 1112; Woodv. *Med. Bot.* p. 503, t. 181.— *T. officinalis.* Smith, *Flor. Brit.* The tormentil, or *septfoil*, is a small perennial plant, very common throughout Europe. The stems, which rise about six or eight inches in height from a woody root, are slender, more or less erect, branching towards the top, and furnished with sessile leaves, which on the stalk usually consist of seven, on the branches of five, digitate, elliptical, villous, deeply serrated leaflets, three larger than the others. The flowers are small, yellow, and solitary upon axillary peduncles. All parts of the plant are astringent, especially the root, which is the part employed. It is gathered in spring.

Properties. The root of tormentil is cylindrical or roundish, rather larger above than at the lower extremity, an inch or two in length, about as thick as the finger, knotty, sometimes contorted, brown or blackish externally, and reddish within. It has a slight aromatic odour, and a very astringent taste. Tannin is an abundant constituent. There is also a red colouring principle, soluble in alcohol, but insoluble in water. Besides these ingredients Meissner found resin, cerin, myricin, gummy extractive, gum, extractive, lignin, water, and a trace of volatile oil. Tormentil has recently been chemically examined by Rembold, who obtained tormentilla red by boiling the tannin of the root with sulphuric acid. It has the same composition as rhatany red. He also obtained kinovic acid from the root by boiling it with milk of lime, adding muriatic acid to the decoction, boiling the precipitate with solution of baryta, decomposing again by muriatic acid, dissolving the precipitate in alcohol, decolorizing with animal charcoal, filtering, concentrating, and crystallizing. (*Am. Journ. of Pharm.*, July, 1868, p. 311; from *Ann. der Chem. und Pharm.*, cxliv. 5.) The root is said to be used for tanning leather in the Orkneys and Western Islands of Scotland, and for staining leather red by the Laplanders. It yields its virtues to boiling water.

Medical Properties and Uses. Tormentil is a simple and powerful astringent, applicable to all cases of disease in which this class of medicines is indicated. We seldom, however, employ it in this country, having indigenous plants of equal virtue. It may be given in substance, decoction, or extract. The dose of the powder is from thirty grains to a drachm. W.

TOXICODENDRON. *U.S. Secondary.*

Poison-oak.

The leaves of Rhus Toxicodendron. *U.S.*

Sumach vénéneux, *Fr.;* Gift-Sumach, *Germ.;* Albero del veleno, *Ital.*

RHUS. See RHUS GLABRUM.

Admitting, as appears generally to be done at present, that *Rhus Toxicodendron* and *Rhus radicans* of Linnæus are mere varieties of the same plant, there are four indigenous species of Rhus which possess poisonous properties—the one above mentioned; *R. vernix*, commonly known by the name of *swamp sumach* or *poison sumach; R. pumilum* of the Southern States; and *R. diversiloba* of California, where it is known by the Spanish name of *hiedra*. Though the first only is designated in the Pharmacopœia, we shall briefly describe the four; as their medical effects are

probably similar, and their operation upon the system such that the plants should be known to every practitioner.

1. *Rhus radicans.* Willd. *Sp. Plant.* i. 1481; Bigelow, *Am. Med. Bot.* iii. 17.—*R. Toxicodendron.* Pursh, *Fl. Am. Sept.* p. 205. Though Elliott and Nuttall consider *R. radicans* and *R. Toxicodendron* as distinct species, the weight of botanical authority is on the other side; and Bigelow declares that he has "frequently observed individual shoots from the same stock, having the characters of both varieties." The difference, however, in their appearance is sufficiently striking to have led to the adoption of different common names; R. radicans being usually called *poison vine*, and R. Toxicodendron, *poison-oak.* The former has a climbing stem, rising to a great height upon trees, rocks, and other objects, to which it adheres by strong rooting fibres, which it throws out from its sides. The leaves, which stand upon long footstalks, are ternate, with broad-ovate or rhomboidal, acute leaflets, smooth and shining on both sides, sometimes slightly hairy on the veins beneath, entire, or irregularly lobed and toothed. The flowers are small, greenish-white, diœcious, and grow in lateral, usually axillary panicles, or compound racemes. The male flowers have five stamens, and the rudiments of a style; the female, which are of only half the size, and on a different plant, have abortive stamens, and a short erect style, standing on a roundish germ, and terminating in three stigmas. The fruit consists of roundish, pale-green or whitish berries.

R. Toxicodendron, or poison-oak, has the form of a shrub from one to three feet high, with leaflets angularly indented, and pubescent beneath. But this character of the foliage is probably not constant; and the stunted growth may be owing to peculiarities of situation. Dr. Bigelow states that the young plants of R. radicans do not put forth rooting fibres until several years old, and are influenced in this respect by the contiguity of supporting objects.

This species of Rhus grows in woods, fields, and along fences from Canada to Georgia. It flowers in June and July. When wounded it emits a milky juice, which becomes black on exposure to the air, and leaves upon linen or other cloth a stain, which cannot afterwards be removed by washing with soap and water, or by alcohol either hot or cold, but deepens by age. It has been proposed as an indelible ink. Ether dissolves it.

The juice applied to the skin frequently produces inflammation and vesication; and the same poisonous property is possessed by a volatile principle which escapes from the plant itself, and produces in certain persons, when they come into its vicinity, an exceedingly troublesome erysipelatoid affection, particularly of the face. Itching, redness, a sense of burning, tumefaction, vesication, and ultimate desquamation, are some of the attendants of this poisonous action. The swelling of the face is sometimes so great as almost entirely to obliterate the features. The effects are experienced soon after exposure, and usually begin to decline within a week. A light, cooling regimen, with saline purgatives, and the local use of cold lead-water, are the best remedies. Alkaline applications would seem to be indicated by Prof. Maisch's discovery of toxicodendron acid as a constituent of the plant, and the probable cause of the eruption. Dr. A. Livezey, of Lumberville, Penn., strongly recommends a saturated tincture of lobelia as a local application in this affection. He applies it by means of linen or muslin cloths, and believes that it arrests the inflammation. (*Boston Med. and Surg. Journ.*, lv. 262.) According to the late Prof. Procter, who was himself very susceptible to this poison, a weak alkaline solution, applied immediately after exposure, seldom fails to prevent the effects; and, after the vesicles are formed, he has found that Monsell's solution (*Liq. Ferri Subsulphatis*, U. S.), introduced by a pointed instrument into the vesicle, renders it abortive. (*Am. Journ. of Pharm.*, Nov. 1863, p. 506.) The preparation known as *aqua phagedænica*, or *yellow wash*, is asserted in a letter to the *Med. and Surg. Reporter* (Oct. 16, 1875, p. 306), from Fauquier Co., Va., to have been used in a case in that neighbourhood with the most prompt success. As used in this instance, the preparation was made in the proportion of twenty grains of corrosive sublimate and five ounces of lime-water, well mixed, and, in this state, applied on rags to the surface affected. Decoction of white-oak bark is also said, applied by bathing to the surface affected, to be very efficient, and is con-

sidered as a specific by Dr. Risk, of Morgan, Kentucky, who seems to speak from much experience. (*Am. Journ. of Med. Sci.*, Oct. 1871, p. 577.) Dr. S. A. Morrison, in his various trials, has employed a solution of half a fluidrachm of carbolic acid and three drachms of sulphite of sodium, in six fluidounces of water, and has never found it to fail. (*Phila. Med. Times*, July 3, 1875, p. 629.) Dr. Charles H. Humphreys, of Brande, Ohio, has experienced marked advantage by sponging the diseased surface every hour during the day with a solution of sulphate of zinc, made with an ounce of the salt and a pint and a half of water. (*Am. Journ. of Med. Sci.*, July, 1874, p. 160.) All persons are not equally liable to the affection, and the great majority are wholly insusceptible of it from any ordinary exposure.

2. *Rhus vernix.* Willd. *Sp. Plant.* i. 1479; Bigelow, *Am. Med. Bot.* i. 96. — *R. venenata.* Gray, *Manual, &c.*, p. 76. *Swamp sumach* is a beautiful shrub or small tree, usually ten or fifteen feet high, but sometimes thirty feet. The bark of the trunk is dark-gray, of the branches lighter, of the extreme twigs and petioles beautifully red. The leaves are pinnate, with four or five pairs of opposite leaflets, and an odd terminal one. These are oblong or oval, entire or slightly sinuated, acuminate, smooth, and, except the one at the end, nearly sessile. The flowers, as in the preceding species, are dicœcious. They are very small, greenish, and in loose axillary panicles. The berries are small, roundish, and greenish-white. The tree grows in swamps and low grounds, from Canada to Carolina, and flowers in June and July. It is thought to be identical with a species of Rhus which grows in Japan, and furnishes a fine black varnish, much used in that country. Dr. Bigelow found that the opaque whitish juice which exudes from our native plant when wounded, and which becomes permanently black on exposure, may be made to afford a brilliant, glossy, durable varnish, by boiling it sufficiently before applying it.

Rhus vernix produces, much more powerfully than *R. radicans*, the poisonous effects already described. Persons coming within its influence are more apt to be affected with the poison, and generally suffer more severely. The whole body is sometimes enormously swollen, and the patient for many days scarcely able to move; but the complaint almost always spontaneously subsides without destroying life. As in the former instance, the susceptibility to the influence of the poison is exceedingly various, and some persons handle the plant with perfect impunity.

3. *Rhus pumilum.* Michaux, *Flor. Americ.* i. 182. This is a southern species, growing in upper Carolina, and not more than a foot in height. It is characterized by its pubescent branches and petioles; its pinnate leaves, with many pairs of oval, nearly acuminate, incised-dentate leaflets, downy beneath; and by its silky fruit. According to Pursh, it is the most poisonous of the genus.

4. *Rhus diversiloba.* Torrey & Gray, *Flor. of North Am.* i. 218. — *R. lobata.* Hooker, *Flor. Bor. Am.* i. 127, t. 46. This species approaches nearly the R. Toxicodendron. It has a somewhat climbing stem, with short, leafy branches. The leaves have three or rarely five leaflets, which are very obtuse, in the female plant slightly, in the male rather deeply pinnately lobed, the lobes being very obtuse, and the incisions acute. The flowers are in axillary, racemose panicles often shorter than the petioles, and the fruit white, somewhat pubescent, and subglobose. The leaves in the male and female plant are so different that they might readily be mistaken for different species. (*Torrey & Gray.*) Though generally a shrub, the plant sometimes climbs over large trees, and has a stem six inches in diameter. In a communication to the *American Journal of Pharmacy* (Sept. 1860, p. 412), the poisonous effects of this plant are described by Dr. C. A. Canfield, who found an invariable antidote to its effects in another California plant, *Grindelia hirsutula*, which is applied to the part either simply bruised or in the form of strong decoction.

It is probable that all parts of Rhus radicans (R. Toxicodendron) are active; but the leaves only are directed in the Pharmacopœia, under the title of Toxicodendron. These are inodorous, have a mawkish acrid taste, and yield their virtues to water. Analyzed by Dr. Joseph Khittel, the leaves yielded tannic acid of the variety which gives greenish precipitates with salts of iron, chlorophyll, wax, fixed oil, resin, sugar, albumen, gum, pectin, starch, oxalic acid, a peculiar neuter substance, and a *volatile alkaloid*, on which the poisonous properties of the plant were supposed to depend. To

obtain this alkaloid, a concentrated infusion of the leaves was distilled with potassa, the distillate saturated with sulphuric acid and evaporated, a mixture of alcohol and ether then added which left sulphate of ammonium behind, the solution distilled with caustic potassa, and an alkaline distillate obtained, which contained the alkaloid in question. But it does not appear to have been further isolated, and no proofs are given of its poisonous properties. (See *Am. Journ. of Pharm.*, Nov. 1858, p. 544.) The results obtained by Dr. Khittel have been subsequently entirely discredited by the experiments of Prof. John M. Maisch, of Philadelphia, who not only failed to detect a volatile alkaloid in the distillate, but found in it a volatile acid, and succeeded in determining this acid to have properties which, though analogous to those of formic and acetic acids, are quite distinct, and entitle it to be regarded as a newly discovered principle. Prof. Maisch gave it the name of *toxicodendric acid*, to which it would seem to be entitled; as there is no doubt that it is the active poisonous principle of the plant. so far, at least, as the irritant effect on the skin is concerned; Prof. Maisch, as well as others exposed to the vapours of the acid, having suffered a copious characteristic eruption of eczematous vesicles on the hand, wrist, and forearm. He employed as remedies against the eruption, solutions of acetate of lead and permanganate of potassium, and ammonia; the last with most satisfactory results. To obtain the acid, the leaves were bruised with six per cent. of slaked lime, and after maceration with water were expressed. The expressed liquid, having been mixed with an excess of sulphuric acid, was distilled, and the vapours were condensed, partly by themselves, so as to obtain the pure acid, and partly in water containing carbonate of barium in suspension, so as to get the toxicodendrate of barium. The acid solution thus obtained is colourless, strongly reddens litmus paper, and neutralizes bases. For further particulars, the reader is referred to the paper of Prof. Maisch in the *Proceedings of the American Pharmaceutical Association*, A. D. 1865; also in the *Am. Journ. of Pharm.* (Jan. 1866, p. 4).

Medical Properties and Uses. The leaves of Rhus Toxicodendron appear to be stimulant and narcotic, producing when swallowed more or less irritation of the stomach and bowels, and promoting the secretory function of the skin and kidneys. Orfila found them to act in the manner of the acrid poisons, and to produce a stupefying effect upon the nervous system. They were successfully used by Du Fresnoy, in France, in the cure of obstinate cutaneous diseases. Dr. Anderson, of Hull, in England, effected cures with the medicine in several cases of palsy. A sense of heat and pricking, with irregular twitchings, was excited by it in the affected parts. Dr. Horsfield and other physicians of this country have used it in consumption and dropsy, but with little success. The remedy has been found efficacious in nocturnal incontinence.

The dose of the leaves recommended by Dr. Anderson was half a grain or a grain three times a day; but this is much too small. Dr. Duncan gave them in larger doses, with little other than a laxative effect. Dr. Horsfield administered a teacupful of the strong infusion without disadvantage. In France, the extract is recommended in doses of fifteen or twenty grains, repeated two or three times a day, and gradually increased to one or two drachms. Some of Du Fresnoy's patients took an ounce without effect. The probability is, that the active principle is volatile, and that the extract is less efficient than the leaves themselves. The risk of experiencing the poisonous effects of the plant upon the system, will probably prevent its extensive employment as a remedy, unless it should prove much more useful than the trials hitherto made give us reason to expect.

Two instances of poisoning by the internal use of the plant have been recorded; one from the eating of the fruit by children, reported in the *Am. Journ. of Med. Sci.* (April, 1866, p. 560) by Dr. J. W. Moorman, of Hardinsburg, Ky.; the other from drinking an infusion of the root, in mistake for sassafras root, also by children, reported by Dr. James Stokes, of Philadelphia, in the *Med. and Surg. Reporter* (Nov. 2, 1867, p. 353). In the first instance, in which nearly a pint of the fruit had been eaten by two children, one six and the other eight years old, after a few hours from the swallowing of the poison, drowsiness and stupor came on, soon followed by vomiting, first of the partially digested fruit, and afterwards of a thick

viscid fluid of a wine colour. This was succeeded by convulsive movements of different parts of the body, with slight delirium. The pupils were dilated. The respiration was hurried, the pulse at first full and strong, but afterwards slow, small, frequent, and feeble. The vomiting was promoted by the use of warm water; and carbonate of sodium was then given freely in solution as an antidote. Both children recovered. In the cases in which an infusion of the root was taken, one, a boy of twelve years, was covered with an eruption over the body, which was especially vesicular in the face, with a dry, hoarse cough, soreness of throat, burning sensations extending to the stomach, high fever, a coated tongue, scanty, high-coloured, and irritating urine, nervous twitchings, and occasional wandering. The diagnosis, somewhat difficult at first, became easy on the occurrence of two other cases, girls respectively of fifteen and seventeen, who with their brother, the boy just mentioned, had been drinking of the infusion referred to. They were treated by saline cathartics in small doses, the local use of lead-water, and an improved diet, and all recovered, with general desquamation. W.

TRAGACANTHA. *U. S., Br.*

Tragacanth.

The gummy exudation from Astragalus verus (*Olivier*), and from other species of Astragalus. *U. S.* A gummy exudation from the stems of Astragalus verus, *Olivier, voy. D. C.;* Nees, *Plant. Med.*, plate 239; and possibly other species. Collected in Asia Minor. *Br.*

Gomme Adraganthe, *Fr.;* Tragant, *Germ.;* Dragante, *Ital.;* Gomo tragacanto, *Span.*

ASTRAGALUS. *Sex. Syst.* Diadelphia Decandria. — *Nat. Ord.* Fabaceæ or Leguminosæ.

Gen. Ch. Legume two-celled, more or less gibbous, with the lower suture turned inwards. *Carina* blunt. *Loudon's Encyc. of Plants.*

Numerous species belonging to this genus yield a gummy matter having the properties of tragacanth. The drug known in commerce by that name was at first erroneously supposed to be obtained from *A. Tragacantha* of Linnæus (*A. massiliensis* of Lamarck), which grows in the south of Europe and north of Africa, and is now said to yield no gum. It was afterwards ascribed, on the authority of Tournefort, to a species (*A. Creticus* of Lamarck) which grows in Crete and Ionia, and on that of Olivier, to *A. verus*, which inhabits Asia Minor, Armenia, and Northern Persia. Labillardière described a species by the name of *A. gummifer*, which he found growing on Mount Libanus in Syria, and from which tragacanth exudes, though not that of commerce. Sieber denies that any one of these species yields the officinal tragacanth, which he ascribes to *A. aristatus*, growing in Anatolia, especially upon Mount Ida, where the gum is most abundantly collected. This plant, however, is not the *A. aristatus* of Villars, which, according to Sibthorp, furnishes tragacanth in Greece. (*Merat and De Lens.*) Professor Lindley received two specimens of plants, said to be those which furnish tragacanth in Turkistan, one of which proved to be *A. gummifer* of Labillardière, which was said to yield a white variety, and the other a new species, which he called *A. strobiliferus*, and which was said to yield a red and inferior product. The fact seems to be, that the commercial drug is collected from various sources; and it is affirmed that all the species of Astragalus with thorny petioles are capable of producing it. These form a natural group, and so closely resemble each other that botanists have found some difficulty in distinguishing them. They are very abundant on the mountains of Asia Minor, and, according to information recently received by M. J. Leon Soubeiran from M. Balansa, a scientific traveller who derived his knowledge from personal observation, the gum-producing species are closely analogous to the *A. Cereticus* of Lamarck. It is in the chain of Anti-Taurus that the gum is chiefly collected. Transverse incisions are made, near the base of the stem, into the medullary part, which alone yields juice. This exudes very slowly, flowing at night, and ceasing during the day; and two weeks usually elapse before the pieces are large enough for collection. The shape of the pieces is influenced by the rapidity of the exudation, and the lines on their surface indicate the

daily concretion. (*Journ. de Pharm.*, Feb. 1856, p. 117, and Feb. 1857, p. 149.) As *A. verus* is designated in the Pharmacopœias of the United States and Great Britain, we shall briefly describe it.

Astragalus verus. Olivier, *Voy. dans l'Empire Ottoman*, p. 342, pl. 44. This is a small shrub, not more than two or three feet high, with a stem an inch in thickness, and numerous very closely crowded branches, covered with imbricated scales, and spines which are the remains of former petioles. The leaves, which are little more than half an inch long, consist of several pairs of opposite, villous, stiff, pointed leaflets, with a midrib terminating in a sharp yellowish point. The flowers are papilionaceous, small, yellow, axillary, aggregate, and furnished with cottony bractes. This species yields the gum collected in Persia, and thence transmitted southward to India through Bagdad and Bassora, northward to Russia, and westward to Aleppo. The juice is said to exude spontaneously during the summer from the stems and branches, hardening as it exudes.

Properties. Tragacanth is either in flaky, leaf-like pieces, irregularly oblong or roundish, or in tortuous vermicular filaments, rounded or flattened, rolled up or extended, of a whitish, yellowish-white, or slightly reddish colour, somewhat translucent, and resembling horn in appearance. It is hard and more or less fragile, but difficult of pulverization, unless exposed to a freezing temperature, or thoroughly dried, and powdered in a heated mortar. The powder is very fine and white. Tragacanth has no smell, and very little taste. Its sp. gr. is 1·384. Introduced into water, it absorbs a certain proportion of that liquid, swells very much, and forms a soft adhesive paste, but does not dissolve. If agitated with an additional quantity of water, this paste forms a uniform mixture; but in the course of one or two days the greater part separates, and is deposited, leaving a portion dissolved in the supernatant fluid. Tragacanth is wholly insoluble in alcohol. It appears to be composed of two different constituents, one soluble in water and resembling gum arabic, the other swelling in water, but not dissolving. The former is said to differ from gum arabic in affording no precipitate with silicate of potassium or sesquichloride of iron. (*Pereira's Materia Medica.*) The latter, which, according to Bucholz, constitutes 43 per cent. of tragacanth, is ranked by some among the peculiar proximate principles with the title of *tragacanthin.* It is probably identical with *bassorin.* It has the property of becoming blue with iodine, which is not the case with bassorin; but this property is ascribed to the presence of a small quantity of insoluble starch. According to M. Guérin, 100 parts of tragacanth contain 53·3 parts of arabin or pure gum, 33·1 of bassorin and insoluble starch, and 11·1 of water, and yield when burned 2·5 parts of ashes. To separate the soluble entirely from the insoluble part, requires agitation with separate portions of water, which are to be decanted and filtered; and the process is to be continued till water ceases to dissolve anything. Examined by Dr. Kützing, by means of the microscope, tragacanth was found to consist of organized cells. (See *Am. Journ. of Pharm.*, xxv. 37.) In conformity with this statement is the remarkable fact, developed by the researches of Hugo von Mohl, that tragacanth is not a secretion of the plant, but the result of the transformation of the cells of the pith, and those of the medullary rays which run across the ligneous part of the stem. (*Ibid.*, xxxi. 243.)

It is stated by Mr. S. H. Maltass that tragacanth is adulterated, in the Levant, with worthless gums brought from Armenia and Caramania, which, as they are originally of a dark colour, and destitute of the flaky form of the genuine gum, are broken into small fragments, and whitened by means of carbonate of lead, before being mixed with the tragacanth. Mr. Hanbury states, in confirmation of this information, that he has detected lead in the *small tragacanth* imported into London. (*Pharm. Journ.*, xv. 20.)

Medical Properties and Uses. Tragacanth is demulcent, but, on account of its difficult solubility, is not often given internally. The great viscidity which it imparts to water, renders it useful for the suspension of heavy insoluble powders; and it is also employed in pharmacy to impart consistence to troches, for which it answers better than gum arabic.

Off. Prep. Confectio Opii, *Br.;* Mucilago Tragacanthæ; Pulvis Opii Compositus, *Br.;* Pulvis Tragacanthæ Compositus, *Br.;* Trochisci Acidi Tannici, *U. S.;* Trochisci Ipecacuanhæ, *U. S.;* Trochisci Potassii Chloratis, *U. S.;* Trochisci Santonici, *U. S.;* Trochisci Zingiberis, *U. S.* W.

TRIOSTEUM. *U. S. Secondary.*

Fever-root.

The root of Triosteum perfoliatum. *U. S.*

Triosteum. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Caprifoliaceæ.

Gen. Ch. Calyx five-cleft, persistent, nearly the length of the corolla; segments linear, acute. *Corolla* tubular, five-lobed, sub-equal; base nectariferous gibbous. *Stigma* somewhat five-lobed, capitate. Berry three-celled, three-seeded, crowned with the calyx. *Nuttall.*

Triosteum perfoliatum. Willd. *Sp. Plant.* i. 990; Bigelow, *Am. Med. Bot.* i. 90; Barton, *Med. Bot.* i. 59. This plant is indigenous and perennial. Several stems usually rise from the same root. They are simple, erect, round, hairy, fistulous, herbaceous, and from one to four feet high. The leaves are opposite, large, mostly connate, oval, acuminate, entire, abruptly narrowed at the base, and pubescent on their under surface. The flowers are of a dull-purple colour, axillary, sessile, rarely solitary, sometimes in pairs, generally in triplets or five together in the form of whorls. The germ is inferior, and the style projects beyond the corolla, into the tube of which the stamens are inserted. The berry is oval and of a deep-orange colour, and contains three hard, bony seeds.

Fever-root, fever-wort, or *wild ipecac*, as this plant is variously called, though not very abundant, is found in most parts of the United States, preferring a limestone soil and shady situations. Its flowers appear in June. The whole plant is bitter; but the root is most active, and is the only officinal part.

It is horizontal, long, about three-quarters of an inch in diameter, thicker and tuberculated near the origin of the stem, of a yellowish or brownish colour externally, whitish within, and furnished with fibres which may be considered as branches of the main root. When dry it is brittle and easily pulverized. It has a sickening odour, and a bitter, nauseous taste. Both water and alcohol take up its active properties, which are retained in the extract.

Medical Properties and Uses. Fever-root is cathartic, and in large doses emetic. The late Professor Barton observed it also to produce a diuretic effect. The bark of the root is the part which has been usually employed. In the quantity of twenty or thirty grains it ordinarily acts upon the bowels; and may be given alone or in combination with calomel at the commencement of fevers. The extract may be given in half the dose. W.

ULMI CORTEX. *Br.*

Elm bark.

The dried inner bark of Ulmus campestris, *Linn.* Broad-leaved Elm, *Woodv. Med. Bot.*, plate 197. From trees indigenous and cultivated in Britain. *Br.*

Ecorce d'orme, *Fr.;* Ulmenrinde, *Germ.:* Scorza del olma, *Ital.;* Corteza de olmo, *Span.*

Ulmus. *Sex. Syst.* Pentandria Digynia.—*Nat. Ord.* Ulmaceæ.

Gen. Ch. Calyx five-cleft. *Corolla* none. *Capsule* (*samara*) compressed, membranaceous. *Willd.*

Ulmus campestris. Willd. *Sp. Plant.* i. 1324; Woodv. *Med. Bot.* p. 710, t. 242. This species of elm is characterized by its doubly serrate leaves, unequal at their base, by its nearly sessile, clustered, pentandrous flowers, and its smooth fruit. It is a large tree, with strong spreading branches, and a rough, cracked bark. It is a native of Europe, where the wood is highly esteemed in the arts.

The inner bark of its young branches, which is the officinal portion, is thin, tough, brownish-yellow, inodorous, and of a mucilaginous, bitterish, and very slightly astringent taste. It imparts to water its taste and mucilaginous properties. Tincture of iodine indicates the presence of starch, and Davy found somewhat more than 2 per cent. of tannin. A vegetable principle called *ulmin* or *ulmic acid*, now believed to be a constituent of most barks, was first discovered in the matter which exudes from the bark of the European elm. It is a dark-brown, almost black substance, without

smell or taste, insoluble in cold water, sparingly soluble in boiling water which it colours yellowish-brown, soluble in alcohol, and readily dissolved by alkaline solutions.

Medical Properties and Uses. The bark of the European elm is demulcent, and very feebly tonic and astringent, and is said also to be diuretic. It has been recommended in cutaneous affections of the leprous character. Dr. Sigmond speaks in strong terms of its efficacy in all the varieties of lepra, in lichenous eruptions, and tinea capitis, employed both internally and externally. (*Medico-bot. Trans.*, i. 169.) It is usually given in the form of decoction, and in chronic cases must be long continued to produce beneficial results.

Off. Prep. Decoctum Ulmi, *Br.* W.

ULMUS. *U.S.*

Slippery-elm Bark.

The inner bark of Ulmus fulva (*Michaux*). *U.S.*

Syn. Ulmus Fulva, *Pharm.*, 1860. *U.S.*

Ulmus. See ULMI CORTEX.

Ulmus fulva. Michaux, *Flor. Americ.* i. 172.— *Ulmus rubra.* F. Andrew Michaux, *N. Am. Sylv.* iii. 89. The *slippery elm*, called also *red elm*, is a lofty tree, rising fifty or sixty feet in height, with a stem fifteen or twenty inches in diameter. The bark of the trunk is brown, that of the branches rough and whitish. The leaves are oblong ovate, acuminate, nearly equal at the base, unequally serrate, pubescent, and very rough on both sides, four or five inches in length by two or three in breadth, and supported on short footstalks. The buds, a fortnight before their development, are covered with a dense russet down. The flowers, which appear before the leaves, are sessile, and in clusters at the extremity of the young shoots. The bunches of flowers are surrounded by scales, which are downy like the buds. The calyx also is downy. There is no corolla. The stamens are five, short, and of a pale-rose colour. The fruit is a membranaceous capsule or samara, enclosing in the middle one round seed, destitute of fringe.

This species of elm is indigenous, growing in all parts of the United States north of the Carolinas, but most abundantly west of the Alleghany mountains. It flourishes in open, elevated situations, and requires a firm, dry soil. From the *white elm* (*U. Americana*) it is distinguished by its rough branches, its larger, thicker, and rougher leaves, its downy buds, and the character of its flowers and seeds. Its period of flowering is in April. The inner bark is the part used, and is brought to the shops separated from the epidermis. Large quantities are collected in the Lower Peninsula of Michigan.

It is in long, nearly flat pieces, from one to two lines thick, of a fibrous texture, a tawny colour which is reddish on the inner surface, a peculiar sweetish, not unpleasant odour, and a highly mucilaginous taste when chewed. By grinding, it is reduced to a light, grayish fawn-coloured powder. It abounds in mucilaginous matter, which it readily imparts to water. The mucilage is precipitated by solutions of acetate and subacetate of lead, but not by alcohol.

Much of the bark brought into the market is of inferior quality, imparting comparatively little mucilage to water. It has the characteristic odour of the genuine bark, but is much less fibrous and more brittle, breaking abruptly when bent, instead of being capable, like the better kind, of being folded lengthwise without breaking. To what this inferiority is owing, whether to difference in the species or the age, or to circumstances in the growth of the tree producing it, we are unable to determine.

Dr. C. W. Wright, of Cincinnati, in a communication to the *Western Lancet*, states that slippery-elm bark has the property of preserving fatty substances from rancidity; a fact derived originally from the Indians, who prepared bears' fat by melting it with the bark, in the proportion of a drachm of the latter to a pound of the former, keeping them heated together for a few minutes, and then straining off the fat. Dr. Wright tried the same process with butter and lard, and found them to remain perfectly sweet for a long time. (*Am. Journ. of Pharm.*, xxiv. 180.)

Medical Properties and Uses. Slippery-elm bark is an excellent demulcent, applicable to all cases in which this class of medicines is employed. It is especially recommended in dysentery, diarrhœa, and diseases of the urinary passages. Like the bark of the common European elm, it has been employed in cutaneous eruptions; but neither in these, nor in any other complaints, does it probably exert any greater powers than such as belong to the demulcents generally. Its mucilage is nutritious; and we are told that it has proved sufficient for the support of life in the absence of other food. The instance of a soldier is mentioned, who lived for ten days in the woods on this bark and sassafras; and the Indians are said to resort to it for nutriment in extreme emergencies. The case of a lad of 15 is recorded, who, a day or two after eating a portion of this bark, became violently ill, and died. The stomach was examined, and found full of the bark twisted into balls. The death was no doubt owing to the large amount of indigestible matter in the stomach, which could not be got rid of by the efforts of nature, and not to any poisonous property of the bark. (*Phila. Med. Times*, Feb. 7, 1874, p. 303.)

Dr. J. R. Dowler, of Beardstown, Ill., reports two cases of tape-worm, one in a child, the other an adult, in which the worm was discharged, as a consequence of chewing and swallowing the bark of the elm. (*Bost. Med. and Surg. Journ.*, March 16, 1865, p. 132.)

It is commonly used as a drink in the form of infusion. (See *Mucilago Ulmi.*) The powder may be used stirred in hot water, with which it forms a mucilage, more or less thick according to the proportion added. The bark also serves as an emollient application in cases of external inflammation. For this purpose the powder may be formed into a poultice with hot water, or the bark itself may be applied, previously softened by boiling. Dr. McDowell, of Virginia, recommended slippery-elm bark for the dilatation of fistulas and strictures (see *Med. Examiner*, i. 244); subsequently Dr. H. R. Storer, of Boston, used it advantageously for dilating the os uteri (*Bost. Med. and Surg. Journ.*, liii. 300); and Dr. A. Abbe, of the same place, succeeded in curing with it a case of stricture of the rectum. (*Ibid.*, liv. 349.)

Off. Prep. Mucilago Ulmi, *U. S.* W.

UVA PASSA. *U. S.*

Raisins.

The dried fruit of Vitis vinifera. *U. S.*

Off. Syn. UVÆ. *Raisins.* The ripe fruit of Vitis vinifera. *Linn.*, the Grape vine, Woodv. *Med. Bot.* plate 195. Dried in the sun or with artificial heat; imported from Spain. *Br.*

Raisins secs, *Fr.;* Rosinen, *Germ.;* Uve passe, *Ital.;* Pasas, *Span.*

VITIS. *Sex. Syst.* Pentandria Monogynia.—*Nat. Ord.* Vitaceæ.

Gen. Ch. Petals cohering at the apex, withering. *Berry* five-seeded, superior. *Willd.*

Vitis vinifera. Willd. *Sp. Plant.* i. 1180; Woodv. *Med. Bot.* p. 144, t. 57. The vine is too well known to require description. This particular species is distinguished by the character of its leaf, which is lobed, sinuated, and naked or downy. The leaves and tendrils are somewhat astringent, and were formerly used in diarrhœa, hemorrhages, and other morbid discharges. The juice which flows from the stem was also thought to be possessed of medicinal virtues, and the prejudice still lingers among the vulgar in some countries. The unripe fruit has a harsh sour taste, and yields by expression a very acid liquor, called *verjuice*, which was much esteemed by the ancients as a refreshing drink, when diluted with water. It contains malic and tartaric acids, and another called by some chemists *racemic acid*, by Berzelius *paratartaric acid*, from its resemblance to the tartaric, with which it agrees in composition, though differing from it in properties. M. A. Petit has ascertained that grape leaves contain 2 or 3 per cent. of glucose, and a quantity of acid varying from 1·3 to 1·6 per cent. Of the acid, tartaric acid constituted one-third, and most of this was in the form of cream of tartar. In a subsequent investigation, M. Petit found that, beside glucose or sugar of grapes, the leaves contained also a notable portion of common or cane sugar. In

one instance he got ·97 per cent. of cane sugar and 2·655 of glucose; in another in which he operated so that the common sugar in the leaves had less opportunity to be converted into glucose, he got 1·58 per cent. of the former and 1·749 of the latter. (*Journ. de Pharm.*, Janv. 1874, p. 41.) The grape, when quite ripe, is among the most pleasant and grateful fruits brought upon the table, and is admirably adapted, by its refreshing properties, to febrile complaints. If largely taken, it proves diuretic and gently laxative. The ripe fruit differs from the unripe in containing more sugar and less acid, though never entirely destitute of the latter. The plant is supposed to have been derived originally from Asia; but it has been cultivated in Europe and Northern Africa from the remotest antiquity, and is now spread over all the temperate civilized regions of the globe. The fruit is exceedingly influenced by soil and climate, and the varieties which have resulted from culture or situation are innumerable. Those which yield the raisins of commerce are confined to the basin of the Mediterranean.*

Raisins are prepared either by partially cutting the stalks of the bunches before the grapes are perfectly ripe, and allowing them to dry upon the vine, or by picking them in their mature state, and steeping them for a short time previously to desiccation in an alkaline ley. Those cured by the first method are most highly esteemed.†

Several varieties of raisins are known in commerce. The best of those brought to this country are the *Malaga raisins*, imported from Spain. They are large and fleshy, of a purplish-brown colour, and sweet agreeable taste. Those produced in Calabria are similar. The *Smyrna raisins* are also large, but of a yellowish-brown colour, slightly musky odour, and less agreeable flavour. They are originally brought from the coast of Syria. The *Corinthian raisins*, or *currants* as they are commonly called in this country, are small, bluish-black, of a fatty appearance, with a vinous odour, and a sweet, slightly tartish taste. Their name was derived from the city in the vicinity of which they were formerly cultivated. At present they are procured chiefly from Zante, Cephalonia, and the other Ionian Islands. In the older Pharmacopœias they are distinguished by the title of *uvæ passæ minores*.

Raisins contain a larger proportion of sugar than recent grapes. This principle, indeed, is often so abundant that it effloresces on the surface, or concretes in separate masses within the substance of the raisin. The *sugar of grapes* (*glucose*) differs

* The vine is in Europe liable to the attacks of a parasite, named Phylloxera, which incapacitates it for bearing, and has often proved a scourge to entire regions of country. Sulphur has been found one of the most effective preventives; but the Abbé Rolancan has proposed what he considers an "infallible remedy," consisting in the pure *essence of Eucalyptus Globulus*, which is introduced, in the quantity of a few drops, into an incision cut in the base of the vine. In about three days the parasite entirely disappears, and the plant remains uninjured. (*New Remedies*, Jan. 1874, p. 348.) For a statement of various methods of destroying the Phylloxera, see a paper by Dumas in the *Journ. de Pharm.* (Avril, 1874, p. 411); see also *Ibid.* (Juin, 1875, p. 494).—*Note to the fourteenth edition.*

† *Culture of Raisins.* The statement in the text in relation to the mode of drying grapes is allowed to remain, because made on what was deemed competent authority; but, in a journey through the raisin districts in the Southeast of Spain, in the spring of 1861, the author made frequent inquiries at Malaga and Valencia, and found no one who had heard of the plan of partially cutting the stalks of the bunches, and then allowing them to dry on the plant. The following is a brief account of the raisin culture near Malaga. The grape cultivated for drying is exclusively the Muscatel. The district appropriated to this purpose consists of red-earth lands, along the coast of the Mediterranean, extending for about 30 miles on each side of Malaga. The grounds planted with the vine are the shore plains and valleys, the smaller hills, and the lower declivities of the mountains. The vines are kept trimmed very low, and the earth between them loosened by the spade; the plough not being used. The grapes are ripe in August, when the bunches are cut off, and carefully dried in the sun, upon a hard level earthen floor, prepared for the purpose, which is protected by a shed when it rains. After one side of the bunch has become dry, the other is carefully turned to the sun. When dried, they are generally packed in wooden boxes, each containing about 25 lbs. The most valuable, called the *bloom raisins* from the preservation of the bloom unbroken on the surface, are packed in paper boxes, and sent, as the author was told, exclusively to the London market, where they are especially esteemed. About a million of boxes are sent annually to the United States, valued at two millions of dollars. The *Valencia raisin* is a different variety from the Malaga. The grape is thicker-skinned, and does not dry well unless with previous preparation. Hence, as soon as picked, they are dipped into a ley made from wood ashes, immediately removed, and then dried. The alkali causes the skin to crack in minute fissures, and thus facilitates drying. The author was assured that the Valencia raisins are not sent to the United States, but exclusively to England, where they are used in puddings. The Malaga grape, imported in the fresh state into this country, is a different variety from the raisin grape, and cultivated higher on the mountains. (*Note to the twelfth edition.*)

from that of the cane; being less sweet, less soluble in cold water, and much less so in alcohol, and forming a syrup of less consistence.

Medical Properties and Uses. The chief medical use of raisins is to flavour demulcent beverages. Taken in substance they are gently laxative; but are also flatulent and difficult of digestion, and, when largely eaten, sometimes produce unpleasant effects, especially in children.

Off. Prep. Tinctura Cardamomi Composita, *Br.;* Tinctura Rhei et Sennæ, *U.S.;* Tinctura Sennæ, *Br.* W.

UVA URSI. *U.S.*

Uva Ursi. Bearberry Leaves.

The leaves of Arctostaphylos Uva Ursi (Sprengel, *Syst.* ii. 287). *U.S.*

Off. Syn. UVÆ URSI FOLIA. *Bearberry Leaves.* The dried leaves of Arctostaphylos Uva Ursi. Spreng. *Syst.*, Woodv. *Med. Bot.* plate 70 (*Arbutus Uva Ursi*). From indigenous plants. *Br.*

Busserole, Raisin d'ours, *Fr.;* Bärentraube, *Germ.;* Corbezzolo, Uva Ursina, *Ital.;* Gayuba, *Span.*

ARCTOSTAPHYLOS. *Sex. Syst.* Decandria Monogynia.—*Nat. Ord.* Ericaceæ.

Gen. Ch. Drupe with five distinct, one-seeded stones. *Corolla* urceolate, with a revolute limb. *Stamens* included. *Anthers* with two spurs at the back. (Lindley, *Med. and Œcon. Bot.* 106.)

Arctostaphylos Uva Ursi. Sprengel, *Syst.* ii. 287; Carson, *Illust. of Med. Bot.* i. 61, pl. 52.—*Arbutus Uva Ursi.* Willd. *Sp. Plant.* ii. 618; Bigelow, *Am. Med. Bot.* i. 66. The *uva ursi*, or *bearberry*, is a low evergreen shrub, with trailing stems, the young branches of which rise obliquely upwards for a few inches. The leaves are scattered, upon short petioles, from half an inch to an inch long, obovate, acute at the base, entire, with a rounded margin, thick, coriaceous, smooth, shining, deep-green on their upper surface, paler and covered with a network of veins beneath. The flowers, which stand on short reflexed peduncles, are in small clusters at the ends of the branches. The calyx is small, five-parted, reddish, and persistent. The corolla is ovate or urceolate, reddish-white, or white with a red lip, transparent at the base, contracted at the mouth, and divided at the margin into five short reflexed segments. The stamens are ten, with short filaments and bifid anthers; the germ round, with a style longer than the stamens, and a simple stigma. The fruit is a small, round, depressed, smooth, glossy, red berry, with an insipid mealy pulp, and five cohering seeds.

This humble but hardy shrub inhabits the northern latitudes of Europe, Asia, and America. It is also found in the lofty mountains of Southern Europe, as the Pyrenees and the Alps; and, on the American continent, extends from Hudson's Bay as far southward as New Jersey, in some parts of which it grows in abundance. It prefers a barren soil, flourishing on gravelly hills, and elevated sandy plains. The leaves are the only part used in medicine. They are imported from Europe; but are also collected within our own limits; and the market of Philadelphia is supplied to a considerable extent from New Jersey. They should be gathered in autumn, and the green leaves only selected.

In Europe the uva ursi is often adulterated with the leaves of *Vaccinium Vitis Idæa*, which are wholly destitute of its peculiar properties, and may be distinguished by their rounder shape, their revolute edges which are sometimes slightly toothed, and the appearance of their under surface, which is dotted, instead of being reticulated like the genuine leaf. Leaves of the *Chimaphila umbellata* are sometimes found among the uva ursi as it exists in our markets. They may be readily detected by their greater length, their cuneiform-lanceolate shape, and their serrate edges.

Properties. Uva ursi is inodorous when fresh, but acquires a smell not unlike that of hay when dried and powdered. Its taste is bitterish, strongly astringent, and ultimately sweetish. It affords a light-brown, greenish-yellow powder. Water extracts its active principles, which are also soluble in officinal alcohol. Among its ingredients are tannic and gallic acids, bitter extractive, resin, gum, fatty matter, a volatile oil, and salts of potassa and lime. The tannic acid is so abundant that the

leaves are used for tanning in Russia. Neither this principle nor gallic acid exists in the leaves of the *Vaccinium Vitis Idæa.*

A crystallizable principle was extracted from uva ursi by Mr. J. C. C. Hughes by the following process. An aqueous extract of the leaves was treated with strong alcohol, and submitted for twenty-four hours to the action of purified animal charcoal. The tincture was filtered and evaporated, and the residue redissolved in alcohol, and treated with animal charcoal as before. After filtration, the liquid was allowed to evaporate spontaneously, and yielded colourless, transparent, needle-shaped crystals, soluble in water, alcohol, ether, and dilute acids, insoluble in the fixed and volatile oils, neutral to test-paper, and combustible. The watery solution was precipitated by subacetate of lead and carbonate of potassium, but not by lime-water or tincture of chloride of iron. One grain of it acted as a powerful diuretic. Mr. Hughes proposed for this substance the name of *ursin.* (*Am. Journ. of Pharm.*, xix. 90.) It has, however, been considered highly probable by Mr. Julius Jungmann that the ursin of Hughes is in fact impure arbutin. (*Ibid.*, May, 1871, p. 205.)

Kawalier obtained a crystalline substance, named *arbutin*, by precipitating the decoction with acetate of lead, filtering, treating the liquid with sulphuretted hydrogen, again filtering, evaporating to the consistence of syrup, and allowing the product to stand for several days. This gradually assumed the form of a crystalline jelly, which, being placed upon linen so as to allow the mother-liquor to drain off, and then pressed, yielded nearly colourless crystals, which were purified by solution in boiling water, and treatment with animal charcoal. Arbutin thus obtained is in long, acicular, colourless crystals, united in tufts, and of a bitter taste. It is soluble in water, alcohol, and ether, unchanged apparently by a heat of 212°, but fusible at a high temperature, without action on vegetable colours, and not precipitated by the salts of sesquioxide of iron, or by acetate or subacetate of lead. It is a glucoside, being resolvable by boiling with sulphuric acid into glucose and a peculiar substance named *arctuvine.* Its formula is $C_{32}H_{21}O_{21}$. (*Chem. Gaz.*, Feb. 15, 1853, p. 61.) Strecker, however, gives a different formula, $C_{24}H_{16}O_{14}+2HO$, and considers the arctuvine of Kawalier as identical with *hydrochinone* prepared by Wöhler from kinic acid. (*Ibid.*, Feb. 1, 1859, p. 48.) A test for arbutin, discovered by Julius Jungmann, is as follows. When phosphomolybdic acid is added to a solution of arbutin previously rendered alkaline by ammonia, or other alkali, a blue colour is produced, which is deep when the solutions are strong, but observable even when they are very dilute. (*Am. Journ. of Pharm.*, May, 1871, p. 204.)*

Another crystallizable principle has been discovered by Trommsdorff, who calls it *ursone.* It appears to be of a resinous character, being tasteless and inodorous, insoluble in water, difficultly soluble in alcohol and ether, fusible, at a higher temperature volatilizable, and inflammable in the air. It is obtained by treating uva ursi with a very small quantity of ether by percolation, allowing the ether to evaporate, washing the crystalline extract with ether, and re-crystallizing from alcohol. (See *Am. Journ. of Pharm.*, xxvii. 334.)

* *Sources of Arbutin.* Besides being a constituent of the two species of Arctostaphylos above mentioned, this principle is somewhat widely diffused in other plants. It is especially found in those belonging to the natural order Ericaceæ; as, *Chimaphila umbellata, Chimaphila maculata, Epigæa repens,* and *Gaultheria procumbens.* In some others it has been supposed to exist because, among the products of the dry distillation of their extract, a principle has been found denominated *hydrokinone,* which is one of the products of the destructive distillation of arbutin; but, as kinic acid yields the same substance in the same way, the inference in relation to the existence of arbutin in the plants is somewhat uncertain. Nevertheless, as kinic acid yields *pyrocatechin* along with hydrokinone, while arbutin gives only the latter; a method of distinguishing the two; the plants from which of these two products only hydrokinone is obtained probably contain arbutin; while, if it yield both of them, there can be no certainty that kinic acid is the principle in the plant. (Prof. John Maisch, *Am. Journ. of Pharm.*, July, 1874, p. 314.)—*Note to the fourteenth edition.*

Analysis of Vaccinium vitis idæa, or *Red whortleberry,* by Dr. Gräger. The berries contain 10·185 of soluble matter, 4·204 of insoluble matter (cellulose, pectin, &c.), and 85·611 of water. The expressed juice yielded 1·975 of free organic acid (citric and malic), 5·185 sugar, 0·476 tannin, 2·333 albuminous and pectinaceous substances, suspended fat, &c., 0·216 inorganic bases (potassa, lime, magnesia, iron), and 89·815 water. The insoluble residue gave, when burned, 0·102 per cent. of ashes, which contained sulphate and phosphate of calcium, silicic acid, and oxide of iron. (*Am. Journ. of Pharm.*, Dec. 1871, p. 543; from *Neues Jahrb. für Pharm.*, Oct. 1871, pp. 208–213.)—*Note to the fourteenth edition.*

Medical Properties and Uses. Uva ursi is astringent and tonic, and is thought by some to have a specific direction to the urinary organs, for the complaints of which it is chiefly used. Others deny that it possesses a peculiar tendency of this kind, and ascribe its effects to its astringent and tonic action. It alters the colour of the urine, and its astringent principle has been detected in that secretion. It probably, therefore, exerts a direct influence on the kidneys and urinary passages. Though known to the ancients, it had passed into almost entire neglect, till its use was revived by De Haen about the middle of the last century. It has acquired some reputation as an antilithic, and has undoubtedly been serviceable in gravel, partly, perhaps, by a direct action on the kidneys, partly by giving tone to the digestive organs, and preventing the accumulation of principles calculated to produce a secretion or precipitation of calculous matter. In chronic nephritis it is also a popular remedy, and is particularly recommended when there is reason to conjecture the existence of ulceration in the kidneys, bladder, or urinary passages. Diabetes, catarrh of the bladder, incontinence of urine, gleet, leucorrhœa, and menorrhagia are also among the diseases in which it has occasionally proved serviceable; and testimony is not wanting to its beneficial effects in phthisis pulmonalis. Dr. E. G. Harris, of Fayette, Alabama, believes it to have the property of promoting uterine contraction, and has employed it with supposed advantage as a substitute for ergot in tedious labours. (See *Med. Exam.*, N.S., ix. 727.) The dose of the powder is from a scruple to a drachm, to be repeated three or four times a day; but the decoction or fluid extract is usually preferred. (See *Part* II.) Arbutin has been tried as a medicine, in the hope that it might have the virtues of the uva ursi, of which it is a constituent, but hitherto with no great success. (*Am. Journ. of Pharm.*, May, 1871, p. 205.)

Another species of Arctostaphylos is *A. glauca*, a small tree or shrub indigenous in California, where it generally grows in dry and rocky places on the west of the mountain ranges. The leaves are highly esteemed as a remedy in diarrhœa and gonorrhœa, being used in the form of decoction. Chemically examined by Mr. John Henry Flint, they were found to contain 9·8 per cent. of tannin; and the ashes of the incinerated leaves, amounting to ·6 per cent., contained potassium, calcium, magnesium, and iron. A crystalline principle has been discovered in the leaves, which Mr. Flint found to be arbutin. (*Am. Journ. of Pharm.*, May, 1873, p. 197.)

Off. Prep. Decoctum Uvæ Ursi, *U. S.;* Extractum Uvæ Ursi Fluidum, *U. S.;* Infusum Uvæ Ursi, *Br.* W.

VALERIANA. *U.S.*

Valerian.

The root of Valeriana officinalis, *U. S.*

Off. Syn. VALERIANÆ RADIX. *Valerian Root.* The dried root of Valeriana officinalis, *Linn.* Woodv. *Med. Bot.*, plate 96. From plants indigenous to and also cultivated in Britain, collected in autumn; wild plants being preferred. *Br.*

Valériane, *Fr.;* Wilde Baldrianwurzel, *Germ.;* Valeriana silvestre, *Ital.;* Valerian silvestre, *Span.*

VALERIANA. *Sex. Syst.* Triandria Monogynia.—*Nat. Ord.* Valerianaceæ.

Gen. Ch. Calyx very small, finally enlarged into a feathery pappus. *Corolla* monopetalous, five-lobed, regular, gibbous at the base. *Capsule* one-celled. (*Loudon's Enc. of Pl.*) *Stamens* exserted, one, two, three, and four. (*Nuttall.*)

Valeriana officinalis. Willd. *Sp. Plant.* i. 177; Woodv. *Med. Bot.* p. 77, t. 32. The *officinal*, or *great wild valerian*, is a large handsome herbaceous plant, with a perennial root, and an erect, round, channeled stem, from two to four feet high, furnished with opposite pinnate leaves, and terminating in flowering branches. The leaves of the stem are attached by short, broad sheaths; the radical leaves are larger and stand on long footstalks. In the former the leaflets are lanceolate and partially dentate, in the latter elliptical and deeply serrate. The flowers are small, white or rose-coloured, agreeably odorous, and disposed in terminal corymbs, interspersed with pear-shaped pointed bractes. The number of stamens is three. The fruit is a capsule containing one oblong-ovate, compressed seed. The plant is a native of Europe, where it grows either in damp woods and meadows, or on dry elevated grounds. As

found in these different situations, it presents characters so distinct as to have induced some botanists to make two varieties. Dufresne makes four, of which three prefer marshy situations. The variety which affects a dry soil (*sylvestris*, L. Ph.) is not more than two feet high, and is distinguished by its narrow leaves. It has been generally believed to be superior to the others in medicinal virtue; but, from experiments of A. Buchner, it appears that the dried roots of the variety which grows in low moist grounds are in no respect inferior, and that the general opinion to the contrary is a prejudice. (*Pharm. Cent. Blatt*, June, 1852, p. 429.)

The root, which is the officinal portion, is collected in spring before the stem begins to shoot, or in the autumn when the leaves decay. It should be dried quickly, and kept in a dry place. It consists of numerous long, slender, cylindrical fibres, issuing from a tuberculated head or rhizome. As brought to this country, it frequently has portions of the stem attached. The English is superior to that from the continent of Europe. Valerian of good quality has been produced by the Shakers at Enfield, New Hampshire. It is produced also in northern Vermont and New York. From our own observation, we know that the plant grows luxuriantly under culture in this country. Mr. Thos. Doliber obtained from the American root 28·97 per cent. of alcoholic extract, and from the English 17·59 per cent. Mr. Doliber states that the American has almost entirely superseded the European in our market. (*Am. Journ. of Pharm.*, Jan. 1867, p. 70.)

Properties. The colour of the root is externally yellowish or brown, internally white. The powder is yellowish-gray. The odour, which in the fresh root is slight, in the dried is strong and highly characteristic, and, though rather pleasant to many persons, is very disagreeable to others. Cats are said to be strongly attracted by it. The taste is at first sweetish, afterwards bitter and aromatic. Valerian yields its active properties to water and alcohol. Trommsdorff found it to consist of 1·2 parts of volatile oil; 12·5 of a peculiar extractive matter, soluble in water, insoluble in ether and alcohol, and precipitated by metallic solutions; 18·75 of gum; 6·25 of a soft odorous resin; and 63 of lignin. Runge found in it a peculiar fixed acid, which produced with bases white salts, becoming green on exposure to the air. (*Chem. Gaz.*, No. 170, p. 452.) Of these constituents the most important is the *volatile oil.* It is of a pale-greenish colour, of the sp. gr. 0·934, with the pungent odour of valerian, and an aromatic taste. It becomes yellow and viscid by exposure.

Trommsdorff ascertained the existence in the oil of a peculiar volatile acid, upon which the name of *valerianic acid* or *valeric acid* has been conferred. This, when separated from the oil, is a colourless liquid, of an oleaginous consistence, having an odour analogous to that of valerian, and a very strong, sour, disagreeable taste. It is soluble in thirty parts of water, and in all proportions in ether and alcohol. It combines with salifiable bases, forming soluble salts, which retain, in a diminished degree, the odour of the acid. (*Journ. de Pharm.*, xx. 316.) From the experiments of MM. Cozzi and Thirault, it would appear that this acid does not pre-exist in the root, but results from the oxidation of the volatile oil. (*Ibid.*, 3e sér., xii. 162.) Valerianic acid is obtained by distilling the impure oil from carbonate of magnesium, decomposing by sulphuric acid the valerianate of magnesium which remains, and again distilling. M. Rabourdin, of Orleans, believing that a large proportion of the valerianic acid remains fixed in the root by union with a base, and does not come over by distillation alone, procures it by adding sulphuric acid to the root with a sufficient quantity of water, distilling, separating the oil, saturating the liquor with carbonate of sodium, evaporating, adding a slight excess of sulphuric acid, and again distilling. (*Ibid.*, vi. 310.) The following process by Messrs. T. and H. Smith, of Edinburgh, avoids the inconvenience of distilling so bulky a root as valerian, while it answers the same purpose as that of M. Rabourdin. Boil the root for three or four hours with rather more than its bulk of water, in which an ounce of carbonate of sodium is dissolved for every pound of the root, replacing the water as it evaporates. Express strongly, and boil the residuum twice with the same quantity of water, expressing each time as before. Mix the liquids, add two fluidrachms of strong sulphuric acid for every pound of the root, and distil till three-fourths of the liquid have passed over. Neutralize this with carbonate of sodium, concentrate the liquid, decompose the

valerianate of sodium contained in it by sulphuric acid, and separate the valerianic acid set free, either by a separatory, or by distillation. (*Am. Journ. of Pharm.*, xvii. 253.) M. Lefort obtains the acid by the rapid oxidation of the volatile oil. He distils 100 parts of the root with 500 of water, 10 of sulphuric acid, and 6 of bichromate of potassium. In this way he has procured a larger proportion of acid than by any other process. (*Journ. de Pharm.*, 3e sér., x. 194.)

The roots of *Valeriana Phu* and *V. dioica* are said to be sometimes mingled with those of the officinal plant; but the adulteration is attended with no serious consequences; as, though much weaker than the genuine valerian, they possess similar properties. The same cannot be said of the roots of several of the *Ranunculaceæ*, which, according to Ebermayer, are sometimes fraudulently substituted in Germany. They may be readily detected by their want of the peculiar odour of the officinal root. According to M. O. Raveil, the valerian in the markets of Paris is largely adulterated with the roots of *scabious* (*Scabiosa succisa* and *S. arvensis*, Linn.). They are shorter than the genuine root, with larger radicles, less rough, little or not at all striated, very brittle, with a white amylaceous fracture. The roots are inodorous in themselves, but acquire smell from contact with the valerian. (*Journ. de Pharm.*, xxvi. 209.)

Medical Properties and Uses. Valerian is gently stimulant, with an especial direction to the nervous system, but without narcotic effects. In large doses it produces a sense of heaviness and dull pain in the head, with various other effects indicating nervous disturbance. The oil, largely taken, is said by M. Barailer, from his own observation, to produce dulness of intellect, drowsiness ending in deep sleep, reduced frequency of pulse, and increased flow of urine. (See *Am. Journ. of Pharm.*, May, 1861, p. 239.) It is useful in cases of irregular nervous action, when not connected with inflammation, or an excited condition of the system. Among the complaints in which it has been particularly recommended are hysteria, hypochondriasis, epilepsy, hemicrania, and low forms of fever attended with restlessness, morbid vigilance, or other nervous disorder. It has also been used in intermittents, combined with Peruvian bark. Mr. N. J. Butler, of Dublin, has found very great advantage in acute rheumatism from baths of valerian, made in the proportion of a pound of the root to 20 gallons of water, the temperature of the bath being 98°. Its power, in the opinion of Mr. Butler, is wonderful in cutting short the most violent attacks of acute rheumatic arthritis. (*Bost. Med. and Surg. Journ.*, Sept. 10, 1868, p. 95.) It has been found very useful by Dr. Bouchard, of La Charité Hospital, in diabetes mellitus and azoturia. (*Lancet*, Nov. 1, 1873, p. 633.) It may be given in powder or infusion. In the latter form, it is said by Professor Joerg, of Leipsic, who has experimented with it, to be less apt to irritate the alimentary canal than when administered in substance. The dose of the powder is from thirty to ninety grains, repeated three or four times a day. The tincture also is officinal. As the virtues of valerian reside chiefly in the volatile oil, the medicine should not be given in decoction or extract. The distilled water is used on the continent of Europe; and the volatile oil is occasionally substituted with advantage for the root. The dose of the oil is four or five drops. Valerianic acid also has been used internally; and a process is given in the U. S. Pharmacopœia for its preparation. (See *Acidum Valerianicum.*) Landerer says that, in his experience, the acid prepared from the root is preferable therapeutically to the artificial acid. Valerianate of caffeina, having been recommended by Dr. Paret, was found effectual by Dr. Gubler in the persistent vomiting of hysteria, in the dose of 1·5 grains, repeated every three or four hours, in the form of pill. (*Am. Journ. of Pharm.*, May, 1875, p. 213.)

Off. Prep. Extractum Valerianæ, *U. S.;* Extractum Valerianæ Fluidum, *U. S.;* Infusum Valerianæ; Oleum Valerianæ, *U. S.;* Tinctura Valerianæ; Tinctura Valerianæ Ammoniata. W.

VANILLA. *U. S.*

Vanilla.

The prepared unripe fruit of Vanilla aromatica. *U. S.*

VANILLA. *Sex. Syst.* Gynandria Monandria.— *Nat. Ord.* Orchidaceæ.

Gen. Ch. Sepals spreading or erect, distinct. *Petals* of a similar form and texture.

Labellum connate with the columna, crested, membranous, convolute, undivided. *Anther* terminal, opercular; pollen granular. *Fruit* a fleshy *pod;* seeds round, destitute of loose tunic. *Lindley.*

Vanilla aromatica. Schwartz, *Flor. Ind. Occid.*—*Epidendrum Vanilla.* Linn. This is a climbing plant, characterized, as a species, by its ovate, oblong, nerved leaves, its wavy sepals, its acute lip, and very long cylindrical capsules. The stem is almost cylindrical, has about the thickness of the little finger, is greenish and fleshy, and is furnished with occasional nodes, each of which has a thick opposite leaf, of about eight inches by three. Its roots penetrate the bark of the tree to which it is attached, from which they obtain nourishment for the plant. After a certain height the stem branches, and forms a spreading top, which, in due season, is covered with large flowers, greenish externally and white within. The fruit is a slender pod, seven or eight inches long, filled with an oily mass containing numerous small, black, shining seeds. The plant is a native of the West Indies, Mexico, and South America; and is said to be cultivated in Java and the Isles of France and Bourbon. It is stated to be grown under glass in England and France, and at Liege, with commercial success. (*Am. Journ. of Pharm.*, xlvi. 419.) Doubts, however, exist whether the best commercial vanilla is derived from this species, and some ascribe it to *Vanilla planifolia.* (*Journ. de Pharm.*, xvi. 274.) It is probable that different varieties of the vanilla of commerce are obtained from different species, of which several, besides the two mentioned, have been described as yielding an aromatic fruit, as *V. Guyanensis*, *V. palmarum*, and *V. pompona.* In Mexico the plant flourishes on the eastern coast, in the States of Vera Cruz and Oaxaca. It begins to bear fruit in three years, and continues to bear thirty or forty years. Though most of the vanilla of commerce is derived from plants growing wild in the forests, yet much is the product of a species of cultivation, which is very simple. All that is necessary is to cut a slip of the stem from the lower part, and plant it near the trunk of a tree, attaching it by cords. The plant immediately takes root in the bark of the tree, and sends out air roots, which, reaching the ground, fix themselves in the soil. The fruit is ready for collection about the end of March, and the harvest continues three months. (Müller, *Am. Journ. of Pharm.*, Jan. 1866, p. 38; from *Vierteljahresschrift für Pharm.*)

The pods are collected before they are quite ripe, dried in the shade, covered with a coating of fixed oil, and then tied in bundles, which are surrounded with sheet lead, or enclosed in small metallic boxes, and sent into the market. Several varieties of vanilla exist in commerce.* The most valuable, called *ley* by the Spaniards, consists of cylindrical, somewhat flattened pods, six or eight inches long, three or four lines thick, nearly straight, narrowing towards the extremities, bent at the base, shining and dark-brown externally, wrinkled longitudinally, soft and flexible, and containing within their tough shell a soft black pulp, in which numerous minute, black, glossy seeds are embedded. It has a peculiar, strong, agreeable odour, and a warm, aromatic, sweetish taste. The interior pulpy portion is most aromatic. Another variety, called *simarona* by the Spaniards, is smaller, of a lighter colour, and less aromatic. A third variety is the *pompona* of the Spaniards. In this, the pods are from five to seven inches long, from six to nine lines broad, almost always open, brown, soft, viscid, and of a strong odour, but less pleasant than that of the *ley*, to which it is considered inferior. According to Bucholz, vanilla does not yield volatile oil when distilled with water; and the aroma appears to depend on chemical changes which take place during and after the curing of the fruit.†

* For further details as to modes of preparing, and as to varieties of the bean recognised in Central America, see *Am. Journ. of Pharm.*, xlvi. 417.

† *Artificial Vanilla.* Vanillin was first artificially produced from coniferin, a glucoside which exists in greater or less abundance in the cambium layer of pines, by E. Tiemann and W. Haarmann (*Pharm. Journ. and Trans.*, June, 1874, 996). The coniferin is first treated with bichromate of potassium and sulphuric acid, and afterwards carried through a somewhat complicated process to separate and purify the vanillin. It is stated that Dr. Haarmann is now manufacturing artificial vanilla on a large scale from the cambium sap of pines. He sells it in the form of an extract, containing two per cent. of vanillin, at a price stated to be about two-thirds that of a corresponding preparation of the natural drug. When diluted and used for flavouring, the odour and taste are said not to be distinguishable from those of the natural vanilla. (*Am. Journ. of Pharm.*, xlvii. 211.)

Vanilla Poisoning. Twenty years ago, Orfila recorded cases of poisoning by the eating of vanilla ices, and recently so many cases have occurred in various cities of Europe as to direct a great deal

Many years since, vanilla was analyzed by Bucholz and Vogel, the former of whom found in it a disagreeably smelling fixed oil, a soft resin smelling feebly of vanilla when heated, a bitterish extractive resembling tannin, sugar, starch, and benzoic acid. But the characteristic odorous principle was not isolated. This object was accomplished by M. Gobley, who, by exhausting vanilla with alcohol of 85°, evaporating the resulting tincture to an extract, softening this with water, and agitating in a flask with ether so long as it gave colour to that fluid, then evaporating the ethereal liquid and treating the residue with boiling water, obtained, on the evaporation of the water, a crop of crystals having the odour of vanilla. Purified by treatment with animal charcoal, and recrystallization, the new principle appeared in the form of colourless, long, four-sided needles, terminated by two faces. It has a strong odour of vanilla, with a hot, biting taste. The crystals are hard, and crack under the teeth. They melt at 195° F., and sublime, at 302° F., in minute needle-shaped crystals, of a shining whiteness. For this substance M. Gobley proposes the name of *vanillin*. It is of difficult solubility in cold water, but is largely dissolved by boiling water, which deposits it on cooling. It is very soluble in alcohol, ether, and the fixed and volatile oils. Diluted acids dissolve it without change. Concentrated sulphuric acid dissolves it, but renders it yellow. Solution of potassa also dissolves it, and yields it unaltered on the addition of an acid. It was believed by M. Gobley to decompose alkaline carbonates. Its composition is represented by the formula $C_{20}H_6O_4$. It is analogous to the coumarin of the Tonka bean, but is not identical with it. When the vanilla pods are enclosed in cases, it often happens that they are covered with a white frost-like efflorescence of minute crystals. These were considered by Bucholz and Vogel as benzoic acid. M. Gobley believes that they are vanillin, the vapours of which, given out by the fruit, condense like frost on its surface. (*Am. Journ. of Pharm.*, March, 1859, p. 130; from *Journ. de Pharm.*, Janv. 1859.) Mr. Stokeby has subsequently confirmed the statement of M. Gobley as to the nature of the frost-like efflorescence on the surface of the bean; but, believing that he has found it to have feeble acid properties, he proposes to call it *vanillic acid*. The formula of Mr. Stokeby differs greatly from that of Gobley, being $C_{34}H_{22}O_{20}$. According to Stokeby, vanillin dissolves in its weight of alcohol and boiling ether, one part dissolves in 11 parts of boiling water, and in 198 parts at 59° F. The sesquichloride of iron gives to all its solutions a fine, deep, violet colour. It passes with water in distillation. If vanilla finely divided be distilled with water, a turbid liquid passes, which becomes clear by agitation with ether; and the ether on evaporation yields crystals of vanillin. Mr. Stokeby found in vanilla resin, wax, a fixed oil, a brown resinous matter, tannic acid changing the salts of iron to green, gum, sugar, phosphates, and sulphates; and muriatic acid separated from it oxalic acid, and potassa humic acid. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 76, A. D. 1866.) In a recent series of very elaborate researches, M. Carles has confirmed the acid nature of these vanilla crystals, and has shown that vanillic acid is isomeric with anisic and creasotic acid, decomposes alkaline carbonates, and forms salts with metallic oxides. He gives the following tests and the formula $C_{16}H_8O_6$. With concentrated sulphuric acid it becomes yellow, or, if nitric acid be present, red; with bromine or chlorine brown, with oxysalts of iron blue; and reduces nitrate of silver in warm solution. (*Journ. de Pharm.*, 4e sér., xvii. 106; *Zeitsch. des Allgem. Apot. Vereines*, Dec. 1871.)

Medical Properties and Uses. Vanilla has the properties of the aromatics generally, but is probably more diffusibly stimulant, with some influence on the nervous

of governmental and professional attention to the subject. Similar instances have repeatedly occurred within the last two years in Philadelphia. The symptoms are those of intense gastro-intestinal irritation, and closely resemble those of cholerine. That the attacks have not simply been cholera morbus induced by the ingestion of cold ices, is shown by the facts that many of the flavoured dishes were pies and even simple farinaceous puddings, prepared in porcelain dishes, and that often whole families were attacked at once. Elaborate chemical investigations have proven the absence of metallic poisons in the ingesta. It seems to be clearly made out that the vanilla bean was the vehicle of the poison; but the nature of the latter has not been determined. Schroff believes it to be cardol derived from the oil of cashew nut, placed upon the vanilla pod to preserve it, but there does not seem to be any proof of this; and it is stated that cardol could not be found in the vanilla pods obtained from the Vienna café at Berlin, where poisoning had occurred. For further particulars, consult *Pharm. Journ. and Trans.*, April, 1874, 853.—*Note to the fourteenth edition.*

system. It is employed more as a perfume, and to flavour chocolate, ice-cream, &c. than as a medicine. It has, however, been recommended as a remedy in hysteria and low fevers, in the form of an infusion made in the proportion of about half an ounce to a pint of boiling water, and given in tablespoonful doses. A fluid extract would be a convenient form for exhibition.*

Off. Prep. Trochisci Ferri Subcarbonatis, *U. S.;* Trochisci Potassii Chloratis, *U. S.* W.

VERATRUM ALBUM. *U. S.*

White Hellebore.

The rhizome of Veratrum album. *U. S.*

Ellebore blanc, *Fr.;* Weisse Niesswurzel, *Germ.;* Elleboro bianco, *Ital.;* Veratro blanco, *Span.*

VERATRUM. *Sex. Syst.* Polygamia Monœcia.—*Nat. Ord.* Melanthaceæ.

Gen. Ch. HERMAPHRODITE. *Calyx* none. *Corolla* six-petaled. *Stamens* six. *Pistils* three. *Capsules* three, many-seeded. MALE. *Calyx* none. *Corolla* six-petaled. *Stamens* six. *Pistils* a rudiment. *Willd.*

Botanists who reject the class *Polygamia* of Linnæus, place this genus in the class and order *Hexandria Trigynia*, with the following character. "Polygamous. *Corolla* six-parted, spreading, segments sessile without glands. *Stamens* inserted upon the receptacle. *Capsules* three, united, many-seeded." *Nuttall.*

Veratrum album. Willd. *Sp. Plant.* iv. 895; Woodv. *Med. Bot.* p. 754, t. 257. This is an herbaceous plant, with a perennial, fleshy, fusiform root or rhizome, yellowish-white externally, pale yellowish-gray within, and beset with long cylindrical fibres of a grayish colour, which constitute the true root. The stem is three or four feet high, thick, round, erect, and furnished with alternate leaves which are oval, acute, entire, plaited longitudinally, about ten inches long by five in breadth, of a yellowish-green colour, and embrace the stem at their base. The flowers are greenish, and arranged in a terminal panicle.

White hellebore is a native of the mountainous regions of continental Europe, and abounds in the Alps and Pyrenees. All parts of the plant are said to be acrid and poisonous; but the root (rhizome) only is officinal. This is brought from Germany in the dried state, in pieces from one to three inches long by an inch or less in mean diameter, cylindrical or in the shape of a truncated cone, internally whitish, externally blackish, wrinkled, and rough with the remains of the fibres which have been cut off near their origin. Sometimes the fibres continue attached to the root. They are numerous, yellowish, and of the size of a crow's quill. White hellebore deteriorates by keeping.

Properties. The fresh root has a disagreeable odour, which is lost by drying. The taste is at first sweetish, and afterwards bitterish, acrid, burning, and durable. The powdered root is grayish. Analyzed by Pelletier and Caventou, white helle-

* *Fluid Extract of Vanilla.* This was prepared by Prof. Procter in the following manner. An ounce of vanilla, cut transversely into short pieces, was beaten with two ounces of sugar and a little alcohol into a pulp, and then submitted to percolation, first with four fluidounces of deodorized alcohol, and afterwards with diluted alcohol, until twelve fluidounces of tincture were obtained. Two ounces of sugar were added to the tincture, which was then evaporated with a gentle heat to six fluidounces. Lastly, ten ounces of sugar were added, and sufficient water to make the whole measure a pint. (*Am. Journ. of Pharm.*, xxvi. 300.) Mr. J. B. Moore (*Am. Journ. of Pharm.*, 1872, 63) splits the pods, cuts them transversely into small pieces, beats them in small successive portions with an equal weight of sugar into a pulp, which will pass through a No. 20 sieve, adds sixteen troyounces of this mixture to five pints of menstruum (three parts alcohol, one part water); puts the whole into a stone jug of the capacity of at least one gallon; corks tightly, puts the jug in a water-bath of from 160° to 170°, keeping the neck cool with cloth wet with cold water, for two hours, shaking occasionally. He then expresses the contents, and percolates the powder first with the menstruum with which it has been macerated, and then with a mixture of three parts of alcohol and one part of water until eight pints have been obtained. This fluid extract may be given in the dose of one or two fluidrachms. It is a very convenient form for the use of vanilla as a flavouring substance.

A Syrup of Vanilla may be prepared by mixing two fluidounces of this fluid extract with two pints of simple syrup. If a perfectly transparent syrup is wanted, rub two ounces of the fluid extract with two drachms of carbonate of magnesium, and half a pint of water gradually added; filter the mixture; then add another half pint of water, and two and a half pounds of sugar; dissolve the sugar with the aid of heat; and, lastly, strain the syrup. The syrup is fitted rather for giving flavour to mixtures, either medicinal or dietetic, than for remedial effect.

bore was found to contain an oily matter consisting of olein, stearin, and a volatile acid; *supergallate* of veratria;* a yellow colouring matter; starch, gum, and lignin; silica, and various salts of lime and potassa. The medicinal properties of the root reside in the veratria, which was first discovered in the seeds of *Veratrum Sabadilla*, and probably exists in other plants belonging to the same family. (See *Veratria* in *Part* II.) Simon believed that he had found two new vegetable alkalies in white hellebore, one of which was named *barytina*, from being precipitated, like baryta, from its solution in acetic or phosphoric acid by sulphuric acid or the sulphates; the other *jervina*, from the Spanish name for a poison obtained from the root of white hellebore. (*Pharm. Cent. Blatt*, 1837, p. 191.)

Medical Properties and Uses. White hellebore is a violent emetic and cathartic, capable of producing dangerous and fatal effects if incautiously administered. For a very well observed case of poisoning, recorded by Dr. Peugnet, see *New Remedies*, Oct. 1872, p. 174. Even in small doses it has occasioned severe vomiting, hypercatharsis with bloody stools, and alarming general prostration. Like many other acrid substances, it appears, in small doses, to be a general stimulant to the secretions. Applied externally upon a portion of the surface denuded of the cuticle, as upon ulcers, for example, it gives rise to griping pain in the bowels, and sometimes violent purging. When snuffed up the nostrils, it occasions great irritation with violent sneezing, and its use in this way is not free from danger. It was employed by the ancients in dropsy, mania, epilepsy, leprosy, elephantiasis, and other obstinate disorders, not without occasional advantage; but the severity of its action has led to its general abandonment. It is sometimes used as an errhine, diluted with some mild powder, in cases of gutta serena and lethargic affections; and the decoction, and an ointment prepared by mixing the pulverized root with lard, have been found beneficial as external applications in the itch, and other cutaneous eruptions. From the resemblance of its operation to that of the *eau médicinale d'Husson*, so celebrated for the cure of gout, it was at one time, though erroneously, conjectured to be the chief constituent of that remedy. A mixture of the wine of white hellebore and the wine of opium, in the proportion of three parts of the former to one of the latter, was introduced into use by Mr. Moore, of London, as a substitute for the *eau médicinale*.

In whatever way white hellebore is used, it requires cautious management. It has been given in doses varying from one grain to a scruple. Not more than two grains should be administered at first. When employed as an errhine, it should be mixed with five or six parts of pulverized liquorice root, or other inactive powder. Ten or twelve grains of the mixture may be snuffed up the nostrils at one time.

W.

VERATRUM VIRIDE. *U. S.*

American Hellebore.

The rhizome of Veratrum viride. *U. S.*

Off. Syn. VERATRI VIRIDIS RADIX. *Green Hellebore Root.* The dried rhizome of Veratrum viride. Collected in autumn in the United States and Canada. *Br.*

VERATRUM. See VERATRUM ALBUM.

Veratrum viride. Willd. *Sp. Plant.* iv. 896; Bigelow, *Am. Med. Bot.* ii. 121. The American hellebore, known also by the names of *Indian poke*, *poke root*, and *swamp hellebore*, has a perennial, thick, fleshy root or rhizome, the upper portion of which is tunicated, the lower solid, and beset with numerous whitish fibres or radicles. The stem is annual, round, striated, pubescent, and solid, from three to six feet in height, furnished with bright-green leaves, and terminating in a panicle of greenish-yellow flowers. The leaves gradually decrease in size as they ascend. The lower are from six inches to a foot long, oval, acuminate, plaited, nerved, and pubescent; and embrace the stem at their base, thus affording it a sheath for a considerable portion of its length. Those on the upper part of the stem, at the origin of the

* According to the researches of Hermann Weffen, the acid of veratrum album is not gallic acid, but a peculiar one, for which he proposes the name of *Jervic Acid*. (*Am. Journ. of Pharm.*, 1873, p. 165; or with more details, *Journ. de Pharm.*, 4e sér., xviii. p. 486.) For an account of recent researches on the alkaloids of V. album, see p. 927.

flowering branches, are oblong lanceolate. The panicle consists of numerous flowers, distributed in racemes with downy peduncles. Each flower is accompanied with a downy, pointed bracte, much longer than its pedicel. There is no calyx, and the corolla is divided into six oval acute segments, thickened on the inside at their base, with the three alternate segments longer than the others. The six stamens have recurved filaments, and roundish two-lobed anthers. The germs are three, with recurved styles as long as the stamens. Some of the flowers have only the rudiments of pistils. Those on the upper end of the branchlets are barren, those on the lower portion fruitful. The fruit consists of three cohering capsules, separating at top, opening on the inner side, and containing flat imbricated seeds.

This indigenous species of Veratrum is found from Canada to the Carolinas, inhabiting swamps, wet meadows, and the banks of mountain streamlets. Early in the spring, before the stem rises, it bears a slight resemblance to the *Symplocarpus fœtidus*, with which it is very frequently associated; but the latter sends forth no stem. From May to July is the season for flowering. The root should be collected in autumn, and should not be kept longer than one year, as it deteriorates by time.

Properties. As found in the shops, it is usually in small pieces or fragments; but sometimes it comes whole or merely sliced, so that its characteristic form may be observed. In this condition it is seen to consist of a rhizome an inch or two in length by somewhat less than an inch in thickness where broadest, tapering to a very obtuse or truncated extremity, compact but light, of a dark-brown colour externally, and either closely invested with numerous yellowish rootlets often several inches long, or exhibiting marks on the surface whence they have been removed. When sliced, the cut surface is of a dingy-white colour. The rootlets are about as thick as a large knitting-needle, or somewhat thicker, obviously much shrunk in drying, and marked by numerous close-set indentations, which give them a characteristic appearance. Not unfrequently portions of the dried stem or leafstalks remain attached to the rhizome, which should always be rejected, as they were ascertained by Prof. Procter to be inert. (*Am. Journ. of Pharm.*, March, 1864, p. 99.) The root has a bitter, acrid taste, leaving a permanent impression in the mouth and fauces. In sensible properties it bears a close resemblance to white hellebore; and has been shown by the experiments of Mr. J. G. Richardson, of Philadelphia, to contain veratria, or at least an alkaloid closely analogous to it. (*Am. Journ. of Pharm.*, xxix. 204.) Mr. J. C. Scattergood, by adding water to a saturated tincture of the root, and afterwards evaporating the alcohol, obtained a resinous precipitate, while from the residuary liquid he succeeded in separating an alkaloid supposed to be veratria. By experimenting separately with the alkaloid and the resin thus procured, Dr. S. R. Percy, of New York, obtained effects to a certain extent similar, and such as characterize the operation of the root, with this remarkable difference, however, that while both substances produced vomiting and prostration, the resin had a much more powerful influence in reducing the frequency of the pulse. Thus, while in one dog, under the action of the veratria, the pulse was reduced from 148 to 112; in another, under that of the resin, with no greater effect in other respects, it fell from 144 to 40; and this result was so constant that it could not be ascribed to accident. A very important inference is that there is a principle in the American hellebore distinct from veratria, upon which its remarkable powers over the circulation mainly depend. There can be little doubt that the so-called resin will be found to be a complex body, possibly containing a distinct alkaloid. (*Ibid.*, Jan. 1863, p. 74.)

To bring down the history of the alkaloid matter of veratrum viride to the present date (Feb. 1869), it is necessary to refer to the recent investigations of Mr. Charles Bullock, the results of which, thus far obtained, appear to be that there are two alkaloids in veratrum viride, neither of which is identical with veratria, that one of these alkaloids is soluble, the other insoluble in ether, and that the resin, supposed to possess the sedative property of the drug, owes this property to the presence of the alkaloid insoluble in ether, for which it has an extraordinary affinity, but, entirely deprived of which, it has no effect on the pulse.*

* The two alkaloids were obtained by Mr. Bullock in the following manner. From a concentrated tincture, acidulated with acetic acid, the resin was thrown down by the addition of water,

Medical Properties and Uses. American hellebore has been thought to resemble its European congener in its effects upon the system, though asserted by Dr. Osgood

and was collected on a filter. The liquid was concentrated, and, after filtration to separate the remaining resin, a little alcohol was added, to prevent the precipitation of colouring matter, and carbonate of sodium sufficient to induce decided alkaline reaction. On the latter addition, the solution became dark and opaque; a further addition of the carbonate increased the precipitation; and now the solution assumed a clear wine-red colour. The precipitate was washed, dried, dissolved in alcohol, and treated with purified animal charcoal. The alcoholic solution was evaporated; the residue was dried and treated at a moderate heat, with water acidulated with sulphuric acid; on cooling, colouring matter was deposited, which was separated by filtration; and the solution was now precipitated with carbonate of sodium. The precipitate, having been washed on a filter till the water passed colourless, was again dissolved in water acidulated with sulphuric acid, and digested with animal charcoal. The solution was again precipitated with carbonate of sodium; and the precipitate, being washed to separate alkaline carbonates, and dried at a moderate heat, was reduced to powder, and agitated with successive portions of ether free from alcohol, which dissolved out the alkaloid, and left it on evaporation as a light-yellow residue, which was detached from the glass capsule in scales resembling tannin. The parts undissolved by ether contained a considerable proportion of the alkaloid insoluble in ether, which was extracted by alcohol, and obtained separate by evaporation. As both the ethereal and the alcoholic products were somewhat coloured, they were severally dissolved in acidulated water, and precipitated by very dilute ammonia, a little alcohol being added to the solution to retain the colouring matter. The two alkaloids were thus obtained colourless; the one soluble in ether being when dried in a soft pulverulent condition; the one insoluble, hard and of a semi-resinous form adhering to the filter. As the discoverers of these alkaloids have modestly avoided assigning them names, and yet these are essential in description, in order to avoid inconvenient circumlocution; we provisionally suggest the title of *veratroidia* for the one soluble in ether, expressive of its close analogy with veratria, and *viridia* for the one insoluble in ether, as representing more closely than the other the peculiar sedative influence of the root. Viridia exists largely in the resinous precipitate thrown down from a concentrated tincture of the root, and is held by the resin with great tenacity. To separate the alkaloid, Mr. Bullock, after exhausting the resin with ether, redissolved it in alcohol, and again precipitated by pouring it into acidulated water; and this operation was repeated several times. At length the resin was dried, powdered, and washed on a filter with acidulated water, until the water was no longer disturbed by neutralization with an alkaline carbonate. On a careful examination of the resin now left, it was found to be free from the alkaloid, and taken internally in doses of one-third of a grain every half hour, until two grains had been taken altogether, produced no effect on the force or frequency of the pulse, and no other inconvenience than certain dyspeptic sensations. To procure the alkaloid it only remained to neutralize the acidulated solution with carbonate of sodium.

Properties of the alkaloids. Neither of them exhibited any evidence of crystallization. In alcoholic solution they restored reddened litmus paper to its normal colour. They were slightly bitter, and dissolved freely in dilute sulphuric, nitric, muriatic, and acetic acids. Both were soluble in alcohol, amylic alcohol, and chloroform: but neither of them in benzole. Both were precipitated from their solutions in acidulated water by alkalies and their carbonates, and were not redissolved by an excess of the precipitant. Both gave a precipitate with perchloride of gold, and copious white precipitates with iodohydrargyrate of potassium. Their reactions, moreover, with the concentrated mineral acids were nearly the same; their solutions in concentrated sulphuric acid being first reddish-yellow, then ochry-red, and finally brown: in nitric acid, colourless or with a slight evanescent rose hue; and in muriatic acid, if in the cold, faintly yellow, deepened by boiling, and after 24 hours a turbid green.

Veratroidia. Solubility in ether is its chief recognised characteristic. It is fusible between 270° and 275° F., in this respect differing from veratria, the melting point of which, according to Soubeiran, is 239° F. It differs also in not producing intense redness by contact with concentrated sulphuric acid, and does not answer to Trapp's test of veratria; that is, dissolving in cold muriatic acid without change of colour; but when boiled assuming a red colour, which finally becomes intense, resembling that of a solution of permanganate of potassium. In its effects on the system it is said closely to resemble veratria, acting like that also as a violent irritant to the nostrils; and it is highly probable that most of the irritant effects of veratrum viride on the stomach are ascribable to the veratroidia.

Viridia. This is prominently characterized by its insolubility in ether. It has a considerably higher melting point than veratroidia, requiring from 335° to 340° F. for fusion. Viridia slightly irritates the nostrils, though much less than the other alkaloid: but its effect in reducing the pulse is much greater. Mr. Bullock states, as the result of several trials with persons in health, that one-fortieth of a grain of the alkaloid, dissolved in alcohol, given every 15 minutes till one-eighth of a grain had been administered, caused in half an hour after the last dose, in every case, a reduction of the pulse of from 8 to 12 beats in the minute. No nausea or other effect was experienced, except an impression on the throat resembling that of pyrethrum; nor was any benumbing effect noticed. From the peculiar physiological action of viridia, it is highly desirable that it should be therapeutically investigated; as it may be a valuable substitute for veratrum viride, possessing all its sedative powers, without the irritant properties that sometimes interfere with the beneficial influence of that medicine.

Now that the existence of two distinct alkaloid principles in veratrum viride is determined, it is much to be desired that their chemical, physiological, toxicological, and therapeutical properties should be systematically and fully investigated. (Wm. Bullock, *Am. Journ. of Pharm.*, Sept. 1865, p. 321; and March, 1866, p. 97; also *Proceedings of the Am. Pharm. Association*, 1867.)—*Note to the thirteenth edition.*

to be wholly destitute of cathartic properties.* In addition to its emetic action, which is often violent and long continued, it is said to increase most of the secretions, and,

THE ALKALOIDS OF VERATRUM ALBUM AND VIRIDE. Since the publication of the last edition of the U. S. Dispensatory, the subject of the alkaloids of veratrum album and viride has been investigated by several observers, with results which leave the subject still in doubt. Dr. Eugene Peugnet (*New York Med. Record*, 1872, p. 120) exhausted veratrum album with dilute acetic acid; precipitated the solution with carbonate of sodium; dissolved the precipitate in dilute sulphuric acid, added a little alcohol, and precipitated with ammonia. The precipitate was separated into two parts by treatment with ether free from alcohol. Each portion was separately purified until it was obtained as a whitish scaly or crystalline powder. Simon originally believed that he had found two alkaloids in V. album besides the veratria of Caventou, but afterwards he discovered one of them to be a lime salt. Peugnet believes, no doubt correctly, that the principle he obtained soluble in ether is the veratria of Caventou, whilst that insoluble in the menstruum is the jervia of Simon. Dr. Peugnet further not being able to find any differences between the "*veratria of Caventou*" which he obtained from V. album, and the *veratroidia* of V. viride, or between the jervia of V. album and the viridia of V. viride, concluded that the alkaloids of the two plants are identical, and that the difference in the physiological action of the two drugs is due to the presence in V. album of a peculiar active resin. The subject was taken up at this point by Mr. Chas. T. Mitchell. He precipitated a concentrated tincture of V. album with water acidulated with acetic acid; precipitated the filtrate with an excess of milk of lime; exhausted the precipitate with boiling alcohol; evaporated, digested the resinous mass with dilute sulphuric acid, and concentrated by evaporation. On cooling the liquid deposited impure sulphate of jervia, which was filtered out, and a little alcohol added to the filtrate, followed by solution of soda in slight excess. The impure alkaloid thus obtained, on separation and purification from some contaminating jervia, was soluble in ether, and was undoubtedly the veratroidia of Peugnet. The V. album resinoid of Peugnet, Mr. Mitchell proved to owe its active properties to the presence of alkaloids; the pure resin he showed to be inert, by separating specimens of the resinoid transmitted to him by Dr. Peugnet into alkaloids and inert resin.

The various researches that have thus been made would seem to show the existence of two alkaloids in V. album, constituting the active principles of the drug. Their identity or non-identity with the alkaloids of V. viride is of course a distinct question. In 1874 (*Amer. Journ. of Pharm.*, 1874), Mr. Mitchell, unaware that he had been anticipated by Dr. Peugnet, announced the presence of jervia in veratrum viride. Subsequently, in an elaborate investigation, Mr. Mitchell failed to find viridia in veratrum viride, and came to the conclusion that it had no existence as a distinct alkaloid, but was more or less impure jervia. As Mr. Bullock has acquiesced in this, it seems established that jervia is common to both veratrum album and viride. Dr. Peugnet appears to be entitled to the credit of having first pointed this out. The correctness of Dr. Peugnet's belief in the identity of veratroidia and the second alkaloid of V. album is much more doubtful. Mr. Mitchell claims that the V. album alkaloid is distinct, and proposes for it the name *veratralbia*. According to Mr. Mitchell, the physical properties and solubilities of the two alkaloids are the same, but veratroidia fuses at 265° F., veratralbia at 340° F.; to the various tests they respond similarly with two or three exceptions. The following table, extracted from Mr. Mitchell's article, will show how closely allied in their chemical behaviour are veratria, veratroidia, and veratralbia.

Reagent.	Jervia.	Veratroidia.	Veratria.	Veratralbia.
Sulphuric acid.	Yellow, changing to deep green.	Yellow, changing to brick-red.	Yellow, changing to crimson.	Yellow, changing to a rich dark brown
Sulph. acid and bromine.	Changes from green to a very light brown, almost colourless.	Brown.	Brick-red.	Dark brown.
Sulph. acid and potas. bichromate.	Yellowish-brown.	Brown.	Brown.	Brown.
Hydrochloric acid (cold).	Colourless solution	Colourless solution	Colourless solution	Colourless solution.
Hydrochloric acid (hot).	Yellow, deepened by boiling.	Yellow, deepened by boiling.	Yellow, changing to deep solferino, on boiling.	Yellow, deepened by boiling.
Nitric acid.	Yellow, deepened by boiling.	Yellow, deepened by boiling.	Yellow, deepened by boiling.	Yellow, deepened by boiling.
Perchlor. of gold.	Curdy yellow precipitate.	Yellowish-white precipitate.	Yellow-white precipitate.	Straw-yellow precipitate.
Iodohydrarg. potas.	Curdy white precipitate.	White precipitate.	White precipitate.	White precipitate.
Bichlor. platinum.	Granular yellow precipitate.	*Flocculent yellow precipitate.*	Very faint precipitate.	*No reaction.*
Sulphocyan. potas.	Flocculent white precipitate.	White precipitate.	White precipitate.	White precipitate.
Chlorine water.	Faint whitish precipitate.	Faint white precipitate.	Faint white precipitate.	Faint white precipitate.
Tannic acid.	White.	White precipitate (faint).	White precipitate (faint).	White precipitate (faint).

* The most striking difference between this and V. album appears from the experiments of Dr.

when freely taken, to exercise a powerful influence over the nervous system, indicated by faintness, somnolency, vertigo, headache, dimness of vision, and dilated pupils. According to Dr. Osgood, it reduces the frequency and force of the pulse, sometimes, when taken in full doses, as low as thirty-five strokes in the minute. It may be safely substituted for the European root in most cases in which the latter is employed, and is highly recommended as a substitute for colchicum by Dr. Tully, of New Haven. Gouty, rheumatic, and neuralgic affections are those to which it appeared best adapted. For an account of its medical properties and applications, the reader is referred to a paper by Dr. Charles Osgood, of Providence, in the *American Journal of the Medical Sciences* (xvi. 296). It may be used in substance, tincture, or extract. Dr. Osgood states the dose in which it will generally prove emetic at from four to six grains of the powder, one or two fluidrachms of a tincture made of six ounces of the fresh root and a pint of alcohol, and one or two grains of an extract made by inspissating the juice of the root. The medicine, however, should, in most cases, be given in doses insufficient to vomit.

After the publication of Dr. Osgood's paper, little attention was paid to the subject until a few years since, when various communications appeared in our Southern medical journals, tending to prove that American hellebore is applicable to the treatment of numerous febrile and inflammatory affections, in which an indication is offered for reducing the frequency of the pulse. The credit of calling public attention to it is due more especially to Dr. W. C. Norwood, of Cokesbury, South Carolina, who employed it with great success in pulmonary inflammation, typhoid fever, &c., and believed that it afforded the means of reducing the frequency of the pulse at will. He used a saturated tincture, made by macerating eight ounces of the dried root in sixteen ounces of alcohol for at least two weeks. Of this he gave to an adult man eight drops, and repeated the dose every three hours, increasing by one drop at each dose, until the pulse was reduced, or nausea and vomiting were occasioned, when it was to be diminished one-half, and continued so long as might be necessary to pre-

The differences between veratroidia and veratralbia are slight, but no slighter than between veratralbia and veratria. A few physiological experiments made with veratralbia have shown me that it is much more active than any veratroidia I have ever used; if the alkaloids are identical it may be that they are both veratria in different degrees of purity, and that the difference in the action of V. album and V. viride are due to differences in the proportionate amounts of the two alkaloids. On the whole, however, the evidence up to this point favours the distinctness of the three alkaloids. Within a few weeks (*Am. Journ. of Pharm.*, April, 1876) Mr. Bullock has come to the conclusion that neither veratroidia or veratralbia have any existence, but that they are both resin contaminated with jervia. He finds that one part of jervia, held in solution in 1000 parts of water acidulated with acetic acid, is precipitated on the addition of an excess of a solution of nitrate of potassium. Veratria, even when the strength of the solution is one in sixty, is not disturbed by the nitre solution. Taking advantage of this, Mr. Bullock was able by repeated solution and precipitation to separate veratroidia into jervia and resin. To this resin he attributes the qualities which cause veratroidia to act so differently from jervia upon the animal system. Unfortunately, as Mr. Bullock's chemical work was not conjoined with any physiological experiments, it has not been proven that the resin just spoken of has the powers he attributes to it. Jervia was obtained by Mr. Bullock in white prismatic crystals resembling sulphate of morphia, fusing at 380° to 385° F.

I have made a very elaborate physiological study of viridia and veratroidia, using specimens obtained in the earlier researches of Mr. Bullock and in the investigation of Mr. Mitchell. Jervia (viridia) acts most powerfully upon the circulation, lowering enormously the arterial pressure by acting directly upon the heart muscle, and by paralyzing the vaso-motor centres; upon the inhibitory nerves of the heart it has little or no action; and the depressant influence which it exerts upon the respiratory centres is altogether subordinate to that upon the circulation. Veratroidia acts most powerfully upon the nerves of the heart, influencing the heart muscle and vaso-motor nerves in only a very slight degree; upon the respiratory centre it exerts a most profound influence. These researches showed that, if veratroidia be a substance contaminated with viridia, that substance must be excessively active; as the veratroidia was active in doses of one-fortieth of a grain, and as the physiological influence of any viridia present was entirely masked. So far as my knowledge goes, a resin exerting any influence at all comparable to this has hitherto been unknown to science, and a suspicion of the correctness of Mr. Bullock's results is certainly allowable.—*Note to the fourteenth edition.* H. C. W., Jr.

Oulmont, of Germany, on the lower animals, to be the extraordinarily irritant effect on the alimentary canal of the V. album, not only causing vomiting and purging, but positive inflammation capable of causing death; while the V. viride, though causing nausea, vomiting, and diarrhœa, and even fatal prostration, gives rise to not the least trace of gastro-intestinal inflammation. (*Neues Repertorium*, xvii. 177, A. D. 1868.)

vent a return of the symptoms. (*Charleston Med. Journ. and Rev.*, vii. 768.) From numerous communications subsequently made to the journals, there can be no doubt of the great efficiency of this remedy in reducing the circulation; and many practitioners speak with great confidence of its usefulness in pneumonia, diseases of the heart with excessive action, inflammatory rheumatism, and other inflammatory and febrile diseases with a greatly excited circulation. The author has used it with decided effect in reducing the frequency of the pulse in cardiac affections, and without materially deranging the stomach. It is said to have cured habitual constipation, given in the dose of three drops of the tincture five times a day. Recovery took place in two weeks. (*Med. Record*, Sept. 15, 1868, p. 320.) Some have found the original commencing dose of Dr. Norwood too large, and he himself has considerably reduced it; but from three to six drops of the saturated tincture, repeated every three hours, and gradually increased, if necessary, until its effects are experienced, may be given with safety. From its powerful emetic properties, and the prostration resulting from excessive doses, it should always be used with great caution, and its effects carefully observed.* Its nauseating and depressing effects are best counteracted by opiates and alcoholic stimulants. A tincture and fluid extract have been introduced into the U. S. Pharmacopœia. (See these preparations in *Part* II.)

Cases of extreme prostration have occurred from abnormally large doses of American hellebore, and sometimes even from moderate doses in instances of extreme constitutional susceptibility; yet no case of death from it in an adult has come to our notice. That it is capable, however, of producing fatal effects is evident from experiments on the lower animals, and from the case of a child of 18 months, under the care of Dr. J. C. Harris, of West Cambridge, Mass., to which about 35 drops of the tincture were given by mistake, with the effect of inducing nausea but not effectual vomiting, great prostration in which the pulse was reduced to 40, loss of consciousness, and ultimately death. (*Am. Journ. of Pharm.*, Sept. 1865, p. 374.)

Off. Prep. Extractum Veratri Viridis Fluidum, *U. S.;* Tinctura Veratri Viridis.

W.

VINUM XERICUM. *U. S., Br.*

Sherry Wine.

Vinum Album. *U. S.* 1850.

Vin blanc, *Fr.;* Weisser Wein, *Germ.;* Vino bianco, *Ital.;* Vino blanco, *Span.*

VINUM PORTENSE. *U. S.*

Port Wine.

Vinum Rubrum. *U. S.* 1850.

Vin rouge, *Fr.;* Rother Wein, *Germ.;* Vino vermiglio, *Ital.;* Vino tinto, *Span.*

Wine is the fermented juice of the grape, the fruit of Vitis vinifera of botanists (See *Uva Passa.*) The juice of sweet grapes consists of a considerable quantity of grape sugar, a peculiar matter of the nature of ferment or yeast, and a small portion of extractive, tannic acid, bitartrate of potassium, tartrate of calcium, common salt, and sulphate of potassium; the whole dissolved or suspended in a large quantity of water. Sour grapes contain, in addition, a peculiar acid isomeric with the tartaric, called *paratartaric acid.* (See *page* 74.) Grape juice, therefore, embraces all the ingredients essential to the production of the vinous fermentation, and requires only the influence of the atmosphere and a proper temperature to convert it into wine. (See *page* 84.)

Preparation. When the grapes are ripe, they are gathered, and trodden in wooden vessels with perforated bottoms, through which the juice, called the *must*, runs into a vat placed beneath.† The temperature of the air being about 60°, the fermenta-

* For an elaborate article on the remedial properties and uses of American hellebore, by Dr. John Bell, the reader is referred to *N. Am. Med.-chir. Rev.*, ii. 914.

† A new mode of extracting the grape juice has been devised by M. Richter, of Stuttgard. He puts the grapes in a drum, provided with a suitable strainer, and rotates this at the rate of 1000 or 1500 times in a minute; the centrifugal force being the expressing agency. The time by this method is greatly diminished, and the quantity of juice is increased 5 or 6 per cent. (*Am. Journ of Pharm.*, Sept. 1865, p. 395.)—*Note to the thirteenth edition.*

tion gradually takes place in the must, and becomes fully established after a longer or shorter period. In the mean time, the must becomes sensibly warmer, and emits a large quantity of carbonic acid, which causes the more solid parts to be thrown to the surface in a mass of froth, having a hemispherical shape, called the *head*. The liquor from being sweet becomes vinous, and assumes a deep-red colour if the product of red grapes. After a while the fermentation slackens, when it becomes necessary to accelerate it by thoroughly mixing the contents of the vat. When the liquor has acquired a strong vinous taste, and become perfectly clear, the wine is considered formed, and is racked off into casks. But even at this stage of the process, the fermentation continues for several months longer. During the whole of this period, a frothy matter is formed, which for the first few days collects round the bung, but afterwards precipitates along with colouring matter and tartar, forming a deposit which constitutes the wine-lees.*

Division and Nomenclature. Wines, according to their colour, are divided into the red and white; and according to their taste and other qualities, are either spirituous, sweet, dry, light, sparkling, still, rough, or acidulous. *Red wines* are derived from the must of black grapes, fermented with their husks; *white wines*, from white grape, or from the juice of black grapes, fermented apart from their husks.† The other qualities of wines, above enumerated, depend on the relative proportions of the constituents of the must, and on the mode in which the fermentation is conducted. The essential ingredients of the must, as a fermentable liquid, are water, sugar, and a ferment. If the juice be very saccharine, and contain sufficient ferment to sustain the fermentation, the conversion of the sugar into alcohol will proceed until checked by the production of a certain amount of the latter, and there will be formed a *spirituous* or *generous* wine. If, while the juice is highly saccharine, the ferment be deficient in quantity, the production of alcohol will be less, and the redundancy of sugar proportionably greater, and a *sweet wine* will be formed. It is stated by M. G. Fleury that levulose undergoes the vinous fermentation much more readily than glucose, and that the sugar of sweet wines is chiefly levulose. Whether a grape yields a sweet or dry wine seems then to depend, to some extent, upon the character of its sugar. (*Journ. de Pharm.*, 4e sér., viii. p. 323.) When the sugar and ferment are in considerable amount, and in the proper relative proportions for mutual decomposition, the wine will be strong-bodied and sound, without marked sweetness or acidity, and of the kind called *dry*. A small proportion of sugar can give rise only to a small proportion of alcohol, and consequently the less saccharine grapes will generate a comparatively weak, or *light wine*, which will be sound and stable in its constitution, in case the ferment is not in excess, but otherwise liable to pass into the acetous fermentation and become acescent. In case the wine is bottled before the fermentation is fully completed, the process will go on slowly in the bottles, and the carbonic acid generated, not having vent, will impregnate the wine, and render it effervescing and *sparkling*. The *rough* or

* In certain parts of France, the wine-makers are in the habit, during the fermentation of the wines upon the marc, of adding plaster of Paris, under the impression that it improves the colour and ensures the stability of the wines. The process is called by the French *plâtrage*. The chemistry of the process has recently been investigated by M. Chancel, and MM. Bussy and Buignet, who coincide in the conclusion that, through the agency of the sulphate of calcium, a portion of the bitartrate of potassium in the grape, which is but partially dissolved by the wine, in consequence of its limited solvent power, is introduced into the wine, increasing its acidity, and contributing to its stability. But these chemists differ as to the precise nature of the change. Thus, while M. Chancel thinks that the reaction between the sulphate of calcium and bitartrate of potassium results in the production of free tartaric acid and sulphate of potassium which dissolve, and tartrate of calcium which remains in the marc; MM. Bussy and Buignet, agreeing with the former that tartaric acid, sulphuric acid, and potassa are imparted to the wine, each in the proportion of a single equivalent, yet believe them to be so combined as to form bitartrate of potassium and bisulphate of potassium; the increased acidity being ascribable to the bisulphate; and, considering the peculiar affinities brought into play, this is undoubtedly, we think, the correct view. Whether the introduction of this new component into wines is beneficial or otherwise, they do not pretend to determine. (*Jour. de Pharm. et de Chim.*, 4e sér., i. pp. 347 and 351.) For means of detecting plastered wine, see *Journ. de Pharm.*, Sept. 1875.—*Note to the thirteenth and fourteenth editions.*

† The colouring matter of the grape is almost insoluble in water, and hence the juice of the red grape is nearly colourless, and will produce a white wine if fermented alone; but, when fermented with the presence of the grape, the alcohol generated dissolves the colouring matter, which is soluble in that liquid: and thus the wine becomes red. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 340, A. D. 1866.)—*Note to the thirteenth edition.*

astringent wines owe their flavour to a portion of tannic acid derived from the husks of the grape; and the *acidulous* wines to the presence of carbonic acid, or of an unusual proportion of tartar. Several of the above qualities often coexist. Thus a wine may be spirituous and sweet, spirituous and rough, sweet and rough, light and sparkling, &c. Wines are made in many countries, and are known in commerce by various names, according to their source. Thus, *Portugal* produces port and lisbon; *Spain*, sherry, saint lucar, malaga, and tent; *France*, champagne, burgundy, hermitage, vin de grave, sauterne, and claret; *Germany*, hock and moselle; *Hungary*, tokay; *Sicily*, marsala or Sicily madeira, and lisa; the *Cape of Good Hope*, constantia; *Madeira* and *the Canaries*, madeira and teneriffe.

In the United States the first attempt to manufacture wine, on an extended scale, was made towards the close of the last century, at Spring Mill, near Philadelphia, by Peter Legaux, agent of the Pennsylvania Vine Company, and proved unsuccessful. The native grape found most suitable by the Company, after the foreign had failed on account of the climate, was the *Schuylkill muscadel grape*. The next attempt was made by the Swiss at Vevay, Indiana, with the Schuylkill grape, and was partially successful; a rough red wine being manufactured which met with a ready sale in the neighbouring States. In a few years the manufacture of this wine languished; foreign wines superseding it. The foreign grape, after numerous trials, not succeeding as a wine grape, investigations were undertaken to determine the adaptation of our various native grapes for making wine. Among these the *Catawba grape*, a native of North Carolina, introduced to public notice by Major Adlum, of Washington City, about the year 1825, is the most esteemed; being largely cultivated in southern Ohio as a wine grape. The chief objection to it is its liability to the rot. The Isabella grape is also cultivated, but more for the table than for wine. It is claimed by some to be a native; but the evidence preponderates in favour of its foreign origin. The wine produced by the Catawba grape, called *catawba wine*, is of three kinds; the still, the sparkling, and the sweet. *Still catawba*, the result of a completed fermentation, is a light, dry, acidulous wine, in these particulars like hock, but entirely different in flavour. It has a pinkish or straw colour. *Sparkling catawba* is made by letting the wine undergo the secondary fermentation in the bottle. It looks like champagne, but has a different and peculiar taste. *Sweet catawba* resembles the lighter sweet wines of Europe, and is prepared by adding sugar to the grape juice before fermentation. These native wines are gradually coming into use, and constantly improving in quality. They are largely manufactured by Mr. N. Longworth, of Cincinnati. The average product of catawba wine is 400 gallons to the acre, and the amount produced in Ohio in 1855 was estimated at 400,000 gallons. (See the remarks of E. S. Wayne, of Cincinnati, in the *Am. Journ. of Pharm.*, Nov. 1855, p. 494.) The *Herbemont* and *Missouri* grapes are also used for making wine; the latter producing a wine said to resemble madeira. The *Scuppernong grape*, indigenous to North Carolina, yields a hard dry wine; and the vine is said to be a very abundant bearer. According to Mr. R. Buchanan, this grape produces from two to three thousand gallons of wine per acre. (*Treatise on the Cultivation of the Grape.* Cincinnati, 1850.) The climate of Texas is peculiarly favourable to the growth of the grape vine. The *El Paso grape* is found in the vicinity of the falls of the Rio Grande; and the *great mustang* grows luxuriantly in every part of the State, and yields a superior red wine. California is rich in native grapes, and produces a considerable quantity of wine, which is now coming into general use. Considering its advantages of soil and climate, there is good reason to believe that it may, at no very distant time, rank among the most productive wine-regions of the globe. At present the grape, for wine-making, is successfully cultivated in eighteen States of the Union. The wine crop of the whole United States for the year 1857 was estimated at three millions of gallons. (Stearns, *Penins. Journ.*, July, 1858, p. 203.) A misfortune in reference to our domestic wines is that, to supply the demand, they are too often sold soon after being made, so that they have not had the opportunity of ripening with age. (*Ibid.*)

Properties. Wine, considered as the name of a class, may be characterized as a spirituous liquid, resulting from the fermentation of grape juice, and containing colour-

ing matter, and other substances, either combined or intimately blended with the spirit. It always contains a small proportion of aldehyd. (*Magnes Lahens.*) All its other qualities vary with the nature of each particular wine. The principal wines used for medicinal purposes are the officinal wines, sherry and port, together with madeira, teneriffe, claret, and champagne.

Sherry (VINUM XERICUM) is of a deep-amber colour, and when good possesses a dry aromatic flavour and fragrancy, with very little acidity. It ranks among the stronger white wines, and contains, on an average, 19 per cent. by measure of alcohol. The U. S. and British Pharmacopœias agree in indicating it as the officinal white wine. It is prepared in the vicinity of Xeres, in Spain, and hence its English name *sherry*. This wine is supposed to have been the *sack* of Shakspeare, so called from the word *sec* (dry). Mr. Henry Long has found about a grain of sulphuric acid in an ounce and a half of sherry wine, and supposes it to be free; but in the light of the experiments of MM. Bussy and Buignet (see note, *page* 930), it is, we think, more likely to be in the state of bisulphate of potassium, resulting from the reaction between bitartrate of potassium, and sulphate of calcium used in preparing the wine. (*Pharm. Journ.*, June, 1867, p. 732.)

Port (VINUM PORTENSE) is of a deep-purple colour, and, in its new state, is a rough, strong, and moderately sweet wine. When kept a certain time in bottles, it deposits a considerable portion of its astringent matter, loses the greater part of its sweetness, acquires more flavour, and retains its strength. If too long kept, it deposits the whole of its astringent and colouring matter, and becomes deteriorated. Considerable quantities of brandy are usually added to it, which causes its heating quality on the palate. It is one of the strongest wines in common use. According to Dr. Muspratt, of Liverpool, the alcohol in genuine port never exceeds 19 per cent. (*Med. Times and Gaz.*, Oct. 1856, p. 355.)

Madeira is the strongest of the white wines in general use. It is somewhat acid, and, when of proper age and in good condition, has a rich, nutty, aromatic flavour. As it occurs in the market, however, it is of very variable quality, on account of the adulterations and mixtures to which it is subjected after importation. The madeira consumed in this country is generally better than that used in England; its adulteration being practised to a less extent with us, and our climate being more favourable to the improvement of the wine. At present, however, little genuine is to be found, in consequence of the destruction of the vine in Madeira; but, as the grape culture is said to have been resumed in the island, we may hope for a speedy return of the wine to the market.

Teneriffe is a white wine, of a somewhat acid taste, and, when of good quality, of a fine aromatic flavour. Its average strength is about the same as that of sherry. It is made from the same grape as madeira, to which it bears a close resemblance.

Claret, called in France *vin de Bordeaux*, from its being produced near that city, in the district of Medoc, is a red wine, and from its moderate strength is ranked as a light wine. It has a deep-purple colour, and, when good, a delicate taste, in which the vinous flavour is blended with some acidity and astringency. The most esteemed kinds are the clarets called *Château-Margaux*, *Château-Lafite*, and *Château-Latour*. Another celebrated variety is the *Château-Haut Brion* of the Pays de Grave. Claret is the French wine most extensively consumed in the United States.

Dr. H. Bence Jones has ascertained the acidity of equal bulks of the above wines, except teneriffe, expressed in grains of caustic soda. The bulk taken was that of 1000 grs. of water at 60°, and the numbers express the extremes of acid; sherry, 1·95–2·85; port, 2·10–2·55; madeira, 2·70–3·60; claret, 2·55–3·45. The same authority has determined the proportion of sugar to the ounce in sherry, port, and madeira, expressed in grains: sherry, 4–18; port, 16–34; madeira, 6–20. Claret contains no sugar. Assuming that the sugar becomes acid in the system, the order of acidity of these wines, beginning with the least acid, is claret, sherry, madeira, port. (*Chem. Gaz.*, Jan. 16, 1854, p. 35.)

Dr. Christison considers it a mistake to suppose that wines become stronger by being kept a long time in cask. His experiments appear to prove the reverse. While, however, the wine is not rendered more alcoholic by age, its flavour is improved, and

apparent strength increased. It becomes less acid partly by the deposition of tartar, and probably also by the reaction between the acids and alcohol resulting in the production of ether.

Composition. Wines consist mainly of water and alcohol. They contain also volatile oil, œnanthic ether, grape sugar, sometimes glycerin in minute proportion (*Journ. de Pharm.*, Oct. 1859, p. 292), gum,* extractive, colouring matter, tannic, malic, phosphoric, carbonic, and acetic acids, bitartrate of potassium (tartar),† and tartrate of calcium. The volatile oil has never been isolated, but is supposed to be the cause of the delicate flavour and odour of wine, called the *bouquet.* According to Dr. F. L. Winckler, the bouquet depends upon the presence of a nitrogenous compound of a volatile organic acid with a volatile base, which has a different smell in different wines. *Œnanthic ether* (*œnanthate of oxide of ethyl*) was discovered in wine by Pelouze and Liebig. It is obtained towards the end of the distillation of wine, on the great scale, for making brandy. It forms only about one part in ten thousand of the wine. It is a colourless liquid, having a peculiar vinous odour, and a taste at first slight, but afterwards acrid. It is considered to be identical with *pelargonic ether*, under which head, in *Part* III., it is more fully described. Œnanthic ether must not be confounded with the substance which gives rise to the bouquet of wine. The other ingredients of wine, just enumerated, are sometimes present and sometimes absent. Thus, sugar is present in sweet wines, tannic acid in rough wines, and carbonic acid in those that effervesce. The different kinds of wine derive their various qualities from the mode of fermentation, the nature of the grape, and the soil and climate in which it may have grown. The alcohol in pure wine is that which results from the vinous fermentation, and is intimately united with the other ingredients of the liquid; but with almost all the wines of commerce a portion of brandy is mixed, the state of union of which is probably different from that of the natural alcohol of the wine. By the British custom-house regulations, 10 per cent. of brandy may be added to wines after importation; but to good wines not more that 4 or 5 per cent. is added.

Most wines on being kept form deposits, whether in the cask or in bottles. M. L. Pasteur divides these deposits into three kinds. 1. One consists of crystals of bitartrate of potassium, of neutral tartrate of calcium, or of a mixture of the two salts. This does not adhere to the sides of the vessel, but has sufficient weight to collect in a small bulk on repose. It is productive of little inconvenience physically, and has no injurious chemical effect on the wine. 2. A second deposit, often confounded with the first, but altogether distinct, is formed of the colouring substances which adhere to the sides of the bottles, especially the most dependent. It is owing to the oxidation, through the air, of the soluble colouring matters of the wine, which thus become insoluble. In consequence of its adhesion to the bottle, it allows the wine to be poured off quite clear. Its formation is generally coincident with improvement in the wine, which becomes at the same time lighter coloured, so that, after many years, the red wines, like port, will be almost as light as madeira. 3. The third kind of deposit is the most troublesome and injurious. It consists of cryptogamic vegetations, which, in the opinion of M. Pasteur, are the exclusive cause of all the alterations in wines which are considered as maladies. These never adhere to the sides of the bottle, unless confined by the colouring matter, which is very rare. They are little bodies so light that the least movement of the bottle disturbs them, and the liquid becomes turbid to a considerable extent. In a mere physical point of view, therefore, they are very inconvenient, by interfering with the decanting of the wine; while, acting as ferments, they cause great mischief not only by the change of the principles of the wine, but by adding to it new products, the direct result of their own action. As most wines are under their influence, the injury they produce in destroy-

* For a paper on the effect of gum upon the determination of the amount of glucose in wine, see *Journ. de Pharm.*, Oct. 1875, p. 274.

† M. Phipson has recognised in some wines, especially a red wine of Meudon, and in some clarets from Bordeaux, the *biracemate* or *paratartrate of potassium*, which he distinguished by the shape of its crystals floating in the wine, and afterwards separated and examined by chemical tests. The crystals are in octagonal tables, partially coloured by the red matter of the wine. He considers its presence as an evidence of good quality in the wine. (*Journ. de Pharm. et de Chim.*, 4e sér., iii. 274, A. D. 1866.)—*Note to the thirteenth edition.*

ing the better qualities of wine is incalculable. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 40, A. D. 1865.) The remedy for this disorder in wines, suggested by M. Pasteur, is to destroy the cryptogams by the aid of heat. All that is necessary is, by means of a water-bath, to expose the wine, in bottles, to a heat of 140° to 160° F. Experience has shown that in this way the wine soon clarifies itself, keeps well afterwards, and with an improved flavour. The process of heating their wines was to some extent employed by the ancients. Appert was the first in modern times to try it; and in fact it is nothing more nor less than his own peculiar process for preserving vegetable liquids. M. de Vergnette-Lamotte also experimented with wines with the same effect, but the theory of the change was first made known by Pasteur. (*Ibid.*, iii. 118, A. D. 1866.)

The intoxicating ingredient in all wines is the alcohol which they contain; and hence their relative strength depends upon the quantity of that substance entering into their composition. The alcohol, however, naturally in wine, is so blended with its other constituents as to be in a modified state, which renders it less intoxicating and injurious than the same quantity of alcohol, separated by distillation and diluted with water. This is hardly true of the alcohol which is not rarely added to wines by manufacturers. Mr. Brande published in 1811 a very interesting table, giving the percentage by measure of alcohol of the sp. gr. 0·825 in different kinds of wine. Similar tables have since been published by M. Julia-Fontenelle, Dr. Christison, and Dr. H. Bence Jones. An abstract of their results is given in the table below; the results of Julia-Fontenelle being distinguished by F., those of Dr. Christison by C., and those of Dr. Jones by J. The rest are Mr. Brande's.*

* *Table of the Proportion by Measure of Alcohol (sp. gr. 0·825) contained in 100 parts of different Wines.*

Lisa (mean)	25·41	Teneriffe	19·79	Lunel	15·52
Raisin wine (mean)	25·12	Teneriffe (C.)	16·61	Ditto (F.)	18·10
Marsala [Sicily madeira] (mean)	25·09	Colares	19·75	Sheraaz	15·52
strongest (J.)	21·10	Lachryma Christi	19·70	Ditto (C.)	15·56
weakest (J.)	19·90	White constantia	19·75	Syracuse	15·28
Port, strongest	25·83	Red constantia	18·92	Sauterne	14·22
mean	22·96	Lisbon	18·94	Burgundy (mean)	14·57
weakest	19·00	Ditto (C.)	19·09	strongest (J.)	13·20
strongest (C.)	20·49	Bucellas	18·49	weakest (J.)	10·10
mean (C.)	16·68	Red madeira (mean)	20·35	Hock (mean)	12·08
weakest (C.)	16·80	Cape muschat	18·25	strongest (J.)	13·00
strongest (J.)	23·20	Cape madeira (mean)	20·51	weakest (J.)	9·50
weakest (J.)	20·70	Grape wine	18·11	Nice	14·63
White port (C.)	17·22	Calcavella (mean)	18·65	Barsac	13·86
Madeira, strongest	24·42	Vidonia	19·25	Tent	13·30
mean	22·27	Alba flora	17·26	Champagne (mean)	12·61
weakest	19·24	Zante	17·05	Ditto (F.)	12·20
strongest (C.)	20·35	Malaga	17·26	Ditto, strongest (J.)	14·80
strongest (J.)	19·70	White hermitage	17·43	weakest (J.)	14·10
weakest (J.)	19·00	Roussillon (mean)	18·13	Red hermitage	12·32
Sercial madeira	21·40	Claret, strongest	17·11	Vin de Grave (mean)	13·37
Ditto (C.)	18·50	mean	15·10	Frontignac (Rives Altes)	12·79
Sherry, strongest	19·81	weakest	12·91	Ditto (C.)	12·29
mean	19·17	ditto (F.)	14·73	Côte rôtie	12·32
weakest	18·25	vin ordinaire (C.)	10·42	Tokay	9·88
strongest (C.)	19·31	Chateau-Latour, 1825 (C.)	9·38	Rudesheimer, first quality (C.)	10·14
mean (C.)	18·47	first growth, 1811 (C.)	9·32	inferior (C.)	8·35
weakest (C.)	16·96	strongest (J.)	11·10	Hambacher, first quality (C.)	8·88
Amontillado (C.)	15·18	weakest (J.)	9·10	Catawba (Stearns)	8 to 11
strongest (J.)	24·70	Malmsey madeira	16·40		
weakest (J.)	15·40	Ditto (C.)	15·60		

Prof. Diez, of Madrid, has ascertained, among other points, the percentage in volume of alcohol, and the percentage of acid, determined by potassa, in forty Rhenish wines. He found these constituents to vary, the former from 12·2 to 9·5 per cent.; the latter from 0·779 to 0·332. (*Central Blatt*, Aug. 26, 1854, p. 651.)

Estimation of the Alcoholic Strength of Wines. Mr. Horsley, of London, gives the following mode of ascertaining the percentage of alcohol in wines. Note the sp. gr. of the wine. Then take 5 fluidounces of it, boil it down in a flask to 2 fluidounces, and allow it to cool. All the alcohol is thus driven off. Add to the residuary liquid sufficient distilled water to bring it to the original measure of 5 fluidounces, and ascertain the sp. gr. of the mixture. Deduct the excess of its sp. gr. over 1·000, which is the sp. gr. of distilled water, from the sp. gr. of the wine as at first noted, and the difference will be the sp. gr. of the alcohol and water in the wine. Then by consulting

Adulterations. Wines are very frequently adulterated, and counterfeit mixtures are often palmed upon the public as genuine wine. Free sulphuric acid in red wines cannot be detected by barytic salts; for all wines contain a small quantity of the soluble sulphates. It may be discovered, however, by dropping the suspected red wine on a piece of common glazed paper, containing starch. If the wine be pure, the spot, when dry, will be violet blue, and the paper unaltered in texture; but if the wine contain even a thousandth part of sulphuric acid, the paper will be spotted rose-red, and prove brittle and friable when slightly rubbed between the fingers. (*Lassaigne, O. Henri,* and *Bayard.*) Formerly the wine dealers were in the habit of putting litharge into wines that had become acescent. The oxide of lead formed with the acetic acid acetate of lead, which, being sweet, corrected the defect of the wine, but at the same time rendered it poisonous. At the present day, this criminal practice is wholly abandoned. The adulteration is readily detected by sulphuretted hydrogen, which causes a black and flocculent precipitate. Mr. Brande, among the numerous samples of wine of suspected purity which he examined, did not find one containing any poisonous ingredient fraudulently introduced. Lead, in minute quantity, may sometimes be detected; but it is derived invariably from shot in the bottle, or from some analogous source. Rhenish wines, when acid from the presence of free tartaric or acetic acid, may be restored by the addition of neutral tartrate of potassium, which gives rise to the formation of cream of tartar. (*Andrew Ure.*) Spurious mixtures, frequently containing very little of the fermented juice of the grape, and which are sold as particular wines, may not be poisonous; but they are, notwithstanding, highly pernicious in their effects upon the stomach, and always produce mischief and disappointment, when depended on as therapeutic agents. The wines most frequently imitated are port and madeira; and cider is the chief ingredient in the spurious mixtures. *English port* is sometimes made of a small portion of real port, mixed with cider, juice of elder berries, and brandy, and rendered astringent with logwood and alum. According to Stracke, genuine wines do not contain salts of potassa in quantity sufficient to yield a precipitate with bichloride of platinum. If, therefore, a suspected wine be evaporated to dryness, and the extract, after being washed with alcohol so long as this is coloured by it, and then dissolved in water, give a precipitate with the bichloride, the presence of cider may be suspected. (*Journ. de Pharm.*, Mai, 1862, p. 442.) By most dealers in wine, colouring is employed, made usually of elder berries and alum. The practice of colouring wines is very reprehensible. In France colouring is openly sold with impunity, and extensively employed; although the wine dealer who uses it is liable to fine and imprisonment. (*A. Chevallier.*) Alum may be detected in red wine by boiling it for a few minutes. If alum be present, even in $\frac{1}{3000}$ part, the wine gradually becomes turbid, and furnishes a flocculent precipitate; while a pure red wine is not rendered turbid, even by long boiling. (*J. L. Lassaigne.*) M. Lapeyrére states (*Journ. de Pharm.*, 4e sér., xi. 291) that logwood may be detected by means of bibulous paper which has been saturated with a neutral acetate of copper; a strip of this, if dipped for a moment into natural wine, takes a gray or grayish rose colour, but, if logwood be present, the tint is a violaceous blue. M. de Cherville dissolves a piece of potash in the wine; if no sediment appear, and the wine becomes greenish, it is uncoloured; if a precipitate fall, it has been coloured; a violet sediment, indicating elder or mulberries; red, beet root or Pernambuco wood; violet red, logwood; yellow, "phytolac" berries; violet blue, privet berries; pale violet, sunflower. (*Phil. Med. Times.*, iv. 639.)

The weaker wines often spoil by keeping. In this case they are apt to dissolve any tartar that may have been deposited, and have been found to contain propionic acid. The result is ascribed by M. Nicklès to a fermentative decomposition of the tartar. Of course, in this state the wine contains potassa, and would not respond

the tables giving the percentage in alcohol of liquids containing alcohol and water, the percentage of alcohol in the wine will be obtained. Thus, suppose the sp. gr. of the wine to be 0·997, and that of the liquid, after treatment as directed, 1·020. Then 0·020, the excess of the latter sp. gr. over that of water or 1·000, deducted from 0·997, give 0·977 as the sp. gr. of the mixed alcohol and water in the wine, which, by referring to the table on page 86, will be found to indicate a percentage by weight of 18 of absolute alcohol. (*Chem. News,* Oct. 19, 1861.)—*Note to the twelfth edition.*

favourably to the test of bichloride of platinum before given. (*Journ. de Pharm.*, Août, 1862, p. 90.) Lactic acid is one of the products of the changes which take place in the spontaneous deterioration of wine; and M. Balard has succeeded in discovering the peculiar lactic acid ferment in spoiled wines. The appearance of this is preceded by that of globules similar to those of yeast; and, after the completion of the lactic acid fermentation, and the commencement of the putrefactive, a throng of vibriones is observable. After the cessation of the vinous fermentation, and during the progress of that of lactic acid, all disengagement of gas ceases. (*Ibid.*, Juillet, 1862, p. 9.)

Besides the grape, a number of other fruits yield a juice susceptible of the vinous fermentation.* The infusion of malt, also, is capable of undergoing this process, and becomes converted into the different kinds of porter and ale. The product in all these cases, though not commonly called a wine, is nevertheless a vinous liquor, and may be classed among the wines properly so called. The following is a list of these vinous liquors, together with the percentage of alcohol which they contain, as ascertained by Mr. Brande: currant wine, 20·55; gooseberry wine, 11·84; orange wine, 11·26; elder wine, 8·79; cider, from 5·21 to 9·87; perry, 7·26; mead, 7·32; Burton ale, 8·88; Edinburgh ale, 6·20; brown stout, 6·80; London porter, 4·20; small beer, 1·28. Dr. H. Bence Jones gives the following percentages of alcohol in the undernamed liquors: cider, from 5·4 to 7·5; bitter ale, from 6·6 to 12·3; porter, from 6·5 to 7·0; brown stout, from 6·5 to 7·9. According to L. Hoffmann, Burton ale consists, in the 100 parts, of carbonic acid 0·04, absolute alcohol 6·62, extract of malt 14·97, and water 78·37; and pale ale, of carbonic acid 0·07, absolute alcohol 5·57, extract of malt 4·62, and water 89·74. None of these liquors should be kept in leaden vessels, for fear of being rendered poisonous.

Medical Properties and Uses. Wine is consumed in most civilized countries; but in a state of health it is at least useless, if not absolutely pernicious. The degree of mischief which it produces depends on the character of the wine. Thus, the light wines of France are comparatively harmless; while the habitual use of the stronger wines, such as sherry, port, madeira, &c., even though taken in moderation, is always injurious, as having a tendency to induce gout, apoplexy, and other diseases dependent on plethora and over-stimulation. All wines, however, when used habitually in excess, are productive of bad consequences. They weaken the stomach, produce disease of the liver, and give rise to gout, dropsy, apoplexy, tremors, and not unfrequently mania. Nevertheless, wine is an important medicine, productive of the best effects in certain diseases. As an article of the materia medica, it ranks as a stimulant and antispasmodic. In the convalescence from protracted fever, it is frequently the best remedy that can be employed. In certain stages of fever, and in extensive ulceration and gangrene, this remedy, either alone, or conjoined with bark and opium, is often our main dependence. According to Dr. Stokes, of Dublin, the weakness or absence of the first sound of the heart is an indication for the use of wine in typhus fever. When given in low febrile affections, if it increase the fulness and lessen the frequency of the pulse, mitigate delirium, and produce a tendency to sleep, its further use may be deemed proper; but, if it render the pulse quicker, augment the heat and thirst, produce restlessness, or increase delirium, it should be immediately laid aside as injurious. In some convulsive diseases, as for example tetanus, wine, liberally given, has often proved useful.

Wine, when used medicinally, should be good of its kind; for otherwise it will disagree with the stomach, and prove rather detrimental than useful. The individual wine selected for internal exhibition must be determined by the nature of the disease, and the particular object in view. Sherry, when in good condition, is a fine wine, and, as it contains very little acid, is to be preferred whenever the stomach is delicate, or has a tendency to dyspeptic acidity. Good madeira is the most generous of the white wines, particularly adapted to the purpose of resuscitating debilitated con-

* It is stated that fruit wines contain phosphate of calcium, whilst grape wines contain phosphate of magnesium; and by that means the two can be distinguished. It is, however, very doubtful whether this is universal, and not merely characteristic of the products of certain neighbourhoods. (*Am. Journ. of Pharm.*, 1872, p. 105.)—*Note to the fourteenth edition.*

stitutions, and of sustaining the sinking energies of the system in old age. The acidity, however, of pure madeira causes it to disagree with some stomachs, and renders it an improper wine for gouty persons. Teneriffe is a good variety of white wine for medicinal use, being of about the medium strength, and agreeing very well with most stomachs. Port is generally used in cases of pure debility, especially when attended with a loose state of the bowels, unaccompanied with inflammation. In such cases it often acts as a powerful tonic as well as stimulant, giving increased activity to all the functions, especially digestion. Claret is much less heating, and is often useful on account of its aperient and diuretic qualities. Champagne is applicable to the sinking stage of low fevers with irritable stomach, and is often useful in the debility of the aged.

All the acidulous wines are contraindicated in the gouty and uric acid diathesis; as they are apt to convert the existing predisposition into disease.

The quantity of wine which may be given with advantage in disease is very variable. In low fevers it may be administered to the extent of a bottle or more in twenty-four hours, either pure, or in the form of *wine-whey*. This is made by adding to a pint of boiling milk, removed from the fire, from a gill to half a pint of white wine, straining without pressure to separate the curd, and sweetening the clear whey with loaf sugar. Wine-whey often forms a safe and grateful stimulus in typhoid fevers, and other febrile affections, which, after depletion, may tend to a state of deficient action, and be accompanied with a dry skin. Under these circumstances, it generally acts as a diaphoretic, and, when used of moderate strength, does not stimulate the system injuriously.

M. Aran, of Paris, has found enemata of wine highly useful in the convalescence from severe diseases. He has also derived benefit from them in chlorosis, dyspepsia, gastralgia attended with debility and gastric irritability, vomiting of food, and obstinate diarrhœa, especially that of phthisis. The rectum should be emptied by a laxative enema, immediately before giving the vinous, which may consist of from five to eight fluidounces of tepid wine, generally diluted with water. (See *Am. Journ. of Med. Sci.*, July, 1855, p. 208.)

Pharmaceutical Uses. White wine is employed as a menstruum to extract the virtues of several plants; and the preparations formed are called *vinous tinctures* or *medicated wines*. Tartar emetic and iron are the only mineral substances prepared in a similar manner. (See *Vinum Antimonii* and *Vinum Ferri*.) For the peculiar powers of wine as a menstruum, see *Vina Medicata*. B.

VIOLA. *U. S. Secondary.*

Violet.

The root of Viola pedata, *U. S.*

Violette odorante, *Fr.;* Wohlriechendes Veilchen, *Germ.;* Violetta, *Ital.;* Violeta, *Span.*

Viola. *Sex. Syst.* Pentandria Monogynia. — *Nat. Ord.* Violaceæ.

Gen. Ch. Calyx five-leaved. *Corolla* five-petaled, irregular, horned at the back. *Anthers* cohering. *Capsule* superior, three-valved, one-celled.

This genus includes numerous species, of which, though perhaps all or nearly all are possessed of analogous properties, one only, the *V. pedata*, is now officinal; the *Viola odorata*, formerly recognised by the London and Edinburgh Colleges, having been rejected by the British Council. *Viola ovata*, an indigenous species, has been recommended as a remedy for the bite of the rattlesnake. (See a paper by Dr. Williams in the *Am. Journ. of Med. Sci.*, xiii. 310.) As *V. odorata* has long held the most conspicuous place in the genus, medically considered, we shall treat of it together with the officinal species.

Viola pedata. Willd. *Sp. Plant.* i. 1160; Curtis, *Bot. Mag.* 89. This is an indigenous species, without stems, glabrous, with many-parted, often pedate leaves, the segments of which are linear-lanceolate, obtuse, and nearly entire. The flowers are large and of a beautiful blue colour, often more or less variegated. The divisions of the calyx are linear and acute. The stigma is large, compressed at the sides, obliquely truncate, and perforate at the apex. The plant grows in dry sandy hills

and fields and rocky woods, from New England to Carolina, and flowers in May and June.

Viola odorata. Willd. *Sp. Plant.* i. 1163; Woodv. *Med. Bot.* p. 251, t. 89. This is a small, pretty, creeping plant, the runners of which are furnished with fibrous roots, and send up annually tufts of leaves and flowers. The leaves are heart-shaped, crenate, and supported on long petioles. The flowers are at the summit of delicate, quadrangular, channeled, radical peduncles. The leaves of the calyx are shorter than the petals, which are obovate, obtuse, unequal, and of a bluish-purple or deep violet colour, except at the claws, which are whitish. The two lateral petals are spreading and bearded towards the base, the inferior furnished with a large spur, and the two upper reflected. In the centre are the stamens with very short filaments, and anthers slightly cohering by an orange-coloured membranous expansion.

The sweet violet is a native of Europe, growing in woods, hedges, and other shady places. It is cultivated in gardens both for its beauty and for medical use, and has been introduced into this country. It is valued chiefly for its flowers, which appear in April and May.

The flowers of this species of violet, besides their beautiful colour, have a peculiar agreeable odour, and a very slightly bitter taste. These properties they yield to boiling water; and their infusion affords a very delicate test for acids and alkalies, being reddened by the former, and rendered green by the latter. Their odour is destroyed by desiccation; and the degree to which they retain their fine colour depends upon the care used in collecting and drying them. They should be gathered before being fully blown, deprived of their calyx, and rapidly dried, either in a heated room, or by exposing them to a current of very dry air. The flowers of other species are often mingled with them, and, if of the same colour, are equally useful as a chemical test.

In the root, leaves, flowers, and seeds of *Viola odorata*, M. Boullay discovered a peculiar alkaline principle, bearing some resemblance to *emetia*, but possessing distinct properties. He called it *violine* (*violia*). It is white, soluble in alcohol, scarcely soluble in water, and forms salts with the acids. It exists in the plant combined with malic acid, and may be obtained by treating with distilled water the alcoholic extract of the dried root, decomposing by means of magnesia the malate of violia contained in the solution, and extracting the alkaloid from the precipitated matters by alcohol, which yields it on evaporation. To obtain it entirely pure, a more complicated process is necessary. Orfila has ascertained that it is exceedingly active and even poisonous. It is probably contained in most of the other species of Viola.

Medical Properties, &c. of the Violets. The herbaceous parts of different species of violet are mucilaginous, emollient, and slightly laxative; and have been used in pectoral, nephritic, and cutaneous affections. Much was formerly thought of the *Viola tricolor*, or *pansy*, as a remedy in crusta lactea. A decoction in milk of a handful of the fresh herb was taken morning and evening, and a poultice made with the same decoction was applied to the affected part. Cures in numerous instances are said to have been effected by this treatment, persevered in for some time. Our own *Viola pedata* is considered a useful expectorant and demulcent in pectoral complaints. (*Bigelow.*)

In Europe, a syrup prepared from the fresh flowers of *Viola odorata* is employed as an addition to demulcent drinks, and as a laxative for infants. The seeds were formerly considered beneficial in gravel, but are not now used. The root, which has a bitter, nauseous, slightly acrid taste, acts in the dose of from thirty grains to a drachm as an emetic and cathartic. It is probable that the same property is possessed by the roots of all the violets; as it is known to be by several species of Ionidium, which belongs to the same natural family. The existence in small proportion of the emetic principle, upon which the powers of the root probably depend, in the leaves and flowers, accounts for the expectorant properties attributed to these parts of the plant.* W.

* *Syrup of Violet.* This was officinal with the Lond. and Ed. Colleges; and, though it has been discarded in the British Pharmacopœia, yet, as it may sometimes prove useful, we give the London formula for its preparation, with the remarks upon it contained in the eleventh edition of the Dispensatory.

"Take of Violets [recent petals] *nine ounces;* boiling Distilled Water *a pint* [Imperial measure];

XANTHORRHIZA. *U.S. Secondary.*

Yellow-root.

The root of Xanthorrhiza apiifolia. *U.S.*

XANTHORRHIZA. *Sex. Syst.* Pentandria Polygynia. — *Nat. Ord.* Ranunculaceæ *Gen. Ch. Calyx* none. *Petals* five. *Nectaries* five, pedicelled. *Capsules* five to eight, one-seeded, semibivalve. *Nuttall.*

Xanthorrhiza apiifolia. Willd. *Sp. Plant.* i. 1568; Barton, *Med. Bot.* ii. 203. — *X. tinctoria.* Woodhouse, *N. Y. Med. Repos.* vol. v. This is an indigenous shrub, two or three feet in height, with a horizontal root, which sends off numerous suckers. The stem is simple, rather thicker than a goose-quill, with a smooth bark, and bright-yellow wood. The leaves, which stand thickly at the upper part of the stem, are compound, consisting of several ovate-lanceolate, acute, doubly serrate leaflets, sessile upon a long petiole, which embraces the stem at its base. The flowers are small, purple, and disposed in long, drooping, divided racemes, placed immediately below the first leaves. The nectaries are obovate and bilobed, the styles usually about six or eight in number.

The yellow-root grows in the interior of the Southern, and in the Western States. Nuttall says that it is abundant on the banks of the Ohio. It flowers in April. The root is the part directed by the Pharmacopœia; but the bark of the stem possesses the same virtues.

The root is from three inches to a foot or more in length, and about half an inch in thickness near the stem. It shrinks somewhat in drying, and, as found in the shops, is in slender pieces of various lengths, diminishing from three or four lines in thickness to the dimensions of a knitting-needle, wrinkled longitudinally, with a light yellowish-brown, easily separable epidermis, a thick, hard, bright-yellow woody portion, and a very slender central pith. It is inodorous, and of a simple but extremely bitter taste. It imparts its colour and taste to water. The infusion is not affected by a solution of sulphate of iron. By the late Professor Barton the bark of the root was considered more bitter than its ligneous portion. Dr. J. Dyson Perrins extracted from it an alkaloid which, both in its reactions and composition, so closely resembled *berberina* that there can scarcely be a doubt of their identity. (*Pharm. Journ.*, May, 1862.)

Medical Properties and Uses. Xanthorrhiza possesses properties closely analogous to those of columbo, quassia, and other simple tonic bitters; and may be used for the same purposes, and in the same manner. Dr. Woodhouse employed it in the dose of two scruples, and found it to lie easily upon the stomach. W.

Sugar [refined] *a sufficient quantity;* Rectified Spirit *a sufficient quantity.* Macerate the Violets in the Water for twelve hours; then express, and filter. Set apart that the dregs may subside; then add a weight of the Sugar double that of the liquid, and dissolve with a gentle heat. Finally, when the syrup has cooled, mix with each fluidounce of it half a fluidrachm of the Spirit." *Lond.*

This syrup has a deep-blue colour and an agreeable flavour. It is said that its colour is most beautiful when it is prepared in well-cleaned pewter vessels; and the influence of the metal is ascribed by M. Augillis, of Ypres, to the attraction of the tin for nascent acetic acid, which he thinks is produced in the flower by fermentation, and has the effect, if not neutralized, of impairing its colour. (*Journ. de Pharm.*, Sept. 1856, p. 194.) As it is apt to fade by time, it is sometimes counterfeited with materials the colour of which is more permanent. The fraud may usually be detected by the addition of an acid or alkali, the former of which reddens the syrup of violets, the latter renders it green, while they produce no such change upon the counterfeit. It should not have the smell or taste of red cabbage, a syrup of which acts in the same way with acids and alkalies.

This syrup acts as a gentle laxative when given to infants in the dose of one or two fluidrachms; but it is used chiefly as a test of acids and alkalies. For the latter purpose, a syrup prepared from the juice of the red cabbage may be substituted. It is very seldom kept in our shops.

M. Bouilhon has devised the following formula on account of the difficulty often experienced of obtaining fresh violet flowers. Take of Dry Violet Petals forty parts; Boiling Distilled Water two thousand parts; Citric Acid about one-tenth of a part. Infuse four hours in a tin vessel, strain off the infusion, pour a little water on the residue, and express until two thousand parts of liquor are obtained; add sugar to this to make syrup.

XANTHOXYLUM. *U.S. Secondary.*

Prickly Ash.

The bark of Xanthoxylum fraxineum, and of Xanthoxylum Carolinianum. *U. S.*

XANTHOXYLUM. *Sex. Syst.* Dicœcia Pentandria. — *Nat. Ord.* Terebintaceæ, *Juss.;* Xanthoxylaceæ, *Lindley.*

Gen. Ch. MALE. *Calyx* five-parted. *Corolla* none. FEMALE. *Calyx* five-parted. *Corolla* none. *Pistils* five. *Capsules* five, one-seeded. *Willd.**

Xanthoxylum fraxineum. Willd. *Sp. Plant.* iv. 757; Bigelow, *Am. Med. Bot.* iii. 156. — *X. Americanum*, Miller; Torrey and Gray, *Fl. of N. Am.* i. 214. The prickly ash is a shrub from five to ten feet in height, with alternate branches, which are covered with strong, sharp, scattered prickles. The leaves are alternate and pinnate, consisting of four or five pairs of leaflets, and an odd terminal one, with a common footstalk, which is sometimes prickly on the back, and sometimes unarmed. The leaflets are nearly sessile, ovate, acute, slightly serrate, and somewhat downy on their under surface. The flowers, which are small and greenish, are disposed in sessile umbels near the origin of the young shoots. The plant is polygamous; some shrubs bearing both male and perfect flowers, others only female. The number of stamens is five, of the pistils three or four in the perfect flowers, about five in the pistillate. Each fruitful flower is followed by as many capsules as it had germs. These capsules are stipitate, oval, punctate, of a greenish-red colour, with two valves, and one oval blackish seed. This species of Xanthoxylum is indigenous, growing in woods and in moist shady places throughout the Northern, Middle, and Western States. The flowers appear in April and May, before the foliage. The leaves and capsules have an aromatic odour recalling that of the oil of lemons. The bark is the officinal portion.

Properties. This, as found in the shops, is in quills, from one or two lines to nearly an inch in diameter, thin, externally of a darkish-gray colour diversified by whitish patches, with the epidermis in many pieces marked by closely set transverse cracks, internally finely striated longitudinally and somewhat shining, and, when derived from the smaller branches, exhibiting occasionally remains of the prickles. The bark is very light, brittle, nearly or quite inodorous, and of a taste which is at first sweetish and slightly aromatic, then bitterish, and ultimately acrid. The acrimony is imparted to boiling water and alcohol, which extract the virtues of the bark. Its constituents, according to Dr. Staples, besides fibrous substance, are volatile oil, a greenish fixed oil, resin, gum, colouring matter, and a peculiar crystallizable principle which he calls *xanthoxylin*, but of which the properties are not designated. (*Journ. of the Phil. Col. of Pharm.*, i. 165.) It is probably identical with the bitter crystalline principle found by MM. Chevallier and Pelletan in the bark of Xanthoxylum Clava Herculis, and named by them *xanthopicrite;* and this has been found by Mr. Perrins to be identical with berberina; so that the prickly ash is to be added to the list of medical substances, already large, in which this widely diffused alkaloid is contained. (*Pharm. Journ.*, March, 1863, p. 403.)

A specimen of bark has been shown to us, collected on the shores of the Chesapeake Bay, and said to be the product of *Xanthoxylum Clava Herculis*, though probably derived from the trunk of the *X. Carolinianum*, as the X. Clava Herculis is a native of the West Indies, and not of the United States, and the X. Carolinianum grows in Virginia. Prof. Bentley first indicated this probable origin of the bark, which, in the eleventh edition of the Dispensatory, was conjecturally referred to the

* The fruit of *Xanthoxylum alatum*, growing in Northern India and China, is known by the name of *Japanese pepper*, being used as a condiment in Japan and China. It is in small roundish capsules, of which one or more stand upon a peduncle, of a reddish-brown colour, and beset externally with numerous little prominences, which appear to enclose the oil to which the fruit owes its pungency. The flavour of the capsule is aromatic, pungent, and agreeable. The seeds are black, shining, and destitute of pungency. Dr. Stenhouse has obtained from the fruit by distillation a liquid volatile oil, isomeric with oil of turpentine, which he calls *xanthoxylene*, colourless, and of an extremely agreeable odour; and a crystalline stearoptene, which separates from the liquid on cooling. This he calls *xanthoxylin*. It is slightly aromatic, insoluble in water, soluble in alcohol and ether, fusible and volatilizable unchanged. (*Pharm. Journ.*, xvii. 19, and N. S. ii. 554.)—*Note to the eleventh and twelfth editions.*

trunk of the officinal species. The specimen referred to resembles the bark above described considerably in its general characters, but differs in consisting of irregular fragments of a bark of larger dimensions, flat or but slightly rolled, and exhibiting, on the outer surface of some of the fragments, large conical, corky eminences, which serve as the bases of the spines, and no doubt give to the trunk of the tree the rough, knotty appearance, which obtained for its congener the name of the club of Hercules.

The researches of Prof. Robert Bridges, made since the publication of the twelfth edition of the Dispensatory, leave no room to doubt that the bark known in the South as the prickly ash bark is that of the X. Carolinianum. (*Am. Journ. of Pharm.*, March, 1865, p. 134.)

Dr. Bigelow states that the *Aralia spinosa*, or angelica tree, which grows in the Southern States, is occasionally confounded with *X. fraxineum*, in consequence partly of being sometimes called, like the latter, *prickly ash*. Its bark, however, in appearance and flavour, is entirely different from xanthoxylum.

Medical Properties and Uses. Xanthoxylum is stimulant, producing, when swallowed, a sense of heat in the stomach, with more or less general arterial excitement, and a tendency to diaphoresis. It is thought to resemble mezereon and guaiac in its remedial action, and is given in the same complaints. As a remedy in chronic rheumatism, it enjoys considerable reputation in this country. The dose of the powder is from ten grains to half a drachm, to be repeated three or four times a day. A decoction, prepared by boiling an ounce in three pints of water down to a quart, may be given in the quantity of a pint, in divided doses, during the twenty-four hours. The powder has sometimes been employed as a topical irritant; and the bark, used as a masticatory, is a popular remedy for toothache, and has been recommended in palsy of the tongue. W.

ZINCUM. *U. S., Br.*

Zinc.

Zinc of commerce, *Br.*

Spelter; Zinc, *Fr.*; Zink, *Germ.*; Zinco, *Ital., Span.*

Zinc occurs native in two principal states; as a sulphuret, called *blende*, and as a carbonate and silicate, to which the name of *calamine* is applied indiscriminately.* It has been detected, in the vegetable kingdom, in a peculiar violet growing on the calamine hills of Rhenish Prussia. It is found most abundantly in Germany, whence the United States have, until recently, been chiefly supplied.† The metal is extracted generally from calamine. This is roasted and mixed with charcoal powder, and the mixture heated in iron cylinders, placed horizontally over a furnace. When the reduction of the zinc commences, iron receivers are adapted to the opening of the cylinder to condense the volatilized metal. The metal is then melted and run into moulds, and forms *speltre*, or the zinc of commerce. In this state it contains iron, and traces of lead, cadmium, arsenic, copper, sulphur, and charcoal. To purify it from these substances, it must be subjected to a second distillation in a crucible, furnished with a tube passing through its bottom, and open at both ends; its upper extremity reaching a little more than half way up the interior of the crucible, and its lower end terminating above a vessel of water. The impure zinc being placed in the crucible, the cover luted on, and the fire applied, the pure zinc is volatilized, and, passing down the tube by a descending distillation, condenses in the water below. In the arts, zinc is purified sufficiently for commercial purposes without volatilization. (See *Chem. News*, xx. 175.)

Properties. Zinc has a bluish-white colour, a peculiar taste, and a perceptible smell when rubbed. Its texture is laminated, and its fracture crystalline. Its malleability

* A small piece of native zinc was exhibited at the International Exhibition at London, in 1862, among the products of Australia, being the first specimen that had been seen of the metal in this state. (*Chem. News*, July 26, 1862.)

† Zinc is now largely manufactured near Bethlehem, Pennsylvania, at the zinc works of the Lehigh Zinc Company. The ore worked is the silicate or electric calamine. Sulphuret of zinc (blende) and sulphuret of cadmium are also found in the same locality. From picked specimens of the ore nearly pure zinc has been obtained. (*Am. Journ. of Pharm.*, Sept. 1860, p. 407.)—*Note to the twelfth edition.*

and ductility are not very great. When perfectly pure, it may be reduced to thin leaves at ordinary temperatures; but the zinc of commerce requires to be heated to a temperature between 212° and 300° to render it sufficiently malleable to be rolled into sheets. The softness of zinc is peculiar, as is shown by the circumstance that it clogs the file, when the attempt is made to reduce it to filings; and hence to have it in the divided form, it is necessary to melt it, and triturate it at the moment of solidification. Its sp. gr. is about 6·8, its equivalent 32·3, and symbol Zn. Favre makes its equivalent 32·99, and Erdmann, 32·527. Subjected to heat it fuses at 773°. According to Dr. A. Von Riemsdyk, it volatilizes to some extent before fusion at a temperature of 515° F. (*Amer. Journ. of Pharm.*, 1869, p. 424.) At full redness it boils, and in close vessels may be distilled over; but in open vessels it takes fire, and burns with a dazzling white flame, giving off dense white fumes. It dissolves in most of the acids with disengagement of hydrogen, and precipitates all the metals either in the metallic state, or in that of oxide. It forms but one well-characterized oxide (a protoxide), and but one sulphuret. The protoxide is officinal, and will be described under another head. (See *Zinci Oxidum.*)

Zinc of good quality dissolves in dilute sulphuric acid, with the exception of a scanty grayish-black residue. If absolutely pure, it would be wholly dissolved. The solution is colourless, and yields white precipitates with ferrocyanide of potassium and hydrosulphate of ammonium. Ammonia throws down from this solution a white precipitate, which is wholly dissolved when the alkali is added in excess. If copper be present, the solution will be rendered blue by the ammonia; if iron, it will be thrown down by this alkali, but not redissolved by its excess. Arsenic may be detected, unless present in very minute proportion, by dissolving the zinc in pure dilute sulphuric acid in a self-regulating reservoir for hydrogen, when arseniuretted hydrogen will be formed, recognisable by its flame producing a dark stain on a white plate.

Zinc is extensively employed in the arts. It is the best metal that can be used, in conjunction with copper, for galvanic combinations. Combined with tin and mercury, it forms the amalgam for electrical machines. Its solution in dilute sulphuric acid furnishes the readiest method for obtaining hydrogen. With copper it forms *brass*, and, in the form of *sheet zinc*, it is employed to cover the roofs of houses, and for other purposes. It is also applied to the covering of iron, to protect it from oxidizement, in the same manner as tin, forming what is known commercially as *galvanized iron*. It should, however, never be used for culinary vessels, as it is soluble in the weakest acids. Zinc and its oxide are dissolved to a certain extent by water containing common salt; a double chloride of zinc and sodium being produced in solution. (*Journ. de Pharm.*, Nov. 1867, p. 397.)

The compounds of zinc are poisonous, but not to the same extent as those of lead. The oxide of zinc, used in painting as a substitute for white lead, is said to be capable of producing a colic, resembling that caused by lead, and called *zinc colic*. It attacks workmen exposed to the dust of the oxide while engaged in packing it in barrels, and yields to the remedies appropriate to the treatment of lead colic. (See *Chem. Gaz.*, Sept. 16, 1850.) This statement, however, is, to say the least, very questionable.

Pharmaceutical Uses. Zinc is never used as a medicine in the metallic state; but is employed in this state to prepare the officinal Sulphate and Chloride of Zinc, and the Reduced Iron of the Br. Pharmacopœia. In combination it forms a number of important preparations, a list of which, with their synonymes, is subjoined.

Zinc is employed medicinally,

I. In the metallic state.

Zincum Granulatum, *Br.*—*Granulated Zinc.*

II. Oxidized.

Zinci Oxidum, *U. S.*, *Br.*—*Oxide of Zinc.*

Zinci Oxidum Venale. *U. S.*

Unguentum Zinci Oxidi, *U. S.*; Unguentum Zinci, *Br.*—*Ointment of Oxide of Zinc.*

III. Combined with chlorine.

Zinci Chloridum, *U. S.*, *Br.*—*Chloride of Zinc.*

Liquor Zinci Chloridi, *Br.*—*Solution of Chloride of Zinc.*

IV. Oxidized and combined with acids.

Zinci Acetas, *U. S.*, *Br.*—*Acetate of Zinc.*

Zinci Carbonas Præcipitata, *U. S.*; Zinci Carbonas, *Br.*—*Precipitated Carbonate of Zinc.*

Ceratum Zinci Carbonatis, *U. S.*—*Cerate of Carbonate of Zinc.*

Zinci Sulphas, *U. S.*, *Br.*—*Sulphate of Zinc. White Vitriol.*

Zinci Valerianas, *U. S.*, *Br.*—*Valerianate of Zinc.* B.

ZINCI OXIDUM VENALE. *U. S.*

Commercial Oxide of Zinc.

The oxide of zinc, obtained by combustion, is used to an enormous extent in the arts as a pigment. It is a snow white powder which, although remarkably pure for a commercial article, is officinal solely for the purpose of making the acetate of zinc.

Off. Prep. Zinci Acetas, *U. S.* H. C. W.

ZINCI SULPHAS. *U. S.*, *Br.*

Sulphate of Zinc. White Vitriol.

This salt was, at the revision of the U. S. Pharmacopœia preceding the last, transferred from the Preparations to the Materia Medica Catalogue, as an article to be purchased of the manufacturer. The British Pharmacopœia gives the following process for its preparation.

"Take of Granulated Zinc *sixteen ounces* [avoirdupois]; Sulphuric Acid *twelve fluidounces* [Imperial measure]; Distilled Water *four pints* [Imp. meas.]; Solution of Chlorine *a sufficiency;* Carbonate of Zinc *half an ounce* [avoird.], or *a sufficiency.* Pour the Acid previously mixed with the Water on the Zinc contained in a porcelain basin, and, when effervescence has nearly ceased, aid the action by a gentle heat. Filter the fluid into a gallon bottle, and add gradually with constant agitation the Solution of Chlorine until the fluid acquires a permanent odour of chlorine. Add now with continued agitation the Carbonate of Zinc until a brown precipitate appears; let it settle, filter the solution, evaporate till a pellicle forms on the surface, and set aside to crystallize. Dry the crystals by exposure to the air on filtering paper, placed on porous tiles. More crystals may be obtained by again evaporating the mother liquor."

Strong sulphuric acid has very little action on zinc; but, when it is *diluted*, water is instantly decomposed, and, while its hydrogen escapes with rapid effervescence, its oxygen combines with the zinc; and the oxide formed, uniting with the acid, generates the sulphate of the oxide of zinc. Thus it is perceived that *hydrogen* is a collateral product of the process. The proportion of the zinc to the strong acid in the process is as 4 to 5·53. The equivalent numbers give the ratio of 4 to 6·06; which indicates that the metal is somewhat in excess. If the materials are mixed at once, without any precaution, the effervescence of hydrogen is apt to be excessive, and to cause the overflowing of the liquid. This may be avoided by commencing the solution of zinc with a very dilute acid, which, as the action slackens, is made by degrees stronger and stronger, by the addition, at intervals, of small portions of fresh acid. As the zinc of commerce generally contains iron, this would contaminate the product, unless precautions were taken to prevent it. Hence the addition of chlorine, which reacts with the sulphate of iron to form tersulphate of sesquioxide of iron and sesquichloride of iron, which, upon the addition of the carbonate of zinc, yield the sulphuric acid and chlorine to the zinc; the sesquioxide of iron being deposited, and the carbonic acid set free. The former is separated by filtration, the latter escapes during the evaporation, the additional sulphate of zinc crystallizes with that first formed, and the chloride of zinc remains in the mother-waters.

Preparation on the Large Scale. Impure sulphate of zinc, as it occurs in commerce, is called *white vitriol.* It is manufactuaed by roasting *blende* (native sulphuret of zinc) in a reverberatory furnace. This mineral, besides sulphuret of zinc, contains

small quantities of the sulphurets of iron, copper, and lead; and by roasting is converted, in consequence of the oxidation of its constituents, into sulphate of zinc, mixed with the sulphates of iron, copper, and lead. The roasted matter is then lixiviated; and the solution obtained, after having been allowed to settle, is concentrated by evaporation; so that, on cooling, it may concrete into a white crystalline mass, resembling lump sugar. In this state it always contains sulphate of iron, and sometimes a small proportion of sulphate of copper. It may be purified from these metals by dissolving it in water, and boiling the solution with oxide of zinc, which converts the sulphates of iron and copper, by precipitating their bases, into sulphate of zinc. The purified solution is then decanted or filtered, and, after due evaporation, allowed to crystallize. It has generally been proposed to purify the white vitriol of commerce by digesting its solution with metallic zinc, under the impression that this is capable of precipitating all the foreign metals; but, according to Berzelius, though it will precipitate copper readily, it has no action on iron.

Properties, &c. Sulphate of zinc is a transparent, colourless salt, having a disagreeable, metallic, styptic taste, and crystallizing usually in small four-sided prisms. Its crystals have considerable resemblance to those of sulphate of magnesium. It effloresces slightly in dry air, and, though neutral in composition, reddens vegetable blues. It dissolves in two and a half times its weight of cold water, and in less than its weight of boiling water, and is insoluble in alcohol. When heated it dissolves in its water of crystallization, which gradually evaporates; and, by a prolonged ignition, the whole of the acid is expelled, and the oxide of zinc left. Potassa, soda, and ammonia throw down a white precipitate of mixed oxide and subsulphate, which is redissolved by the alkali in excess. If iron be present, it is precipitated also, but not redissolved. The alkaline carbonates precipitate the metal in the state of white carbonate. Pure sulphate of zinc is precipitated white by ferrocyanide of potassium and hydrosulphate of ammonium. What is thrown down by chloride of barium or acetate of lead (sulphate of barium or sulphate of lead) is not dissolved by nitric acid. If copper be present, ammonia will produce a blue tinge; if iron, the ferrocyanide of potassium will cause a bluish-white precipitate instead of a white one, and tincture of galls a purple colour. Cadmium and arsenic may be detected by acidulating the solution with sulphuric acid, and passing a stream of sulphuretted hydrogen through it; when, if either of these metals be present, it will be thrown down as a yellow sulphuret. Sulphate of zinc is incompatible with alkalies and alkaline carbonates, hydrosulphates, lime-water, the soluble salts of lead, and astringent infusions.

The impure commercial variety of sulphate of zinc, called white vitriol, is in the form of irregular white masses, having some resemblance to lump sugar. The lumps usually exhibit, here and there on the surface, yellow stains, produced by sesquioxide of iron. It is less soluble than the pure salt on account of its containing less water of crystallization.

Composition. Crystallized sulphate of zinc consists of one eq. of sulphuric acid 40, one of oxide of zinc 40·3, and seven of water 63 = 143·3. The white vitriol of commerce contains but three eqs. of water.

Medical Properties and Uses. This salt is tonic, astringent, and, in large doses, a prompt emetic. Before the discovery of tartar emetic, it was much employed to produce vomiting; but at present its use as an emetic is restricted principally to the dislodging of poisons, for which purpose its property of operating promptly renders it particularly suitable. As a tonic, it is supposed to be well suited to cases of debility, attended with irritation, being less heating than sulphate of iron. In dyspepsia it has been used with advantage in small doses, from a quarter of a grain to a grain, repeated several times a day; but, if good effects are not soon apparent, it should be laid aside. In the night-sweats of consumption it acts with singular efficacy, combined with extract of hyoscyamus, given at bedtime in the form of pill, composed of one grain of the salt to four of the extract. The combination has been used in these sweats, with the effect of arresting them in about thirty cases, by Dr. E. J. Coxe, of New Orleans. In obstinate intermittents it is a valuable resource, and may be given alone, or conjoined with cinchona or sulphate of quinia. But it is in spasmodic diseases, such as epilepsy, chorea, pertussis, &c., that it has been principally employed

Dr. Paris speaks of its efficacy in high terms, in spasmodic cough, especially when combined with camphor or myrrh, and "in affections of the chest attended with inordinate secretion." As an astringent it is chiefly employed externally. Its solution constitutes a good styptic to bleeding surfaces, and is frequently resorted to as an injection in fluor albus and gonorrhœa, and as a collyrium in ophthalmia. In some conditions of ulcerated sore-throat, it forms a useful gargle. In the eczematous eruption produced by Rhus Toxicodendron, the frequent application of a solution of half an ounce to the pint is said by Dr. C. H. Humphreys to give relief in twenty-four hours. (*Am. Journ. Med. Sci.*, lxviii. 160.) It has been employed also in solution with success as a remedy for nasal polypi, in the proportion of two scruples, gradually increased to an ounce of the salt, to seven fluidounces of water, applied by means of lint and by injection. The dose, as a tonic, is from one to two grains; as an emetic, from ten to thirty grains. To children affected with hooping-cough, it may be given in doses of from an eighth to a quarter of a grain two or three times a day. When used as a collyrium, injection, or gargle, or as a wash for indolent ulcers, from one to three grains or more may be dissolved in a fluidounce of water. For medicinal purposes the crystallized salt should be used, and in no case the impure white vitriol of commerce.

Prof. Simpson, of Edinburgh, has recently (1857) called attention to the value of dried sulphate of zinc, in the form of powder, paste, or ointment, as a caustic. He attributes to it the advantages of being powerful, rapid, manageable, safe, and not deliquescent. In a recent paper he reports his successful use of it as a caustic in indurated inflammatory ulcers of the cervix uteri; in lupus; in ulcerous forms of skin diseases; in removing the small red sensitive tumours which form at the orifice of the female urethra, and in destroying ulcerated condylomata and warty excrescences. The dried salt should be finely levigated. The caustic paste is made by incorporating an ounce of the powder with a drachm of glycerin; and the caustic ointment, by thoroughly mixing the same quantity of the powder with two drachms of lard. (See *Am. Journ. of Med. Sci.*, April, 1857, p. 485.) Dr. Eben Watson, Surgeon to the Royal Infirmary of Glasgow, also bears testimony to the utility of dried sulphate of zinc as an escharotic. He particularly insists upon its advantages as a caustic application to callous ulcers, for the purpose of destroying their surface, exciting a new action, and disposing them to heal. The application causes severe pain, which should be relieved by opiates freely given, and continued until the sloughs separate, about the fifth day.

Sulphate of zinc, in an overdose, acts as an irritant poison. Besides vomiting and incessant retching, it produces anxiety, distressing restlessness, and extreme prostration. Few cases are on record of fatal poisoning by this salt; the patient being generally relieved by its prompt expulsion in vomiting. Four cases, however, have been reported in an Italian journal, two of which proved fatal. In one of the fatal cases, an ounce and a half had been swallowed by mistake for Epsom salt. The treatment consists in the free administration of bland drinks, the use of opium to allay irritation, and the employment of the usual antiphlogistic remedies, should symptoms of inflammation arise.

Off. Prep. Zinci Carbonas, *Br.;* Zinci Carbonas Præcipitata, *U. S.;* Zinci Valerianas, *Br.* B.

ZINCI VALERIANAS. *U.S., Br.*

Valerianate of Zinc.

Valerianate of Zinc was formerly included among the preparations of the U. S. Pharmacopœia, but at the last revision was transferred to the Materia Medica list. The British Pharmacopœia still gives a formula for its preparation; this, with the old U. S. formula and remarks upon them contained in the last edition of the U. S. Dispensatory, may be found in the foot-note.*

* "Take of Valerianate of Soda *two troyounces and a half;* Sulphate of Zinc *two troyounces* and *four hundred and twenty grains;* Distilled Water, *a sufficient quantity.* Dissolve the salts separately, each in twenty fluidounces of Distilled Water, and, having heated the solutions to 212°, mix them, and set the mixture aside to crystallize. Decant the mother-water from the crystals, and put them upon a filter in a funnel to drain. Mix the mother-water and the drainings, evapo-

Properties. This salt is in white, pearly scales, having a faint odour of valerianic acid, and a metallic, styptic taste. It dissolves in 160 parts of cold water, and in 60 of alcohol of 0·833. The solutions, which have an acid reaction, become turbid on the application of heat, but clear again on cooling. The salt, as obtained by the officinal formulas, is anhydrous; but, when formed by exactly saturating carbonate of zinc, made into a paste with water, with valerianic acid, it contains twelve eqs. of water, and, when dried at 122°, perfectly resembles the anhydrous salt. (*G. C. Wittstein.*) Acetate of zinc, impregnated with oil of valerian, has been substituted for this salt; but at present, from the relative costliness of the oil, there is no inducement to this fraud. The butyrate of zinc has been sold in Paris for the valerianate, and is so like it as not to be distinguished by its physical properties. The two salts, however, may be discriminated by adding a concentrated solution of the acid of the suspected salt, obtained by distillation with sulphuric acid, to a concentrated solution of acetate of copper. If the acid is the butyric, its addition to the solution of the acetate disturbs the transparency of the latter, by the formation of a bluish-white precipitate; while, if the valerianic, no change is produced. (Larocque and Huraut, *Journ. de Pharm.*, 3e sér., ix. 430.)

Medical Properties. Valerianate of zinc was proposed as a remedy, on theoretical grounds, by Prince Louis-Lucien Bonaparte. Upon trial it was found to possess antispasmodic properties. By some of the Italian physicians it has been extolled as a remedy in neuralgic affections. Dr. Namias, of Venice, employed it with advantage in anomalous nervous affections, attended with palpitation of the heart, constriction of the throat, and pain in the head. Dr. Francis Devay, of Lyons, found it useful in epilepsy, and in the nervous affections which accompany chlorosis. The dose is one or two grains, repeated several times a day, and given in the form of pill. (See a paper on this valerianate by Prof. Procter, in the *Am. Journ. of Pharm.* for April, 1845.) B.

ZINGIBER. *U. S., Br.*

Ginger.

The rhizome of Zingiber officinale. *U. S.* The scraped and dried rhizome. *Br.*

Gingembre, *Fr.;* Ingwer, *Germ.;* Zenzero, *Ital.;* Gengibre, *Span.*

ZINGIBER. *Sex. Syst.* Monandria Monogynia.—*Nat. Ord.* Scitamineæ, *R. Brown;* Zingiberaceæ, *Lindley.*

Gen. Ch. Flowers spathaceous. Inner limb of the *corolla* with one lip. *Anther* double, with a simple recurved horn at the end. *Germen* inferior. *Style* enclosed in the furrow formed by the anther. *Loudon's Encyc. of Plants.*

Zingiber officinale. Roscoe, *Trans. Linn. Soc.* viii. 348; Carson, *Illust. of Med. Bot.* ii. 55, pl. 98.—*Amomum Zingiber.* Willd. *Sp. Plant.* i. 6; Woodv. *Med. Bot.* p. 731, t. 260. The ginger plant has a biennial or perennial, creeping, tuberous root or rhizome, and an annual stem, which rises two or three feet in height, is solid, round, erect, and enclosed in an imbricated membranous sheathing. The leaves are lanceolate, acute, smooth, five or six inches long by about an inch in breadth, and

rate at a heat not exceeding 200° to four fluidounces, and again set aside to crystallize. Add the crystals, thus obtained, to those in the funnel, wash the whole with a little Distilled Water, and, having removed them with the filter, spread them on bibulous paper, and dry them with a heat not exceeding 200°." *U. S.*

"Take of Sulphate of Zinc *five ounces and three-quarters* [avoirdupois]; Valerianate of Soda *five ounces* [avoird.]; Distilled Water *a sufficiency.* Dissolve the Sulphate of Zinc and the Valerianate of Soda, each in two pints [Imperial measure] of the Water; raise both solutions to near the boiling point, mix them, cool, and skim off the crystals which are produced. Evaporate the mother-liquor at a heat not exceeding 200°, till it is reduced to four [fluid] ounces; cool again, remove the crystals which have formed, and add them to those which have been already obtained. Drain the crystals on a paper filter, and wash them with a small quantity of cold Distilled Water, till the washings give but a very feeble precipitate with chloride of barium. Let them now be again drained, and dried on filtering paper at ordinary temperatures." *Br.*

These formulas are essentially the same as that of the late Dublin Pharmacopœia. In the formation of the salt a double decomposition takes place between the reacting salts, resulting in the production of valerianate of zinc and sulphate of sodium. Upon mixing the hot solutions, crystals of the sparingly soluble valerianate of zinc form on the surface of the liquid; and during the progress of its concentration to one-tenth, more of them are successively produced. These are then washed with cold distilled water to separate adhering sulphate of sodium, drained on a filter and dried.

stand alternately on the sheaths of the stem. The flower-stalk rises by the side of the stem from six inches to a foot, and like it is clothed with oval, acuminate sheaths; but it is without leaves, and terminates in an oval, obtuse, bracteal, imbricated spike. The flowers are of a dingy yellow colour, and appear two or three at a time between the bracteal scales.

The plant is a native of Hindostan, and is cultivated in all parts of India. It is also cultivated in the West Indies, whither it was transplanted from the East, and at Sierra Leone in Africa. The flowers have an aromatic smell, and the stems, when bruised, are slightly fragrant; but the root is the portion in which the virtues of the plant reside. This is fit to be dug up when a year old. In the West Indies, the ginger crop is gathered in January and February, after the stems have withered. After having been properly cleansed, the root is scalded in boiling water, in order to prevent germination, and is then rapidly dried. Thus prepared, it constitutes the ordinary ginger of commerce, or *black ginger*, as it is sometimes called from the darkish colour acquired in the process. It is imported chiefly from Calcutta, and is known to the druggists by the name of East India ginger; but recently considerable quantities have been brought from Africa, and some probably reaches us from the West Indies. In Jamaica another variety is prepared by selecting the best roots, depriving them of their epidermis, and drying them separately and carefully in the sun. This is called in the books *white ginger*, and is most highly valued. It reaches us from England, where it is said to undergo some further preparation, by which its appearance is improved. It is usually called in our markets *Jamaica ginger*. The root is also at present imported from the East Indies deprived of the epidermis. Considerable quantities are brought immediately from the West Indies in a recent state, and sold by the confectioners. A preserve is made from ginger by selecting the roots while young and tender, depriving them of their cortical covering, and boiling them in syrup. This is occasionally imported from the East and West Indies. When good it is translucent and tender.

The *recent root* is from one to four inches long, somewhat flattened on its upper and under surface, knotty, obtusely and irregularly branched or lobed, externally of a light-ash colour with circular rugæ, internally yellowish-white and fleshy. It sometimes germinates when kept in the shops.

The *common* or *black ginger* is of the same general shape, but has a dark ash-coloured wrinkled epidermis, which, being removed in some places, exhibits patches of an almost black colour, apparently the result of exposure. Beneath the epidermis is a brownish, resinous, almost horny cortical portion. The interior parenchyma is whitish and somewhat farinaceous. The powder is of a light yellowish-brown colour. This variety is most extensively used.

The *Jamaica* or *white ginger* differs in being entirely deprived of epidermis, and white or yellowish-white on the outside. The pieces are rounder and thinner, in consequence of the loss of substance in their preparation. They afford when pulverized a beautiful yellowish-white powder, which is brought from Liverpool in jars. This variety is firm and resinous, and has more of the sensible qualities of ginger than the black. The uncoated ginger of the East Indies resembles the Jamaica, but is darker, being gray rather than white. As the Jamaica commands a much higher price than even the uncoated East India production, the latter is sometimes altered to simulate the former. This is sometimes done by coating the exterior with sulphate or carbonate of calcium, sometimes by bleaching, by which not only the exterior, but also the internal parts are rendered whiter than in the unprepared root. Trommsdorff found, in a specimen which he examined, evidences of the presence of chlorides, sulphates, and calcium; and concluded that the bleaching was effected by chlorine, or by chloride of lime and sulphuric acid. Having macerated some black ginger in water, deprived it of the cortical portion, treated it for twenty-four hours with sulphuric acid diluted with nine times its weight of water, and finally placed it in a mixture of chloride of lime and water, in which it was allowed to remain for two days, he found it, upon being washed and dried, to present an appearance closely resembling that of the finest white ginger, both on the surface and internally. (*Annal. der Pharm.*, xvii. 98.) According to Brande, ginger is often washed in whiting and

water; and Pereira states that it is sometimes bleached by exposure to the fumes of burning sulphur.

General Properties. The odour of ginger is aromatic and penetrating, the taste spicy, pungent, hot, and biting. These properties gradually diminish, and are ultimately lost by exposure. The virtues of ginger are extracted by water and alcohol. Its constituents, according to M. Morin, are a volatile oil; a resinous matter, soft, acrid, aromatic, and soluble in ether and alcohol; a sub-resin insoluble in ether; a little osmazome; gum; starch; a vegeto-animal matter; sulphur; acetic acid; acetate of potassium; and lignin. The peculiar flavour of the root appears to depend on the volatile oil, its pungency partly on the resinous or resino-extractive principle. A considerable quantity of pure white starch may be obtained from it. The volatile oil, examined by A. Papousek, was yellow, of the odour of ginger, and of a hot aromatic taste. Its sp. gr. was 0·893, and boiling point 475°. Deprived of water by distillation with anhydrous phosphoric acid, it consisted of carbon and hydrogen, with the formula $C_{10}H_8$, and therefore belongs to the camphene series. (See *Chem. Gaz.*, Jan. 1, 1853, p. 12.) Papousek considers it a hydrate of camphene. (*Gmelin*, xiv. 70.) According to Zeller, one pound of the dried root yields one drachm and seventeen grains of volatile oil. (*Cent. Blatt*, 1855, p. 207.) Those pieces of ginger which are very fibrous, light and friable, or worm-eaten, should be rejected. The commercial powder of ginger is very frequently adulterated, rice starch, flour ginger which has been exhausted in making preparations, and even brick-dust and chalk being used for the purpose, and the loss of pungency atoned by the addition of capsicum or mustard.

Medical Properties and Uses. Ginger is a grateful stimulant and carminative, and is often given in dyspepsia, flatulent colic, and the feeble state of the alimentary canal attendant upon atonic gout. It is an excellent addition to bitter infusions and tonic powders, imparting to them an agreeable, warming, and cordial operation upon the stomach. When chewed it produces much irritation of the mouth, and a copious flow of saliva; and, when snuffed up the nostrils in powder, excites violent sneezing. It is sometimes used as a local remedy in relaxation of the uvula, and palsy of the tongue and fauces. Externally it is rubefacient. It may be given in powder or infusion. The dose of the former is from ten grains to a scruple or more. The infusion may be prepared by adding half an ounce of the powdered or bruised root to a pint of boiling water, and may be given in the dose of one or two fluidounces. A fluid extract and oleoresin of ginger are now officinal, and are very convenient preparations. (See *Extractum Zingiberis Fluidum* and *Oleoresina Zingiberis* in *Part* II.) The dose of the former may be from ten to thirty minims, of the latter from two to five minims. There is also an officinal tincture, the dose of which is about a fluidrachm.

Off. Prep. Acidum Sulphuricum Aromaticum; Confectio Scammonii, *Br.;* Extractum Zingiberis Fluidum, *U. S.;* Infusum Sennæ, *Br.;* Infusum Zingiberis, *U. S.;* Oleoresina Zingiberis, *U. S.;* Pilulæ Scillæ Compositæ; Pulvis Aromaticus, *U. S.;* Pulvis Cinnamomi Compositus, *Br.;* Pulvis Jalapæ Comp., *Br.;* Pulvis Opii Comp., *Br.;* Pulvis Rhei Comp.; Pulvis Scammonii Comp., *Br.;* Syrupus Rhamni, *Br.;* Tinctura Zingiberis; Tinctura Zingiberis Fortior, *Br.;* Vinum Aloës. W.

PART II.

PREPARATIONS.

The preparation of medicines, which constitutes the art of Pharmacy, comes within the peculiar province of the apothecary. It is for his guidance that the various formulas of the Pharmacopœia have been arranged, and to him that their directions are especially addressed.*

A few general observations, therefore, of an explanatory nature, calculated to facilitate the progress of the pharmaceutical student, will not be misplaced under the present head. The duty of the apothecary is to obtain a supply of good medicines, to preserve them with care, to prepare them properly for use, and to dispense them. Our remarks will embrace each of these points.

The substances obtained from the mineral and animal kingdoms, and those furnished by the chemical manufacturer, are of a nature to admit of no general precepts as to their proper condition, which would not be suggested by the common sense of the purchaser. He must receive them as offered, and judge of their fitness for his purposes by his knowledge of the peculiar properties of each. The same remark applies to vegetable substances from abroad; but, with respect to indigenous plants, the apothecary is frequently called upon to exercise his judgment in relation to their collection and desiccation, and will derive advantage from some brief practical rules upon the subject.†

Collecting and Drying of Plants. The proper mode of proceeding varies according to the nature of the part used. The different parts of plants are to be gathered at the period when the peculiar juices of the plant are most abundant in them. In the rhizomes and roots of *annual* plants this happens just before the time of flowering; in those of *biennials*, after the vegetation of the first year has ceased; and in those of *perennials*, in the autumn after vegetation has ceased, or in the spring before it has commenced. They should be washed, and the small fibres, unless they are the part employed, or unless experience has shown, as in the instance of podophyllum, that they are equally efficacious with the larger portion, should be separated from the fleshy solid part, which is to be cut in slices previously to being dried. *Bulbs* are to be gathered after the new bulb is perfected, and before it has begun to vegetate, which is at the time the leaves decay. *Barks*, whether of the root, trunk, or branches, should be gathered in the autumn or early in the spring. The dead epidermis, and the decayed parts, are to be separated. Of some trees, as the slippery elm, it is the inner bark only that is preserved. *Leaves* are to be gathered after their full development, before the fading of the flower. The leaves of biennial plants do not attain perfection until the second year. *Flowers* should in general be gathered at the time

* These preliminary observations to the second part of the work were originally prepared by Mr. Daniel B. Smith, then President of the Philadelphia College of Pharmacy. They have from time to time been considerably modified since their first appearance; but never to the same extent as in the edition preceding the eleventh. The alterations then made were such as the improvements in Pharmacy suggested, and were deemed necessary to render the work a proper exponent of the existing state of knowledge upon the subject. The surviving author, while he alone is responsible for all that has been added to or modified in the work of Mr. Smith, so far as concerns arrangement and expression, has great satisfaction in acknowledging his indebtedness, for most valuable aid in the revision, to Professor William Procter, of the Philadelphia College of Pharmacy. So short a time has elapsed since the publication of the twelfth edition that comparatively few changes have been made in the present; but we have endeavoured not to pass over anything which appeared to deserve notice in this place. (*Note to the twelfth and thirteenth editions.*)

† For a paper on the cultivation of medicinal herbs at Mitcham, England, see *Pharm. Journ.*, Sept. 5, 1874, p. 182. Probably most, if not all, the plants there grown could be economically raised in this country. (*Note to the fourteenth edition.*)

of expansion, before or immediately after having fully opened; and some, as the Rosa Gallica, while in the bud. *Aromatic herbs* are to be gathered when in flower; leaves, flowers, and herbs in clear dry weather, in the morning, after the dew is exhaled. *Stalks* and *twigs* are collected in autumn; *seeds* at the period of full maturity.

Vegetables should be dried as rapidly as is consistent with their perfect preservation. Those collected in the warm months, and during dry weather, may, except in a few instances, be dried by spontaneous evaporation in a well-ventilated apartment; and some, as roots and barks, may be exposed to the direct rays of the sun. Drugs thus prepared are spoken of as *air-dried*. The "Alden method of pneumatic evaporation" consists essentially of a vertical chamber with the drugs on trays of open wire-work and ascending currents of warm air. (*Pharm. Journ. and Trans.*, iv. p. 891.) In spring and autumn, and especially in damp, foggy, or rainy weather, the drying room should be artificially heated, and furnished with apertures near the top for the escape of the moist warm air, and others beneath in the direction of the prevailing wind, so as to command a current of air. The arrangements for supplying heat, which may consist of a small stove, or a drum connected with a stove in another apartment, should be capable of regulation; so that the temperature may range between 70° and 100° Fahr. at will. The substances to be dried should be supported on wicker or tinned wire hurdles, arranged horizontally above each other, so that the ascending and lateral currents of air may pass over and through every part. *Fibrous roots* may be dried in the sun, or at a heat from 65° to 80° in the drying room. *Fleshy roots* and rhizomes should be cut in transverse slices not exceeding half an inch in length, and, during the drying process, should be stirred several times to prevent moulding; the heat being at first maintained at about 100°. *Bulbs* must have the outer membranes peeled off; in other respects they are to be treated like fleshy roots. *Barks*, *woods*, and *twigs* readily dry in thin layers in the open air. *Leaves*, after separation from the stalks, should be loosely strewed over the hurdles, and their position changed twice a day till they become dry. When very succulent, they require more care in order to prevent discoloration. For dry and thin leaves the heat need not exceed 70°; for the succulent it may be gradually raised to 100°. *Annual plants* and *tops*, if not too juicy, may be tied loosely in small bundles, and strung on lines stretched across the drying room. *Flowers* must be dried carefully and rapidly so as to preserve their colour. They should be spread loosely on the hurdles, and turned several times by stirring. When flowers or leaves owe their virtues to volatile oils, greater care is necessary. *Succulent fruits*, as berries, may be dried, when in bunches, by suspending them in the drying room.* Air-dried drugs are so far from anhydrous, that it has been shown, by Mr. George W. Kennedy (*Am. Journ. of Pharm.*, 1872, p. 172, and 1874, p. 158), that they lose from eight to ten per cent. on being dried with artificial heat. In many instances this is sufficient to make a perceptible difference in the galenical preparations. Mr. Kennedy also found that drugs artificially dried absorb moisture from the air, especially in moist weather. It appears probable that, in many cases, the gain of moisture is such that after a time drugs which have been artificially dried become equivalent to air-dried specimens.

According to the experiments of Dr. L. Schoonbrodt (*Am. Journ. of Pharm.*, xli. p. 319), almost all plants suffer more or less deterioration in drying, the changes consisting in volatilization and oxidation. He believes the alteration to be least when the plants are hurriedly dried and compressed, in the manner practised by the Shakers.

* It is sometimes very difficult to dry glutinous substances, such as gum in its various forms, so as to preserve the original appearance; as the particles are apt to adhere together, and give rise to amorphous masses more or less solid and translucent. To obviate this, Reischauer proposes to effect the drying in an ethereal medium, in which ether takes the place of the removed water, and prevents the adhesion of the particles. A well-closed glass vessel is filled with ether or other similar fluid, with chloride of calcium, quicklime, or other desiccating agent at the bottom. The substance to be dried is placed in a shallow saucer below the surface of the ether. The rationale of the operation is simply that, as the drying agent absorbs water from the ether, this absorbs it from the substance to be dried, until the latter is sufficiently deprived of it. This of course parts with the ether absorbed by subsequent evaporation. It is obvious that the process is applicable only to bodies which are insoluble in ether, or in any fluid that may be substituted for it. (*Chem. News*, March 16, 1866, p. 123.)—*Note to the thirteenth edition.*

The following table, taken from the Edinburgh Dispensatory, presents the amount yielded by 1000 parts of the vegetables respectively mentioned, after being dried.

Root of Angelica Archangelica	263	Leaves of Digitalis purpurea	180
Aspidium Filix Mas	500	Hyoscyamus niger	135
Inula Helenium	187	Melissa officinalis	220
Valeriana sylvestris	316	Salvia officinalis	220
Bark of the Oak	410	Tops of Mentha piperita	215
Elder	292	Flowers of Anthemis nobilis	338
Elm	375	Borago officinalis	96
Twigs of Solanum Dulcamara	398	Lavandula vera	510
Leaves of Atropa Belladonna	140	Sambucus Ebulus	256
Conium maculatum	185	Petals of Papaver Rhœas	84
Datura Stramonium	110	Rosa rubra	330

PRESERVATION OF MEDICINES. The proper preservation of medicines is an object of the greatest importance to the apothecary. The apartment destined for a store room should be quite dry, and capable of being ventilated at will, and protected from vermin. As a general rule, drugs should be excluded from the light, and not packed away until thoroughly dry. New parcels should not be put in old receptacles until these have been examined and freed from dust and insects. Barrels and boxes, well fitted with movable covers, are suitable for most roots, barks, and woods, and for some herbs, leaves, and seeds. They should be painted externally, and are less liable to harbour insects when varnished inside with a solution of shellac, imbued with aloes, wormwood, or colocynth. *Roots* and *bulbs* which are to be preserved fresh, should be buried in dry sand. *Aromatic leaves* and those containing alkaloids, *flowers*, most *seeds*, and some *roots* especially liable to the attacks of insects, should be kept in tin canisters, or in light boxes lined with lead, tin, or zinc, or in opaque glass or earthenware vessels. Double-cased tin vessels are admirably adapted to the preservation of vegetables. These should be frequently examined in order to prevent deterioration from insects or moisture. The use of vessels exhausted by the air-pump has been suggested. M. A. Melseus has proposed that at the bottom of the drawer be placed a shallow iron tray covered with a close, strong gauze ; the drugs to rest upon the tray, in which carbonate of potassium is to be placed. M. L. Créteur uses wide-mouthed bottles, whose stoppers are ground out so as to receive a charge of quicklime. (*Am. Journ. of Pharm.*, xlvi. 12.) When insects are discovered in a drug, the best means of destroying them, according to Lutrand, Squibb, and others, is to suspend an open vial containing, or a sponge wet with, chloroform in the canister, which is to be closed securely, so that the atmosphere of the vessel may become saturated with the vapour. Cantharides and ergot may be thus treated. The presence of a little ether in the bottle has often also great effect in preventing the attacks of worms ; and benzole, carbolic acid, and bisulphide of carbon may be employed for the same purpose. Moths may be attracted and poisoned by hanging up cloths wet with a mixture of molasses, a strong solution of arsenic, and a few drops of essence of pear. Bundles of aromatic herbs, the leaves of which are very friable, as sage, marjoram, &c., should be wrapped loosely in refuse paper, so as to preserve a due proportion between stems, leaves, and flowers. *Gum-resins*, unless in original packages, should be kept in earthen jars or tinned boxes ; *fixed* and *volatile* oils, in canisters or bottles closely stopped, in a cool dark place, where the average temperature is about 60°. Substances in the form of fecula should be kept in oak barrels, or in canisters, and carefully examined from time to time to detect and remove insects. Preparations, such as decoctions, which will bear boiling, may be kept by pouring them whilst boiling into bottles and using an india-rubber cork with a glass syphon tube, the lower external end of which is kept closed by a rubber tube and clip.

GARBLING OF DRUGS. Drugs frequently require to be garbled before they are in a proper state for use. *Senna* is to be separated from the stalks and legumes ; *cetraria* from moss, leaves, and sticks ; *myrrh* from bdellium, &c.; *gum Senegal* from Bassora gum and a terebinthinate resin ; *flaxseed* from clover and garlic seed ; *seneka* from ginseng ; *spigelia* from the stems and leaves, and both it and *serpentaria* from adhering dirt. Seroons of cinchona should be examined, and the barks assorted before they are put by for use. *Gums* and *gum-resins* should be garbled, and the tears preserved separately.

Weights and Measures. A precise acquaintance with the recognised measures of weight and capacity is essential to the operations of the apothecary. The weights used by him in compounding medicines, and dispensing them by prescription, are the troy pound and its divisions; those by which he buys and sells commercially, the avoirdupois pound and its divisions. The former contains 5760 grains, the latter 7000 grains; so that 11 troy pounds are nearly equivalent to 9 pounds avoirdupois. The troy pound contains 12 ounces of 480 grains; the avoirdupois pound 16 ounces of 437½ grains; eleven of the former being nearly equal to twelve of the latter. The troy ounce is divided, for the use of the apothecary, into 8 drachms of 60 grains each; and the drachm into 3 scruples of 20 grains each. The United States Pharmacopœia recognises the troy weights, but employs only the grain and ounce, and, to prevent confusion, designates the latter weight by the name of *troyounce;* and whenever, in this work, any term is used expressive of weight, when not otherwise stated, it is to be understood as being of the denomination of troy weight. The British Pharmacopœia employs the avoirdupois pound and ounce, and the troy grain.

The measures used by the apothecary, in this country, are the wine pint and gallon. The wine pint contains 28·875 cubic inches. The weight of a pint of distilled water, at 62° Fahrenheit and 30 inches of the barometer, is 7289·7 grains, or 1 pound 3 ounces 1 drachm 29·7 grains troy, or 1 pound 289·7 grains avoirdupois. The gallon is divided into 8 pints, the pint into 16 fluidounces, the fluidounce into 8 fluidrachms, the fluidrachm into 60 minims. The weight of a fluidounce of water is 455½ grains, being 18 grains more than an avoirdupois ounce. A drop is generally though incorrectly considered as equivalent to a minim. Drops vary in size according to the nature of the fluid, and the size and shape of the lip from which they fall. A drop of water nearly equals a minim. A fluidrachm of antimonial wine will make, on an average, about 72 drops, one of laudanum 120 drops, one of alcohol 138 drops, one of ether 150 drops, and one of chloroform more than 200 drops. For a table showing the relative value of minims and drops, see the *Appendix.* The U. S. Pharmacopœia recognises the wine measure as here given, but, in its processes, employs only the pint and its subdivisions, omitting the use of the gallon altogether. The measures recognised by the British Pharmacopœia are the Imperial gallon of 70,000 grains of distilled water, or 277 cubic inches, and its divisions. This gallon is divided into 8 pints of 20 fluidounces each. The fluidounce is divided as that of wine measure, but differs from it in value, containing precisely an ounce avoirdupois (437·5 grains) of distilled water. Measures are employed, both in the U. S. and Br. Pharmacopœias, to express the quantity of liquids in most of their formulas; but, in reference to the stronger acids, chloroform, and the fixed oils, weights are now generally preferred.

Liquids are to be dispensed from graduated measures, of which those holding from a fluidounce to a pint are hollow inverted cones; and those holding a fluidrachm, and graduated to every five minims, are cylindrical. For smaller quantities than five minims, a slender tube holding a fluidrachm may be used, having the aliquot parts divided off, and marked with a diamond. Alsop's minimeter, which consists of a slender glass syringe graduated into sixty parts, each equal to a minim, is the most convenient and accurate instrument for measuring fractions of a fluidrachm. Care should be taken to verify these instruments. This may be done by reference to the table in the *Appendix,* in which the value of each division of measure is given in grains; distilled water at 60° F. being the standard. The following approximate measures are used in prescribing medicines; viz., a wineglassful containing two fluidounces, a tablespoonful half a fluidounce, a dessertspoonful two fluidrachms, and a teaspoonful a fluidrachm.*

* A patented glass measure is made, in Philadelphia, by Mr. William Hodgson, Jr., which, besides peculiar advantages in its graduation, would appear to have the great merit of being uniform, as it is cast in moulds. The measures imported from England are graduated in accordance with the subdivisions of the Imperial pint, and are not applicable to American pharmacy. For a similar reason those brought from Germany are generally unfit for use in our shops. Every apothecary should satisfy himself of the accuracy of the measures he employs. By possessing one on which he can rely, he can use it to determine the correctness of others.

Specific Gravity. The specific gravity of liquids affords one of the best tests of their purity. The instrument commonly used by the apothecary for ascertaining this is *Baumé's hydrometer*. This is a glass bulb loaded at one end, and drawn out at the other into a tube on which the scale is marked. That used for alcohol is graduated by loading it until it sinks to the foot of the stem (which is marked zero) in a solution of one part of common salt in nine parts of water. It is then put into water, and the place to which it sinks marked 10° of the scale, which is constructed from these data. The hydrometer for liquids heavier than water is made by loading it, so that in distilled water it shall sink nearly to the top of the stem. The place to which it sinks in a solution of 15 parts of salt in 85 parts of water is then marked 15°, and the scale divided off. For a table exhibiting the value of these scales in specific gravities, see the *Appendix*. Hydrometers are made specially for syrups, acids, and saline solutions. Those for syrups should have a very short tube, graduated from 20° to 40° of Baumé's scale for heavy liquids. The advantage of a short stem is, that the instrument may be used in small vessels.*

The hydrometers commonly imported are so carelessly made that scarcely any two will agree, and little dependence can be placed on their accuracy. A more certain method consists in weighing the liquor at a uniform temperature in a bottle, the capacity of which, in grains of distilled water, has been previously ascertained. If a bottle be selected which will hold exactly 1000 grains of water at 60°, the weight in grains of the quantity of any liquid which it will hold, will be the specific gravity of that liquid. Such bottles are sold in the shops. If one is not attainable, an ordinary vial may be used, and the specific gravity obtained by dividing the weight of the liquid examined by the weight of the water. The operation is rendered more accurate by fitting a smooth cork to the vial, passing a pin transversely through it so as to rest on the lips of the vial, and then cutting a small vertical groove into the side of the cork, so as to admit of the escape of the excess of liquid when the cork is inserted.

Gay-Lussac's centesimal alcoholmeter is a very useful instrument, being graduated so as to indicate the percentage by measure of absolute alcohol in any mixture of pure spirit and water; but unfortunately the commercial instruments are too often inaccurate.

The specific gravity of a solid is ascertained by first weighing it in air and then in water, and dividing the former weight by the difference between the two. If lighter than water, it should be first weighed in the air, then in air and in water in connection with a heavier body, which has itself been previously weighed in air and in water; and the weight of the lighter body in the air should be divided by the excess of the difference between the weights in air and water of the two conjoined, over that of the weights in air and water of the heavier body alone. If the body be soluble in water, its relative weight to that of some other liquid of known specific gravity should be ascertained, in the manner above directed, and this weight multiplied by the specific gravity of that liquid.

The specific gravity of insoluble powders heavier than water, as calomel, may be obtained by introducing 100 grains into a thousand-grain bottle, adding first a little distilled water and thoroughly agitating, with the thumb over the orifice, so as to rid the solid particles of adherent air, then filling the bottle accurately with more of the water, ascertaining the weight of the contents in grains, subtracting the number of grains, exceeding 1000, from the weight of the powder in air, and dividing the latter by the difference. When the powder is soluble, or lighter than water, another liquid, as alcohol, ether, or oil of turpentine, may be used, the necessary allowance being

* For some interesting observations in reference to the inaccuracy of the existing tables of specific gravities corresponding to the general degrees of Baumé's hydrometer, to the uncertainty of the hydrometer in use, and to a mode of remedying these inconveniences, the reader is referred to a paper by Mr. Henry Pemberton in the *Am. Journ. of Pharm.* (xxiv. 1), and, for a good and accurate method of graduating hydrometers, to a communication from Dr. W. H. Pile, in the same journal (xxiv. 310). It may be useful to physicians practising in the country, and to apothecaries, to know that reliable hydrometers and other instruments are kept for sale, at this time (A. D. 1864), by Dr. Pile in Philadelphia.

made for the difference in specific gravity. Very accurate thousand-grain bottles are now made in Philadelphia.*

Mechanical Division. One of the simplest methods of preparing medicines is their reduction, by mechanical means, to a state of minute division. This is effected by the operations of slicing, bruising, rasping, filing, triturating, grinding, sifting, levigation, and elutriation. When the result is a fine powder, the process or processes employed are called *pulverization*.

The more important drugs which are sold in the state of powder are pulverized by persons who pursue that occupation for a livelihood. Owing to the readiness with which fraud can be perpetrated in this operation, the apothecary cannot be too careful to place his drugs in honest hands. In sending drugs to the powderer a certain percentage of powder is sometimes required, without regard to the condition of the drugs, as to moisture, extraneous admixture, &c., which percentage often cannot be obtained without the addition of foreign matter. This procedure on the part of the druggist is one of the chief sources of dishonesty of the powderer, and is highly reprehensible. The loss of weight during the processes of pulverization is due to the evaporation of moisture, the unavoidable escape of dusty particles, and the useless residue called *gruffs*. We have been informed that it is not customary, with the powderers in this country, to reject the less active and less readily pulverizable constituents, as the ligneous parts of certain roots, but to continue the process till almost the whole will pass through the sieve. The following statement has been abbreviated from a table prepared by MM. Henry and Guibourt. One thousand parts of the substances mentioned yielded, when pulverized—†

Roots.	*Parts.*
Jalap	940
Rhubarb	920
Columbo	900
Liquorice root	900
Valerian	860
Elecampane	850
Gentian	850
Florentine orris	850
Rhatany	850
Calamus	840
Virginia snakeroot	800
Ipecacuanha	750
Squill (bulb)	820
Barks.	
Cinchona, pale	875
Cinchona, red	880
Cinchona, yellow	900
Cinnamon	890
Angustura	825
Leaves.	
Hemlock	800
Savine	800
Digitalis	790
Belladonna	785
Senna	720
Henbane	530
Flowers.	
Chamomile	850
Saffron	800
Fruits.	
Mustard	950
Black pepper	900
Nux vomica	850
Colocynth	500
Vegetable Products.	*Parts.*
Aloes	960
Tragacanth	940
Opium	930
Gum arabic	925
Scammony	915
Catechu	900
Liquorice (extract)	810
Animal Substances.	
Castor	900
Spanish flies	850
Mineral Substances.	
Red oxide of mercury	980
Red sulphuret of mercury	950
Arsenious acid	950
Sulphuret of antimony	950
Tin	825

The apothecary often finds it necessary to pulverize drugs in small quantities. For this purpose he should be provided with *mortars* of iron, brass, Wedgwood ware, glass, and marble, sieves of several degrees of fineness, at least one hand-mill, one or more cutting knives, a rasp, and a pair of pruning shears.

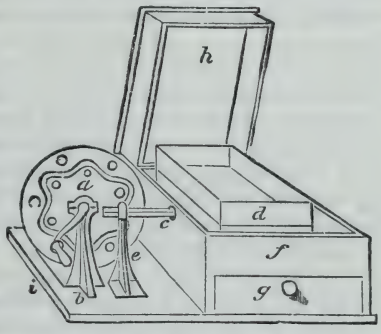
* Mr. Chas. Muncy gives the following table as representing the inaccuracies of the British Pharmacopœia in regard to specific gravity.

	Sp. gr. B. P.	Sp. gr. found.		Sp. gr. B. P.	Sp. gr. found.
Acid. sulphurosum (9·2 per ct.)	1·040	1·048	Liquor sodæ chloratæ	1·103	1·090
Ext. cinchonæ liquidum	1·100	1·122	Syrupus ferri iodidi	1·385	1·400
Liquor bismuthi	1·122	1·134	Syrupus mori	1·330	1·298
Liquor calcis chloratæ	1·035	1·050	Syrupus papaveris	1·320	1·330
Liq. ferri perchloridi fort	1·338	1·445	Syrupus sennæ	1·310	1·320
Liq. hydrargyri nitratis acidus	2·246	2·130	Tinctura ferri perchloridi	·992	1·007
Liq. plumbi subacetatis	1·260	1·270			

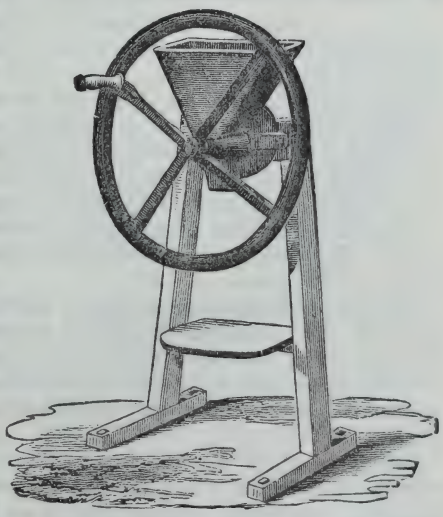
—*Note to the fourteenth edition.*

† We are told that, in consequence of improvements in drug mills, the loss in powdering is less than formerly; and what occurs is due mainly to the loss of moisture in drying previously to the pulverization. We refer for a table giving the percentage of loss in powdering, of many medicines, prepared by Mr. Thos. J. Covell, of Brooklyn, New York, to the *Am. Journ. of Pharm.* (March, 1867, p. 116).—*Note to the thirteenth edition.*

Contusion should be performed in an iron or brass mortar, the latter being used for astringent substances. The curve of the interior surface of the bottom should be elliptical, and that of the pestle should be of the same kind, but of shorter radius, so that, when the pestle stands vertically in the mortar, their surfaces may approximate pretty closely for some distance around the point of actual contact. Powdering by contusion is much facilitated by using a large mortar, with the pestle suspended on a spring so as to assist in elevating it. In powdering acrid substances, as well as to prevent loss in those that are dusty, a leathern cover should be attached to the pestle, and held tightly around the edge of the mortar by a circular wooden frame. The operator should guard himself against the fine particles of very acrid substances, like cantharides, euphorbium, &c., by standing with his back to a current of air, and covering his nostrils with a wet cloth. He should be careful not to impede the process by introducing too large a quantity of the material, so as to clog the pestle. After the pestle has been in action a certain time, the fine particles accumulate so as to hinder the reduction of the coarser. At this point the sieve should be brought into requisition. *Sieves* for powders are constructed of woven brass wire, and silk cloth (bolting cloth). The best arrangement for the apothecary's use is that known as the box or drum sieve, being cylindrical, with a cover above, and a receptacle below for the powder. After introducing the contents of the mortar, a jerking circular motion should be given to the sieve, without much jarring, so that none but the finest particles may pass. The coarser portion should then be returned to the mortar to be again acted on. A set of simple sieves, formed by tacking pieces of woven wire, with meshes varying from the sixtieth to the fourth of an inch, to square wooden frames, should be provided to prepare drugs for percolation and other modes of solution. When the quantity of material to be sifted is large, recourse may be advantageously had to *Harris's patent sieve*, which has the merits of the drum sieve, with great facility of use. (See *Am. Journ. of Pharm.*, xxv. 31.) A figure of this instrument is given in the margin.



Grinding. The hand-mill is exceedingly useful for the coarse comminution of drugs, especially of those which, from their acrimony, may annoy the operator in the process of contusion. *Swift's drug mill* is one of the most useful and manageable of the kind. It does not answer well for fibrous drugs like slippery elm and sarsaparilla, unless they have been sliced transversely in short sections.



Trituration is the effect produced where a circular motion, accompanied by pressure, is communicated to the pestle; and is applied most generally to friable substances, or to powders obtained by other means, with a view to their further and more regular comminution. The operation is accelerated by alternately increasing and diminishing the circular movements, so as to bring the pestle in contact with all parts of the surface of the mortar. Dover's powder and red oxide of mercury are instances requiring this operation; and in prescriptions for powders, where different substances of variable molecular condition are associated, this process is employed to bring them to a uniform state of division.

Levigation, or *porphyrization* as it was formerly called, is a kind of trituration effected between the flat surfaces of a slab and muller. As the surfaces are equidistant at all parts, a substance, subjected to their action, has its particles more uniformly divided than between the surfaces of a mortar and pestle. It is usual to moisten the powder with water or alcohol (in which it should be insoluble) so as to bring it to a pasty consistence. The slab and muller are made of glass, porphyry, Wedgwood ware, or marble.

Elutriation bears the same relation to trituration and levigation that sifting does to contusion. It consists in agitating a powder, obtained by those processes, in a large quantity of water, allowing the coarser particles to subside, and pouring off the supernatant liquid, holding the finer particles in suspension, that they may settle separately. The pasty thick mass, left when the clear liquid is decanted, is put into a funnel, and dropped in small portions on a chalk stone so as to form small conical masses. The fineness of the powder depends on its specific gravity, and on the length of time which elapses before the liquid from which it subsides is drawn off.

Various means are used to facilitate powdering. All vegetable substances must be carefully and thoroughly dried. No part of the business of the powderer requires more care than this, especially in relation to substances which owe their activity to volatile principles. The heat derived from steam, regulated below 100° for aromatic substances, and below 140° for others not injured thereby, is the most appropriate. Resins, gum-resins, and gums must be powdered in cold frosty weather. Tragacanth and nux vomica must be dried by a stove heat, and powdered while hot. The fibrous roots, as liquorice and marsh-mallow, should be previously cut into thin transverse slices. Agaric is to be beaten into a paste with water, then dried, and triturated. Cloves and the aromatic seeds may be ground in a hand-mill, and afterwards triturated. Squill and colocynth, the comminution of which is sometimes aided by soaking them in mucilage of tragacanth and then drying, are best powdered in a dry atmosphere, after having been thoroughly dried by a stove heat. Camphor requires the addition of a few drops of alcohol. The efflorescent salts may be obtained in the state of fine powder by exsiccation; and those which are insoluble in alcohol may be precipitated by it, in impalpable powder, from their aqueous solutions. Vanilla, mace, and other oily aromatic substances, may be rubbed to powder with sugar; magnesia and white lead, by friction on a wire sieve.

Care should be taken, in powdering, to separate previously the inert portions and impurities, and to mix intimately the whole of the powder which is reserved for use. The central woody fibre of ipecacuanha and of other roots, the virtues of which reside in the bark, is to be rejected. The first portions of those barks to which lichens and the dead epidermis adhere, are inert; as are also the last particles of the fibrous roots and barks.

Ivory, horn, nux vomica, wood, and iron are prepared for pharmaceutic purposes by filing and rasping; guaiacum wood and quassia by turning in a lathe; roots, stalks, and dried herbaceous plants by cutting with a large pair of shears, or with a large knife, fixed in a frame at one end, and furnished with a long handle at the other. Tin and zinc are granulated by melting them, and strongly agitating while they are cooling; and carbonate of potassium, by stirring with an iron rod the concentrated solution as it concretes. Earthy insoluble substances are conveniently reduced to powder by levigation.

Powders, as obtained by levigation, elutriation, precipitation, &c., often require to be dried. The process of drying may generally be effected by exposure to a dry air, aided or not by a moderate heat; but it is much facilitated by the action of absorbent substances, such as bibulous or unsized paper, porous bricks, &c. A convenient method is to spread the powder on brick-tiles, covered with a double layer of bibulous paper.

SEPARATION OF MIXED SUBSTANCES. Various mechanical operations for this purpose are resorted to in practical pharmacy. Some of these relate to the separation of solids from liquids, others to that of one liquid from another.

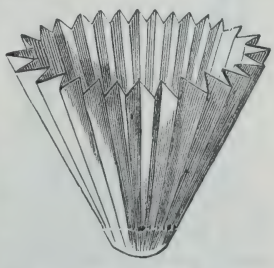
Separation of Solids from Liquids. This includes the processes of decantation, filtration, percolation, straining, expression, clarification, &c.

Decantation. Solids may be separated from liquids, when there exists no chemical action between them, by being allowed to subside. The supernatant liquid may then be carefully poured off; or it may be drawn off by a syphon, or separated by filtering. The last operation, or expression by a stronger force, is necessary to separate the whole of the liquid; but decantation should always be employed when appropriate, as much time is thus saved in filtering.

Jars larger at bottom than at top, and furnished with a lip for pouring, called *precipitating jars*, are sold in the shops, and are proper for decantation, precipitation, and the receiving of filtering liquids. When the decanted liquid is the object of the process, and the powder subsides very slowly, the precipitation may be greatly hastened by the addition of a small quantity of solution of gelatin. Decantation by pouring is facilitated by holding vertically against the lip a glass rod, which attracts and directs the current, and prevents it from running down the sides of the vessel. The syphon is a tube bent like the letter U, having one limb longer than the other. When it is filled with liquid, and the shorter end is inserted in the fluid to be decanted, a current is established towards the longer limb, owing to the greater weight of its contents, and continues as long as the shorter limb is kept below the surface of the liquid.

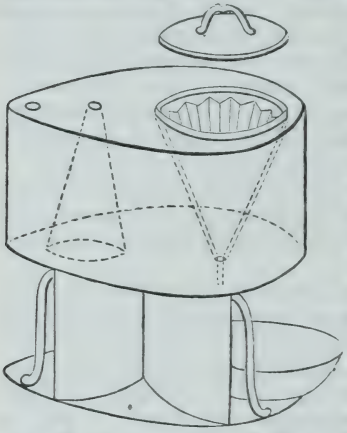
Filtration consists in pouring a mixture of solid and liquid matter on a porous surface, called a filter or strainer, which admits of the passage of the fluid only, and is designed either to clarify the liquid, or to separate the solid from the associated liquid by washing and draining.

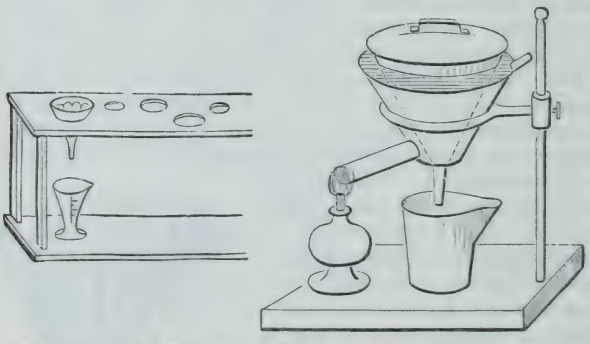
Filters or strainers are made of unsized paper, muslin, linen, or woollen cloth, charcoal, glass and sand, and porous earthenware.* The apothecary should be provided with several kinds of filtering paper, one of which should be white and free from matter soluble in dilute acids, especially oxides of iron. A *charcoal filtering paper* is now made, which serves the double purpose of clarifying and decolorizing liquids. It is prepared either by incorporating powdered animal charcoal with the pulp out of which the paper is made, or placing it, in the process of manufacture, between two layers of the pulp. As the charcoal diminishes the cohesion of the paper, a sheet of gauze is inserted in each piece, or in the centre of each piece, when used as a filter, in order to give it strength at the apex when folded. (*Am. Journ. of Pharm.*, xxx. 586.) Paper filters are *plain* or *plaited*. The plain filter is made by folding a square piece of paper twice, so as to bring the four corners together, and then separating one of the layers from the other three so as to form a hollow cone, which is inserted in a funnel. Such filters are best for precipitates; but when rapid filtration is required, the plaited filter, by presenting a much greater extent of surface, and numerous channels for the descent of the liquid, is to be preferred. The paper is folded into 32 triangular surfaces, all the points meeting in the centre, and the edge presenting a zigzag outline as in the figure. In some cases it may be necessary to place a small cone of the same material outside of the large one to strengthen it. Paper manufactured for filtering should be made in square, instead of oblong sheets, as much waste might be thus prevented. Paper in a circular form, and of various sizes, prepared expressly for filtering, is now imported from France. When the liquid is too viscid to pass readily through paper, a cotton or woollen bag of a conical shape may be used. Cotton flannel with a thick nap is well suited for syrups. Acids may be filtered through a layer of fine siliceous sand, supported in the neck of a glass funnel by pieces of glass gradually decreasing in size. M. Boettger, having noticed that pyroxylin is attacked only by ethereal liquids, proposes to employ it in the filtration of corrosive liquids, such as the strong acids, concentrated solution of permanganate of potassium, &c. The pyroxylin is introduced in the form of a plug at the neck of the funnel. (*Journ. de Pharm.*, Juin, 1860, p. 472.) Castor oil, syrups, and oxymels may be filtered through coarse paper, made entirely of woollen



* This new filter has been suggested by Chas. E. Munroe for use in arsenical and antimonial analysis, when a filter that will withstand a high heat is required. (*Chem. News*, xxiv. 77.)—*Note to the fourteenth edition.*

shreds; but the best material for fixed oils is hatter's felt, in the conical form in which it is prepared in the making of hats. This may be attached to a tin ring, and suspended over a suitable vessel. Melted fats, resins, wax, and plasters may be *strained* through muslin stretched over a square frame, or a hoop. Hair cloth or wire gauze is better suited for plasters than muslin. Small sieves of fine bolting cloth serve for straining emulsions, decoctions, and infusions; and a temporary strainer of this kind may be made by fastening a piece of muslin between the upper and lower parts of a common wooden pill box, and then cutting off the ends so as to leave the rim only of the box around the muslin. The filtration of viscid substances is facilitated by heat. Filtration through boneblack is practised for muddy or dark-coloured liquids. Much inconvenience is often experienced in the filtration of hot saturated saline solutions, by the cooling of the liquid, and consequent crystallization of the salt, in the filter and neck of the funnel. To obviate this, the tin apparatus represented in the wood-cut was contrived by Dr. Hare. The vessel is filled with hot water, which is kept at a boiling heat by a spirit lamp placed under the cavity having the shape of an inverted funnel. A glass funnel with a filter is placed in the other cavity, and the liquid passes through rapidly. In filtering alcoholic solutions, it is necessary to protect the liquid from the flame of the lamp, and for this purpose the partition underneath has been added. No apothecary should be without this useful apparatus.* The arrangement of Dr. Hare has been simplified by having a funnel with double sides, as in the figure, with a hollow cylindrical projection at the lower part, to which a spirit lamp heat may be applied, while the funnel is supported on a lamp stand; the space between the sides being filled with water. Frames of various sizes for holding funnels and filters will be found useful. The wood-cut represents the one commonly used. The efflorescence of saline solutions on the edge of the filtering paper may be prevented by dipping it in melted tallow or lard.



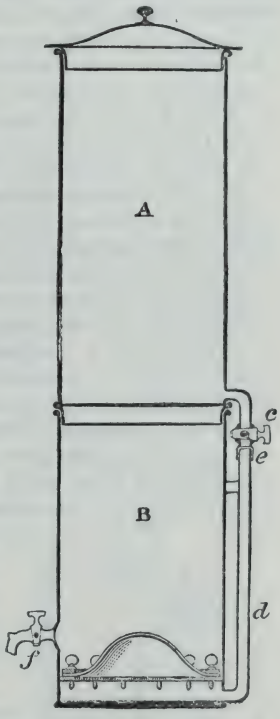


The filtration of liquids which are altered by exposure to the air requires much caution. A very simple method of accomplishing it is to insert a slender tube of glass into the funnel, long enough to reach below the neck, while the upper part is nearly as high as the top of the funnel. The space between the tube and the neck must be filled with bits of glass and fine sand so as to form a good filtering bed; the liquid is then poured in, and the top of the funnel covered with a plate of glass. If this be luted on, and the funnel luted into the neck of a bottle, the process will be performed with perfect accuracy. Another way of performing this operation, in relation both to liquors altered by the carbonic acid of the air, and to those which are very volatile, as ethereal and ammoniacal solutions, consists in covering the funnel with a sheet of tin-foil, or moist bladder, and putting a small tube within and against the side of the funnel, extending nearly to the top, so as to form a communication

* For a hot filter fitted for analytical use, see *Am. Journ. of Pharm.*, xlvii. 354. For a method of using cotton wool as a filter in analytical processes, see *Chem. News*, xxvii. 261. For a filter pump, see *Ibid.*, xxxii. 33, 45; see also *Am. Journ. of Pharm.*, xlv. 395. (*Note to the fourteenth edition.*)

between the atmosphere of the receptacle and that of the funnel. By such an arrangement ordinary filtering through paper can be conducted with perfect success with ether or solution of ammonia. The filtration of large quantities of liquids is facilitated by having a self-supplying apparatus, so that the level of liquid in the filter may be constant. This is effected by inserting a tube, with a bore of a quarter of an inch, through the cork of a large bottle containing the liquid to be filtered, and supporting the bottle in an inverted position over the filter, as at page 973, so that the tube shall dip slightly below the surface of the liquid. As this descends, its place is supplied from the bottle above. Another arrangement, in which a syphon is used, is figured in page 960.*

In filtering in the ordinary method, much embarrassment is often experienced. especially with viscid substances, such as fixed oils, in consequence of the collection of the solid matters at the bottom of the funnel, offering a constantly increasing impediment to the passage of the liquid. This is obviated by *filtering upwards.* Some years since, Professor Procter contrived an instrument for this purpose; and more recently a very ingenious apparatus has been invented by Mr. Wm. R. Warner, which combines the advantage of upward filtration, with that of applying heat to maintain a due degree of fluidity in the liquid filtered; both very desirable objects in the filtration of fixed oils. A wood-cut is given in the margin, copied from that of Mr. Warner, in the *American Journal of Pharmacy* (Jan. 1861, p. 13). The instrument consists essentially of two cylindrical vessels of tinned iron, one placed on the top of the other; the upper one (A) about 22, the lower (B) 18 inches in height, and both about 10 inches in diameter. The two communicate by means of a tube (*d*) proceeding, on the outside, from near the bottom of the upper vessel, and entering through the side of the under one near the bottom, into a compartment, separated from the upper portion of the vessel by a diaphragm formed of hatter's felt. This is secured, at its circumference, between a projecting ledge of tinned iron soldered to the sides of the vessel, and a ring of the same material fastened to it by screws. The tube is made in two pieces so as to allow the vessels to be separated, and is provided with a stop-cock (*c*) near the top. The lower vessel has an outlet (*f*) near the bottom of its upper compartment, which is also provided with a stop-cock. When the instrument is used, the oil is introduced into the upper instrument at top, where it is furnished with a lid, and the stop-cock of the tube is opened, so that the liquid shall pass through the tube into the lower compartment of the lower vessel. By the pressure of the column of liquid it is thus forced upward against the diaphragm of felt, which, being porous, allows its passage through into the upper compartment, where the clarified liquid accumulates and whence it may be drawn off through the lower stop-cock. The instrument may be placed upon a stove, in order to maintain such a heat as may be deemed advisable. The filtered liquid should be drawn off occasionally, so as not to interfere with the passage of additional portions through the felt.



A simple apparatus for hastening filtration has been proposed by Dr. Picard, consisting of a precisely conical funnel, connected, by means of an elastic joint, with a glass tube not more than a foot in length and straight except near its upper end, where it makes a complete turn upon itself, the effect of which is to act as an aspirator, and hasten the movement of the fluid through the tube. It is important that

* For the figure and description of an apparatus for continuous filtration, applicable also, with some modification, to the washing of precipitates, see a paper, by Mr. Henry B. Brady, in the *Pharmaceutical Journal and Transactions* (Oct. 1868, p. 216).

the filtering paper should lie, wetted, in close contact with the glass, so as not to admit a bubble of air between them. The rate of filtration is said to be thus accelerated, so as to be ten or twelve times more rapid than when an unbent tube is used. (*Chemical News*, Jan. 12, 1866, p. 23.)*

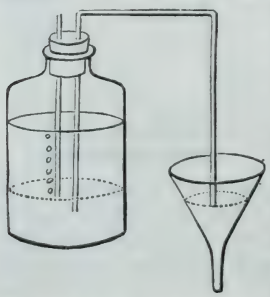
Expression is required to separate the last portions of tinctures and infusions from the dregs. A screw-press is used for this purpose. The substance to be pressed is put into a cylinder of strong sheet tin, the sides of which are pierced with small holes. This is placed on a square tray of tin having a lip for pouring. A block of wood, which fits into the cylinder like a piston, is placed on the top, and the whole is put under the screw-press, the pressure of which is gradually brought to bear upon it.

This press is to be used for expressing the juices of fresh plants, which must be previously well beaten in a mortar, water being added to those which are hard and dry. The juices of succulent fruits, as strawberries, raspberries, &c., are most advantageously extracted by filling several strong flannel bags about two-thirds full, without bruising them, laying these in a pile on a tray, placing a strong block over the whole, and gradually bringing the press to bear upon them. The expressed oils are obtained by bruising the seeds which contain them, and enclosing the bruised mass in strong bags, which are placed in a firm hollow frame, and subjected to strong sudden pressure by driving up a wedge. Expressed oils are clarified from mucilage by boiling them with water.

A small hydraulic press has been constructed, in which oil is used instead of water, so as to avoid the breaking of the instrument that might result from the freezing of the water in winter. (See *Proceed. of the Am. Pharm. Assoc.*, 1864.)

The *clarification* of liquids may be effected by the addition of some coagulable substance, such as milk or an aqueous solution of ichthyocolla. The white of an egg beaten up with water will coagulate with a gentle heat, and clarify any liquid with which it is mixed. The vegetable acids will clarify many of the expressed juices; and the juice of sour cherries will cause the complete separation of the pectin of currant and raspberry juice, so as to fit them for syrups.

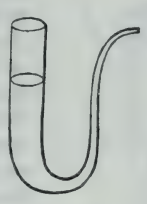
Precipitation is sometimes mechanical, as in the *levigating* and *elutriating* of chalk, and sometimes chemical, as in the preparation of the precipitated carbonate of calcium by decomposing chloride of calcium. When a precipitant is directed to be added until no further precipitation takes place, the fact may be ascertained by taking a drop of the liquid on a glass plate, and trying it with the precipitant. The formation of a precipitate is often much assisted by agitation, or by heat. The separation of the supernatant liquid from the precipitate is most effectually accomplished by means of a syphon. When the liquid is a saline solution, it is necessary to wash the precipitate until the water exhibits no trace of the salt. In doing this, great care must be taken to select the purest and clearest water, and the ultimate drying of the precipitate must be performed in a filter, or on a porous stone.



The apparatus figured in the margin is very convenient for procuring a constant and gentle stream of water, in washing precipitates, and in clearing crystals of the impurities of their mother-water. It consists of a syphon having legs of equal length, one of which is inserted in an air-tight bottle nearly filled with water, and the other dips into the funnel. A straight open tube is also inserted in the bottle, the lower end of which is about half an inch or an inch above the end of the syphon. It is obvious that the water will run from the syphon no longer than till the water in the funnel is level with the end of the straight tube. The same effect may be produced by using an inverted bottle and tube, as figured in page 973.

* For a description with figures, of an apparatus invented by Mr. A. B. Spencer, of Rochester, N. Y., intended to facilitate filtration, on a small scale, by the production of a partial vacuum in the receiving vessel, thus bringing atmospheric pressure to bear on the passing fluid, see a paper by Mr. Ed. Parrish, in the *American Journal of Pharmacy*, March, 1866, p. 107; from the *Proceedings of the Am. Pharm. Association*, A. D. 1865. (*Note to the thirteenth edition.*)

Separation of Liquids. Liquids which have no chemical affinity, and differ in specific gravity, may be separated by allowing them to remain at rest in the separating funnel represented in the annexed figure, and then drawing off the heavier fluid. Another very convenient method of separating fluids is by means of the *separatory* figured in the wood-cut in the margin. The last drops of the heavier fluid may be drawn off by means of this instrument.





APPLICATION OF HEAT. The most efficient and economical means of obtaining heat is a subject of great importance to the pharmaceutist, on account of the variety of processes in which it is required.

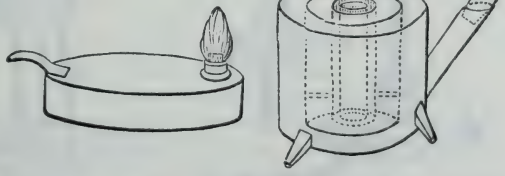
With the small *furnaces*, which are now made of fire-clay, of various patterns and sizes, almost all the operations of the laboratory which require heat can be performed. The fuel used is charcoal, although anthracite will burn in those of a larger size, and is to be preferred where a uniform heat is necessary for several hours. The apothecary should be provided with a complete set of these useful utensils, including one with a dome for a reverberatory furnace. By adding a pipe several feet in length to this, and urging the fire with a pair of double bellows, the heat may be raised to that of an air furnace. A small pipe of sheet iron with a cone at the lower end, as in the figure, to fit on the furnace, will be found an excellent means of obtaining an intense heat in those of the smallest size. For operations on a smaller scale, a convenient means of obtaining heat is by alcohol lamps. Alcohol burns without smoke or smell, and is on every account, except its price, preferable to oil as a fuel. The figures beneath represent the usual forms of *spirit lamps*. The larger one will be found very useful in heating spatulas for spreading plasters.





Gas burners afford a yet more eligible and economical means of applying heat than alcohol lamps. When coal gas is mixed with a due proportion of atmospheric air before ignition, it burns with a bluish flame, and produces but little if any smoke. The gas burner (p. 962) consists of a cylinder of sheet or tinned iron from 2 to 4 inches in diameter, and 6 or 8 inches long, open at the inferior end, while the upper end, which is slightly flared, is covered with a piece of number 40 or 50 brass wire-gauze, fastened on with wire. This burner is supported vertically over an ordinary gas jet in any convenient position, and the gas, on being allowed to issue into it, rises from its superior levity, mixes with the air, and is ignited by means of a taper above the gauze. The heat can be managed by regulating the flow of gas, and by using burners of different sizes. The left of the two figures in the margin (p. 962) exhibits this arrangement. That on the right, in which a tube conveying gas (*a*) enters the cylinder horizontally while the air passes in at *b* below, is an arrangement suggested by Dr. Bridges, and may be adapted to the common bat-wing or fish-tail gas burner. Gas furnaces in great variety of pattern are now constructed on the same principles. One of the best of these, for general purposes, is that contrived by the late Prof. Parrish. (See a *Treatise on Pharmacy*, by E. Parrish, 4th ed., p. 100, figs. 127 and 128.)





Bunsen's gas burner, with Griffin's modifications, is a very convenient instrument, now much used. The simple burner consists of a tube (*b*, fig. 1, p. 962), screwed into the top of a metallic stand (*a*, fig. 1), containing a small chamber, which is pro-

vided with four lateral openings for the admission of air. Beneath these openings a gas tube enters the chamber, ending in a small jet tube in its axis, so that the gas is made to mix thoroughly with the atmospheric air entering through the orifices, before it reaches the mouth of the burner, thus ensuring a more thorough combustion and a stronger heat. One of the modifications of the simple burner is a cap of brass, shaped like a truncated cone (*c*, fig. 1), with four lateral perforations, which fits around the chamber (*a*), and rotates about it, so as to close or open its orifices at will, and thus regulate the flame. Another modification is a cylindrical cap of brass, to be fitted to the top of the tube, perforated with numerous small holes at its circumference, and having at the top either a few small holes (*d*, fig. 1), or one large opening in the centre, furnished with a sliding valve by which it may be opened or closed at pleasure (*b*, fig. 2). The burner is represented in action by fig. 2; at *b*, with the flame issuing from the central opening at the top, and at *a* with this opening closed, and the burning gas escaping at the lateral orifices; the former being adapted to produce a concentrated heat, as for igniting crucibles, the latter for a more diffused heat, as in evaporation. Fig. 3 represents the burner surrounded by a sheet iron cylinder, supported on three legs, and provided at top with three short arms, for the support of the vessel to be heated. Within this is a cylinder of fire-clay, which serves to confine the heat. The whole forms a small furnace, a section of which is exhibited in fig. 4, in which the position of the burner is shown within the cylinder. (See *Am. Journ. of Pharm.*, Jan. 1862, p. 46.)*

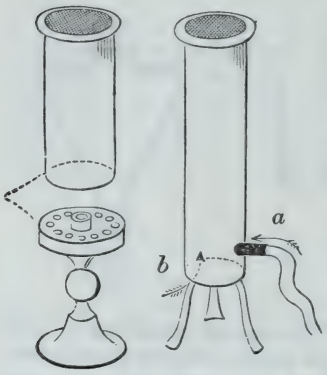


Fig. 1.

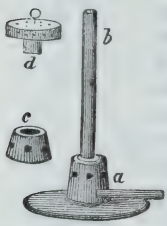


Fig. 2.

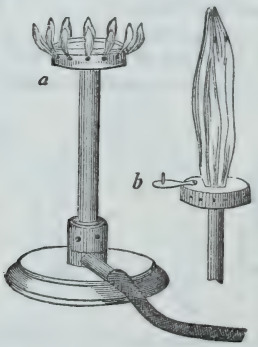


Fig. 3.

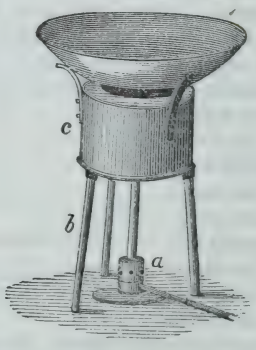
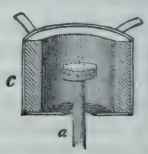


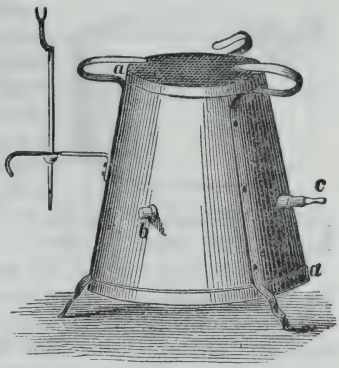
Fig. 4.



Warren's laboratory safety lamp is another instrument meriting a brief notice. It is intended to protect from danger of fire, in distilling ether and other inflammable liquids. It consists of a truncated cone of sheet iron, 6 inches in diameter at bottom by 4 at top, and 5·5 inches high, with a top and bottom of No. 50 brass wire-gauze, held in place by movable brass rings, as at *a a* (p. 963). An opening (*b*) in the side, which may be closed with a cork, serves for applying a match. Another opening (*c*) admits the entrance of a piece of gas pipe, which then forms a horizontal ring in the centre of the instrument, 3·5 inches below the upper gauze. This is provided on the upper

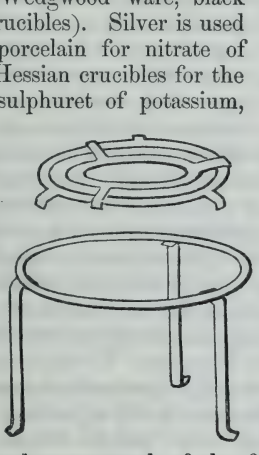
* We are informed that these furnaces have been made for sale by Messrs. Bullock & Crenshaw Philadelphia.

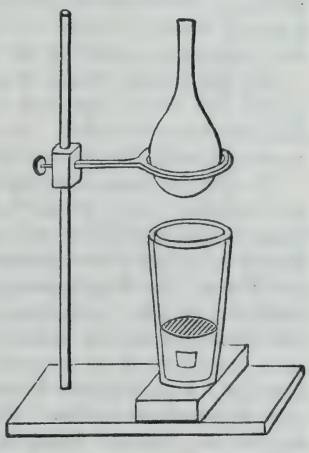
surface with small holes for the escape of gas. When used as a safety lamp, the gas is to be lighted within, and the flame will be confined by the gauze; when for ordinary purposes, the gas may be lighted above the upper gauze. The air for combustion is supplied through the lower gauze. The notched rod at the side is for the support of retorts, tubes, &c. (See *Am. Journ. of Pharm.*, May, 1862, p. 218.)



For supporting the substance to be heated, iron tripods, of various heights and sizes, must be provided. These should be furnished with sets of concentric rings, as in the figure, for vessels of different sizes. A very convenient support is the stand and ring figured in the wood-cut, which will answer for a spirit lamp, or for a small furnace made from a black lead crucible, as in the figure.

The temperature required for fusion in pharmaceutic processes seldom exceeds a red heat; and the vessels used are *crucibles* of silver, platinum, porcelain, Wedgwood ware, black lead, and fire-clay (Hessian crucibles). Silver is used for the fusion of potassa, porcelain for nitrate of silver, and black lead and Hessian crucibles for the metals, glass of antimony, sulphuret of potassium, and the ordinary operations which require a great heat. They are severally liable to objections; silver fuses too readily; platinum is very costly; porcelain and Wedgwood ware do not bear sudden changes of temperature; black lead, which bears these changes, is destroyed by saline substances, and burns in a current of air; and the Hessian crucibles are so porous as to absorb and waste much of the fused substance. The crucible should be covered with a lid or an inverted crucible, and should be supported at a little distance from the bottom of the grate, and surrounded and covered with ignited coals.





Liquefaction is performed in open earthen, copper, or iron vessels, and care must be taken not to raise the heat so as to char or inflame the substance.

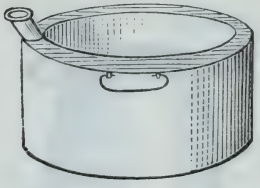
A *sand-bath* is an indispensable part of the pharmaceutic apparatus. It is usually an iron pot, or a shallow vessel of sheet iron, capable of holding sand to the depth of four or six inches. It serves to regulate the action of the heat on vessels which do not bear a rapid change of temperature. It is sometimes heated to a red heat, as in preparing the mineral acids, though more frequently used for the evaporation of saline solutions and vegetable juices.*

Evaporation is one of the most important operations of the pharmaceutical laboratory, and on its proper management depends the value of a large number of preparations. The readiness with which organic matter is modified by direct heat, has caused the invention of various means and apparatus to effect evaporation under the most favourable circumstances, as the *water-bath*, *steam-bath*, *solution bath*, *vacuum pans*, &c.

The *water-bath* is to be used in all cases where a heat above that of boiling water would be injurious. A convenient one consists of two copper vessels, the upper one

* For a method of heating stone vessels to a very high, regulated heat, by means of paraffin see *Am. Journ. of Pharm.*, xlii. p. 463. (*Note to the fourteenth edition.*)

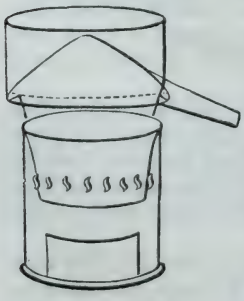
of which is well tinned. It is still more convenient to have the water-bath constructed as a hollow vessel, with one opening at the top for the escape of steam and for the introduction of the water, as in the figure. By inserting a cork in the aperture, the contents of the inner vessel may be poured out, as from a dish, without spilling the water. It may be made of tinned iron, or preferably of tinned copper. Where a temperature above that of boiling water, and not exceeding 228°, is required, the water-bath may be filled with glycerin, or a saturated solution of common salt, sulphate of sodium, or chloride of calcium, the last-mentioned salt permitting a heat as high as 240° when desired.



Steam-baths are by far the most useful and easily regulated of the arrangements for indirect heating. When steam heat is applied in a double-sided vessel like the water-bath, this is called a steam jacket, and must have two openings, one for the ingress of the steam, the other for the exit of the air, and for drawing off the condensed water. When the steam jacket is strongly made, a heat of 300° may be readily commanded. A more economical and easily applied arrangement consists in placing a coil of tube in the vessel containing the liquid to be evaporated, and causing a strong current of steam to circulate through it. For further remarks on apparatus for evaporation, including the vacuum pan, see *Extracts.*

The apothecary should be provided with a set of evaporating vessels, of porcelain, glazed iron, tinned iron, and copper. For metallic solutions vessels of Berlin porcelain are the most useful. In most cases of surface evaporation, where the product is uncrystallizable, the process should be hastened by stirring.

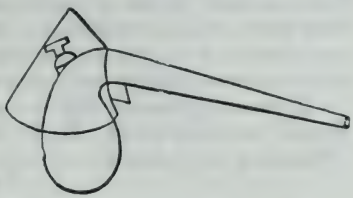
Distillation consists in vaporizing a liquid in one vessel, and conducting the vapour into another vessel, where it is condensed and collected. The process is used for separating a liquid from solid substances which it may hold in solution, or with which it may be mixed; for separating a more volatile liquid, as ether and alcohol, from one less so; for impregnating a liquid with the volatile principles of plants to the exclusion of other principles, as in the preparation of aromatic spirits and waters; and for separating, by means of aqueous vapour, the essential oils and volatile proximate principles of the vegetable kingdom. When, in the last two operations, the distillation is repeated with the same liquid and a fresh quantity of the plant, the operation is called *cohobation.* The process for separating one liquid from another is termed *rectification.* Distillation is also used for obtaining the volatile products which result from the decomposition by heat of substances of animal or vegetable origin. The oils which are obtained in this manner are called *empyreumatic oils.* Sometimes the result is an acid, as the succinic acid, and sometimes a volatile alkali, as in the destructive distillation of animal substances. Alcohol is very often employed as a mere agent in pharmaceutic processes, and, after it has performed its office in the process, may either be thrown away with the refuse liquids, or separated and preserved by distillation. The low price of alcohol in this country had until recently rendered the former proceeding the more expedient of the two; but alcohol is now so much enhanced in price that the apothecary will generally find his account in saving it by distillation.

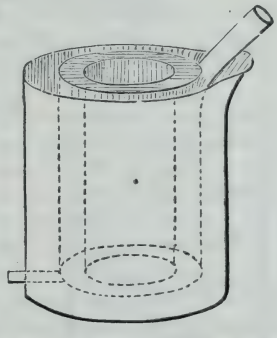


The *common still and worm*, the vessels in general use for *distillation*, are too well known to need description. A convenient still or alembic for small operations, which may be heated by a spirit lamp, is figured in the wood-cut. The top of the head is kept filled with cold water; and all escape of vapour is prevented by having an inner ledge to the still, and filling the space in which the head fits with water. The condensation of all the vapour is secured by adapting a worm, or a long tube, to the apparatus. The boiler of this still may hold one or two gallons, and it will be found a very useful means of recovering the alcohol, in making alcoholic extracts. It may easily be converted into a water-bath, by fitting on the top of the boiler a vessel of con-

venient form. These stills are easily adapted to the common cylindrical anthracite stoves, used for heating, by means of a sheet-iron collar, through which the boiler of the still is made to pass, and on which it is supported.

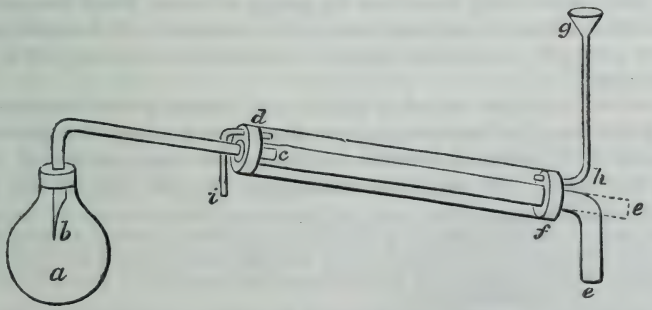
When the common glass retort and receiver are used for the distillation of liquids, care should be taken not to apply the luting until the atmospheric air is expelled, unless the receiver has a tubulure for its escape. The chief objects to be aimed at are to keep the body of the retort hot, and the neck and receiver cool. A hood of pasteboard or tin, as represented in the figure, will much facilitate the former; and the latter will be gained by keeping the neck and receiver wrapped in wet cloths, on which a stream of cold water is kept running. This may be conveniently done by means of a syphon, made by dipping one end of a strip of cotton or woollen cloth in a vessel of water, and allowing the other end to hang down upon cloths bound loosely around the receiver and the neck of the retort. The apparatus figured in the margin is one of the best for the condensation of ethereal vapour, as in regaining the ether in the process for making ethereal extracts. It consists of a close, hollow, cylindrical tin vessel, having a large neck above for the insertion of the neck of a retort or a tube; and a small tube below for the escape of the condensed ether. This vessel sits in a large one open at top. which is kept filled with cold water, constantly renewed by a tube descending to the bottom.





Liebig's distillatory apparatus, commonly so called, but originally invented, we believe, by the elder Weitzel, of Stockholm, is very convenient for performing the process of distillation on a small scale. Its peculiarity consists mainly in the *refrigeratory* for condensing the vapour. Below is a figure of the instrument, which, with the description, is copied from the last edition of the Edinburgh Pharmacopœia.

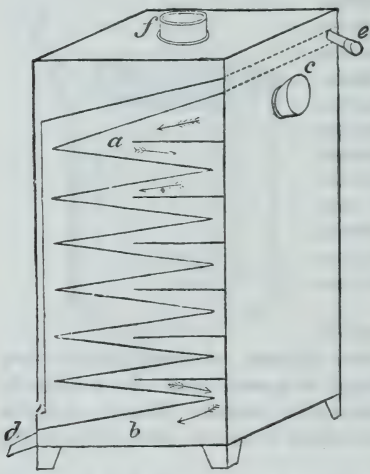
"In all operations, except where inorganic acids are to be distilled, it is greatly preferable to use a globular matrass (*a*), to which is fitted with a cork a tube (*bc*), cut obliquely at its lower end (*b*), curved above at a somewhat acute angle, and



fitted at the other end to a refrigeratory. This refrigeratory consists of a long narrow cylinder (*df*) slightly inclined to the horizon, and of a tube (*ce*) which passes along the centre of the cylinder, and is fixed at each end, so that the space between them is air-tight; and by means of a funnel (*gh*) entering at the lower end of this interspace, and an exit tube (*di*) from its upper extremity, a stream of cold water may be kept constantly running, by which refrigeration, and the condensation of vapours within the inner tube, are far more effectually accomplished than by any other mode that has hitherto been devised." The object of the oblique ending of

the tube at *b*, is to prevent any of the fluid which may be driven against it, during the ebullition, from passing along the tube. The inner tube of the refrigeratory should be made of glass or block-tin, the outer may consist of glass, brass, copper, or common tinned iron. The end *e* of the central tube is either straight, or curved downward, so that it may be inserted into a bottle, when the liquid distilled is very volatile. By connecting the funnel with a cistern by means of a syphon, and allowing the water to flow out from the bent tube (*di*) into a bucket or sink, the distillation may be allowed to go on for a long time without supervision. Dr. Christison states that a refrigeratory, with the outer tube a foot long, and an inch and a quarter in diameter, will be sufficient to condense the whole vapour from a matrass, holding two pints of alcohol briskly boiling.

Warner's condenser. This is a convenient instrument in the distillation of alcoholic liquids, invented by Mr. W. R. Warner, and figured in the *American Journal of Pharmacy* for January, 1861 (p. 15). It consists of an oblong rectangular box of tinned iron, with a broad opening (*f*) at top, for the admission of the refrigerating liquid, and a smaller one (*e*) near the top for its escape. A diaphragm is placed in the vessel near the top obliquely across, so that one of the four angles is lowest. From this angle, communicating with the small compartment above, a tube proceeds downward to near the bottom of the vessel; and a little below its orifice another diaphragm is placed, but not completely across like the first. Connected with the edge of the lower diaphragm is a series of partial ones, oblique like the others, proceeding upward, and so connected as to divide the vessel into two equal parts, leaving a small space between the edges of the partitions on each side and the sides of the vessel, and a space also between the uppermost of the partial partitions and the complete diaphragm near the top. Into this space a tube (*e*) is inserted near the top of the instrument. The vapour admitted through a large opening (*c*) in the upper part of one side of the vessel, enters into one of the compartments, while cold water poured in through the opening at top fills the other compartment, and escapes through the tube (*e*) near the summit. The vapour being compelled, by partial septa, to follow the course of the oblique partitions, along a circuitous route (*ab*), in which it is brought into contact with a large extent of refrigerated surface, is condensed, and passes out at the spout near the bottom.*



When certain liquids are boiled in glass vessels, sudden jars or succussions are apt to occur, which are often inconvenient, and sometimes interrupt the process. These may be obviated by giving a metallic coating to the lower portion of the interior surface of the vessel. Mr. Redwood recommends for this purpose the process of

* Two new stills for pharmaceutical purposes, one by Prof. Wm. Procter, Jr., the other by Mr. Thos. S. Wiegand, of Philadelphia, are described and figured in the *Proceedings of the American Pharmaceutical Association*, A. D. 1863, pp. 207 and 210, both of which merit the attention of pharmaceutists. For a third new still for pharmaceutical purposes, see *Amer. Journ. of Pharm.*, 1869, p. 197. (*Note to the twelfth edition.*)

When mixed liquids to be separated by distillation have closely approximating boiling points, it is often difficult to get them pure, or so nearly pure as to have a constant temperature of ebullition; the less volatile being constantly disposed to rise with those which are more so, and thus contaminate the product. Mr. C. W. Warren has contrived an apparatus in which the evil is in a considerable degree obviated. This he accomplishes by causing the vapours from the distilling vessel to pass by means of a worm, through a bath, kept at a heat corresponding with the boiling point of that one of the mixed liquids which has the lowest. When the mingled vapours pass through the bath, those which belong to the less volatile bodies condense into a liquid which falls back towards the still; while the most volatile passes on, and is condensed by cold water or ice in a receiver. The apparatus, as well as the principles on which it operates, is explained by Mr. Warren in the *Chemical News* (Aug. and Sept. 1865, pp. 85, 97, 110), where it is also figured. See also *Am. Journ. of Pharm.*, 1865, p. 449. (*Note to the thirteenth edition.*)

Drayton. He introduces into the flask or retort as much ammoniacal solution of silver as may cover the part to be coated, precipitates the silver by the addition of essential oils, and afterwards thoroughly cleanses the vessel by boiling in it successive portions of alcohol, until the silver becomes perfectly bright, and all smell of the oil is removed. A coating of platinum may also be obtained, though less perfect, by precipitating a solution of the bichloride of that metal by formic acid, and afterwards boiling. (See *Am. Journ. of Pharm.*, xx. 333.) These succussions are moderated and sometimes prevented by putting in the retort a number of small angular fragments of glass or quartz crystal. According to Dr. G. C. Wittstein, all that is necessary to prevent them is to have some conductor which may convey the heat from the bottom of the fluid to the surface. A glass rod will generally answer the purpose, but for liquids of a high boiling point, as sulphuric acid, a platinum wire of the thickness of a knitting needle is preferable. P. Pellogio has proposed a plan by which these shocks may be entirely prevented, even in the instance of sulphuric acid. It consists in the insertion of a glass tube, as wide as possible, through the tubulure nearly to the bottom of the retort, with the upper end bent almost to a right angle, and drawn out to nearly capillary dimensions, so as to establish a communication between the cavity of the retort and the outer air. (*Chem. News*, April 3, 1866, p. 165.)

Hugo Miller overcomes bumping by passing through the cork to the bottom of the liquid a glass tube, whose lower end is drawn into a fine point and whose outer end is connected with a gas generator or a gasometer, so that a slow, continuous current of carbonic acid, hydrogen, or air is passed into the fluid. (*Am. Journ. of Pharm.*, xli. 422.)

When the object of distillation is to preserve the residuum, and this is liable to injury from heat, as is the case with vegetable extracts, the operation is best performed in vacuo. For this purpose the still and recipient are made so as to form an air-tight apparatus, and the latter is furnished with a stop-cock, which is kept open until the whole of the atmospheric air is expelled by the vapour. It is then closed, and a vacuum formed and maintained in the recipient by surrounding it with cold water.* The distillation is carried on in this manner at a much lower temperature than under ordinary circumstances; and the heat may be applied by a water or steam bath, with greater certainty of obtaining an uninjured product. For a more extended account of vacuum apparatus, see *Extracts.*

Sublimation. The vapours of some volatile solids have the property of condensing into the solid form, either in mass, or in a state of minute division. The operation in which this occurs is called *sublimation.* When the product is compact it is called a *sublimate*, when slightly cohering it is called *flowers.* The operation is generally performed in a sand-bath; and the apparatus consists of two vessels fitting each other, one being inverted over the other. The shape, size, material, and depth of the vessel, and the degree of heat to be applied, are regulated by the nature of the substance operated on. For the details of this process, see the articles *Corrosive Sublimate*, *Camphor*, and *Benzoic Acid.*†

* For a description and figure of a special apparatus for distilling in a vacuum obtained by absorbing carbonic acid with caustic potassa, see *Pharm. Journ. and Trans.*, May, 1871, p. 883. (*Note to the fourteenth edition.*)

† *Micro-sublimation.* This name has been given to a process, first suggested by Dr. Helwig, of Mayence, in 1864, and afterwards investigated by Prof. Wm. A. Guy, of King's College, and Mr. H. J. Waddington, of London, which consists in the joint application of a subliming heat and of the microscope to the examination of volatilizable substances. The objects gained by the process are the determination of the volatility of bodies, the precise temperature at which they sublime, and the forms they assume when they condense from the state of vapour, and thus the ability to identify the several substances examined, even though existing in very small proportions, and mixed with various other bodies. The adaptability of the process to the detection of poisons is one of its greatest merits; and in this light it was originally mainly treated by Helwig; but it is susceptible of a wide application to the interests of science in general. Perhaps the most important part of the process is the proper regulation of the heat, so that it shall act with entire uniformity on the object, and, as to its degree, shall be perfectly at the command of the operator. The want of these advantages has led to great mistakes in previous investigations, both as to the volatility of certain substances, and the true subliming points of many known to be capable of sublimation. The following is the description of Mr. Waddington's apparatus for the application of heat. It consists of a spirit lamp, a piece of thin iron plate, and a few glass rings. There should be a very slight concavity in the upper surface of the plate, so that when a glass slip three inches long is laid upon it, the centre shall be about an eighth or sixth of an inch below the surface

Lutes. The most precious material for the chemist is glass, the transparency, insolubility, and hardness of which fit it for almost every purpose. India rubber tubing has almost entirely superseded other materials for the formation of joints,* but it is often necessary to strengthen glass by means of lutes, which will bear a heat at which glass would soften; and the application of lutes for this purpose, and for securing the junctures of tubes and vessels, is an important part of the pharmaceutic art. Those lutes which are required for coating vessels exposed to a great heat are made of Stourbridge clay. The clay is made into a paste with water, mixed with chopped straw or cut hemp, and successive coats are applied as they become dry. Dr. Hare recommends the fine wool-like turnings of iron for this purpose, instead of chopped straw. Earthenware vessels may be rendered impervious to air or vapours by brushing over them a thin paste, made of slaked lime, and a solution of borax containing an ounce to the half-pint. This is allowed to dry, and the vessel is then coated with slaked lime and linseed oil, beaten till the mixture becomes plastic. Earthenware retorts, thus coated, may be safely used more than once, the coating being renewed every time.

Fat lute is still sometimes applied to the joinings of apparatus to prevent the escape of corrosive vapours. It is made like glaziers' putty, pipe-clay being substituted for whiting. It will bear a considerable heat, and great care must be taken that the part where it is applied is perfectly dry. If it be exposed to heat, slips of moistened bladder must be wrapped around it, and secured with twine.

Roman cement and plaster of Paris may be applied in the same manner as fire-clay. When used for securing the joinings of apparatus, a coating of oil or wax will render them air-tight.

A very useful lute is formed by beating the white of an egg thoroughly with an equal quantity of water, and mixing it with some slaked lime in the state of fine powder so as to form a thin paste. This must be spread immediately on strips of muslin, and applied to the cracks or joinings intended to be luted. It soon hardens, adheres strongly, and will bear a heat approaching to redness without injury. A leak in this lute is readily stopped by the application of a fresh portion. Solution of glue, or any liquid albuminous matter, may be used in the place of the white of eggs.

of the glass. This is to prevent actual contact between the plate and the glass holding the substance under examination. The plate has three straight parallel lines drawn across it, one through the centre, the others an inch and a half distant on either side. The glass rings are for the support of a glass plate for the reception of the sublimate. The object is placed on a slip of glass, which is laid on the iron plate, and the recipient placed over it on a ring. The glass which receives the sublimate should not be very thin, as it changes temperature too rapidly. The slide of a microscope is a proper recipient. The flame of the lamp should not be immediately beneath the object. As the heat of the iron plate varies somewhat, the desired degree may sometimes be obtained by moving the supporting slip from side to side. The object should always be aimed at of having the receiving glass but a few degrees lower in temperature than that which holds the object. The quantity operated on may be very small; and generally the smaller the quantity the better the result. A convenient quantity is $\frac{1}{20}$ of a grain; but perfectly characteristic sublimates may be obtained from as little as $\frac{1}{1000}$ or $\frac{1}{1500}$ of a grain. By this process many organic substances have been proved to be sublimable not formerly thought to be so. This is the case with many of the vegetable alkaloids, and many proximate principles not alkaline. All the sublimates unchanged by heat should possess the crystalline form of the original substances; and Mr. Waddington never considers a result satisfactory unless this end is obtained. In reference to the determination of the temperature of fusion and sublimation, Prof. Guy attaches a thermometer to the apparatus. The bulb of this he fixes in the centre of a copper plate, and attaches the stem to a retort stand to support it. On the copper plate a minute portion, say $\frac{1}{100}$ of a grain, of the body to be examined, is placed, on a small piece of glass, somewhere between the centre and circumference, and around this a glass ring, on which is placed the disk for receiving the sublimate. The heat is then applied to the under surface of the copper plate, at a point equidistant from the object and the bulb of the thermometer. (See a figure by Prof. Guy in the *Pharm. Journ. and Trans.*, Feb. 1868, p. 372.) It is a common statement that certain bodies are partly volatilized and partly decomposed by heat. But the probability is that there is a subliming point at which no decomposition takes place; and the contrary has been supposed because slight differences of temperature have not been observed in the ordinary methods. There are many directions and cautions more or less requisite for a successful application of this process, for which we have no space, and must content ourselves with referring to the original essays. Throughout the present edition, we have noticed here and there the results obtained in reference to individual objects, always quoting the authority. (See papers by Prof. Guy in the *Pharmaceutical Journal and Transactions*, June, 1867, p. 718; July, Aug., Sept., and Oct., 1867, pp. 10, 58, 106, and 195; and Feb. 1868, p. 370; also by Mr. H. Waddington, *Ibid.*, March, 1868, p. 409. See also *Am. Journ. of Pharm.*, Sept. 1867, p. 432; and *B. & F. Medico-chir. Rev.*, Oct. 1868.)—*Note to the thirteenth edition.*

* H. Karsten makes a gas-tight junction by inserting one tube vertically into the other, and then surrounding the end of the outer tube by a cup in which mercury is put.

The following recipe is given by M. Knaff for a *strong liquid glue*, which is said not to gelatinize, to keep well, and to be very convenient for pasting. Take 3 parts of good glue in little fragments, cover it with 8 parts of water, and allow it to stand for some hours; then add half a part of muriatic acid and three-fourths of a part of sulphate of zinc, and expose the whole for ten or twelve hours to a heat between 178° and 189° F. (See *Am. Journ. of Pharm.*, July, 1868, p. 330.)

An excellent cement for surfaces of iron consists of one part of sulphur, two of sal ammoniac, and eighty of iron filings, mixed together and slightly moistened. It is rammed or caulked into the joints, and solidifies perfectly in time.

White lead ground in oil is an excellent cement for broken glass. Spread upon linen, it forms a good coating for a cracked surface, but dries slowly. Strips of bladder macerated in water adhere well to glass, and are very useful.

A mixture of whiting and paste or gum-water, spread upon strips of paper, forms an excellent luting for joinings not exposed to acrid vapours or great heat.

A useful lute is formed by spreading a solution of glue on strips of cloth, and coating them, after they are applied, with drying oil.

Linseed meal, beaten into a uniform mass with water, milk, lime-water, rye paste, or thin glue, and applied in thick masses, adheres well, and when dry will resist most vapours.

Cap cement is made of six parts of rosin, one part of yellow wax, and one of Venetian red. It is a very useful cement for fastening metals or wood to glass, and for rendering joints impervious to water. *Soft cement* is used for the same purposes, and is made of yellow wax, melted with half its weight of turpentine, and coloured with a little Venetian red. It is very useful for rendering the stoppers of bottles perfectly air-tight.

The *Armenian* or *diamond cement*, used for cementing glass, precious stones, &c., and highly esteemed by the jewellers of Turkey, is made in the following manner in the East. "Dissolve 5 or 6 pieces of mastic, each of the size of a large pea, in as much alcohol as will render it liquid. In another vessel, dissolve in French brandy or good rum as much isinglass, previously softened by water, as will make a two-ounce phial full of very strong glue, to which small pieces of galbanum or ammoniacum must be added, and rubbed with it till dissolved. Then mix the whole with sufficient heat, and keep the glue in a phial closely stopped. When used, the phial containing it is to be put into boiling water." (See *Am. Journ. of Pharm.*, Jan. 1866, p. 57.)

A cement of which *gutta-percha* forms a part has been very highly recommended by Edmund Davy. It is made by melting together, in an iron pan, two parts of common pitch and one of gutta-percha, stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid, and elastic; but it softens with heat, and at 100° is a thin fluid. It may be used as a soft paste, or in the liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, &c. It may be used even for glazing windows. (See *Am. Journ. of Pharm.*, xxix. 457.)

French cement is made by gradually adding finely powdered slaked lime to caoutchouc, perfectly melted over a fire in a covered iron pot, stirring constantly, until the mixture is so thick that, removed from the fire, well beaten in a mortar, and moulded in the hands, it shall have the consistence of putty. It answers well for cementing glass. (*Ibid.*, July, 1864, p. 374.)

French putty is prepared as follows. Seven pounds of linseed oil are boiled for about two hours with four pounds of brown umber, after which two ounces of finely cut wax are added; the mixture is removed from the fire and five and a half pounds of prepared chalk and eleven pounds of white lead are well incorporated.

Caoutchouc, dissolved in heated copal varnish, is said to make a good waterproof glue, for cementing wood and leather.

Casein, dissolved in a cold saturated solution of borax or of silicate of sodium, is recommended by Dr. Wagner as a cement, answering the purpose of strong glue in many instances.

A new cement, having excellent properties, is described by M. Sorel. It is a hydrated basic oxychloride of magnesium, and is prepared by mixing magnesia with

a solution of chloride of magnesium. The cement is harder in proportion to the greater density of the solution. In most cases M. Sorel employs a solution of 20° to 30° of the arcometer of Baumé. In preparing the cement various other metallic chlorides may be substituted, in whole or in part, for the chloride of magnesium. It is very white, and becomes very hard, and may be moulded like plaster. Objects may be made with it having the hardness and colour of marble. (*Journ. de Pharm. et de Chim.*, Mai, 1868, p. 328.)

A *cement* for *fixing iron* in wood or horn may be made by melting eight ounces of sulphur and one pound of colophony. When used it is to be powdered with half a part of fine sand, brick-dust, or iron filings, the cavity filled with the powder, the iron heated and plunged in. (*Amer. Journ. of Pharm.*, xlii. p. 469.)

CHEMICAL OPERATIONS. Some of the chemical processes, conducted by the apothecary, have been explained in the former part of this Introduction. It remains to notice others in constant or frequent use.

Solution. The act of solution, in which solid substances assume the fluid state through the agency of liquids, is one of the most important operations of practical pharmacy. The process has received a variety of names, according to the mode of applying the menstruum and the degree of heat employed; as *maceration*, *infusion*, *digestion*, *decoction*, *displacement* or *percolation*, and *circulatory displacement*.*

Two classes of substances are the subjects of solution; those which dissolve entirely in the menstruum, as salts, gum, &c., and those which consist of soluble and insoluble matter, as roots, leaves, barks, &c. The former yield *simple solutions;* the latter *infusions*, *decoctions*, *tinctures*, *wines*, &c. Solution is sometimes accompanied by chemical reaction, as when metals are dissolved in acid liquids. Mechanical division facilitates solution by increasing the extent of surface. Heat as a general rule favours solubility. All aqueous solutions of solid bodies are denser than water. A solution is said to be saturated when the dissolved substance ceases to be taken up at common temperatures. A saturated solution of one salt will dissolve other salts, a fact taken advantage of in purifying nitre, and other saline bodies in powder, by percolating them with their own saturated solutions. Rapid solution, when unaccompanied by chemical reaction, causes a reduction of temperature; hence, in such cases, where dense solutions are required, heat should be employed to counteract that effect. In dissolving a substance wholly soluble in the amount of liquid used, a convenient method is to powder it in a mortar, add the liquid in portions, and decant until the whole is dissolved. Capsules and flasks are the most suitable vessels for performing solution when heat is necessary. If the solid softens before dissolving, as in the case of the extracts, a capsule should be used, with constant stirring. When effervescence occurs, a flask should be used inclined to one side to avoid loss; or, if the capsule be employed, an inverted funnel should be placed over it. When the quantity of a substance is large, and time permits, the process called *circulatory displacement* is preferable, especially in making saline solutions. This is performed by suspending the salt, enclosed in a piece of gauze or other porous tissue, near the surface of the liquid. The solution proceeds rapidly; as the liquid in contact with the salt, by becoming saturated and heavier, descends to give place to less saturated portions, so as to cause a kind of circulation of the solvent. This process is applied to the arts, and has been suggested in making infusions and tinctures.

Infusion is the subjecting of a substance containing soluble principles to the action of a menstruum, which is usually water. Hot infusions are made by pouring boiling water on the substance, and allowing it to remain in a covered vessel till cold. Cold infusions are made with cold water, and require several hours to attain their full strength. *Maceration* is the term employed to denote the action of liquids upon medicines, when allowed to remain upon them for some time, at a heat from 60° to 90°. *Digestion* is the name given to the same operation, when conducted at a temperature between 90° and 100°. This process is sometimes effected at higher temperatures; but the heat is uniform during the operation, and always below the boiling

* The attention of physicians and apothecaries is called to *Storer's Dictionary of Solubilities*, published in Cambridge, Mass., in which useful information on the solubility of different substances may often be found, which might not be readily obtained elsewhere. (*Note to the twelfth edition.*)

point of the liquid. It is commonly performed in glass bottles or flasks, and a common fire or stove heat, or the water-bath, is employed. When digestion is performed with alcohol and ether at temperatures near their boiling points, the vessel should be connected with a refrigerated worm, or other condenser, to save the vaporized portion. Soubeiran places the worm above the digesting vessel, so that the condensed liquid runs back at once into the vessel.

Decoction, or boiling, is much employed in extracting the virtues of plants; but it is often disadvantageous, as most of the proximate principles of vegetables are altered by it, especially when long continued. When it is practised, the ebullition should generally be continued for a few minutes only, and the liquid be allowed to cool slowly in a close vessel. For further remarks on infusions and decoctions, see the preliminary notices to these classes of preparations.

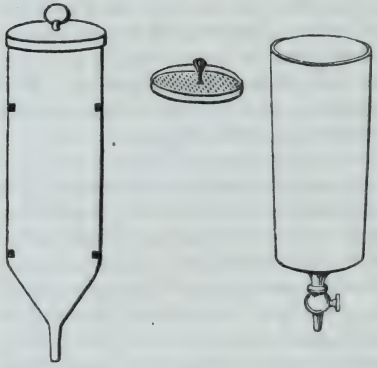
Lixiviation is a process used to separate a *soluble* from a porous *insoluble* body. It consists in placing the substance to be lixiviated in a vessel, the bottom of which is covered with straw, sand, &c., pouring water upon it, allowing the water to remain until saturated, and then drawing it off through an opening at the bottom of the vessel. It is found that, if fresh water is poured on without disturbing the mixture in the vessel, it does not mix with the liquid already there, but percolates the solid particles, driving the saturated liquid before it; so that, for example in lixiviating wood ashes, if a gallon of water has been poured on the ashes, and allowed to become saturated with the alkali, we shall obtain, by this mode of proceeding, a gallon of strong ley, and immediately thereafter the water will become almost tasteless. This fact has been applied to the service of the pharmaceutist, and has led to some valuable improvements in the mode of extracting the medicinal qualities of plants.

Percolation. Filtration by Displacement. This is the process of lixiviation, applied to pharmaceutical processes, under certain conditions and with certain objects which give it a somewhat distinctive character. It was first introduced into notice by the Messrs. Boullay, of Paris, in the year 1833, and, though received at first with some hesitation, has now come into almost universal adoption, and is officinally recognised as an important agency both in the U. S. and British Pharmacopœias. The principle of the process is, that a permeable powder, consisting partly of soluble and partly of insoluble substances, when submitted, in a cylindrical or conical instrument, open at top and partially closed by a porous material at bottom, to the action of a menstruum poured upon it, yields its soluble parts to the liquid, which, in its descent by its own gravity or by pressure from the liquid above, becomes more or less saturated, and in this state escapes beneath, without mingling in its passage through the powder, or but in a slight degree, with the liquid pressing upon it from above. If the menstruum be supposed to be in layers in the powder, the lower layers are pressed downwards or displaced by the upper with little admixture, so that they severally escape from the instrument with the degree of concentration acquired in their passage; and each successive layer is less and less impregnated, until the powder is at length exhausted, and the liquid last added passes in the state in which it enters. Now what is true of one liquid is true of different liquids; and if a particular liquid be first added, and then followed by a second, the two do not mingle, and the latter takes from the former little or nothing of what it may have dissolved. Thus, if alcohol or ether be first introduced, and then followed by water, the alcoholic or ethereal solution formed may all be displaced by the water, without being to any considerable extent diluted with it. The idea was at one time entertained, that there is absolutely no intermixture or next to none; but experience has shown that this was not exactly true, and that there is in fact a slight mixture of the successive and contiguous layers.

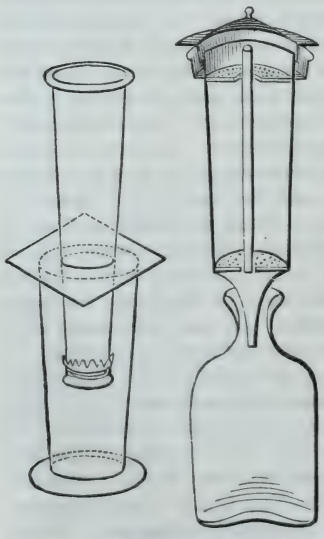
A little reflection will show, what abundant trial has proved, that this method has advantages in various ways, over that of simple mixture of the solid and liquid, however this may be aided by other agencies, as by agitation, heat, and expression. In the first place, the particles of the menstruum are brought more thoroughly into contact with those to be acted on, and each successive layer of the liquid comes into contact with the solid with a higher solvent power than that which it has displaced; so that the powder is both more rapidly and more thoroughly exhausted. In the second place, as the liquid which first passes is saturated or nearly so before it escapes,

highly concentrated solutions may be obtained with great facility; and, each successive portion being less and less saturated, it is possible in this way to separate the stronger from the feebler portions, which is sometimes an object of great practical importance. Thirdly, the last particle of dissolved matter may be obtained by displacing the liquid by another menstruum or an additional portion of the same, and great waste thus avoided; and though the same object may be accomplished to a great extent by expression, the method of displacement is both more thorough and convenient. Fourthly, by the employment of a cheaper menstruum as the displacing agent, considerable loss may be saved, in obtaining solutions in which the menstruum is very costly. A single example will serve to show the value of this process. The Messrs. Boullay, by subjecting four ounces of bruised cinchona to percolation with half a pint of water, and then adding four half-pints in succession, obtained the following results.

1st	half-pint	yielded	3 drs.	48 grs.	dry extract.
2d	do.	"	1 dr.	5 grs.	do.
3d	do.	"		15 grs.	do.
4th	do.	"		9 grs.	do.
5th	do.	"		7 grs.	do.



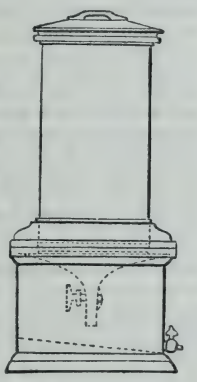
The figure in the margin represents *Boullay's filter*, or *percolator*. It consists of a long tin vessel, nearly cylindrical, but narrower at the lower end, which has a funnel-shaped termination, for the purpose of being inserted in the neck of a bottle. A metallic plate, or diaphragm, pierced with holes, like a colander, and having a handle in the centre, fits accurately in the lower part of the cylinder; and upon this is to be placed, when the instrument is used, a thin layer of carded cotton, tow, or a piece of cotton flannel. Another similarly pierced plate is to be provided, to place upon the top of the powder after it has been introduced into the percolator. A stop-cock at the lower end of the instrument, as represented in the second figure, will be convenient for regulating the discharge of the liquid.

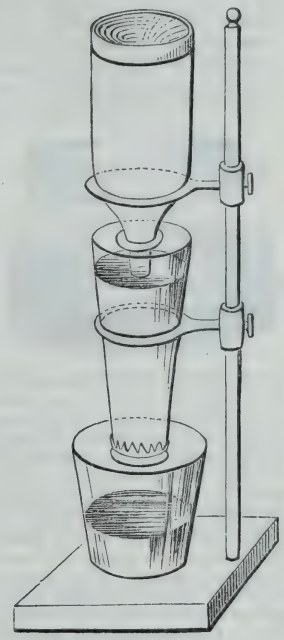


Cylinders 14 inches long by 2½ in width at the base, 14 inches by 4, and 17 by 6, are convenient sizes for ordinary use. Queensware and glass percolators are now to be procured from the druggists, and are useful for acid or astringent solutions. In a large proportion of the cases of percolation, small vessels only are required. The common glass cones used as lamp glasses, figured in the margin, when inverted, with a piece of close canvas or flannel tied over the smaller end, form convenient percolators; and their transparency enables the operator to assure himself that the powder is properly stratified before adding the menstruum. A tin percolator, formed with a double rim, into which the rim of the lid is inserted (the interstice being filled with water so as to make an air-tight juncture), and furnished with an open vertical tube, extending from the top through the diaphragm below, is employed when volatile liquids, as ether, alcohol, and spirit of ammonia, are used as menstrua. It is figured in the margin. When it is wished to operate upon a very fine powder, it may be found advisable to increase the height of the column of liquid by making the top of the cylinder air-

tight, and inserting a tin tube several feet long, which must be kept filled with the liquid. All the substantial advantages, however, of this method may be obtained without pressure. For operating on very small quantities of a substance, an adapter or the neck of a broken retort may be used, by loosely stopping the lower and smaller end with a piece of cotton.

Soubeiran has adapted to Boullay's filter a receiver of tin, from which the filtered liquor may be drawn off by a stop-cock at the most dependent part. An apparatus of this kind is represented in the margin. One of the most important points, in conducting the displacement process, is to keep the ingredients constantly saturated, with a stratum of the displacing liquid over them. To avoid the necessity of constant supervision to effect this, the arrangement represented in the right-hand one of the two marginal figures may be used. An ordinary bottle containing the menstruum, with a tube of a quarter of an inch bore passing through the cork, is inverted over the percolator, with the end of the tube dipping in the liquid above the ingredients.*





For powders which swell much on the addition of water a conical percolator is greatly preferable to those of a cylindrical or nearly cylindrical shape; and a common glass funnel may be used. Indeed, most of the ordinary tinctures may be prepared with great facility by means of glass funnels, which may be had of all capacities, from that of half a pint to that of two gallons.

But, in order that the process of percolation may be successfully employed, it is necessary to lay down various precepts for the guidance of the learner; and even those best instructed theoretically can hardly hope to avoid errors, unless they have by practice thoroughly qualified themselves for operating correctly. An inference from this fact is that, in the execution of pharmaceutical processes, when an alternative between percolation and another method is offered, the wholly inexperienced operator should prefer the latter. Under the heading of "general officinal directions," a few pages in advance, will be found valuable precepts for conducting percolation, to which, as well as to the explanations that may be deemed necessary, the pharmaceutical student is referred.†

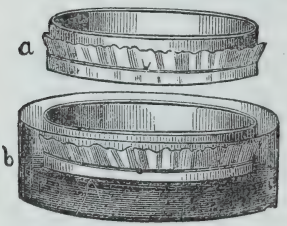
* For an ingenious apparatus, invented by Dr. E. R. Squibb, in which the same object is obtained by means of a bottle placed on a higher level than the percolator, and connected with it by means of two syphon tubes, see *Am. Journ. of Pharm.*, March, 1858, p. 99.

† Dialysis. This name has been given by Mr. Graham, Master of the Mint, London, to a process based upon the different diffusibility of liquids, by which mixed substances may often be separated from each other, and important ends thus obtained. Though not yet officinally employed in pharmacy, it is capable of beneficial application in many instances by the apothecary, and therefore demands a brief description. It is well known that substances, in the liquid state, have the property of diffusing themselves, by their own inherent power, through other liquids. Mr. Graham ascertained that this property was possessed by different substances in very unequal degrees; and, on pushing his investigations into the subject, found that there was good reason to divide bodies into two classes based on their degree of diffusibility, one class consisting generally of crystallizable substances, which are highly diffusible, the other of uncrystallizable substances, especially those capable of forming a gelatinous mass with water, which diffuse themselves very slowly. The first class Mr. Graham proposed to name *crystalloids* from their property of crystallizing, the second *colloids* from their resemblance to glue in the power of gelatinizing. An example of the first we have in sugar, of the second in gum. Another discovery made by Mr. Graham

Filtration under Pressure. In chemical laboratories the method invented by Prof. R. Bunsen has been found to be a very great improvement, and we cannot see any reason why in large pharmaceutico-chemical factories the plan should not be advantageous. Sprengel's water pump consists essentially of a long vertical tube with a second shorter one set into it at an angle. Water falling through the long tube drags air down with it from the orifice of the shorter tube. The principle has long been practised upon in the blast furnaces of Catalonia. If the shorter bi-tube be connected

was that a thin layer of gelatin in the form of jelly, interposed between two liquids, offered no obstacle to the passage of the crystalloids from one to the other, while it completely prevented the passage of the colloids; and this property he found to belong not only to gelatin, but to other substances having a similar molecular constitution, as bladder, parchment, paper sized with starch paste, &c., of which the most convenient is the texture known as *parchment-paper*, prepared by immersing unsized paper in a cold mixture of two measures of sulphuric acid and one of water, and subsequently thoroughly washing it to free it from acid.

Upon the principles here stated, Mr. Graham contrived a very simple apparatus, which he called the dialyser, and a figure of which is given in the margin. It consists of two parts, one a circular glass recipient (*b*), about a foot in diameter and six inches deep, the other (*a*) a similar circular vessel from six to ten inches in diameter and about two inches deep, the circumference of which consists of a band of gutta-percha, and the bottom of a circular piece of parchment-paper, the edges of which are brought over the lower rim of the gutta-percha band nearly to the top, and fastened outside of it by a string, or by a narrow hoop of gutta-percha. The first part, or circular basin, is to receive distilled water, and should contain from five to ten times the quantity of the liquid that may be introduced into the smaller vessel. The latter is to float upon the surface of the water in the former, and is to receive the liquid to be submitted to dialysis, which should not be more than half an inch deep on the paper bottom. It is important that the parchment-paper employed should have no rent or aperture and should be brought well up, and well secured on the outside of the gutta-percha, to prevent the liquid from passing between them. If any liquid containing a mixture of colloid and crystalloid matter be placed in the floating vessel, after some hours it will be found that a portion of the latter has passed through the parchment-paper, and is held in solution by the distilled water of the larger vessel, while the colloid matter remains. The distilled water thus impregnated is called the *diffusate*. The parchment-paper, or any similar material used as the septum, is applicable to the dialysis only of substances held in watery solution, and will not answer for alcoholic or ethereal liquids. M. Guignot has found that *porous or unglazed earthenware* is capable of acting efficiently as a dialysing septum. Thus, a porous vessel containing pure water was placed in another vessel containing a solution of sugar and gum; and, at the end of 24 hours, a greater portion of the sugar had passed into the inner vessel, but not a discoverable particle of gum. (*Pharm. Journ.*, N. S., iv. 317.) It is obvious that very different arrangements might be made to accomplish the same ends. Thus a bladder containing a similar mixture, suspended in a jar of distilled water, should yield similar results. Graham's apparatus is preferable to others only for its convenience.



It is not our purpose to treat of all the applications of the process of dialysis. We shall refer to those only in which it may prove useful to the pharmaceutist. 1. It facilitates in many instances the separation of the active matter of any artificial or natural mixture, to a considerable extent, from the inert and useless, the former being very often crystalline, and the latter colloidal. Thus infusions or decoctions of medicines, such as opium, belladonna, aconite, &c., submitted to dialysis, might give up more or less completely their crystalline principles, such as the salts of morphia, atropia, aconitia, &c., to the water, while the gummy, resinoid, extractive, and colouring matters, &c. might remain behind. In effecting the analysis of organic bodies, one of the most embarrassing problems is to get rid of the inert principles, which interfere with the action of chemical reagents; and the process of dialysis may here often be brought to the aid of the operator. 2. In searching for poisons in organic mixtures, as in the contents of the stomach, in which the application of tests is often rendered abortive by the colloidal matter present, the problem of the presence of the poison may be sometimes solved by submitting the suspected matter to dialysis. The poison will often be found in the diffusate, separated from the other matters, and may then be detected by the ordinary tests. Arsenious acid, morphia, strychnia, brucia, and digitaline have been tried in this way, and given successful results. (See *Am. Journ. of Pharm.*, Sept. 1864, p. 414.) 3. In pharmaceutic operations, it often happens that salts and other crystallizable substances are thrown away as refuse matter, because they would not repay the cost of time and material necessary for their recovery. It is possible that, by this simple inexpensive process, these substances may be separated from the useless matters and thus saved. 4. An economical application has recently been made of the process to the restoration of salted meat to the fresh state. If some salt beef with its brine be enclosed in a bag of material suitable for dialysis, as of untanned leather, and the bag be immersed in sea-water, in the course of some days the beef and brine will have been rendered sufficiently fresh for use, the salt having passed out into the sea-water. (*Chem. News*, May 28, 1864.) (See, on the subject of dialysis, papers by Prof. Redwood in the *Pharm. Journ.*, April, 1862, p. 515, and by Prof. Procter in the *Am. Journ. of Pharm.*, July, 1862, p. 312.)—*Note to the twelfth edition.*

Notwithstanding the very important aid promised by this process to pharmacy when first announced, we are informed that it has proved less practically useful than was hoped; as the great dilution of the diffusate renders it liable to chemical change in the case of organic substances, and makes also a great amount of evaporation necessary. (*Note to the thirteenth edition.*)

with a receiver a more or less perfect vacuum will be formed in the latter. Prof. Bunsen connects a filtering apparatus with this receiver, and thereby gets a very powerful atmospheric pressure upon the liquid in the apparatus.

Crystallization. Numerous chemical substances, in becoming solid, when their solutions are evaporated, take on certain regular forms. The bodies having such forms are called *crystals*, and the process for obtaining them, *crystallization.* The most usual method is by the evaporation of solutions, either spontaneously, or by heat. The extent to which the evaporation should be carried depends on the solubility of the substance. The proper degree of concentration is attained, when a drop of the solution, removed to a cool glass plate, deposits well-formed crystals. When set aside to crystallize, a solution should not be disturbed until deposition ceases. The crystals are large in proportion to the slowness of the cooling of the solution, to effect which the vessel is sometimes set in the drying closet, and sometimes left to cool with the sand-bath. The deposition of crystals is facilitated by suspending some insoluble substance, as wood, or sheet lead, in the solution, or crystals of the same substance, which are thus increased in size. When it is desirable to have small acicular crystals, the solution should be cooled rapidly, and stirred constantly meanwhile.

Crystallization is one of the best means of purifying many substances; the impurities remaining wholly or chiefly in the residual liquid called *mother-water.* Fine silky crystals, which retain their mother-water by capillary attraction, must be dried by strong expression in a linen bag. The finest silky crystals may be entirely freed from adhering liquid, by placing them in a funnel which fits closely to one of the necks of a double-mouthed bottle, and fitting a tube to the other, through which air is drawn. The current of air, in passing through the funnel, carries the water with it, and dries the crystals perfectly.

Effects of Heat. The operations which require a heat greater than that used in digesting are *liquefaction*, *fusion*, *calcination*, *ustulation*, *incineration*, *distillation*, *sublimation*, and *reduction.*

Liquefaction is the melting of those substances that become soft previously to fusion, as wax, tallow, plaster, &c. The heat employed is always below that at which charring takes place.

Fusion is the melting of those substances which pass immediately from the solid to the fluid state. It is employed in pharmacy in preparing nitrate of silver and caustic potassa for casting into cylinders. The former must be melted in a porcelain, the latter in an iron crucible. The moulds in which they are cast are formed of two thick plates of cast-iron or silver, with semi-cylindrical grooves that fit accurately to each other. Fusion is also used in preparing the glass of antimony.

Calcination is the term applied to the changes produced in mineral substances by intense heat, not attended with fusion, and leaving a solid residue, and is often synonymous with oxidation. The term *ustulation* is restricted to the metallurgic operations of roasting ores, to drive off the volatile matters, as arsenic, &c. Calcination is often used to express the ustulation or burning of carbonate of magnesium. This is to be performed in an earthen vessel at a red heat. Exposure to the heat of a potter's furnace, during the burning of the kiln, is an excellent mode of performing the operation. More commonly the carbonate is burnt in an iron pot, which is objectionable; as the heat soon oxidizes the iron, and the oxide scales off and mixes with the magnesia, which is seldom free from iron when prepared in this way.

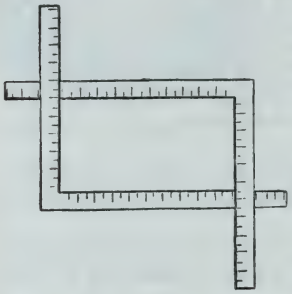
Incineration, as the name expresses, is the operation of burning substances for the sake of their ashes. It is performed in obtaining phosphate of calcium, the Cornu Ustum of the late London Pharmacopœia. The bones are burnt in an open fire until all the combustible matter is consumed.

Reduction is that operation by which certain binary compounds of the metals are brought to the metallic state, by heating them alone, or with some substance capable of attracting the combined substance and setting the metal at liberty. Arsenious acid is thus reduced by heating it with charcoal, and oxide of iron, in powder, by heating it in a current of hydrogen. When, in the reduction of metallic compounds, some third substance interferes with the process, as silica, a substance capable of combining with this is added, called a *flux.*

Dispensing of Medicines. A large portion of the operations of the apothecary is performed in the shop extemporaneously. In dispensing medicines from the counter, he is continually called upon to put his previous knowledge in practice, and often to substitute extemporaneous for the regular officinal formulas. There is no part of his business which requires, for its proper performance, so much ready knowledge and so accurate a judgment. A few directions, suggested by running the eye over the list of preparations of the Pharmacopœia, may be found useful.

Aromatic Waters. It may sometimes be necessary for the apothecary to make extemporaneously an aromatic water, not usually kept in the shops. In this case he is to prepare it by rubbing two drops of the essential oil with from four to six grains of carbonate of magnesium for every fluidounce of water, and filtering.

Plasters. It is sometimes desirable to apply plasters prepared from herbs. These may be made extemporaneously, by mixing the soft extract of the plant with about twice its weight of melted adhesive plaster. The most suitable material on which to spread plasters is soft white leather. A margin of half an inch should be allowed to remain around the plaster. The plaster iron or spatula may be heated over the large spirit lamp, figured in page 961. A skilful apothecary will be able to spread the plaster uniformly and evenly, without overheating it so as to corrugate or penetrate the leather. A convenient instrument for determining the size, and preserving a straight edge, consists of two squares made of tin and graduated to inches, as in the annexed figure; or pieces of paper may be cut out and pasted on the leather, so as to enclose a space of the required dimensions. The plaster should first be melted on a piece of brown paper, and then transferred to the leather, in order to prevent its being applied at too great a heat. For all the officinal plasters, the apothecary should have small tin trays open on one side, on which to melt them. If the plaster to be spread is a very large one, it is better to liquefy the material in a capsule, and add it to different parts of the leather as it is wanted, till the whole is covered. For the description of an apparatus for spreading plasters, see *Emplastra.*

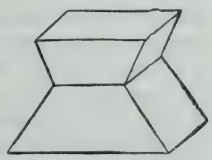


Decoctions and Infusions. These are often ordered in prescriptions in the quantity of a few ounces. A very convenient vessel for preparing them is the common nursery lamp, which consists of a cylindrical vessel, open at one side to receive a spirit lamp, and at the top to receive a teapot or tin boiler. The *infusion mug* of Mr. Alsop, of London (see *Infusa*), which consists of a queensware vessel, with a perforated diaphragm of the same material resting on a ledge at one-third of its height from the top, is the best instrument for this purpose. The material to be infused is placed on the diaphragm, and the boiling water poured on till it rises over the ingredients. No stirring is necessary, and the process is accomplished rapidly. Infusions and decoctions may be kept during hot weather, and for many months, by straining them *while hot*, and pouring them at once into bottles provided with accurately ground stoppers. The bottle must be quite filled; the stopper being made to displace its own bulk of the liquid. A common bottle with a perforated cork stopper may be used, if the hole be instantly closed, and the cork covered with sealing wax. The hotter the liquid and the freer from air bubbles, the better will the infusion keep.

Neutral Mixture and Effervescing Draught. Neutral mixture is known to be saturated perfectly, when it does not affect litmus paper either in its blue state or reddened by an acid. The carbonic acid, extricated in its preparation, combines at first, without effervescence, with the remaining carbonate, and forms a bicarbonate. This circumstance may lead, unless the solution be tested, to the supposition that the mixture is saturated. For preparing the effervescing draught, it is advisable to keep in the shop a solution of carbonate of potassium containing an ounce to the pint. The silica which this salt contains precipitates after a few weeks, and leaves a perfectly clear solution; whereas that prepared at the time it is to be used always becomes turbid after being saturated.

Extemporaneous Mixtures. In preparing these by direction of the physician, it is of the first importance to mix the ingredients in the manner best calculated to ensure a smooth and readily miscible compound, without grittiness or imperfectly comminuted portions, when a part of the constituents may be insoluble. Kino and extract of rhatany should be first dissolved in boiling water, when admissible. If an aromatic water is directed, they should be rubbed to powder, mixed with the insoluble ingredients, if any, and the water gradually added, the whole being triturated till smoothly mixed. Emulsions of the gum-resins should be rubbed till all the particles are softened, and then strained, if any extraneous matter is present. Water can be saturated with camphor by means of carbonate of magnesium, and an aqueous mixture of any strength may be made with it, by triturating the camphor with magnesia, and shaking the mixture before using it. Camphor softens the gum-resins, and solid fats and oils, and may be rendered permanently miscible with water, in considerable quantity, by trituration with a fifth part of myrrh. In preparing oily emulsions in which gum arabic, or gum and sugar are the medium, a sufficient quantity of water must be added (generally about twice their weight) to convert them into a thick mucilage before adding the oil, which must then be thoroughly mixed with the mucilage, and the remaining water added gradually with great care. Gum arabic is best suited for this purpose in a powder somewhat less fine than as ordinarily used. Ether is rendered more soluble in water by trituration with spermaceti. The mixture should be filtered to separate the superfluous spermaceti. If elaterium is to be incorporated in a mixture, it should be first rubbed with a little alcohol, then with sugar or syrup, and lastly with the other ingredients. When a few drops of croton oil are to be suspended in a mixture, the latter will be more permanent if a little olive oil be added with the croton oil to increase its quantity. Mixtures that contain the resinous tinctures, should also contain syrup, with which the tincture should be first mixed, and the water then added very gradually. If a mixture is to contain laudanum and a fixed oil, the former should be first mixed with the syrup and the oil afterwards incorporated, and lastly the water. The mixture will not otherwise be uniform. When a considerable quantity of sugar is added to a mixture, it is best to use syrup, employing a fluidrachm of syrup for each drachm of sugar, and making allowance for the water contained in the syrup, which equals half its bulk.

Powders. Powders are often mixed together with difficulty, by means of a pestle and mortar, on account of their differing greatly in weight, or of their softness and compressibility, as charcoal and magnesia, or rhubarb and magnesia. In these cases the mixing should be completed with a spatula on paper. In dividing powders into doses, it is very desirable to fold the packages neatly and of a uniform size. The *powder folder* represented in the figure is very useful for this purpose. It may be made of mahogany or other hard wood. Instruments of this kind with a movable cheek, so as to be widened or contracted by a screw, and made of brass, are used in some shops.



When volatile or deliquescent substances, as camphor and carbonate of potassium, are prescribed in several powders, these should be enveloped separately in tin-foil or waxed paper; and when the number of dosés is more than two, they should be enclosed in a paper box.

Pills. In ordering pills care must be taken to avoid the use of deliquescent salts, and to deprive those which are efflorescent of their water of crystallization. The mass must be thoroughly incorporated previously to being divided; and this is particularly important when extracts of different degrees of hardness enter into the composition. A section of the mass should be throughout of uniform colour and consistency. Pills are to be rolled and preserved in powdered liquorice root, or lycopodium powder, which ought to be kept for use in a tin box with a perforated lid, like a pepper-box. The liquorice root is preferable on the pill-machine, as finer and more adhesive; the lycopodium in the pill-box, as less liable to attract moisture, and not disposed, like the former, to become mouldy. When pills are of too soft a consistence, a little liquorice powder may be incorporated with them to render them more firm. Pills, into the composition of which gum arabic enters, should be softened with syrup, and not with water, as the latter renders the mass difficult to roll. For further remarks relative to the formation of masses for pills, see *Pilulæ*.

Gum-resins. Gummi-resinæ. The method of treating gum-resins, now that it has ceased to be a special subject of officinal direction, may be appropriately considered in this place. Gum-resins are concrete natural juices of plants obtained by spontaneous exudation or incision, and consisting of gum and resin, associated for the most part with more or less volatile oil, and frequently with other substances, such as extractive, bassorin, starch, wax, and various salts. The gum and resin are essential ingredients, but exist in very different proportions in the different varieties. All the gum-resins are partially soluble in alcohol and in water, but completely so in neither of these liquids. Diluted alcohol, on the contrary, dissolves them almost entirely, especially if assisted by heat. With water they form an opaque emulsion; the resin, essential oil, and other insoluble constituents being held in suspension by the dissolved gum. They are to a certain extent soluble in vinegar. Upon several of them, especially myrrh and ammoniac, carbonate of potassium so reacts as to render them soluble in water, or capable of being permanently retained in suspension by that liquid. A good method of effecting their suspension in any watery vehicle, is to rub them with a few drops of pure almond oil so as to form a smooth paste, and then very gradually to add the liquid, continuing the trituration. In forming an emulsion with myrrh very rich in oil and resin, the union with water is greatly facilitated by rubbing the gum-resin, after it has been well beaten, with a little gum arabic before adding the water.

They are often so impure from admixture of vegetable and mineral substances, as to be unfit for use until purified. Various modes of effecting this object have been practised. Some of the gum-resins, as galbanum, are so far fusible, that they may be rendered sufficiently liquid by heat to admit of straining through a hempen cloth. Care should be taken in this process not to apply too great a heat, and it is best that the liquefaction should be effected by means of a water-bath. But several of them, as assafetida and ammoniac, are not sufficiently fusible at the temperature of boiling water to admit of being strained with facility. As they are usually brittle and pulverizable when very cold, they may be freed from the coarser impurities by powdering them in the winter season, and sifting the powder, which afterwards agglutinates with warmth. This plan is recommended by Mr. Brande in relation to assafetida, ammoniac, and galbanum. When boiled with hot water, any of the gum-resins, though not dissolved, will form a semi-liquid mass capable of being strained; and this was the method employed by the London College for their purification. It is liable to the objection that a portion of the volatile oil, upon which their medical virtues in part depend, is driven off; and the gum-resins thus prepared are adapted more especially for external use. The French pharmaceutists purify these substances by dissolving them in diluted alcohol, filtering, and evaporating the solution. This process, though liable in a still greater degree than that of the London College to the objection of diminishing the virtues of the medicine by driving off the essential oil, has the advantage of completely separating all insoluble substances, however minutely divided, such as fine sand or other earth which might pass through the pores of a hempen strainer. For internal use, it is best to select the gum-resin so pure as not to require purification. M. Constantin recommends, as an effectual method of producing permanent homogeneous emulsions with the gum-resins, to put into a marble or porcelain mortar the quantity directed of the gum-resin, in small pieces, to add about four times its weight of alcohol, to set this on fire and triturate with a porcelain pestle until the alcohol is consumed, and lastly to rub the soft mass, thus produced, with the liquid gradually added. (*Journ. de Pharm.*, xxvi. 39.)

Suppositories and *lozenges* or *troches* are other preparations often extemporaneously made by the apothecary, which are not described here; as they will be found sufficiently treated of, in a general way, in a subsequent part of this work, in connection with the several substances belonging to them.

Implements. The proper cleanliness of his vessels is an object of great importance to the apothecary. Open vessels, as mortars and measures, are easily cleansed, and should be wiped dry immediately after being washed. Fats and resins are readily removed by pearlash, or tow and damp ashes, or sand; red precipitate and other metallic substances by a little nitric or muriatic acid; Prussian blue by means of pearlash. Bottles may be cleansed from the depositions which accumulate on their

sides and bottoms from long use in the shops, by a few shreds of grocers' paper, and a little clean water. They are to be shaken so as to give the paper and water a centrifugal motion, which effectually removes the dirt from the sides. They may be freed from oil by a little strong nitric acid, after the action of which water will thoroughly cleanse them. Long sticks armed with sponge, or dry linen or cotton cloth, should be provided for wiping dry the interior of flasks and bottles.* A wire, bent at the end into a sort of hook, will be found useful for getting corks out of bottles. Wire instruments with three prongs are made specially for this purpose. In the absence of these, a loop of twine will often be found convenient for effecting the same object. When the glass stopper of a bottle is fast, it may often be loosened by gently tapping its sides alternately with the handle of a spatula. Sometimes a drop or two of oil, alcohol, chloroform, or water, will soften the cementing substance. It will sometimes answer to wrap the stopper in a cloth, insert it in a crevice or hole, in a table or door, and twist the bottle gently and dextrously. Sometimes the stopper may be loosened by quickly expanding the neck in the flame of a lamp, and tapping the stopper before the heat has reached it. The bottle should be constantly turned in the hand during the heating process, to avoid unequal expansion and fracture. In the absence of a flame, a piece of twine, turned twice around the neck and drawn back and forward rapidly, will soon heat it sufficiently in most instances. When the stopper of a bottle containing caustic alkali adheres, in consequence of the neck not having been wiped thoroughly dry, it is almost impossible to loosen it, and the neck must be cut off. The adhesion in such cases may be prevented by dipping the stopper before insertion in melted paraffin, on which the alkalies have no action. It is said that organic substances, which are altered by exposure to light in ordinary glass bottles, undergo no change when contained in orange-coloured bottles.

The apothecary should be provided with spatulas of wood, whalebone, and horn, as well as of steel. It should be an invariable rule to clean every knife and graduated measure immediately after it is used, and to put the dirty mortars apart from the clean. Too much particularity and order in all the minute details of the shop cannot be practised. The counters should be cleaned every day, and wiped as often as they become dusty. The scales should be thoroughly cleaned every week, and wiped always after using them for dusty substances; and the prescription *balance* should be kept carefully enclosed in a glass case, and the dishes wiped after each time of using. The beam should occasionally be wiped with a soft cotton or silk cloth. The mortar stand should pass through the floor and cellar into the ground, so as not to jar the counter during the contusion of substances, and thus injure the balance. Bottles should be replaced as soon after being taken down and used as possible, and should on no account be changed from their accustomed place on the shelf. For the preservation of leaves, flowers, aromatic powders, calomel, and other medicines to which light is injurious, the bottles should be coated with tin-foil, or with black or orange-coloured varnish.

No apothecary should be unprovided with a set of *troy weights*, as without them he will find it difficult to comply with the officinal directions for the preparation of his medicines; and the drawer in which his smaller weights are kept should be clean

* The odour of volatile oils, and other strong-smelling substances, such as musk, may be removed from bottles, mortars, &c., by means of the pulp of bitter almonds or peach kernels, bruised peach leaves, or other substances containing hydrocyanic acid. But fatty matters should first be removed by an alkaline solution, and resins by alcohol. (*Journ. de Chim. Méd.*, 1845, p. 535.) It is asserted that the powder of black mustard has the same effect. (*Ibid.*, 2e sér., iii. 727.)

In a communication by Prof. Procter to the *Am. Journ. of Pharm.* (Nov. 1868, p. 510), the alternate use of *benzine* and solution of one of the alkaline carbonates with lime, is strongly recommended for the cleansing of cod-liver oil bottles, which are often returned to the shop with the oil, thickened by exposure, adhering both to their inner and outer surfaces. The benzine is first used, and then the alkaline solution with lime; the operation can be repeated if needful; and the whole process is completed by a thorough rinsing with water. For more precise particulars the reader is referred to the journal. (*Note to the thirteenth edition.*)

It is sometimes difficult to cleanse glass and porcelain to which organic matters have long adhered. These sometimes become so hard and dry as to resist solvents. C. Brunner recommends, in such instances, to moisten the surface to be cleansed with strong sulphuric acid, to sprinkle on the acid some powdered bichromate of potassium, and to let the vessel stand for some hours in a warm place. The organic matter is thus destroyed and may easily be washed away. (*Chem. Gaz.*, No. 410, p. 430.)

and free from dust, so that the weights may be accurate. In dispensing medicines, no vial or parcel should be suffered to leave the shop without its appropriate label; and this, in the case of prescriptions, should always be the physician's direction as to the manner of taking it, and not the name of the medicine, unless it be so directed by him. The prescription, or a copy of it, should be retained and numbered, and the same number marked on the parcel or bottle. Everything connected with the shop, and the dispensing and putting up of medicines and parcels, should be characterized by *neatness*, *accuracy*, *system*, and *competent knowledge*.*

The apprentice who desires to qualify himself for his business, should carefully study Turner's, Graham's, or Fownes's Elements of Chemistry, Mohr and Redwood's Practical Pharmacy, Parrish's Treatise on Pharmacy, and Morfit's Chemical and Pharmaceutical Manipulation, which may be termed the hand-books of his profession.

D. B. S.

General Officinal Directions.

As all the processes of the United States and British Pharmacopœias are either described or fully detailed in the following pages, it is proper that the prefatory explanations in these works should be introduced in this place, in order that the reader may be prepared to understand the precise signification of the terms employed.

Weights. The U. S. Pharmacopœia recognises the *troy* or *apothecaries'* pound, and its divisions of ounces, drachms, scruples, and grains, for the expression of weights, but actually employs, in its processes, only the grain and ounce. The following explanations are given on the subject of weights.

"In order to avoid the danger of mistakes from confounding the troy and avoirdupois pounds, the term, *pound*, is disused in the formulas of this work, and the desired weight is expressed in ounces, each containing four hundred and eighty grains. This ounce is always printed *troyounce*, to guard against the error of substituting for it the avoirdupois ounce, consisting of four hundred and thirty-seven and a half grains. The drachm and scruple are also disused, and replaced by their equivalents in grains. It is highly important that persons engaged in preparing medicines should be provided with troy weights. But those who are not so provided can make their avoirdupois weights available as substitutes for troy weights, by bearing in mind that 42·5 grains, added to the avoirdupois ounce, will make it equal to the troy ounce; and that 1240 grains, deducted from the avoirdupois pound, will reduce it to the troy pound." *U. S.*

As the common weights of the country are the avoirdupois weights, and every apothecary is in possession of the lower denominations of the apothecaries' weight, viz. grains, scruples, and drachms, there can be no difficulty in complying with the officinal directions. The British Council, in their recently published Pharmacopœia, have abandoned the troy weights formerly employed by the London and Edinburgh Colleges, and substituted the avoirdupois pound and ounce, the former of 7000 grains, the latter of 437·5 grains; conforming in this respect with the Dublin College, but adhering to the old grain, and rejecting all intermediate divisions. It is a subject for congratulation that the Dublin drachm and scruple, of 54·68 grains and 18·22 grains respectively, have been abandoned.

Both in the *United States* and *British Pharmacopœias*, with the exception, in the former, of the mineral acids, fixed oils, and chloroform, the quantity of fluids is generally indicated by the liquid measure, consisting of the gallon and its divisions of pints, fluidounces, fluidrachms, and minims. It is highly necessary that the apothecary should understand that this distinction is rigidly observed, in this work, in all the details which follow, and that, whenever the simple terms pound, ounce, and drachm are employed, they must be considered as belonging to the denomination of troy weight, unless when otherwise expressly intimated. This caution is the more necessary, as these terms are often confounded with the corresponding divisions of liquid measure, viz. the pint, fluidounce, and fluidrachm. (See Tables of Weights and Measures in the *Appendix*.)

* *Impermeable Paper.* An impermeable paper, which may be useful for wrapping certain substances in, may be made by plunging the sheet for an instant into an ammoniacal solution of copper, then passing it between cylinders and drying it. (*Am. Journ. of Pharm.*, xlvi. p. 582.)—*Note to the fourteenth edition.*

Measures. The U. S. Pharmacopœia adheres to the old wine gallon and its division of pints, fluidounces, fluidrachms, and minims; but actually employs, in its processes, no denomination of measure higher than the pint. In the British Pharmacopœia the Imperial gallon and its divisions, before used by all the British Colleges, have been retained. This discrepancy is very unfortunate, as no one denomination of the Imperial measure corresponds exactly with the same denomination of the wine measure; and the formulas, therefore, of the British Council, so far as measures are concerned, when they agree in terms with those of the United States Pharmacopœia, differ from them in reality; while in other cases, though differing in terms, they may be quite or very nearly identical. It is very important that the apothecary should bear this distinction in mind; and, when he has occasion to carry into effect one of the foreign formulas, that he should make the due allowances. He will find, among the Tables in the *Appendix* of this work, a statement of the relative value of the several denominations of the Imperial and wine measures, and, by consulting this statement, will be enabled to convert the former into the latter without difficulty. We have endeavoured to obviate, as far as possible, this source of inconvenience, if not of danger, by indicating in our accounts of the British processes the kind of weight or measure intended, whenever the discrepancy is such as to be a point of any importance. Though the Imperial fluidounce, fluidrachm, and minim differ somewhat from the wine measures of the same denomination, yet that difference is so small that we have not always deemed it necessary to make them objects of special notice. At the temperature of 60° F., the U. S. pint of distilled water weighs 7291·2 grains, and the fluidounce 455·7 grains; while the Imperial pint of distilled water, at the same temperature, weighs 7000 grains, and the fluidounce 437·5 grains. The measures kept in the shop should be graduated according to the divisions of the wine gallon; as this is recognised by our own officinal standard.

Temperature. When there is occasion to indicate the temperature, Fahrenheit's thermometer is employed in the *U. S.* and *Br. Pharmacopœias.* In the former, the term *gentle heat* indicates any temperature between 90° and 100°.

Specific Gravity. In both *Pharmacopœias*, when the specific gravity of a body is given, it is considered to be at the temperature of 60° of Fahrenheit.

Saturation. The *U. S. Pharmacopœia* states that "when an acid or alkali is directed to be saturated, the point of saturation is to be ascertained by means of litmus and turmeric, in the way usually followed by chemists." For this purpose litmus or turmeric paper is usually employed; the latter being rendered brown by the alkalies, the former being reddened by the acids, and having its blue colour restored by the alkalies. (See *Lacmus* and *Curcuma.*)

Containing Vessels. In the *U. S. Pharmacopœia* it is ordered that, in all cases in which bottles are directed to be well stopped, they must be closed with glass stoppers. In the late *London Pharmacopœia* it was directed that, when not otherwise ordered, glass, porcelain, or stoneware vessels should be used for preparing and preserving medicines, at the same time guarding especially against the employment of earthen vessels glazed with lead. The same College also directed that acid, alkaline, and metallic preparations, and salts of every kind, be kept in stopped glass bottles, which, for certain substances, should be of black or green glass.

Percolation, or *Filtration by Displacement.* In relation to this process, the following directions are given in the *U. S. Pharmacopœia.*

"The kind of filtration, known as *percolation* or the *process of displacement*, directed in this Pharmacopœia, consists in subjecting a substance or substances, in powder, contained in a vessel called a *percolator*, to the solvent action of successive portions of a menstruum, in such a manner that the liquid, as it traverses the powder in its descent to the recipient, shall become charged with the soluble portion of it, and pass from the percolator free from insoluble matter.

"When the process is successfully conducted, the first portion of the filtered liquid, or *percolate*, will be nearly saturated with the soluble constituents of the substance treated; and, if the quantity of menstruum be sufficient for its exhaustion, the last portion will be nearly destitute of colour, odour, and taste.

"The percolator should be either conical, or nearly cylindrical with a conical ter-

mination at the smaller end, and provided internally with a porous or colander-like partition or diaphragm, resting transversely immediately above its neck, for the support of the powder. Ordinary glass funnels, varying in capacity from one to eight pints, are to be preferred for most of the operations requiring percolation in this Pharmacopœia; but percolators may also be made of earthenware or tinned iron, especially of the latter material when required of large size. Tinned iron, however, should not be used when the liquid acts chemically on the material. In the several formulas in which percolators are used, their form and material will always be designated when there is a preference in these respects. In cases in which these variations of the instrument are indifferent, the term percolator simply will be employed. When a funnel is used, a circular piece of muslin or of lint, pressed into the neck by means of a cork with notched sides, forms a good diaphragm; but in all cases a similar piece of muslin, moistened slightly with the menstruum, should be interposed between the diaphragm and the powder, to prevent the passage of the fine particles of the latter.

"The substance to be subjected to percolation, after having been reduced by sifting to a uniform powder, of the fineness indicated in the formula, is to be put into a basin with from one-fourth to one-half of its weight of the menstruum, and the two rubbed together until the powder is uniformly moistened.

"A portion of the powder is now to be carefully placed upon the diaphragm, prepared as above directed, and pressed gently until the muslin, resting against the sides of the percolator just above the neck, is covered with a uniform layer. The remainder of the powder is then to be transferred to the percolator, and compressed evenly and firmly, and the level surface covered with a circular piece of moistened muslin, so that the liquid poured upon it may penetrate equably, and not disarrange the powder.

"The percolator being now properly supported, with its neck in a bottle previously marked for the quantity or quantities of liquid to be percolated, the menstruum is to be poured on the muslin until the space above is nearly filled; and a layer of it must be constantly maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or until the requisite quantity of percolate has been obtained.

"If the fineness of the powder and its arrangement in the percolator have been properly attended to, the percolate will pass out, by drops, with greater or less rapidity, according to the size of the percolator; but, if, by reason of accidental imperfection in the powder, or in the packing, the liquid pass more rapidly than this, the neck of the percolator should be obstructed by means of a cork until the requisite slowness has been attained.

"When the dregs of a tincture are to be subjected to percolation, after maceration with all the menstruum, the liquid portion should be drained off, the solid portion packed in a percolator as before described, and the liquid gradually poured on until all has passed the surface, when, immediately, sufficient of the original menstruum should be poured on to displace the absorbed liquid, until the prescribed quantity of the tincture has been obtained.

"*Fineness of Powders.* As different degrees of fineness are necessary in powders, according to their nature and mode of treatment, the special degree required is designated in the several formulas. For this purpose the terms very fine, fine, moderately fine, moderately coarse, and coarse are used;—the powder passed through a sieve of eighty or more meshes to the linear inch being designated as *very fine;* through one of sixty meshes, *fine;* through one of fifty meshes, *moderately fine;* through one of forty meshes, *moderately coarse;* and through one of twenty meshes, *coarse.*" *U. S.*

The principles of the process of percolation and the apparatus in which it is performed have already been presented in sufficient detail. (See *page* 971.) The advantages of the process are, that the active soluble principles of medicinal substances are in general extracted by it more speedily, thoroughly, and economically than by any other mode; that concentrated solutions of these principles are more easily obtained; and that no portion of the impregnated menstruum need be lost by remaining in the

solid mass. It is, however, liable to the objection, that considerable experience and skill are necessary to carry it properly into effect, and that, if improperly performed, it must often result in preparations very different from those contemplated in the formulas. It should not, therefore, be resorted to in the fulfilment of officinal directions, when any alternative is given, unless by individuals who have acquired the requisite skill by practice.

The sources of failure in this process are chiefly an improper degree of comminution in the substance to be acted upon, and an improper condition of the mass after it has been introduced into the instrument. If the material be in too fine a powder, it resists or obstructs the passage of the fluid; if too coarse, it allows the fluid to pass too rapidly, and at the same time opposes its cohesion to the solvent power of the menstruum. If merely bruised, especially if fibrous pieces of some length are intermixed, it causes the fluid to make irregular channels, and thus to act upon it partially. An improper packing of the material occasions similar inconveniences. If too compact it impedes, if too loose it injuriously facilitates the passage of the solvent, and if not uniform it produces an irregular flow, which necessarily vitiates the result. The liquid, finding an easier passage at one part than another, flows more rapidly in that direction, and thus makes channels by which it may in great measure or wholly escape, with little influence upon the mass. Besides, the uniform progression, by which each superadded portion displaces that immediately beneath it, is broken, the successive layers become intermingled, and thus one of the peculiar advantages of the process is lost. The following observations may be of some use in assisting the operator to avoid these consequences.

The solid material should always be in the state of a uniform powder, to which, when not required to be fine, it may be conveniently brought by grinding in a common coffee-mill. If its texture be very hard, firm, and not easily permeable by moisture, as in certain barks, woods, and ligneous roots, it should be finely powdered. If, on the contrary, the texture be loose and spongy, and especially if the material be disposed to swell up and form a viscid mass with water, so as to impede percolation, as in the case of gentian and squill, the powder should be coarser; though the substances which require this treatment when water is used, may not require it with another solvent, as alcohol or ether. The difficulty, however, arising from the swelling of the material is now almost entirely obviated by the employment of conical percolators, such as glass funnels, which by their shape allow the free expansion of the material upward, and thus prevent compression. Though funnels have been long in use as percolators, the principle of their favourable action was, we believe, first suggested by Prof. Procter. To secure uniformity in the powder, it should always be passed through a sieve before being used; and the proper degree of fineness is secured by having the number of openings in the linear inch of the sieve duly regulated. According to Prof. Grahame, formerly of Baltimore, the sieve should generally have 60 meshes to the linear inch, especially for tinctures; but for substances which must be used in coarse powder 40 meshes are preferable. In the U. S. Pharmacopœia, the degree of fineness varies from 20 to 80 meshes to the linear inch, and, with great propriety, the precise degree of fineness adapted to each substance is indicated, in the several preparations, by the use of the terms *very fine*, *fine*, *moderately fine*, *moderately coarse*, and *coarse*; these terms having their exact value determined by the preliminary directions above quoted.

It has generally been considered advisable, before introducing the material into the instrument, to mix it with a portion of the solvent, and allow it to stand for some time in another vessel. It thus becomes more penetrable and more easily acted on by the menstruum, admits of a more uniform packing, and, if liable to swell with water, undergoes this expansion where it cannot have the effect of checking percolation. Opinion, however, has considerably changed on this point. It is obvious that, when it is desirable to have the first portion of the percolate as concentrated as possible, it is necessary that the powder should be no further moistened than may be essential for proper packing in the instrument. When previously mixed with the powder, the portions of liquid which first pass will have only the strength acquired by the maceration; whereas, when added to the powder but slightly moistened in the percolator, each particle of the menstruum passes successively, along the whole line of its descent,

from particle to particle of the powder in all its strength, taking something from each as it descends until completely saturated; and it is also obvious that the higher the column, that is the greater the depth of the packed powder, the greater will be the chance of complete saturation. Besides, since the introduction of conical percolators into use, the disadvantages of compression from swelling have been so far obviated that the previous maceration is less needful on this account. Professor Grahame prefers that no more of the menstruum should be preliminarily employed than may be sufficient to dampen the powder, so as to enable it to be packed properly, and facilitate the passage of the liquid through the powder. The quantity must differ with the character of the powder, and is directed in each officinal preparation. As a general rule, it varies, as stated in the foregoing officinal directions, from one-fourth to one-half the weight of the powder. When concentrated solutions are not needed at first, as generally in the tinctures and infusions, the previous maceration with the menstruum cannot be of any material disservice. When employed, it may continue on the average about twelve hours; but a much shorter time will often answer. It has sometimes been recommended to perform this preliminary maceration in the displacement filter, its lower orifice being closed for a time. With some substances this may be done without disadvantage; but, in all those instances in which the material is liable to swell considerably with water, and thus to choke the passage, if a cylindrical percolator be used, the maceration should take place in another vessel.

The packing of the material in the instrument is that part of the process which most requires experience in the operator, and about which the least precise rules can be given. When mixed with a considerable portion of fluid, it will often subside of itself into the proper state; but generally it requires some pressure, and the degree of the latter must be in proportion to the looseness of texture in the material; reference, however, being always had to its disposition to swell with water. Certain substances in which this property is found, such as gentian and rhubarb, must not be pressed compactly when water is the solvent. As the percolation advances, and portions of the substance acted on are dissolved, the mass often becomes too loose, and requires to be again pressed down. Substances which are apt to form with the menstruum an adhesive and impermeable mass, such as the resins and gum-resins, may be advantageously mixed, in the state of coarse powder, with about half their weight of perfectly clean white sand, as suggested by the late Mr. Duhamel. (See *Am. Journ. of Pharm.*, x. 15.) The sand separates the particles of the mass, and allows the menstruum a readier access.

After the moistened material has been properly packed, the upper surface should be made quite level, and then covered with a circular disk of tin pierced with numerous minute holes, or, what is probably better, a circular piece of muslin as directed in the Pharmacopœia. If the disk be of filtering paper, as some have recommended, it should be kept in its place by pieces of glass rod. The solvent is thus made to enter into the mass equably, and prevented from forming partial passages by bearing upon one or a few points. The liquid is now to be introduced in successive portions, as stated in the officinal directions above given.

If the lower diaphragm of the percolator be duly covered with a close filtering material, the percolate will always be clear from the beginning. The best material for the purpose is, perhaps, a piece of fine patent lint. Prof. Procter informs us that he finds advantage in covering the tissue which may be placed on the diaphragm by a thin layer of sand. Should the filtrate, however, be from any cause turbid, it should be returned into the instrument, before the addition of any displacing menstruum; and the same thing should continue to be done, until the liquid comes away perfectly clear. If the percolation be too rapid, pressure may be made upon the upper diaphragm so as to render the mass more compact; or the instrument may be closed below for a time, as stated in the officinal directions. Hence the advantage of having a stop-cock near the lower end for regulating the discharge. In the absence of a stop-cock, a soft cork may be used, with a small groove cut lengthwise for a short distance from its smaller end. By withdrawing the cork until the groove appears, a passage for the fluid can be opened at will. But if due attention be paid to the fineness of the powder and the proper packing of it, there will seldom be any oc-

casion for this caution. Dr. Squibb states that the liquid should escape at the rate of about one drop every two seconds, or about three fluidounces in an hour. (*Am. Journ. of Pharm.*, March, 1858, p. 98.) When the percolation is too slow, it may be increased by the pressure of a column of liquid, and this plan may sometimes be advantageously resorted to when the powder is very fine, or large masses of material are operated upon. (See *page* 972.) When the object is to keep up a constant supply of the percolating fluid, it may be accomplished by filling a long-necked bottle or matrass with the fluid, and inverting it over the filtering instrument, with its mouth beneath the surface of the liquid in the latter.

Hot liquids may be used in the process as well as cold, and are sometimes preferable when the substance yields its active principles more largely at an elevated temperature. But there is often an inconvenience in employing hot water; as it dissolves or renders glutinous substances not affected by cold water, which are not requisite and may even be injurious in the preparation, and which tend to embarrass the process by filling up the interstices of the mass, and thus rendering it less permeable. An instrument has been invented by Mr. C. A. Smith, of Cincinnati, by which the menstruum is made to enter the contents of the percolator in the state of hot vapour, and, being condensed by means of a refrigerating vessel surrounding the percolator, passes out in the liquid form, highly impregnated with the soluble principles of the material operated on. (See *Am. Journ. of Pharm.*, xviii. 98.)

The first portion of filtered liquid is very strongly impregnated, and the portions which subsequently come away are successively less so. It is sometimes desirable to obtain the whole of the particular solvent employed. This end may be very nearly attained by adding, at the close of the process, enough of another liquid to supply the place of that retained in the mass. It was Boullay's idea, that the whole of the liquid contained in the moist material might be thus driven out of it or displaced by the one added, without any admixture of the two. This, however, has been ascertained not to be exactly true; and, however carefully the process may be conducted, some mixture will take place. Hence, it is recommended, when one liquid is added in order to displace another, to introduce first a shallow layer of the same liquid with that contained in the mass. In some instances, the solvent, if consisting of two liquids, is resolved into these in the process. Thus, when myrrh is subjected to percolation with proof spirit, the first liquid which comes away is alcohol holding the oil and resin of the myrrh in solution.

There are very few substances to which the mode of filtration by displacement will not be found applicable, if due attention be paid to the circumstances which require variations in the process.*

Pharmacopœias.

As the Pharmacopœias of the United States and Great Britain constitute the basis of the present work, there would seem to be an obvious propriety in devoting, in the present place, a few words to the explanation of their general character. Pharmacopœias are authoritative codes for the regulation of the Materia Medica and Pharmacy within the limits where their authority is admitted. Every fully civilized nation has one or more recognised Pharmacopœias. In most countries they are prepared under

* Much is due for the improvements which have added to the efficiency of percolation, as practised in the United States, to Prof. Grahame, late of Baltimore, Prof. Procter of Philadelphia, and Dr. Squibb of New York, whose several papers on the subject are published in the *Proceedings of the Am. Pharm. Assoc.* (A. D. 1858, p. 255), and in the *Am. Journ. of Pharm.* (March, 1858, p. 97, and July, 1859, p. 317.)—*Note to the twelfth edition.*

Repercolation. This name has been given by Dr. Edward R. Squibb to a modification of the process of percolation, especially adapted to economy in the use of alcohol and other high-priced fluids used as menstrua, which theory and experience unite in determining to be very important for the object aimed at. It consists essentially in the use of the same portion of percolating fluid with different portions successively of the substance percolated, so that the percolate becomes intensely concentrated, and not only is much of the menstruum saved, but much less evaporation is necessary in obtaining the extracted matter. There may be some waste in the medicine submitted to this process, as it is scarcely possible that it should be so thoroughly exhausted as it is in the ordinary process; but the loss in this direction is trifling when compared with the gain in that of a very costly menstruum. The subject will be more fully treated of under the head of *Extracts*, to the preparation of which repercolation is especially applicable. (*Note to the thirteenth edition.*)

the authority more or less direct of the government, and have the sanction of law. In the United States the Pharmacopœia is the result of the voluntary action of the Professions of Medicine and Pharmacy, and has no other sanction than that of opinion. Nevertheless, within the limits of the two Professions referred to, it is probably quite as authoritative as though established by legal enactment. Works of this kind are necessarily compendious, as it is only by adhering to what is generally admitted to be essential, that they can expect to secure general acceptance. To give them full effect, explanations, comment, and various illustrations are necessary; and it is for this purpose that works called Dispensatories are written. Until recently there were three Pharmacopœias in the British Dominions, under the sanction respectively of the three Colleges of London, Edinburgh, and Dublin. This created much confusion in Great Britain, which in some degree extended also to the United States, where these works were at one time our only Pharmaceutical codes, and, in consequence of the general use of British works on medicine, continued to exert a considerable influence. By a very wise determination of the medical profession in Great Britain and Ireland, operating through the general Parliament, the three Pharmacopœias have been succeeded by a single one for the Empire, prepared under the direction of the Medical Council, which is at present the legal representative of the whole profession. It is this work, styled the British Pharmacopœia, that we comment upon in the present edition of the Dispensatory; the three former London, Edinburgh, and Dublin Pharmacopœias having been superseded by it. The first British Pharmacopœia was published in 1864, but in various points proved so unsatisfactory to the medical and pharmaceutical professions that a revision was imperatively called for; and in 1867 a new and much altered edition was published, which, with subsequent additions, is now the recognised standard.

The U. S. Pharmacopœia consists essentially of two parts, one called the Materia Medica, giving a list of the recognised medicines, with definitions sufficient to establish their identity and purity, and the other entitled Preparations or Preparations and Compounds, giving processes for the preparation of such medicines as may be supposed to be made by the apothecary. This was also the plan of all the old British Pharmacopœias, including the first edition of the work especially so designated, though with some modifications peculiar to itself; but the arrangement has been abandoned in the present British Pharmacopœia, which has, unwisely, we think, adopted a mere alphabetical succession of objects, like a dictionary or encyclopædia, placing in immediate contiguity medicines and preparations, without any other relation than the alphabetical succession of the initial letters of their names. This is a return to the practice of the earlier pharmacy, which experience taught to be inconvenient as well as unscientific, and in the adoption of which the present British Pharmacopœia stands almost if not entirely alone. Another change in the British Pharmacopœia is in the character of the nomenclature, which, in the first edition, was neat and simple, following for the most part that of the old London Pharmacopœia, and corresponding to a considerable extent with our own, which was framed with great care, and upon sound principles. Instead of giving medicines the simplest names, as Anthemis, Arnica, Buchu, Calumba, Cinchona, Senega, Serpentaria, &c., it has been thought advisable in very many instances to include in the title the part used, as Anthemidis Flores, Calumbæ Radix, Cinchonæ Cortex, thus returning to the old cumbrous nomenclature, out of which medicine and pharmacy have been gradually working their way, after a long struggle, into the present beautiful and convenient simplicity. Another point in which the U. S. Pharmacopœia has the advantage is the existence of a Secondary Catalogue, which may receive doubtful medicines, upon the value of which all cannot agree, and in which may be placed new medicines yet on trial but not generally adopted, and others going out of use, but still not without advocates in the profession. The British Materia Medica is somewhat more elaborate than ours in its descriptions, which is a doubtful merit, as the work is thus liable to come into unnecessary conflict with opinion, and thus to provoke contradiction. Besides the medicines and preparations, the British Pharmacopœia has an Appendix, containing a list of substances, with the modes of preparing them when necessary, used in testing the medicines employed; and, moreover, two other supplementary lists, one

of substances used as ordinary tests in determining the character and purity of medicines, and the other of certain preparations employed in volumetric analysis, which we are disposed to consider as useful features of the work, and which will be given at the close of *Part* II. of the Dispensatory, so far as the individual articles may not be noticed elsewhere in the book. In 1874 the general Council added to the British officinal list a number of substances, in a separate brochure, entitled Additions to the British Pharmacopœia.

ACETA.

Vinegars.

Under this title, in the United States Pharmacopœia, are included both Distilled Vinegar, and those preparations usually denominated *Medicated Vinegars*. The latter are infusions or solutions of various medicinal substances in vinegar or acetic acid. The advantage of vinegar as a menstruum is that, in consequence of the acetic acid which it contains, it will dissolve substances not readily soluble, or altogether insoluble, in water alone. It is an excellent solvent of the organic alkalies, which it converts into acetates, thereby modifying, in some measure, though not injuriously, the action of the medicines of which they are ingredients. As ordinary vinegar contains principles which promote its decomposition, it should be purified by distillation before being used as a solvent. Infusions prepared with it, even in this state, are apt to spoil in a short time; and a portion of alcohol is usually added to contribute to their preservation. A small quantity of acetic ether is said to result from this addition; and on the continent of Europe, the place of the alcohol is frequently supplied by an equal amount of concentrated acetic acid. At present diluted acetic acid is generally preferred as the menstruum to distilled vinegar, as being of more uniform strength. In consequence of their liability to change, the medicated vinegars should be made in small quantities, and kept but for a short time. W.

ACETUM DESTILLATUM. *U. S. Distilled Vinegar.*

"Take of Vinegar *eight pints*. Distil, by means of a sand-bath, from a glass retort into a glass receiver, seven pints. Distilled Vinegar may be substituted for Diluted Acetic Acid in the preparation of the officinal vinegars." *U. S.*

Distilled vinegar, though formerly among the London and Edinburgh officinals, has been omitted in the Br. Pharmacopœia.

Vinegar is a very heterogeneous liquid, containing colouring matter, gum, sugar, alcohol, &c.; and the object of the distillation is to purify it. (See *Acetum*.) The first portion that distils contains alcohol, aldehyd, and pyroacetic spirit (acetone), these being the most volatile ingredients; next the acetic acid comes over much purified, but weaker than it exists in the vinegar, on account of its being less volatile than water; and, if the distillation be stopped when the pure vinegar ceases to come over, there will be found in the retort a liquid of a deep-brown colour, very sour and empyreumatic, and containing free tartaric and malic acids, bitartrate of potassium, and other substances. This statement explains why the last portion (one-eighth) is not distilled; the seven-eighths which first come over being alone preserved. The residuary liquid in the retort, if diluted with an equal bulk of hot water, may be made to yield, by a fresh distillation, a quantity of weak acetic acid equal to the residuary liquid, and of about the strength and purity of officinal distilled vinegar.

Wine vinegar furnishes a stronger and more aromatic distilled vinegar than malt or cider vinegar. The U. S. Pharmacopœia does not give the density, on account of its being an uncertain criterion of strength. The saturating power is the proper test of the acid present. This, according to the Pharmacopœia, is such that 100 grains of the Distilled Vinegar saturate not less than 7·6 grains of bicarbonate of potassium, so that it must have at least the strength of the officinal Diluted Acetic Acid. The saturating power, thus given, indicates 5 per cent. as the proportion of monohydrated acetic acid contained in it. Considering the ordinary pharmaceutical uses of distilled vinegar, variations in its strength, limited as they are by the qualities of different vinegars, are of no great consequence. Its purity is the point of importance. If, however, precision be attempted, the saturating power and not the density must be

indicated; and directions should be given for bringing a distilled vinegar, which varies from the standard of saturating power, to that standard by the addition either of pure acetic acid or of distilled water. The reason why density cannot be depended upon, is that the specific gravity is not in proportion to the strength. If the vinegar contain a good deal of alcohol and pyroacetic spirit, the distilled product will be light, but not necessarily weak. This remark applies particularly to distilled wine vinegar.

The U.S. Pharmacopœia directs the distillation of vinegar to be conducted in glass vessels; but it is generally distilled in a copper alembic furnished with a pewter worm. The use of these metals, however, endangers metallic impregnation. Mr. Brande has suggested that the condenser might be made of very thin silver, a metal not acted on by acetic acid of any strength. If this cannot be procured, the head and worm should be of glass or earthenware. Empyreuma is effectually prevented by distilling by means of steam.

Properties. Distilled vinegar is a limpid, colourless liquid, of a weak acetous taste and smell, less agreeable than those of common vinegar. It is wholly volatilized by heat. It is not a perfectly pure solution of acetic acid in water; but contains a small portion of aldehyd, and also of acetic ether, which rise in the distillation. It is on account of the partial decomposition of the aldehyd that distilled vinegar, when saturated with an alkali, is liable to become of a reddish or brownish colour. The Pharmacopœia, however, directs that it should not change colour upon the addition of ammonia. When distilled in metallic vessels, it is apt to contain traces of copper, lead, and tin. Copper is detected, after saturating with ammonia, by the addition of ferrocyanide of potassium, which produces a brown cloud; lead by iodide of potassium, which occasions a yellow precipitate; and tin by a solution of terchloride of gold, which causes a purplish appearance. The last two metals are discovered also by sulphuretted hydrogen, which occasions a dark-coloured precipitate. The non-action of this gas proves the absence of metals generally. Distilled vinegar should not have an empyreumatic taste or a sulphurous smell. As usually prepared, however, it is somewhat empyreumatic. British malt vinegar is allowed by law to contain one-thousandth of sulphuric acid; but, when it is distilled, this acid does not come over. If, however, sulphuric acid should be accidentally present in distilled vinegar, it may be detected by chloride of barium or acetate of lead. If muriatic acid be present, it may be shown by a precipitate being formed with nitrate of silver; and if nitric acid be an impurity, the vinegar will possess the property, by digestion, of dissolving silver, which may be detected afterwards by muriatic acid.

According to M. Strohl, the freshly precipitated oxalate of calcium affords a means of detecting mineral acids in vinegar. He dissolves one-fifth of an equivalent of oxalate of ammonium and the same amount of chloride of calcium in a litre of water, and adds a half cubic centimetre of each solution to 50 cubic centimetres of the suspected vinegar. If no distinct precipitate appear the vinegar contains a mineral acid. (*Journ. de Pharm.*, Sept. 1874.)

Medical Properties and Uses. The medical properties of distilled vinegar are the same as those of common vinegar (see *Acetum*); but the former, being purer, and not liable to spontaneous decomposition, is preferable for pharmaceutical purposes. Still, distilled vinegar is less pure than the officinal diluted acetic acid, which has been substituted for it in the preparations.

Off. Prep. Tinctura Opii Acetata. *U.S.* B.

ACETUM CANTHARIDIS. *Br. Vinegar of Cantharides.*

"Take of Cantharides, in powder, *two ounces* [Avoirdupois]; Glacial Acetic Acid *two fluidounces* [Imperial measure]; Acetic Acid *eighteen fluidounces* [Imp. meas.], or *a sufficiency.* Mix thirteen fluidounces of the Acetic Acid with the Glacial Acetic Acid, and digest the Cantharides in this mixture for two hours at a temperature of 200°; then transfer the ingredients, after they have cooled, to a percolator, and, when the liquid ceases to pass, pour five fluidounces of Acetic Acid over the residuum in the apparatus. As soon as the percolation is complete, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient Acid to make one pint [Imp. meas.]." *Br.*

This preparation was formerly officinal in all the Pharmacopœias of the British Islands;

being recognised under its present title by the Edinburgh and Dublin Colleges, and under that of Acetum Cantharidis (Epispasticum) by the London; but it was omitted in the first British Pharmacopœia, to be resumed in the present. The mode of preparation differs mainly in the partial substitution of percolation for maceration and expression. The addition of the glacial to the officinal acetic acid is simply to increase the strength of the latter. The preparation is a little stronger than that of the late London Pharmacopœia, but weaker than the Edinburgh and Dublin.

This preparation is intended exclusively for external use, as a speedy epispastic. It is said, when lightly applied by a brush, to act as a rubefacient; and, when rubbed freely upon the skin for three minutes, to be followed, in two or three hours, by full vesication. The pain produced by the application, though more severe, is also more transient than that occasioned by the blistering cerate. From experiments made by Mr. Redwood, it may be inferred that the old Acetum Cantharidis of the London Pharmacopœia, which was prepared by maceration without heat, proved epispastic chiefly if not exclusively in consequence of its acetic acid, and that it contained little of the active principle of the flies. (*Lond. Pharm. Journ. and Trans.*, Oct. 1841.) Prof. Procter found that, by digestion at a temperature of 212° F., the active principle of the flies is readily taken up by officinal acetic acid, though a portion of the cantharidin is deposited upon cooling. (*Am. Journ. of Pharm.*, xxiv. 299.) It would seem, therefore, that the vinegar of Spanish flies would be best prepared with the aid of heat; and, to a certain extent, this advantage is enjoyed in the present process.* W.

ACETUM LOBELIÆ. *U. S. Vinegar of Lobelia.*

"Take of Lobelia, in moderately coarse powder, *four troyounces;* Diluted Acetic Acid *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Acetic Acid, pack it firmly in a conical glass percolator, and gradually pour upon it Diluted Acetic Acid until the filtered liquid measures two pints.

"Vinegar of Lobelia may also be prepared by macerating the powder in two pints of Diluted Acetic Acid for seven days, expressing the liquid, and filtering through paper." *U. S.*

This is a good preparation of lobelia, and might well be formed into a syrup, by the addition of sugar, as in the syrup of squill. It has the advantage that acetic acid gives stability to the alkaloid, which is very liable to decomposition, especially under the influence of heat. It may be used for all the purposes for which lobelia is given, either in substance or tincture; but is best adapted to cases in which the medicine is exhibited in small doses frequently repeated, with a view to its antispasmodic and expectorant action, as in asthma, spasmodic catarrh, and catarrhal croup, in which it may often be advantageously conjoined with the syrups of seneka and squill. For these purposes the dose for an adult is from thirty minims to a fluidrachm, repeated three or four times a day, or more frequently if required. In the paroxysm of spasmodic asthma one or two fluidrachms may be given every two or three hours till relief is obtained. The emetic dose would be half a fluidounce. W.

ACETUM OPII. *U. S. Vinegar of Opium. Black Drop.*

"Take of Opium, dried, and in moderately coarse powder, *five troyounces;* Nutmeg,

* The *vinegar of colchicum* (*acetum colchici*) was omitted in the last revision of the U. S. Pharmacopœia, although a very active preparation. The following is the article on it in the last edition of the U. S. Dispensatory. "Take of Colchicum Root, in fine powder, *two troyounces;* Diluted Acetic Acid *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Acetic Acid, allow it to stand for half an hour, pack it firmly in a conical glass percolator, and gradually pour upon it Diluted Acetic Acid until the filtered liquid measures two pints. Vinegar of Colchicum may also be prepared by macerating the Colchicum Root, in moderately fine powder, with two pints of Diluted Acetic Acid, in a close glass vessel, for seven days; then expressing the liquid, and filtering through paper." The dose is from 30 drops to half a fluidrachm.

Vinegar is an excellent solvent of the active principle of colchicum; and the organic alkali of the latter loses none of its efficacy by combination with the acetic acid of the former. Of the two formulas above given, the first, directing percolation, is much preferable to the second, permitting maceration, if performed by competent hands; and the same remark will apply to all the medicated vinegars in which an alternative formula is given.

Medical Uses. This preparation has been extolled as a diuretic in dropsy, and may be given in gout, rheumatism, and neuralgia; but the wines of colchicum are usually preferred. It is recommended by Scudamore to be given in connection with magnesia, so as to neutralize the acetic acid of the menstruum. The dose is from thirty drops to two fluidrachms. W.

in moderately coarse powder, *a troyounce;* Saffron, in moderately coarse powder, *one hundred and fifty grains;* Sugar *eight troyounces;* Diluted Acetic Acid *a sufficient quantity.* Macerate the Opium, Nutmeg, and Saffron with a pint of Diluted Acetic Acid for twenty-four hours. Put the mixture into a conical glass percolator, and return the liquid which first passes until the filtrate becomes clear. Then gradually pour on Diluted Acetic Acid until the filtered liquid measures twenty-six fluidounces. In this dissolve the Sugar, and, having strained the solution, add sufficient Diluted Acetic Acid to make the whole measure two pints." *U. S.*

The vinegar of opium was introduced into the Pharmacopœias as an imitation of or substitute for a preparation, which has been long in use under the name of *Lancaster* or *Quaker's black drop*, or simply *black drop*. The formula of the first edition of the U. S. Pharmacopœia was so deficient in precision, and so uncertain in its results, that it was abandoned in the second edition; but, as these objections were obviated in a process by Mr. Charles Ellis, published in the *American Journal of Pharmacy* (vol. ii. page 202), and as the preparation continued to enjoy a considerable degree of professional and popular favour, it was deemed proper to restore it to its officinal rank at the subsequent revision of the Pharmacopœia. The U. S. formula above given is essentially that of Mr. Ellis, but with improvements which obviate the necessity of evaporation. The preparation has, we think unfortunately, been omitted in the British Pharmacopœia with most of the other vinegars. The advantages of the black drop over laudanum are, probably, that disturbing principles contained in opium and soluble in alcohol are left behind by the aqueous menstruum employed; while the meconate of morphia is converted by the acetic acid into the acetate. In the original process, published by Dr. Armstrong, who found it among the papers of a relative of the proprietor in England, *verjuice*, or the juice of the wild crab, was employed instead of vinegar. Other vegetable acids also favourably modify the narcotic operation of opium; and lemon-juice has been employed in a similar manner with vinegar or verjuice, and perhaps not less advantageously.*

The vinegar of opium may sometimes be advantageously used when opium itself, or the tincture, in consequence of peculiarity in the disease or in the constitution of the patient, occasions so much headache, nausea, or nervous disorder, as to render its employment inconvenient if not impossible. It exhibits all the anodyne and soporific properties of the narcotic, with less tendency to produce these disagreeable effects, at least in many instances. The U. S. preparation is of double the strength of laudanum, six and a half minims containing the soluble parts of about one grain of opium, supposing the drug to be completely exhausted by the menstruum. The dose may be stated at from seven to ten drops or minims. W.

ACETUM SANGUINARIÆ. *U. S. Vinegar of Bloodroot.*

"Take of Bloodroot, in moderately coarse powder, *four troyounces;* Diluted Acetic Acid *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Acetic Acid, pack it firmly in a conical glass percolator, and gradually pour upon it Diluted Acetic Acid until the filtered liquid measures two pints.

"Vinegar of Bloodroot may also be prepared by macerating the powder in two pints of Diluted Acetic Acid for seven days, expressing the liquid, and filtering through paper." *U. S.*

This was one of the new officinals of the U. S. Pharmacopœia of 1860. It is no doubt an efficient preparation, and may be used for the same purpose as the powdered root. When first prepared, it has a deep-red colour, which is diminished by time; but through what chemical agency is unknown; as, according to the late Prof. Procter, the change is independent of the acetate of sanguinarina, which is formed in the process.

* The following is the formula given in the first edition of the U. S. Pharmacopœia. "Take of Opium *half a pound;* Vinegar *three pints;* Nutmeg, bruised, *one ounce and a half;* Saffron *half an ounce.* Boil them to a proper consistence; then add Sugar *four ounces;* Yeast *one fluidounce.* Digest for seven weeks, then place in the open air until it becomes a syrup; lastly, decant, filter, and bottle it up, adding a little sugar to each bottle." The boiling to a *proper consistence*, the digestion in the open air *until a syrup is formed*, and the addition of a *little sugar* to each bottle, are all indefinite directions which must have led to uncertain results. Independently of this want of precision, the point in which the old process chiefly differs from that at present officinal is, that, in the former, fermentation is induced by the addition of yeast. But fermentation is of very doubtful value in the process; at least its advantages have not been proved.

(*Am. Journ. of Pharm.*, May, 1864, p. 210.) A syrup may be formed from this vinegar by the addition of sugar, as in the syrup of squill. The dose of the vinegar of bloodroot as an emetic is three or four fluidrachms; as an alterative and expectorant, from fifteen to thirty drops or minims. It has been used as a local remedy in ringworm and other cutaneous diseases, and has been found by Dr. R. G. Jennings efficient as a gargle in the sorethroat of scarlet fever. W.

ACETUM SCILLÆ. *U. S.*, *Br.* *Vinegar of Squill.*

"Take of Squill, in moderately coarse powder, *four troyounces;* Diluted Acetic Acid *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Acetic Acid, and, after the mixture has ceased to swell, transfer it to a conical glass percolator, pack it carefully, and gradually pour upon it Diluted Acetic Acid until the filtered liquid measures two pints.

"Vinegar of Squill may also be prepared by macerating the Squill with two pints of Diluted Acetic Acid for seven days, expressing the liquid, and filtering through paper." *U.S.*

"Take of Squill, bruised, *two ounces and a half* [avoirdupois]; Diluted Acetic Acid *one pint* [Imperial measure]; Proof Spirit *one and a half fluidounce* [Imp. meas.]. Macerate the Squill in the Acetic Acid for seven days, then strain with expression, add the Spirit to the strained liquor, and filter." *Br.*

The process now officinal differs from that of the Pharmacopœia of 1860 in allowing the mixture to swell before being transferred. As pointed out by Prof. Procter (*Am. Journ. of Pharm.*, July, 1864, p. 298), the old process was rendered nugatory by the tendency of the squill to swell into an adhesive mass in the percolator.

This was formerly an officinal of the Lond., Ed., and Dub. Colleges, but was omitted as a distinct preparation in the first British Pharmacopœia, being retained simply as the first step in the preparation of the syrup. It has, however, been introduced into the present edition. As vinegar of squill is apt to be injured by keeping, it should be prepared frequently, and in small quantities, as wanted for use. The spirit added to it in the British formula was intended to contribute to its preservation; but, in the quantity used, it is doubtful whether it would have any such effect. The Vinegar is employed chiefly in the preparation of the syrup of squill. Upon standing, it deposits a precipitate, consisting, according to Vogel, of citrate of calcium and tannic acid.

Medical Uses. This preparation has all the properties of the squill in substance, and is occasionally prescribed as a diuretic and expectorant in various forms of dropsy and of pulmonary disease; but the syrup is usually preferred, as it keeps better, and is less unpleasant to the taste. The dose is from fifteen minims to a fluidrachm; but the latter quantity would be apt to nauseate. It should be given in cinnamon-water, mint-water, or other aromatic liquid calculated to conceal its taste and obviate nausea.*

Off. Prep. Oxymel Scillæ, *Br.;* Syrupus Scillæ. W.

* *Acidum Aceticum Camphoratum* (*Ed., Dub.*). *Camphorated Acetic Acid.* This is an old officinal of the Ed. and Dub. Pharmacopœias, which, though omitted in the British, deserves to be retained in a note, if only from its old reputation. It was prepared as follows.

"Take of Camphor *one ounce* [avoird.]; Rectified Spirit *one fluidrachm;* Strong Acetic Acid *ten fluidounces.* Reduce the camphor to powder by means of the Spirit; then add the Acid, and dissolve." *Dub.*

The use of the alcohol is simply to facilitate the pulverization of the camphor, and a few drops are sufficient. Acetic acid in its concentrated state readily dissolves camphor. In this preparation, the whole of the camphor is taken up by the acid. In consequence of the powerful chemical agency of the solution, and its extreme volatility, it should be kept in glass bottles accurately fitted with ground stoppers. Camphorated acetic acid is an exceedingly pungent perfume, which, when snuffed up the nostrils, produces a strongly excitant impression, and may be beneficially resorted to in cases of fainting or nervous debility. It was an officinal substitute for Henry's *aromatic spirit of vinegar.*

At Apothecaries' Hall, in London, an *aromatic vinegar* is prepared by dissolving the oils of cloves, lavender, rosemary, and calamus, in highly concentrated acetic acid. It is used for the same purpose as the officinal camphorated acetic acid, being dropped on sponge, and kept in smelling-bottles. A similar preparation may be made extemporaneously by adding to a drachm of acetate of potassium, contained in a stoppered bottle, three drops of one or more of the aromatic volatile oils, and twenty drops of sulphuric acid. (*Pereira.*)

A preparation called *Marseilles vinegar,* or *thieves' vinegar* (*vinaigre des quartres voleurs*), consisting essentially of vinegar impregnated with aromatic substances, was formerly esteemed a prophylactic against the plague and other contagious diseases. It is said to have derived its name and reputation from the circumstance, that four thieves, who, during the plague at Marseilles, had plundered the dead bodies with impunity, confessed, upon the condition of a pardon, that they

ACIDA.

Acids.

Acids are compounds which are capable of uniting in definite proportions with alkalies, earths, and ordinary metallic oxides, with the effect of producing a combination, in which the properties of its constituents are mutually destroyed. Such combinations are said to be neutral, and are denominated salts. Most acids have a sour taste, and possess the power of changing vegetable blues to red; and though these properties are by no means constant, yet they afford a convenient means of detecting acids, applicable in practice to most cases. The above explanation of the nature of an acid is that usually given; but, according to strict definition, acids are compounds having a strong electro-negative energy, and, therefore, possessing a powerful affinity for electro-positive compounds, such as alkalies, earths, and ordinary oxides. It is this antagonism in the electrical condition of these two great classes of chemical compounds that gives rise to their mutual affinity, which is so much the stronger as the contrast in this respect is greater. In the majority of cases, the electro-negative compound or acid is an oxidized body, but by no means necessarily so. When an acid does not contain oxygen, hydrogen is usually present. These peculiarities in composition have given rise to the division of acids by some writers into *oxacids* and *hydracids*. *Vegetable acids*, for the most part, contain both hydrogen and oxygen.

The number of acids used in medicine is small; but among these are to be found examples of the three kinds above mentioned. B.

ACIDUM ACETICUM DILUTUM. *U. S.*, *Br.* *Diluted Acetic Acid.*

"Take of Acetic Acid *a pint;* Distilled Water *seven pints.* Mix them." The sp. gr. of this acid is 1·006, and 100 grains of it saturate 7·6 grains of crystallized bicarbonate of potassium. *U. S.**

"Take of Acetic Acid *one pint* [Imperial measure]; Distilled Water *seven pints* [Imp. meas.]. Mix." *Br.* The sp. gr. of this acid is 1·006. 440 grains by weight (one fluidounce [Imp.]) requires for neutralization 313 grain-measures of the *volumetric solution of soda*, corresponding to 3·63 per cent. of anhydrous acetic acid. One fluidounce [Imp.], therefore, corresponds to 16 grains of anhydrous acid. *Br.*

The object of having this preparation is to possess a weak solution of *pure* acetic acid, which may be substituted for distilled vinegar in all formulas in which nicety is required. Distilled vinegar contains a little organic matter, which is always darkened or precipitated when its acid is saturated with an alkali, an occurrence which does not take place when the diluted acetic acid is employed. The saturating strength of the diluted acid of the U. S. Pharmacopœia indicates the same proportion of monohydrated acetic acid as is contained in the officinal distilled vinegar, namely, 5 per cent. The British diluted acid has the same sp. gr. as our own, viz. 1·006.

In making this preparation, whenever the apothecary is doubtful as to the strength of the acetic acid he employs, it will be his duty to ascertain its saturating power, and, if this should vary from the standard, to vary the dilution accordingly.

Diluted acetic acid has been employed with advantage in scarlatina by Dr. I. B. Brown, of London, who published a treatise on its use in 1846. Dr. B. F. Schneck,

owed their safety to the use of it. The *aromatic acetic acid* of the former Edinburgh Pharmacopœia was intended as a simplification of this nostrum. It was made by macerating for a week an ounce of rosemary, an ounce of sage, half an ounce of lavender, and half a drachm of cloves, with two pounds of distilled vinegar, then expressing the liquor and filtering. Origanum was afterwards substituted for sage, and thirty fluidounces of acetic acid for two pounds of distilled vinegar. In the last edition of the Pharmacopœia the preparation was abandoned. In the present state of knowledge, it is hardly necessary to observe that neither the original nostrum, nor its substitute, has any other power of protecting the system against disease than such as may depend on its slightly stimulant properties, and its influence over the imagination. W.

* Considerable discussion has recently taken place in regard to the amount of sulphuric acid to be added to acetate of sodium in preparing commercial acetic acid. F. Mohr recommends equal equivalents, 12 parts of acetate of sodium and 4 to 4½ parts of the acid, and has been confirmed in this by M. Büchner. (*Journ. de Pharm.*, Août, 1873.) M. Hirsch (*Ibid.*, Mai, 1875) has found that if the acid be diluted with an equal part of water before mixing, equal equivalents yield satisfactory result; but that when it is desired to get glacial acetic acid, it is best to use more than one equivalent of the concentrated sulphuric acid. (*Note to the fourteenth edition.*)

of Lebanon, Pa., has imitated this practice, and with good results. (*Am. Journ. of Med. Sci.*, July, 1857, p. 27.)

Off. Prep. Acetum Lobeliæ, *U. S.;* Acetum Opii, *U. S.;* Acetum Sanguinariæ, *U. S.;* Acetum Scillæ; Emplastrum Ammoniaci, *U. S.;* Liquor Ammonii Acetatis, *U. S.;* Liquor Morphiæ Acetatis, *Br.;* Syrupus Allii, *U. S.* B.

ACIDUM BENZOICUM. *U. S.*, *Br.* *Benzoic Acid.*

"Take of Benzoin, in coarse powder, *twelve troyounces.* Spread the Benzoin evenly over the bottom of an iron dish eight inches in diameter, cover the dish with a piece of filtering paper, and, by means of paste, attach it closely to the rim. Then, having prepared a conical receiver or cap of thick, well-sized paper, of rather larger diameter than the dish, invert it over the latter, so as to fit closely around the rim. Next apply heat by means of a sand-bath, or of the iron plate of a stove, until, without much empyreuma, vapours of Benzoic Acid cease to rise. Lastly, separate the receiver from time to time, and remove the Benzoic Acid from it and the paper diaphragm, as long as the Acid continues to be deposited." *U. S.*

The British Pharmacopœia has omitted its process for the preparation of benzoic acid, and defines it to be "a crystalline acid obtained from benzoin, and prepared by sublimation," with the formula $HO,C_{14}H_5O_3$ or $HC_7H_5O_2$.

The Pharmacopœias now unite in the preparation of benzoic acid by sublimation. Formerly the benzoin was mixed with an equal weight of sand; but this has been omitted, as not only useless, but probably injurious by favouring the production of empyreumatic substances. The acid, which exists in the benzoin combined with resin, is volatilized by the heat, and condensed in the upper part of the apparatus. Unless the temperature is very carefully regulated, a portion of the resin is decomposed, and an oily substance generated, which rises with the acid, and gives it a brown colour, from which it cannot be entirely freed by bibulous paper; and this result sometimes takes place even with the greatest caution. The process for subliming benzoic acid may be conducted in a glazed earthen vessel, surmounted by a cone of paper, or by another vessel with a small opening at the top, and a band of paper pasted round the place of junction. After the heat has been applied for an hour, the process should be suspended till the condensed acid is removed from the upper vessel or paper cone, when it may be renewed, and the acid again removed, and thus alternately till coloured vapours rise. Mohr, after many experiments, recommends the following plan as unobjectionable. In a round cast-iron vessel, eight or nine inches in diameter and two inches deep, a pound or less of coarsely powdered benzoin is placed, and uniformly strewed over the bottom. The top of the vessel is closed by a sheet of bibulous paper, which is secured to the sides by paste. A cylinder of thick paper in the form of a hat, just large enough to fit closely around the sides of the pot, is then placed over it, and in like manner secured by paste. A moderate heat is now applied by means of a sand-bath, and continued for three or four hours. The vapours pass through the bibulous paper, which absorbs the empyreumatic oil, and are condensed within the hat in brilliant white flowers, having an agreeable odour of benzoin. (*Annal. der Pharm.*, xxix. 178.) After a time the bibulous paper becomes so saturated with empyreumatic products as no longer to arrest them, and should then be replaced with a fresh piece. (*Maisch.*) The remaining acid of the benzoin may be extracted, if deemed advisable, by treating the residue of the balsam with lime or carbonate of sodium. The process of Mohr was adopted in the 1860 edition of the U. S. Pharmacopœia, and is probably preferable to any method heretofore proposed. From the mode of preparing benzoic acid by sublimation, it was formerly called *flowers of benzoin.*

Another mode of separating the acid from benzoin is by combining it with a salifiable base, and precipitating with an acid. Such is the process of Scheele. It consists in boiling the powdered benzoin with hydrate of lime and water, filtering the solution of benzoate of calcium thus obtained, and precipitating the benzoic acid with muriatic acid. Carbonate of sodium or of potassium may be substituted for the lime, and sulphuric for the muriatic acid; and the precipitated benzoic acid may be purified by dissolving it in boiling water, which will deposit it upon cooling. The acid, however, requires to be still further purified by repeated crystallization from small portions of

boiling water. A little animal charcoal may be employed to render the crystals quite colourless. These processes afford a purer product than that obtained by sublimation, but not preferable in a medicinal point of view; as the small quantity of oil present in the sublimed acid adds to its stimulant properties, and at the same time renders it pleasant to the smell. In order to get the benzoic acid in the form to which the eye is accustomed, it has been proposed to sublime the acid after its precipitation.

Several other modes of extracting the acid have been recommended. The following is the process of Stolze. One part of the balsam is dissolved in three parts of alcohol, the solution filtered and introduced into a retort, and the acid saturated by carbonate of sodium dissolved in a mixture of eight parts of water and three of alcohol. The alcohol is distilled off; and the benzoate of sodium contained in the residuary liquid is decomposed by sulphuric acid, which precipitates the benzoic acid. This is purified by solution in boiling water, which lets fall the acid when it cools. By this process Stolze obtained 18 per cent. of acid from benzoin containing 19·425 per cent. By the process of Scheele he obtained 13·5 per cent.; by the agency of carbonate of sodium, 12 per cent.; by sublimation only 7·6 per cent. Nevertheless, Mr. Brande says that the last process is on the whole the most economical. According to this author, good benzoin affords by sublimation from 10 to 15 per cent. of the acid contaminated with empyreumatic oil, and about 9 per cent. of the purified acid. Professor Scharling has prepared benzoic acid by means of heated steam, and obtained 8 per cent. (*Am. Journ. of Pharm.*, xxiv. 236.)

The acid is said to be obtained very cheaply from *naphthalin* by a new process. We have seen no precise account of the method employed, but are informed that it is very extensively carried out by M. Castheluz in Paris. The *naphthalin* ($C_{20}H_8$) is first transformed into a bichloride (quadrichloride $C_{20}H_82Cl_2$), and this by oxidation into *phtalic* acid ($C_{16}H_4O_62HO$), which is combined with ammonia to form the phtalate ($C_{16}H_4O_62NH_3$). This by distillation furnishes *phtalamid* ($C_{16}H_5NO_4$), which by distillation with three parts of hydrate of lime yields *benzonitril* ($C_{14}H_5N$); and the latter, boiled with a solution of caustic soda, becomes benzoate of sodium, from which benzoic acid is precipitated by muriatic acid. (*Chem. News*, Dec. 13, 1867, p. 296.) According to Wm. A. Tilden (*Pharm. Journ. and Trans.*, July, 1870), the naphthalin is oxidized by nitric acid into oxalic and phtalic acid ($C_{10}H_8+4O = H_2C_2O_4+H_2C_8H_4O_4$), then converted into a phtalate of calcium and strongly heated with hydrate of lime, whereby the phtalate is converted into carbonate and benzoate of calcium.

A considerable quantity of benzoic acid has, within a few years, been imported into the United States from Europe, said to have been prepared from the urine of cattle and horses, by boiling the hippurate of calcium obtained with hydrochloric acid. It is white, has a fine lustre, and is said to be very pure, but sometimes has a slight urinous odour indicative of its origin. (*Am. Journ. of Pharm.*, xxvii. 23; *Pharm. Journ.*, July, 1875.)

Properties. Sublimed benzoic acid is in white, soft, feathery crystals, of a silky lustre, and not pulverulent. From solution the acid crystallizes in transparent prisms. When quite pure it is inodorous; but, prepared by sublimation from the balsam, it has a peculiar, agreeable, aromatic odour, dependent on the presence of an oil, which may be separated by dissolving the acid in alcohol, and precipitating it with water. Its taste is warm, acrid, and acidulous. It is unalterable in the air, but at 250° melts, and at a somewhat higher temperature rises in suffocating vapours. The Br. Pharmacopœia gives as its melting point 248°, and boiling point 462°. It is inflammable, burning without residue. It is soluble in 200 parts of cold water (*Annals of Pharmacy*, i. 206), and in about 24 parts of boiling water, which deposits it upon cooling. The addition of borax increases its solubility. It is readily dissolved by alcohol, and by concentrated sulphuric and nitric acids, from which it is precipitated by water. The fixed oils also dissolve it. It is entirely soluble in solutions of potassa, soda, ammonia, and lime, from which it is precipitated by muriatic acid. Its solution reddens litmus paper, and it forms salts with salifiable bases; but its acid properties are not powerful.* Benzoic acid consists of *benzyl* and oxygen, and in the uncombined state

* *Test.*—According to T. L. Phipson (*Chem. News*, July, 1873, p. 13), if three equivalents of benzoic acid be mixed with one equivalent of glucose and a large excess of monohydrated sulphuric acid be added, after slight warming a fine blood-red colour is developed, after a time becoming brown, and

usually contains water. The anhydrous acid has, however, been isolated by Gerhardt. (*Chem. Gaz.*, x. 237.) Benzyl consists of fourteen eqs. of carbon 84, five of hydrogen 5, and two of oxygen 16 = 105. The crystallized acid contains one eq. of benzyl 105, one of oxygen 8, and one of water 9 = 122, the formula being $C_{14}H_5O_3$,HO. It cannot be deprived of its water by heat, but sometimes loses it in combination. Benzoic acid is a characteristic constituent of the balsams, and has been found in various other vegetable, and some animal products.* When heated it should sublime without residue; but the Br. Pharmacopœia allows a slight residue for impurities.

Medical Properties and Uses. Benzoic acid is irritant to the alimentary mucous membrane, and stimulant to the system, and has been thought to be expectorant; but it is not much used internally, except as a constituent of one or two officinal preparations. It was proposed by Dr. Alexander Ure as a remedy for uric acid deposits in the urine, and for the chalk-like concretions, consisting of urate of sodium, in the joints of gouty individuals. He supposed it to operate by converting the uric into hippuric acid, and consequently the insoluble urates into soluble hippurates. It appears, however, from the observations of Dr. Garrod and Mr. Keller, that such a transformation of uric acid does not take place, but that the benzoic acid is itself converted into hippuric acid, which is always found in the urine, when the former acid is taken freely. The quantity of uric acid in the urine remains undiminished. But it has been shown by Kletzinsky that, though the uric acid is unaffected, the urea is decidedly diminished; and the quantity of nitrogen contained in the urea lost is almost exactly represented by the nitrogen of the hippuric acid formed; so that the benzoic acid is probably converted into the hippuric by combination with a nitrogenous body, either derived from the urea or formed at the expense of it. (*Ann. de Thérap.*, 1860, p. 110.) In consequence of the acid state of urine produced by benzoic acid, it has been found useful in the phosphatic variety of gravel; though its beneficial influence, being purely chemical, continues only during its use. It is said to have cured nocturnal incontinence of urine. Mr. White Cooper has employed it with supposed advantage in a case of rheumatic sclerotitis. (See *Am. Journ. of Med. Sci.*, N. S., xxv. 518.) It has been very highly recommended in ammoniacal cystitis by Prof. Gosselin (*Arch. Gén.*, Nov. 1874.) The urine is rendered neutral or acid, and great relief afforded. In calculous cases a great advantage is the prevention of the formation of the ammoniaco-magnesian phosphate. It is necessary to give very large doses. One gramme a day should be exhibited in the beginning, and increased rapidly to four grammes. Relief is never afforded before the fifth day; sometimes not until the nineteenth. Prof. Gosselin employs an emulsion of one part of benzoic acid, three parts of glycerin, and one hundred and fifty parts of mucilage. Dr. Lemaire (*Phila. Med. Times*, vol. iv. p. 638) commends most highly, in acute gonorrhœa, the use of half a drachm of tincture of cannabis Indica and fifteen grains of benzoic acid in twenty-four hours. Benzoic acid may be readily dissolved in water by the addition to it of four parts of phosphate of sodium, or one part and a half of biborate of sodium. The dose is from 10 to 30 grains. It is an ingredient in some cosmetic washes, and has been employed by way of fumigation as a remedy in affections of the skin. It has also been employed as a local hæmostatic, in connection with alum, with considerable asserted success; but there can be little doubt that alum is the more efficient ingredient. Prof. Salkowsky (*Pharmaceutische Zeitung*, June, 1875) claims that benzoic acid is one of the most powerful antiseptics known. Its value has been confirmed by F. Baden Benger (*Pharm. Journ.*, p. 211, Sept. 1875), who has found that one-fourth of a grain of it added to a fluidounce of infusion of orange, buchu, or gentian, will cause it to keep unchanged for at least one month.

finally blackish. Salicylic acid gives a similar reaction. Hippuric acid yields a clear brown colour, passing into blood-red, and finally into black, with the evolution of a large quantity of gas believed to be carbonic oxide. (*Note to the fourteenth edition.*)

* *Benzyl*, which was at first hypothetical, has been isolated. When benzoate of copper is cautiously distilled without water, it yields a product which crystallizes on cooling. This substance has the smell of geranium, melts at 158° F., and has a composition represented by the formula $C_{14}H_5O_2$. When heated with hydrate of potassa, it is converted into benzoic acid, with the escape of hydrogen. It is, therefore, benzyl. It was discovered by Etting, and afterwards investigated by Stenhouse. (*Fownes's Chemistry*, Am. ed., 1858, p. 401.)

Off. Prep. Ammonii Benzoas, *U. S.;* Ammoniæ Benzoas, *Br.;* Tinctura Camphoræ Composita, *Br.;* Tinct. Opii Ammoniata, *Br.;* Tinct. Opii Camphorata, *U. S.* W.

ACIDUM GALLICUM. *U. S., Br. Gallic Acid.*

"Take of Nutgall, in fine powder, *thirty-six troyounces;* Purified Animal Charcoal, Distilled Water, each *a sufficient quantity.* Mix the Nutgall with sufficient Distilled Water to form a thin paste, and expose the mixture to the air, in a shallow glass or porcelain vessel, in a warm place, for a month, occasionally stirring it with a glass rod, and adding from time to time sufficient Distilled Water to preserve the semi-fluid consistence. Then submit the paste to expression, and, rejecting the expressed liquor, boil the residue in eight pints of Distilled Water for a few minutes, and filter while hot through Purified Animal Charcoal. Set the liquid aside that crystals may form, and dry them on bibulous paper. If the crystals be not sufficiently free from colour, they may be purified by dissolving them in boiling Distilled Water, filtering through a fresh portion of Purified Animal Charcoal, and crystallizing." *U. S.*

The *Dublin College* gave two processes, of which the first has been retained, with a few verbal modifications, in the British Pharmacopœia. It is essentially the same as the U. S. process; differing in requiring an exposure of six weeks instead of a month, in not expressing the paste before boiling in water, in expressing the impure acid deposited from the filtered decoction before redissolving it in boiling water, and in omitting the use of animal charcoal. The second process of the Dublin College, based on the influence of sulphuric acid in favouring the change of tannic into gallic acid, has the merit of requiring less time for completion. Notwithstanding its rejection in the late revision of the British Pharmacopœia, we retain it in the form of a note.*

The U. S. process is founded upon the fact that, when galls in infusion, or in the state of moistened powder, are exposed to the air, their tannic acid is gradually converted into gallic acid, with the absorption, as has been generally believed, of oxygen, and the escape of an equivalent quantity of carbonic acid. The gallic acid, being freely soluble in boiling but very sparingly in cold water, is extracted from the altered galls by decoction, and is deposited as the water cools. A repetition of the solution and deposition renders the acid more pure; but it cannot be obtained wholly colourless unless by the aid of animal charcoal. In the U. S. Pharmacopœia of 1850 it was neglected to direct *purified* animal charcoal; an inadvertence which has since been corrected. There are few processes in which it is more necessary that this decolorizing agent should be purified. The presence of the slightest quantity of sesquioxide of iron interferes with the bleaching of the acid; and it is even advisable to examine the filtering paper, lest it may contain sufficient of this substance to vitiate the results of the process. The first crop of crystals in the U. S. process retains a very large proportion of water; and it will be found convenient to subject them to strong expression between folds of bibulous paper.

* *Process by Sulphuric Acid.* "Take of powdered Galls *one pound* [avoirdupois]; Oil of Vitriol of Commerce *twenty-six fluidounces;* Water *five pints and fourteen* [*fluid*]*ounces* [Imp. meas.]. Steep the galls for twenty-four hours in one part of the water, then transfer them to a glass or porcelain percolator, and pour on a pint and a half of the water in successive portions. Dilute five ounces of the oil of vitriol with an equal bulk of water, and, when the mixture has cooled, add it to the infusion obtained by percolation, stirring well, so as to bring them into perfect contact. Let the viscid precipitate which forms be separated by a filter, and to the solution which passes through add five ounces more of the oil of vitriol, which will yield an additional precipitate. This being added to that previously obtained, let both be enveloped in calico, and subjected to powerful pressure. Dissolve the residue in the rest of the oil of vitriol, this latter being first diluted with what remains of the water; boil the solution for twenty minutes, then allow it to cool, and set it by for a week. Let the deposit which has formed at the end of this period be pressed, dried, and then dissolved in three times its weight of boiling water, clearing the solution, if necessary, by filtration, and, when it has cooled down to 80°, decant the liquid from the crystalline sediment which has formed, and wash the latter with three ounces of ice-cold water. Finally, let it be transferred to blotting paper, and, when deprived by this of adhering liquid, let it be dried perfectly at a temperature not exceeding 212°. The gallic acid obtained may be rendered nearly white by dissolving it in twenty times its weight of boiling distilled water, and causing the solution to traverse a stratum of prepared animal charcoal spread upon a calico filter. When the liquid passes through colourless it should be evaporated to one-sixth of its volume, and then suffered to cool in order to the separation of the crystallized acid." (*Dub.* A. D. 1850.)

Dr. C. Wetherill, believing that gallic acid differs from the tannic simply in containing water, conceived the idea of preparing the former from the latter by the fixation of water. This he effected through the agency of sulphuric acid. Having mixed 13 drachms of tannic acid with 22 fluidounces of sulphuric acid and four times that bulk of water, he heated the mixture to the boiling point, and then allowed it to stand. In a few days an abundant precipitate of white gallic acid took place, amounting to 87·4 per cent. of the tannic acid. (*Am. Journ. of Pharm.*, xx. 112.) Upon the same principle is based the second process of the Dublin College above referred to. Dr. Christison, in his Dispensatory, states that the process was originally suggested by Liebig. It is now understood that tannic acid is a glucoside, convertible through exposure of galls to the air, and more rapidly by sulphuric acid, into glucose and gallic acid; and thus to a certain extent is explained the rationale of both the processes here noticed.

The elder Robiquet first suggested that galls contain a principle capable of converting tannic into gallic acid, with the presence of water, and in the absence of atmospheric air. M. Laroque proved that this principle acts as a ferment, and that the change referred to is the result of a *gallic acid fermentation* in the galls. M. Edmond Robiquet has shown that galls contain *pectose* and *pectase*, the former of which, according to the experiments of M. Frémy, is the principle out of which pectin is formed in plants, and the latter a peculiar ferment which effects the transformation. It appears that in galls the pectase, aided by a proper temperature and the presence of water, changes not only pectose into pectin, but also tannic into gallic acid. Strecker had previously advanced the opinion that tannic acid is a combination of gallic acid and sugar, the latter of which is destroyed in the process for procuring gallic acid, which is thus simply set free from the combination. It would seem, if this view is correct, that the pectase acts upon the saccharine matter of the tannic acid, causing its conversion into carbonic acid and alcohol, and liberating the gallic acid, and that the process is in fact an example of the vinous fermentation. M. E. Robiquet admits the occasional transformation of tannic acid into gallic acid and sugar, but does not believe that the sugar pre-exists as such in the tannin. (*Journ. de Pharm.*, 3e sér., xxiii. 241.) Wittstein, in endeavouring to obtain gallic acid from *Chinese galls* (see *page* 429) by forming them into a paste with water, found that but a very small proportion of the acid was generated at the end of six weeks. Thinking that this might have resulted from the want of the ferment in the Chinese galls, he added to these one-eighth of their weight of common galls, and, at the end of three weeks, obtained an amount of gallic acid nearly equal to one-half the weight of the galls employed. The same result, though more slowly, followed the addition of yeast to the Chinese galls. Wittstein obtained both carbonic acid and alcohol as products of this operation, thus favouring the views of Strecker as to the constitution of tannic acid.

Properties. Gallic acid is in delicate, silky, acicular crystals, which, as ordinarily found in the shops, are slightly brownish, but when quite pure are colourless. It is inodorous, and of a sourish, astringent taste. It is soluble, according to Braconnot, in 100 parts of cold and 3 of boiling water, is very soluble in alcohol, and but slightly so in ether. Mr. Thomas Weaver, of Philadelphia, has found that it is soluble in glycerin in the proportion of 40 grains to the ounce, and that the solution may be diluted to any extent with water without affecting its transparency. (*Am. Journ. of Pharm.*, xxix. 82.) It reddens litmus, and produces a deep bluish-black colour with solutions of the salts of sesquioxide of iron, which disappears when the solution is heated; a result which Dr. Mahla has shown to depend on the conversion of the gallic into gallhumic or metagallic acid, by the loss of the constituents of carbonic acid and water. (*Am. Journ. of Sci. and Arts*, Nov. 1859.) It does not precipitate gelatin, or a solution of sulphate of protoxide of iron. It should leave no residue when burnt, and is entirely dissipated when thrown on red-hot iron. On exposure to the air, its solution undergoes spontaneous decomposition; but it is said that, by the addition of a drop of oil of cloves, it may be kept for a long time without change. (*Pharm. Journ.*, xvi. 223.) T. Löwe has found that gallic acid, dissolved in water, is converted into tannic acid by nitrate of silver through its oxidizing

influence; and that the change is more complete when a salt of gallic acid is used. (*Chem. News*, Jan. 31, 1868, p. 59; from *Journ. für pract. Chem.*, cii. 111.) By the action of arsenic it is converted almost entirely into tannic acid without the production of arsenious acid. (Schiff, *Chem. News*, xxix. p. 73.) A very delicate test for gallic acid has been proposed by Henry R. Procter (*Am. Journ. of Pharm.*, Aug. 1874.) It consists in adding the suspected solution to a faintly alkaline solution of arseniate of sodium or potassium. If gallic acid be present an intense green colour is soon developed, appearing, if the liquid be quiet, first upon the surface. Prof. Flückiger has pointed out (*Pharm. Journ.*, Aug. 1, 1874) that the arseniate plays no part in this test. The change is produced by any alkali, whether caustic or not, provided it is present in very small quantity. The reaction does not occur with gallo-tannic or pyrogallic acid. A test proposed by Flückiger consists in adding to the solution of gallic acid a dilute (1 to 100) solution of pure protosulphate of iron. To the colourless solution a little acetate of sodium is to be added, when a deep violet colour will appear, due to the formation of gallate of the protoxide of iron. The formula of gallic acid is $C_{14}H_6O_{10}$ (*Gmelin*). Heated to 420° it gives out carbonic acid, and is changed into *pyrogallic acid.* (See *Part* III.)

Medical Properties. Forming an ingredient in all astringent products containing gallo-tannic acid, gallic acid was at one time supposed to be the active principle of the vegetable astringents. This reputation it afterwards lost when the properties of tannic acid became well known. But it has recently again come into notice, and is now thought by many to be a very valuable astringent, having the property of arresting hemorrhages when taken internally, especially those from the uterus and urinary passages. In all cases of hemorrhage in which the bleeding vessels must be reached through the route of the circulation, it is believed by some to be more efficient even than tannic acid, as its chemical affinities do not afford the same impediment to its absorption as those of the latter acid. But in hemorrhage from the alimentary mucous membrane, or from any other part with which tannic acid can be brought into direct contact, the latter astringent is by far the most effectual. Gallic acid has been employed also with advantage in pyrosis, and the night-sweats of phthisis. In albuminuria, when there is a very large amount of albumen excreted, gallic acid may be employed with service to diminish the flow (H. C. Wood, *Philad. Med. Times*, 1871), and the drug has even been used in acute Bright's disease, following scarlatina, with asserted great advantage. (Dr. J. T. Jameson, *New Remedies*, Oct. 1875.) It is said not to constipate the bowels. The dose is from five to fifteen grains three or four times a day, and may be given in the form of pill or powder. The acid has been employed as a gargle in inflammatory affections of the fauces. The comparative facility with which it is dissolved by glycerin, and the readiness with which the solution mixes with water, suggest the use of this menstruum when it may be desirable to employ the medicine locally as a gargle or injection.

Off. Prep. Glyceritum Acidi Gallici, *U. S.;* Glycerinum Acidi Gallici, *Br.* W.

ACIDUM HYDROCYANICUM DILUTUM. *U. S., Br. Diluted Hydrocyanic Acid. Prussic Acid. Cyanohydric Acid.*

"Take of Ferrocyanide of Potassium *two troyounces;* Sulphuric Acid *a troyounce and a half;* Distilled Water *a sufficient quantity.* Mix the Acid with four fluidounces of Distilled Water, and pour the mixture, when cool, into a glass retort. To this add the Ferrocyanide of Potassium, dissolved in ten fluidounces of Distilled Water. Pour eight fluidounces of Distilled Water into a cooled receiver, and, having attached this to the retort, distil, by means of a sand-bath, with a moderate heat, six fluidounces. Lastly, add to the product five fluidounces of Distilled Water, or as much as may be sufficient to render the Diluted Hydrocyanic Acid of such a strength, that 12·7 grains of nitrate of silver, dissolved in distilled water, may be accurately saturated by 100 grains of the acid.

"Diluted Hydrocyanic Acid, when wanted for immediate use, may be prepared in the following manner.

"Take of Cyanide of Silver *fifty grains and a half;* Muriatic Acid *forty-one grains;* Distilled Water *a fluidounce.* Mix the Muriatic Acid with the Distilled Water, add the Cyanide of Silver, and shake the whole together in a well-stopped vial. When

the precipitate formed has subsided, pour off the clear liquid, and keep it for use. Diluted Hydrocyanic Acid must be kept in well-stopped bottles protected from the light." *U. S.*

"Take of yellow Prussiate of Potash *two ounces and a quarter* [avoirdupois]; Sulphuric Acid *one fluidounce* [Imperial measure]; Distilled Water *thirty fluidounces* [Imp. meas.], or *a sufficiency*. Dissolve the Prussiate of Potash in ten [fluid]ounces of the Water, then add the Sulphuric Acid previously diluted with four [fluid]ounces of the Water and cooled. Put the solution into a flask or other suitable apparatus of glass or earthenware, to which are adapted a condenser and a receiver arranged for distillation, and having put eight [fluid]ounces of Distilled Water into the receiver, and provided efficient means for keeping the condenser and receiver cold, apply heat to the flask until by slow distillation the liquid in the receiver is increased to seventeen [fluid]ounces. Add to this three [fluid]ounces of the Distilled Water, or as much as may be sufficient to bring the acid to the required strength, so that one hundred grains (or 110 minims) of it, precipitated with a solution of nitrate of silver, shall yield ten grains of dry cyanide of silver." *Br.*

The British preparation has the sp. gr. 0·997. If 270 grains of it be made alkaline by solution of soda, they will require 1000 grain-measures of the *volumetric solution of nitrate of silver* to be added before a permanent precipitate begins to form, corresponding to 2 per cent. of the real acid.

Hydrocyanic acid was admitted into the French Codex in 1818, into the United States Pharmacopœia in 1820, into the Dublin in 1826, into the London in 1836, and into the Edinburgh in 1839. It is now made by one chief process; namely, from the ferrocyanide of potassium by the action of sulphuric acid. It is also obtained by an extemporaneous process, in the U. S. Pharmacopœia, by decomposing cyanide of silver. When ferrocyanide of potassium is decomposed by sulphuric acid, the residue in the retort is sulphate of potassium, mixed with an insoluble compound of two eqs. of cyanide of iron, and one of cyanide of potassium (*Everitt's salt*). According to Wittstein, the reaction takes place in two steps. In the first, three eqs. of ferrocyanide $3(FeCy + 2KCy)$ react with six eqs. of hydrated sulphuric acid $6(HO,SO_3)$, and produce six eqs. of sulphate of potassium $6(KO,SO_3)$, and three eqs. of hydroferrocyanic acid $3(FeCy + 2HCy)$. In the second step, when heat is applied, the three eqs. of hydroferrocyanic acid $3(FeCy + 2HCy)$ react with an additional eq. of ferrocyanide $(FeCy + 2KCy)$, so as to produce six eqs. of hydrocyanic acid, 6HCy, which distil over, and two eqs. of Everitt's salt $2(2FeCy + KCy)$, which remain in the retort with the sulphate of potassium. (*Pharm. Journ.*, March, 1856, p. 429.) Everitt's salt, so named from its discoverer, is a yellowish-white powder. Like ferrocyanide of potassium, it is a double cyanide of iron and potassium; but the equivalent proportion of the two cyanides is reversed. As it appears in practice, it is apt to be greenish, owing probably to the presence of a little Prussian blue.

According to the late Mr. Phillips, an excess of sulphuric acid would endanger the production of formic acid. The proportion of the acid should not exceed three-fourths of the weight of the ferrocyanide. In relation to the most convenient method of bringing the hydrocyanic acid to the standard strength, and to some other points in its preparation by the officinal formula, the reader is referred to a paper by Prof. Procter in the *Am. Journ. of Pharm.* (xix. 259).

In the U. S. process for obtaining hydrocyanic acid extemporaneously, the reacting materials are single equivalents respectively of cyanide of silver and muriatic acid. These, by double decomposition, generate hydrocyanic acid which dissolves in the water, and chloride of silver which subsides, and from which the acid is poured off when clear. (See *Argenti Cyanidum.*) The extemporaneous process is useful to country practitioners; because the acid will not generally keep. A portion of hydrocyanic acid, if purchased by a practitioner, may spoil on his hands, before he has occasion to use it; but if he supply himself with cyanide of silver, he may readily at any moment prepare a small portion of the acid, by following the directions of the formula.

The French Codex of 1837 gives the following process for hydrocyanic acid, in place of the three previously contained in that work. Take of bicyanide of mercury

thirty parts; muriatic acid (sp. gr. 1·17) twenty parts. Reduce the bicyanide to powder, and introduce it into a small tubulated glass retort, placed over a furnace. Adapt to its neck a tube about 13 inches long, and half an inch in diameter, and filled, one-half with pieces of marble, and the remainder with chloride of calcium. To this tube, arranged nearly horizontally, adapt a smaller one, bent at a right angle, and plunging into a graduated tube, surrounded with a mixture of common salt and pounded ice. The apparatus being thus arranged, and the junctures well luted, add the muriatic acid; and, having allowed the action to take place for a few moments in the cold, apply the heat gradually. When the action is over, drive forward any acid which may have condensed in the large tube, by means of a live coal brought near to it, and passed along its whole length. The quantity of acid found in the graduated tube is mixed with either six times its bulk, or eight and a half times its weight, of distilled water. In this process Gay-Lussac's strong acid is first obtained in the graduated tube, and afterwards diluted to a given extent with water. The object of the marble and chloride of calcium is to detain, the former muriatic acid, the latter water.

Another process for obtaining medicinal hydrocyanic acid, proposed by Dr. Clark, and adopted by Mr. Laming, is by the reaction of tartaric acid on cyanide of potassium in solution. Laming's formula is as follows. Dissolve twenty-two grains of the cyanide in six fluidrachms of distilled water, and add fifty grains of crystallized tartaric acid, dissolved in three fluidrachms of rectified spirit. Crystallized bitartrate of potassium precipitates, and each fluidrachm of the clear decanted liquor contains one grain of pure hydrocyanic acid. The reaction in this process takes place between two eqs. of tartaric acid, one of cyanide of potassium, and one of water. The water is decomposed, and the tartaric acid, potassium, and oxygen unite to form the bitartrate, and the cyanogen and hydrogen to form the hydrocyanic acid. Dr. Pereira considered this process to have several advantages, but very properly objected to it on account of the trouble and expense of obtaining the cyanide of potassium pure, and its liability to undergo spontaneous decomposition. (See *Potassii Cyanidum.*) This difficulty may, according to Mr. B. S. Proctor, be remedied by substituting the double cyanide of zinc and potassium, a cheap and stable salt, which even in solution may be kept without change almost indefinitely. He proposes the following formula as yielding an acid of officinal strength. Water 1 ounce; cyanide of zinc and potassium 22 grains; tartaric acid 40 grains. Dissolve the cyanide in water, add the acid, and allow the precipitate to subside; decant the clear liquid. (*Pharm. Journ.*, Sept. 1874.)

The processes, thus far given, are intended to furnish a *dilute* hydrocyanic acid for medicinal purposes. The methods of obtaining the *anhydrous* acid are different. Vauquelin's process for the anhydrous acid is to pass a current of hydrosulphuric acid gas over the bicyanide of mercury contained in a glass tube, connected with a receiver kept cold by a freezing mixture of ice and salt. The first third only of the tube is filled with the bicyanide; the remaining two-thirds being occupied, half with carbonate of lead, and half with chloride of calcium; the carbonate being intended to detain the hydrosulphuric acid gas, the chloride to separate water. Another process for the anhydrous acid is that of Gautier, thus described by Berzelius. Ferrocyanide of potassium is fused without access of air, whereby it is converted into a mixture of cyanide of potassium and carburet of iron. The mass obtained, after having been pulverized and placed in a flask, is slightly moistened with water, and acted on with muriatic acid, added by small portions at a time. By a double decomposition between the cyanide and muriatic acid, chloride of potassium and hydrocyanic acid are formed. The flask is then plunged into hot water, which causes the hydrocyanic acid to be disengaged in form of vapour. This is passed through a tube containing chloride of calcium, and finally received in a small flask kept cool by a freezing mixture.

The process of Wöhler for the anhydrous acid is the following. The cyanide of potassium selected is a black cyanide, formed by fusing together, in a covered crucible, 8 parts of dry ferrocyanide, 3 of ignited cream of tartar, and 1 of charcoal in fine powder. The cyanide, while still warm, is exhausted by 6 parts of water; and

the clear solution, placed in a retort, is decomposed by cold diluted sulphuric acid, gradually added. The hydrocyanic acid is condensed first in a U-tube, containing chloride of calcium, and surrounded with ice-cold water, and afterwards in a small bottle, connected with the U-tube by a narrow tube, and immersed up to the neck in a mixture of ice and salt. After the acid has been condensed and dehydrated in the U-tube, the cold water surrounding it is withdrawn by a syphon, and replaced by water at a temperature between 85° and 90°, whereby the anhydrous acid is made to distil over into the small bottle.

M. Berthelot has made hydrocyanic acid synthetically. He first prepares by a direct synthesis of its elements *acetylene*, a carbo-hydrogen remarkable for its chemical affinities. He then mixes vapours of acetylene with pure nitrogen, passes a series of electric discharges from a Ruhmkorff coil, and, when the odour of prussic acid is perceptible, agitates with a solution of potassa to get the fixed cyanide. (*Journ. de Pharm.*, Avril, 1869.)

Properties of the Medicinal Acid. Diluted hydrocyanic acid, of the proper medicinal strength, is a transparent, colourless, volatile liquid, possessing a peculiar smell, and a taste at first cooling and afterwards somewhat irritating. It imparts a slight and evanescent red colour to litmus. If it reddens litmus strongly and permanently, the fact shows the presence of some acid impurity. It is not reddened by the iodocyanide of potassium and mercury. The non-action of this test shows the absence of contaminating acids, which, if present, would decompose the test, and give rise to the red iodide of mercury. It is liable to undergo decomposition if exposed to the light, but is easily kept in a bottle covered with black paint or black paper. From experiments carefully conducted by MM. Bussy and Buignet, it appears that, when the alteration in the acid under the influence of light has begun, it will afterward go on very rapidly in the dark; and that, after exposure for a certain time to the light, though no alteration may be apparent, an influence has nevertheless been exerted which disposes to change, and promotes decomposition even in the absence of light. Hence the necessity of immediately enclosing the acid in bottles from which the light is excluded. (*Journ. de Pharm.*, Dec. 1863, p. 475.)* Its most usual impurities are sulphuric and muriatic acids; the former of which may be detected by chloride of barium, which will produce a precipitate of sulphate of barium; and the latter, by precipitating with nitrate of silver, when so much of the precipitate as may be chloride of silver will be insoluble in boiling nitric acid, while the cyanide of silver is readily soluble. The presence of these acids, in slight amount, is injurious only by rendering uncertain the strength of the medicinal acid, as ascertained by its saturating power. It is now generally acknowledged that mineral acids prevent the deterioration of the dilute prussic acid. But the presence of a mineral acid is not necessary for its preservation; for Dr. Christison has known the medicinal acid from ferrocyanide of potassium to keep perfectly well, although nitrate of barium did not produce the slightest muddiness. Nevertheless it has been recently shown that much of the acid

* Anhydrous hydrocyanic acid sometimes undergoes an apparently spontaneous molecular change, by which it is converted into a black solid body, supposed to be *paracyanogen* ($2NC_2$ or N_2C_4), or its compounds. This change takes place more slowly in watery solutions of the acid, which are converted into a black liquid; and it is only in a state of extreme dilution, when, for example, water contains not more than one per cent. of the acid, that it is altogether prevented. It sometimes takes place in the officinal diluted acid; and Prof. Procter has shown us a bottle, which had been most carefully closed, and kept excluded from the light, and in which, nevertheless, the acid had become as black as ink. The cause of this phenomenon remained long unknown; but recently M. E. Millon has satisfied himself, by experiment, that the real agency is the presence of ammonia, which may sometimes operate even through the air. (*Journ. de Pharm.*, Janv. 1862, p. 48.) The preservative influence of a little sulphuric acid in the diluted hydrocyanic acid is thus explained; and it is not impossible that the greater resistance offered to the change by the preparation made by the officinal process, in which sulphuric acid is used, than by the others, may be owing to the influence of this acid, either passing over with its vapour, or acting on the acid vapour before it leaves the retort. An important practical inference from all this is the necessity of providing, as far as possible, that ammonia should in no manner have access to the acid, during or after its preparation. (*Note to the twelfth edition.*)

The effect of ammonia in inducing changes in dilute hydrocyanic acid is denied by Pettit (*Amer. Journ. of Pharm.*, Jan. 1873). Mr. Rimmington asserts that hydrocyanic acid acts upon the alkali of some varieties of glass. Mr. Siebold, who has confirmed this, declares that the addition of hydrochloric acid is perfectly useless as a preservative, except when the prussic acid is kept in bottles which yield the alkali. (*Pharm. Journ.*, Sept. 1874.)—*Note to the fourteenth edition.*

as kept in the drug stores is often below the officinal strength. Various remedies have been proposed. (*Pharm. Journ.*, July, 1871; Feb. 1, 1874; Sept. 1874.) One of these is to reduce the strength to one-tenth per cent., this weak solution being said not to undergo change. Mr. John Williams has found in a series of experiments that the addition of 20 per cent. of glycerin has a very pronounced influence in preventing deterioration. (*Pharm. Journ.*, Sept. 1874; Sept. 1875.) If lead be present in prussic acid, it may be detected by hydrosulphuric acid gas, which will cause a blackish precipitate. Hydrocyanic acid is incompatible with nitrate of silver, the salts of iron and copper, and most of the salts of mercury. According to the experiments of Prof. Flückiger (*Am. Journ. of Pharm.*, Dec. 1872) it does not form salts with the alkaloids.

Formerly the medicinal acid was of different strengths, as ordered by the different pharmaceutical authorities; but happily the U. S. and Br. Pharmacopœias conform in this important point. At one time its strength was indicated by its specific gravity, which is lower in proportion as it is stronger; but this unprecise mode of estimate is not now relied on; and, though the Br. Pharmacopœia gives the sp. gr. of its dilute acid at 0·997, yet both it and that of the United States give the saturating power as an index of the strength. According to the *United States* formula, 100 grains of the acid must accurately saturate 12·7 grains of nitrate of silver dissolved in distilled water, and produce a white precipitate (cyanide of silver), which, when washed and dried, at a temperature not exceeding 212°, shall weigh 10 grains, and be wholly soluble in boiling nitric acid. The Br. Pharmacopœia directs that 270 grains of it, when treated with solution of soda in excess, shall require the addition of 1000 grain-measures of the *volumetric solution of nitrate of silver*, before a permanent precipitate begins to form. To explain this test it is necessary to notice that cyanide of silver, though itself insoluble, is rendered soluble by combining with cyanide of sodium, in the proportion of one eq. of each. When, therefore, the diluted hydrocyanic acid is converted, by the addition of soda, into cyanide of sodium, no permanent precipitate will begin to appear, upon the addition of nitrate of silver, until more than sufficient cyanide of silver is produced to form the soluble compound referred to, which happens when one-half of the cyanide of sodium has been converted into cyanide of silver. An acid of the strength indicated by either of these methods, contains two per cent. of anhydrous acid. The test of entire solubility in boiling nitric acid, applied to the precipitate obtained by nitrate of silver, is intended to verify its nature; for, if the hydrocyanic acid contain muriatic acid, part of this precipitate would be chloride of silver, not soluble in the boiling acid. Scheele's medicinal hydrocyanic acid contains about 5 per cent. of anhydrous acid; and, therefore, two minims of it are equal to five of the U. S. acid. The use of Scheele's acid should be discouraged as unnecessary, and as leading to dangerous mistakes.

MM. Fordos and Gélis have proposed, as a test of the strength of the compounds containing cyanogen, an alcoholic solution of iodine of known strength; as, for example, three grains to the fluidounce. The test solution is added, drop by drop, to the cyanogen compound, until a permanent yellowish tinge is produced. The iodine unites with the cyanogen, and with the substance in combination with the cyanogen, in the ratio of their several equivalents; and hence the cyanogen present is easily calculated from the proportion of iodine expended in uniting with it. This test is commended for its accuracy by Mr. James Roberton, of Manchester. (See *Am. Journ. of Pharm.*, Nov. 1853, p. 551.)

Properties of the Anhydrous Acid. Hydrocyanic acid, perfectly free from water, is a colourless, transparent, inflammable liquid, of extreme volatility, boiling at 80°, and congealing at 5°. Its sp. gr. as a liquid is 0·6969, at the temperature of 64°; and as a vapour 0·9423. Its taste is at first cooling, then burning, with an after-taste in the throat like that of bitter almonds; but, from its extremely poisonous nature, it must be tasted with the utmost caution. Its odour is so strong as to produce immediate headache and giddiness; and its vapour so deleterious that the smallest portion of it cannot be inhaled without the greatest danger. Both water and alcohol dissolve it readily. It is much more prone to undergo decomposition than the dilute acid. In the course of a few hours, it sometimes begins to assume a reddish-brown colour,

which becomes gradually deeper, till at length the acid is converted into a black liquid, which exhales a strong smell of ammonia. It is a very weak acid in its chemical relations, and reddens litmus but slightly. It does not form solid compounds with metallic oxides, but a cyanide of the metal, the elements of water being exhaled. According to Sobero, hydrocyanic acid is generated, in sensible quantities, by the action of weak nitric acid on the volatile oils and resins. Wöhler affirmed in 1828 that picric acid when treated with baryta-water yields it; and Julius Post and H. Hübner have recently found that nitro and dinitrobenzol also do so when treated, the former with fusing potassa, the latter with boiling dilute solutions of potassa. It has also been formed by the slow action of carbonate of potassium on tincture of hyoscyamus, given together as a medicine. (Dr. J. T. Plummer, of Indiana, *Am. Journ. of Pharm.*, xxv. 513.) Though a product of art, it exists in some plants, and is generated by reaction between the constituents of many vegetable products upon contact with water. These products are usually amygdalin and emulsin, but according to Peckholt the root of the *Manihot utilissima* copiously generates hydrocyanic acid with water, although he was unable in 15 analyses to find amygdalin in it. (*Amer. Journ. of Pharm.*, Oct. 1872.) (See *Amygdala Amara.*)*

Composition, &c. Hydrocyanic acid consists of one eq. of cyanogen 26, and one of hydrogen 1 = 27; or, in volumes, of one volume of cyanogen and one of hydrogen without condensation, its formula being HNC_2 or HCy. *Cyanogen* (Cy) is a colourless gas, of a strong and penetrating smell, inflammable, and burning with a beautiful bluish-purple flame. Its sp. gr. is 1·8157. It was discovered in 1815 by Gay-Lussac, who viewed it as a compound radical, which, when acidified by hydrogen, becomes hydrocyanic acid. It consists of two eqs. of carbon 12, and one of nitrogen 14 = 26; or, in volumes, of two volumes of carbon vapour and one of nitrogen, condensed into one volume. The ultimate constituents of the acid are, therefore, two eqs. of carbon, one of nitrogen, and one of hydrogen. A process for liquefying cyanogen gas may be found in the *Chemical News*, No. 562, Sept. 1870, p. 113.

Hydrocyanic acid, in a dilute state, was discovered in 1780 by Scheele, who correctly stated its elements to be carbon, nitrogen, and hydrogen; but the peculiar way in which they are combined was first pointed out by Gay-Lussac, by whom also the anhydrous acid was first obtained.

Medical and Toxical Properties. Hydrocyanic acid is one of the most deadly poisons known, proving, in many cases, almost instantaneously fatal. According to Dr. Christison, a grain and a half of the anhydrous acid is capable of producing death in the human subject. One or two drops of the pure acid are sufficient to kill a vigorous dog in a few seconds. The post-mortem appearances are glistening and staring expression of the eyes; gorged state of the venous system with fluid, dark, or bluish-black blood, especially of the veins of the brain and spinal marrow; and sometimes redness of the internal coat of the stomach. The lungs are sometimes natural, at other times turgid with blood. It is not true, or rarely true, that the muscles are insensible to the galvanic current. Notwithstanding the tremendous energy of this acid as a poison, it has been ventured upon in a dilute state as a sedative, anodyne, and antispasmodic. Though occasionally employed as a remedy prior to 1817, yet it did not attract much attention until that year, when Magendie published his observations on its use in diseases of the chest, and recommended it to the profession. When given in medicinal doses gradually increased, it produces the following symptoms in different cases; peculiar bitter taste; increased secretion of saliva; irritation of the throat; nausea; disordered respiration; pain in the head; giddiness; faintness; obscure vision; and tendency to sleep. It appears to have a special action on the larynx and trachea. (*Dr. Cogswell.*) The pulse is sometimes quickened, at other times reduced in frequency. Occasionally salivation and ulceration of the mouth are produced. It has been extensively used in complaints of the respiratory organs, and is supposed to exert

* It has been proposed to employ solutions of these vegetable products for the extemporaneous preparation of hydrocyanic acid, and in the Swedish Pharmacopœia the *Emulsio Hydrocyanata* has replaced entirely the dilute prussic acid. An emulsion is first made of 3 parts of sweet almonds, 2 of sugar, and 24 of water. To 80 parts of this emulsion are added one part of amygdalin. In an hour the mixture is ready for use; one ounce of it contains one-third of a grain of anhydrous acid. Dose, one to two teaspoonfuls. (*National Med. Journ.*, July, 1871.)—*Note to the fourteenth edition.*

a control over pulmonary inflammation, after the excitement has been diminished by blood-letting; and there is no doubt that, in some instances, it has proved beneficial under such circumstances. Dr. Joseph Johnson, of Charleston, S. C., found it useful in pneumonia. In phthisis it may be resorted to with advantage as a palliative for the cough. In various other affections of the chest, attended with dyspnœa or cough, such as asthma, hooping-cough, and chronic catarrh, it has often been decidedly beneficial, by allaying irritation or relaxing spasm. In hypertrophy of the heart and aneurism of the aorta, it has also been used with benefit. In certain affections of the stomach, characterized by pain and spasm, and sometimes attended with vomiting, but unconnected with inflammation, and in similar painful affections of the bowels, it has proved beneficial in the hands of several practitioners. It has also been administered as an anodyne in several painful affections, as cancer, tic douloureux, &c., but with doubtful advantage. In mania, it is often useful in the paroxysmal excitement characteristic of that disease, and occasionally has been thought to contribute to a cure by its permanent action. (*Ann. de Thérap.*, 1865, p. 111.) Sometimes it is used externally, diluted with water, as a wash in cutaneous diseases. The late Dr. A. T Thomson insisted particularly on its efficacy in allaying the itching of impetiginous affections.

The dose of the diluted hydrocyanic acid is from two to six drops, dissolved in distilled water, or mixed with gum-water or syrup. It should be administered with the greatest caution, on account of its minute dose, and variable strength as found in the shops. The proper plan, therefore, is to begin with a small dose, two drops for example, and gradually to increase the quantity until some obvious impression is produced. If giddiness, weight at the top of the head, sense of tightness at the stomach, or faintness come on, its use should be discontinued. In all cases in which a fresh portion of medicine is used, the dose should be lowered to the minimum quantity, lest the new sample should prove stronger than that previously employed. When resorted to as a lotion, from thirty minims to a fluidrachm may be dissolved in a fluidounce of distilled water.

Toxicology. Hydrocyanic acid is so rapidly fatal as a poison that physicians have seldom an opportunity to treat its effects. When not immediately fatal, the symptoms produced are sudden loss of sense, trismus, difficult and rattling respiration, coldness of the extremities, smell of the acid proceeding from the mouth, though this is sometimes absent, smallness of the pulse, swelling of the neck, dilatation, immobility, and sometimes contraction of the pupils, convulsions, &c. The antidotes and remedies, most to be relied on, are chlorine, ammonia, cold affusion, and artificial respiration. Chlorine in the form of chlorine water, or weak solutions of chlorinated lime or soda, may be exhibited internally, or applied externally. When chlorine is not at hand, water of ammonia, largely diluted, may be given, and the vapour arising from it cautiously inhaled. A case is related, in the *Dublin Med. Journal* for Nov. 1835, of poisoning by this acid, in which the diluted aromatic spirit of ammonia applied to the mouth, and the solid carbonate assiduously held to the nostrils, produced speedy and beneficial effects. Cold affusion was first proposed in 1828 by Herbst, of Göttingen, and its utility was subsequently confirmed by Orfila. Its efficacy is strongly supported by experiments performed in 1839 by Dr. Robinson and M. Lonyet, who quickly resuscitated rabbits, apparently dead from hydrocyanic acid, by pouring on their head and spine a stream of water, artificially refrigerated. In a case of poisoning, reported by Dr. Christison in 1850, the patient recovered under a stream of cold water, poured upon the head from a moderate height. In another case, reported in the *Lancet* in 1854, in which the largest recorded quantity was taken to be followed by recovery (2·4 grains of anhydrous acid), the cold water douche was the principal remedy. (See *Am. Journ. of Med. Sci.*, July, 1854, p. 276.) Messrs. T. & H. Smith, of Edinburgh, have recommended, as an antidote for the medicinal acid, a mixture of the sulphates of the protoxide and sesquioxide of iron, swallowed after a solution of carbonate of potassium. So soon as the antidote comes in contact with hydrocyanic acid, sulphate of potassium is formed, and the poison is converted into Prussian blue. It may be prepared extemporaneously, by adding ten grains of sulphate of protoxide of iron, and a drachm of the tincture of chloride of iron, to a fluidounce of water contained in one

vial, and twenty grains of carbonate of potassium to a fluidounce of water in another vial. The patient is made to swallow the solution of carbonate of potassium, and immediately afterwards the mixed ferruginous solution. This quantity is estimated to be sufficient to render insoluble nearly two grains of the anhydrous acid.* In one instance this antidote is said to have proved effectual. (*Pharm. Journ. and Trans.*, Oct. 1865, p. 139.) *Atropia* has been proposed as a counter-poison, on the grounds of its physiological action, and of experiments made with it on the lower animals. M. W. Preyer even claims as the result of experiments upon rabbits and guinea-pigs that it is, if used hypodermically at once, an unfailing antidote. (See *Am. Journ. of Med. Sci.*, Oct. 1868, p. 577.) It has, however, been shown by the elaborate experiments of Keen (*Proc. Phil. Acad. Nat. Sci.*, 1869), of Reese (*Amer. Journ. Med. Sci.*, Jan. 1871), and of Boehm and Knie (*Archiv für Exper. Path. und Therap.*, Bd. II.), to be of little or no antidotal value even in the case of the lower animals. Morphia has also been supposed to be antagonistic to hydrocyanic acid.

Tests. After suspected death from poison, it is sometimes necessary to ascertain whether the event was caused by this acid. At a period long after death, it would be needless to search for so volatile a poison; but it has been recognised three weeks after death, in a case reported by M. Brame, in which about six drachms of acid, containing between 8 and 9 per cent. of anhydrous acid, had been swallowed. The best test is that proposed by Liebig in 1847, consisting in the change of the hydrocyanic acid into hydrosulphocyanate of ammonium, which salt is then tested with a sesquioxide salt of iron. Two drops of the acid, so dilute as not to afford the least blue tint with the salts of iron, upon being mixed with a drop of bihydrosulphate of ammonium, and heated upon a watch-glass until the mixture is colourless, yields a solution of hydrosulphocyanate of ammonium, which becomes of a deep blood-red colour upon the addition of the sulphate of sesquioxide of iron, in consequence of the formation of the sulphocyanide of iron. (*Chem. Gaz.*, April 1, 1847; from Liebig's *Annalen.*) This test is praised by Mr. A. S. Taylor, who found it to act characteristically on two grains of dilute hydrocyanic acid, containing only 1-3930th of a grain of anhydrous acid. To render the test thus delicate, Mr. Taylor deems it necessary to evaporate the liquid gently to dryness, after the addition of the bihydrosulphate of ammonium, in order to bring the hydrosulphocyanate to the solid state before adding the iron test, a fractional part of a drop of which will commonly suffice to produce the characteristic colour. Should the acid be mixed with organic matters, Mr. Taylor proposes a modification of Liebig's test as follows. Place it in a watch-glass, and invert over it another, holding in the centre a drop of bihydrosulphate of ammonium. In from half a minute to ten minutes, without heat, the bihydrosulphate will be converted into the hydrosulphocyanate of ammonium; and, upon removing the upper glass, and evaporating its contents to dryness, the iron test will produce the blood-red colour. MM. O. Henry and E. Humbert have proposed, as a test of hydrocyanic acid, first to convert it into cyanide of silver by distilling the suspected matters into a dilute solution of nitrate of silver, and then to decompose the cyanide by iodine, so as to form iodide of cyanogen. The dried cyanide is added to half its estimated weight of *pure* iodine, contained in a test tube. Upon the application of a gentle heat, iodide of cyanogen is formed, and characteristic crystals of it are deposited on the cool surface of the tube. (*Journ. de Pharm.*, Mars, 1857, p. 173.)

An extremely sensitive test of hydrocyanic acid, in the state of vapour, has re-

* In a subsequent communication the Messrs. Smith recommend the following proportions. Mix of solution of perchloride of iron (*Br.*) 37 minims, crystallized protosulphate of iron, as pure as possible, 25 grains, and about half a fluidounce of water. Dissolve 77 grains of crystallized carbonate of sodium in the same measure of water. These quantities will neutralize between 150 and 200 minims of medicinal hydrocyanic acid. (*Pharm. Journ. and Trans.*, Oct. 1865, p. 147.) Still more recently the authors propose to substitute magnesia for carbonate of sodium, as better fitted to neutralize any considerable quantity of gastric acid that might be present. The following is the formula now recommended. From one to two drachms of magnesia, made into a smooth cream with water, is to be first administered, and then 16 minims of solution of perchloride of iron (*Br.*) and 12½ grains of green vitriol dissolved together in water. These quantities are calculated for 100 minims of medicinal hydrocyanic acid. Should more than this be supposed to have been taken, the ferruginous ingredients must be increased in proportion, but not the magnesia. (*Ibid.*, Nov. 1865, p. 276.)—*Note to the thirteenth edition.*

cently been offered by Schönbein. It consists of white filtering paper imbued with the resin of guaiacum, by dipping it in a solution of 3 parts of the resin in 150 of alcohol, and then dried, and at the moment of use moistened with a solution of sulphate of copper containing 1 part in 500 of water. If now brought into contact with hydrocyanic acid, whether dissolved in water or diffused in the air in the form of vapour, it instantly becomes blue. According to Schönbein, it will change colour in air containing only a forty millionth of hydrocyanic acid. (See *Am. Journ. of Pharm.*, March, 1869, p. 174.) The test cannot, however, be relied on, since a similar reaction is yielded by numerous other substances, such as nitrous, nitric, and hydrochloric acids, chlorine, bromine, iodine, ammonia, dilute sulphuric acid, chromic acid, bichromate of potassium, &c. The paper should be exposed to a current of air, drawn through the suspected liquid, and, if indications be yielded, distillation practised to get the volatile acid in a state of sufficient purity to be submitted to the sulphur-iron test. This, as performed by Almén and Strieve, consists of adding sulphide of ammonium, so as to form a sulphocyanide; converting this into the non-volatile sulphocyanide of potassium by the addition of drops of liquor potassæ; then evaporating nearly or quite to dryness; adding a few drops of water, acidulated with hydrochloric acid, and finally adding a drop or two of sesquichloride of iron, when the blood-red of the sulphocyanide will be developed. (*Boston Med. and Surg. Journ.*, July, 1873.) Another test, which was proposed by Schönbein, and which was found to be exceedingly delicate by M. Büchner, is dependent upon the power prussic acid has of preventing the catalytic action of the red blood corpuscles. Normally, when these are brought into contact with oxygenated water, the latter is decomposed and oxygen liberated; if prussic acid be present no oxygen is set free, but the mixture becomes of a deep-brown colour. In this Büchner recognised 5 milligrammes of the anhydrous acid in 600 grammes of blood and water. This test is not applicable to old blood. (*Am. Journ. of Pharm.*, Sept. 1869.)

Off. Prep. Vapor Acidi Hydrocyanici, *Br.* B.

ACIDUM MURIATICUM DILUTUM. *U. S.* Acidum Hydrochloricum Dilutum. *Br.* *Diluted Muriatic Acid. Dilute Hydrochloric Acid.*

"Take of Muriatic Acid *four troyounces;* Distilled Water *a sufficient quantity.* Mix the Acid, in a glass vessel, with sufficient Distilled Water to make the Diluted Acid measure a pint. The sp. gr. is 1·038." *U. S.*

"Take of Hydrochloric Acid *eight fluidounces* [Imperial measure]; Distilled Water a sufficiency. Dilute the Acid with 16 fluidounces [Imp.] of the water; then add more water, so that, at a temperature of 60°, it shall measure 26½ fluidounces [Imp. meas.]. Or, as follows: Take of Hydrochloric Acid 3060 grains; Distilled Water *a sufficiency.* Weigh the Acid in a glass flask, the capacity of which, to a mark on the neck, is one pint [Imp. meas.]; then add Distilled Water until the mixture, at 60° temperature, after it has been shaken, measures a pint [Imp. meas.]." *Br.*

The existing U. S. formula differs from that of 1850 in substituting four troyounces for four fluidounces. In both, the resulting diluted acid measures a pint. The present is somewhat weaker than the former diluted acid, having the sp. gr. 1·038, while that of 1850 was 1·046; but the difference is of no practical importance as regards the dose, the diminution in strength amounting only to about one-eleventh of the whole. The British preparation is stronger even than ours of 1850, having the sp. gr. 1·052. "345 grains by weight (6 fluidrachms) require for neutralisation 1000 grain-measures of the *volumetric solution of soda*, corresponding to 10·58 per cent. of real acid. Six fluidrachms [Imperial] contain one eq. or 36·5 grains of hydrochloric acid HCl." *Br.* The extreme precision of the British formula, though no doubt useful when the diluted acid is used as a test, is quite unnecessary in a therapeutical point of view.

The medical properties and applications of muriatic acid have been detailed in *Part* I., under the head of *Acidum Muriaticum.* The dose of the diluted acid is from twenty minims or drops to a fluidrachm, and may be taken in water or other convenient vehicle, sweetened or not as may be deemed expedient.

Pharm. Uses. In preparing Ferri et Quiniæ Citras. *Br.*

Off. Prep. Liquor Morphiæ Hydrochloratis, *Br.;* Liquor Strychniæ, *Br.;* Morphiæ Hydrochloras, *Br.* B.

ACIDUM NITRICUM DILUTUM. *U. S., Br. Diluted Nitric Acid.*

"Take of Nitric Acid [sp. gr. 1·42] *three troyounces;* Distilled Water *a sufficient quantity.* Mix the Acid, in a glass vessel, with sufficient Distilled Water to make the Diluted Acid measure a pint. The sp. gr. of Diluted Nitric Acid is 1·068." *U. S.*

"Take of Nitric Acid *six fluidounces* [Imperial measure], Distilled Water *a sufficiency.* Dilute the Acid with 24 fluidounces [Imp. meas.] of the Water; then add more water, so that at a temperature of 60° it shall measure 31 fluidounces [Imp. meas.]. Or, as follows:

"Take of Nitric Acid 2400 grains, Distilled Water *a sufficiency.* Weigh the Acid in a glass flask, the capacity of which, to a mark on the neck, is one pint [Imp. meas.]; then add Distilled Water until the mixture, at 60° temperature, after it has been shaken, measures a pint." *Br.*

The U. S. acid, as now directed, varies little from the officinal acid of 1850, which was made by mixing a fluidounce of the officinal nitric acid with six fluidounces of distilled water, and had the sp. gr. 1·07; while the present preparation contains three troyounces in a pint of the diluted acid, and has the sp. gr. 1·068; being only about one-thirty-eighth weaker, which is a difference of no practical importance. The British diluted acid is considerably stronger than our own in the same measure. It has the sp. gr. 1·101; and "361 grains by weight (six fluidrachms) require for neutralisation 1000 grain-measures of the *volumetric solution of soda*, corresponding to 14·95 per cent. of anhydrous nitric acid. Six fluidrachms [Imp. meas.], therefore, correspond to 54 grains of the anhydrous acid (one eq. of NO_5)." *Br.*

In making the U. S. diluted acid, the apothecary should be careful to use acid of the sp. gr. 1·42; or, if the acid used is weaker than this, to add proportionally less water; otherwise the diluted acid would be weaker than it is directed to be in the Pharmacopœia.*

The medicinal properties of the diluted acid are the same as those of the strong acid. (See *Acidum Nitricum.*) The dose of the U. S. diluted acid is from twenty to forty drops or minims, that of the British, from fifteen to thirty, three times a day, sufficiently reduced with water at the time of taking it. B.

ACIDUM NITROMURIATICUM. *U. S. Nitromuriatic Acid.*

"Take of Nitric Acid [sp. gr. 1·42] *three troyounces;* Muriatic Acid *five troyounces.* Mix the Acids in a glass vessel, and when effervescence has ceased, keep the product in a well-stopped bottle, in a cool place, protected from the light." *U. S.*

In the old formula four fluidounces of nitric acid were mixed with eight fluidounces of muriatic acid, or in the proportion of one to two by measure. The difference between the old and new acid is insignificant, the muriatic acid being, according to the calculation of Mr. A. B. Taylor, one-forty-ninth increased. (*Am. Journ. of Pharm.*, Sept. 1863, p. 410.)†

Nitromuriatic acid is the *aqua regia* of the earlier chemists, so called from its property of dissolving gold. Nitric and muriatic acids, when mixed together, mutually decompose each other. According to the researches of Gay-Lussac (June, 1848), the reaction gives rise to two compounds, in variable proportions, of nitric oxide and chlorine (NO_2Cl_2 and NO_2Cl), mixed with free chlorine; the former being analogous in constitution to hyponitric, the latter to nitrous acid. The power, however, of nitro-

* *A quantitative test* for *nitric acid* in water, which has been brought prominently forward since the revision of the earlier portions of this book, has for its basis the power of the acid to decolorize indigo in the presence of sulphuric acid. It was first proposed by M. Boussingault, in 1857, and was subsequently simplified by M. Marx. Finally, M. Fischer has substituted indigotine for indigo, on account of its solution being permanent. His method is first to prepare a test solution by mixing 5 cubic centimetres of solution of indigotine with 30 cubic centimetres of pure sulphuric acid, and then adding a titrated solution of nitrate of potassium (5 decigrammes to the litre) until the blue colour is changed to a faint green. Then the solution of indigotine is diluted until one cubic centimetre is decolorized by 0·2525 milligrammes of nitrate of potassium. In using this test solution the temperature should always be at least 110° Centigrade, and the amount of sulphuric acid should always be at least double the joint volume of the indigotine solution and the water. (*Journ. de Pharm.*, Nov. 1874.)—*Note to the fourteenth edition.*

† For an apparatus for making nitromuriatic acid upon a large scale, see *Pharm. Journ.*, xi. 422

muriatic acid to dissolve gold, and similar metals having a weak affinity for oxygen, is owing exclusively to the free chlorine present, and is in no wise dependent on the compounds above referred to, which remain entirely passive during the solution of the metal. (*Journ. de Pharm.*, Août, 1848.) Adopting the views of Gay-Lussac, the proportion of the acids for total mutual decomposition would be two eqs. of nitric and six of muriatic acid; and the products would be the two compounds of nitric oxide and chlorine, free chlorine, and water. Assuming this proportion, it follows that a large excess of nitric acid is employed in the U. S. formula. According to the same views, the proportion of free chlorine must be variable, dependent upon the relative proportion of the nitric oxide compounds to each other. For every eq. of NO_2Cl_2 formed, one eq. of chlorine will be set free; while for every eq. of NO_2Cl, two eqs. of chlorine will be evolved. The precise circumstances that determine the simultaneous formation of the two nitric oxide compounds, and their constantly varying proportion to each other, have not been pointed out by Gay-Lussac in the paper above referred to. When nitromuriatic acid is made from strong acids, there is always a loss of the nitric oxide compounds and of free chlorine by effervescence, in consequence of the acids not containing sufficient water to hold the gaseous products in solution. Hence the substitution, in the U. S. Pharmacopœia of 1850, of nitric acid of 1·42 for the acid of 1·5 was an improvement.

Properties. Nitromuriatic acid has an orange colour, soon changing to a golden-yellow, and the odour of chlorine. It possesses the power of dissolving gold and platinum. It should be kept in a cool dark place, on account of its liability to lose chlorine by heat, and to have it converted, by the action of light, into muriatic acid, through the decomposition of water. On account of its tendency to decomposition, it should not be made in large quantities, nor be very long kept by the apothecary; and care should be taken not to transfer it to the bottle in which it is to be dispensed, until effervescence has ceased, lest the pressure within should drive out the stopper. Nitric and muriatic acids, as found in the shops, are sometimes so weak that when mixed they will not readily act on gold-leaf. In this case, their solvent power may be rendered effective by the addition of a little sulphuric acid, which, by its superior affinity for water, concentrates the other acids, and causes immediate action.*

Medical Properties and Uses. Nitromuriatic acid was brought to the notice of the profession, in consequence of the favourable report of its efficacy as an external remedy in hepatitis, made by Dr. Scott, formerly of Bombay. When thus employed, it produces a tingling sensation of the skin, thirst, a peculiar taste in the mouth, and occasional soreness of the gums and plentiful pytalism; and at the same time stimulates the liver, as is evinced by an increased flow of bile. It is used either by sponging, or in the form of a local or general bath. When applied by sponging, the acid is first diluted so as to have the sourness of strong vinegar. When used as a foot-bath, three gallons of water, contained in a deep narrow wooden tub, may be acidulated with six fluidounces of the acid. In this the feet and legs are to be immersed for twenty minutes or half an hour. The bath may be employed at first daily, and afterwards twice or thrice a week; and the sponging may be used at the same time. The bath is said to be effective in promoting the passage of biliary calculi. The solution, prepared for a bath as above mentioned, may be used for a week, adding to it daily a pint of water, acidulated with two fluidrachms of the acid, to make up for the waste by evaporation. The bath should have a temperature of about 97°, which may be attained by heating part of the acid solution, and throwing it back into the remainder. For further details, see *Pharmaceutical Journal*, July, 1851, p. 38.

Nitromuriatic acid is much used internally, and is an excellent remedy in chronic hepatic affections, and in oxaluria. It is sometimes given also in syphilitic diseases. It is most efficient when of an orange colour. The dose is four to six drops, largely diluted with water. B.

ACIDUM NITROMURIATICUM DILUTUM. *U. S.* ACIDUM NITRO-HYDROCHLORICUM DILUTUM. *Br. Diluted Nitromuriatic Acid. Dilute Nitro-hydrochloric Acid.*

"Take of Nitric Acid *a troyounce and a half;* Muriatic Acid *two troyounces and*

* In relation to nitromuriatic acid, see a paper in the third volume of the Journal of the Philadelphia College of Pharmacy, by Mr. Daniel B. Smith, of this city.

a half; Distilled Water *a sufficient quantity.* Mix the Acids in a well-stopped bottle, having the capacity of a pint. Shake them together occasionally during twenty-four hours, and then add sufficient Distilled Water to make the Diluted Acid measure a pint. Lastly, keep it in a cool place, protected from the light." *U. S.*

"Take of Nitric Acid *three fluidounces;* Hydrochloric Acid *four fluidounces* [Imperial measure]; Distilled Water *twenty-five fluidounces* [Imp. meas.]. Mix the Acids, and allow them to remain for twenty-four hours in a bottle, the mouth of which is partially closed, then add the Water in successive portions, shaking the bottle after each addition, and preserve the mixture in a stoppered bottle. Sp. gr. 1·074. Six fluidrachms [Imp. meas.] (352·4 grains by weight) require for neutralisation 920 grain-measures of the *volumetric solution of soda.*" *Br.*

Between diluted nitric and hydrochloric acids no reaction occurs; and therefore both Pharmacopœias direct that the acids shall be mixed before dilution. But according to the researches of Mr. Tilden, confirmed by Mr. Redwood (*Pharm. Journ.*, x. p. 580), water determines a decomposition of the products resulting from the reaction between nitric and hydrochloric acid, and the reformation of hydrochloric and nitric acids, with a little nitrous acid. It would seem, therefore, that dilute nitromuriatic acid is not an eligible preparation. Clinical experience long since convinced me that it does not represent the strong acid. The dose is from ten to twenty drops or minims, three times a day, and may be given in a large wineglassful of water, sweetened or not as may be deemed expedient. H. C. W.

ACIDUM PHOSPHORICUM DILUTUM. *U.S., Br. Diluted Phosphoric Acid.*

"Take of Phosphorus *three hundred and sixty grains;* Nitric Acid *five troyounces*, or *a sufficient quantity;* Distilled Water *a sufficient quantity.* Mix five troyounces of Nitric Acid with half a pint of Distilled Water, in a porcelain capsule, of the capacity of two pints. Add the Phosphorus, and invert over it a glass funnel of such dimensions that its rim may rest on the inside of the capsule, near the surface of the liquid. Place the capsule on a sand-bath, and apply a moderate heat until the Phosphorus is dissolved, and red vapours cease to rise. If the reaction become too violent, add a little Distilled Water; and if the red vapours cease to be evolved before the Phosphorus is all dissolved, gradually add Nitric Acid, diluted to the same extent as before with Distilled Water, until the solution is effected. Then, removing the funnel, continue the heat until the excess of nitric acid is driven off, and a syrupy liquid, free from odour and weighing two [troy]ounces, remains. Lastly, mix this, when cold, with sufficient Distilled Water to make it measure twenty fluidounces, and filter through paper.

"Diluted Phosphoric Acid may also be prepared by dissolving a troyounce of Glacial Phosphoric Acid in three fluidounces of Distilled Water, adding to the solution forty grains of Nitric Acid, boiling it until reduced to a syrupy liquid, and free from the odour of nitric acid, and then adding sufficient Distilled Water to make the Diluted Acid measure twelve fluidounces and a half." *U. S.*

"Take of Phosphorus *four hundred and thirteen grains;* Nitric Acid *six fluidounces* [Imperial measure]; Distilled Water a *sufficiency.* Put the Nitric Acid, diluted with eight [fluid]ounces [Imp. meas.] of Distilled Water, into a tubulated retort connected with a Liebig's condenser, and, having added the Phosphorus, apply a gentle heat, so as slowly to distil five fluidounces [Imp. meas.] of liquid. Return this to the retort, and continue the distillation, occasionally returning the distillate, until the phosphorus has entirely disappeared. Transfer the contents of the retort to a porcelain dish of hard well-enamelled ware, and evaporate the liquid until it is reduced to four fluidounces [Imp. meas.]; then transferring it to a platinum vessel, continue the evaporation until it is reduced to about two fluidounces [Imp. meas.], and orange-coloured vapours are no longer formed. Mix it now with Distilled Water until, when cold, it measures one pint [Imp. meas.]." *Br.*

The first formula of the U. S. Pharmacopœia differs only in its manipulations from the British, which is essentially that of the late London Pharmacopœia. In both, phosphorus is oxidized at the expense of the nitric acid, which, in giving up a portion of its oxygen to the phosphorus, is converted into nitric oxide, becoming red

hyponitric acid vapours as it escapes. Strong nitric acid acts too energetically on phosphorus, producing explosion and rapid combustion; but when diluted, as in the processes above given, it parts with its oxygen slowly, and it is even desirable to aid the operation with a gentle heat. Along with the nitrous fumes, a portion of the undecomposed nitric acid also rises in vapour, which, in the British process, to prevent loss, is collected by means of a distillatory apparatus, and returned into the retort. In the U. S. process, the same end is effected by placing over the liquid in the capsule a glass funnel, upon the inner surface of which the acid is condensed, and returns of itself into the capsule so as considerably to simplify the operation. This modification was originally suggested by Mr. Geo. W. Andrews, of Baltimore, who, however, inverted a dish over the materials; the suggestion of the funnel being due to Prof. Procter. The operation being continued till the whole of the phosphorus is converted into phosphoric acid and dissolved, and the liquid having been deprived of any remaining acid, and reduced to a certain weight by concentration, the process is completed by adding a certain measure of water; so that an acid of definite strength is obtained. Mr. C. Lewis Diehl, jun., has found, in carrying the U. S. process into effect, that the glass funnel covering the capsule almost always breaks through the violence of the reaction, thus causing loss of phosphorus, besides annoyance to the operator. He, therefore, prefers using a French tubulated glass retort. (*Am. Journ. of Pharm.*, March, 1867, p. 138.) The U. S. diluted acid has the sp. gr. 1·056; and 100 grains of it are saturated by 23·4 grains of bicarbonate of potassium without precipitation. Diluted Phosphoric Acid is defined "Phosphoric acid $3HO,PO_5$, dissolved in water and corresponding to 10 per cent. by weight of anhydrous phosphoric acid PO_5." *Br.* It has the sp. gr. 1·08. "335 grains by weight of it poured upon 180 grains of oxide of lead in fine powder, leave by evaporation a residue, which, after it has been heated to dull redness, weighs 215·5 grains. Six fluid-drachms, therefore, correspond to 35·5 grains of anhydrous phosphoric acid ($\frac{1}{2}$ an eq. of PO_5)." *Br.*

The second U. S. formula consists in simply boiling glacial phosphoric acid in water, with the addition of a little nitric acid. By this process the glacial acid, which is monobasic, is converted into the tribasic acid, which is the medicinal phosphoric acid. The nitric acid operates, in this instance, simply by its presence in favouring the change, without itself undergoing decomposition. (See *Acidum Phosphoricum Glaciale*, p. 65.) The proportions of acid and water are so arranged that the diluted acid shall have the same strength as that procured by the first process.

Much dissatisfaction has been caused among pharmaceutists by the fact that diluted phosphoric acid frequently produced a white precipitate in solutions of the sesquisalt of iron. Examination showed that this occurred only in the product of the second process in which the glacial acid is used. From a paper of Mr. Louis Dohme (*Proceed. Am. Pharm. Assoc.*, 1874, p. 431), and a debate thereon (*Ibid.*, p. 511), it appears that this results from the presence of pyrophosphoric acid. Considerable difficulty was experienced in driving off all the nitric acid, and in the attempt to do so the temperature became so elevated as to reconvert some of the tribasic acid back to the bibasic form. This occurred slightly at 300°, but to a much greater extent between 350° and 400° F. Mr. Remington stated that much of the glacial acid was contaminated with soda; and in a subsequent report of Mr. Dohme (*Ibid.*, 1875) it is affirmed that between fourteen and fifteen per cent. of soda was found in different specimens of this acid. The dilute acid made by the first process can be brought to the boiling point of 450°, and will then only produce a slight cloud, and if diluted, when cool, with about half its bulk of cold water, which causes considerable elevation of temperature, forms a clear solution with tincture of iron. The same acid evaporated, heated to redness, allowed to congeal, and then dissolved in water, precipitated the iron solution. The addition of twenty per cent. of pyrophosphate of sodium to the same dilute acid made a preparation which in all respects resembled that made from the glacial acid; thus giving evidence that the presence of this contamination was the cause of the difference in the two preparations.

It has been suggested that red phosphorus might be substituted for common phosphorus, as producing the same results, with less danger of explosion; but when the

officinal process is carefully followed in reference to the due dilution and to the use of a moderate heat, there is no danger to be apprehended.

Properties. Diluted phosphoric acid is a colourless, inodorous, sour liquid, acting strongly on litmus, and possessing powerful acid properties. Although evaporated so as to become dense, it is not corrosive like the other mineral acids. Dr. Neubaur found that the strong acid, when pure and warm, was capable of dissolving oxalate of calcium. The officinal acid is not precipitated by chloride of barium or nitrate of silver. If precipitates are produced, chloride of barium indicates sulphuric acid or a sulphate; nitrate of silver, muriatic acid or a chloride. Strips of copper or silver are not affected by the acid, showing the absence of nitric acid; it is not coloured by sulphuretted hydrogen, proving the general absence of metals; and albumen produces no precipitate with it, indicating the non-existence of metaphosphoric acid. If carbonate of sodium causes a precipitate, phosphate of calcium, or some other phosphate insoluble in water, is probably held in solution. It has been supposed that one-tenth of phosphorous acid would render the diluted acid dangerous to life; but experiments go far to show that this was an erroneous opinion, as half a drachm of that acid given to a dog produced no obvious poisonous effect. (See *Am. Journ. of Pharm.*, July, 1858, p. 359.) Phosphorous acid may be detected by testing the medicinal acid with a solution of corrosive sublimate, which will be converted into calomel if this impurity be present. (Pagels, *Chem. Gaz.*, Jan. 15, 1857.)

The following is a table exhibiting the quantity of pure phosphoric acid contained in solutions of different densities, prepared by Mr. John Watts, of London, and published in the *Pharm. Journ. and Trans.*, Oct. 1865, p. 191.

Specific Gravity.	Per-centage.	Specific Gravity.	Per-centage.	Specific Gravity.	Per-centage.	Specific Gravity.	Per-centage.	Specific Gravity.	Per-centage.
1·508	49.60	1·392	40·86	1·293	32·71	1·185	22·07	1·081	10·44*
1·492	48·41	1·384	40·12	1·285	31·94	1·173	20·91	1·073	9·53
1·476	47·10	1·376	39·66	1·276	31·03	1·162	19·73	1·066	8·62
1·464	45·63	1·369	39·21	1·268	30·13	1·153	18·81	1·056	7·39†
1·453	45·38	1·356	38·00	1·257	29·16	1·144	17·89	1·047	6·17
1·442	44·13	1·347	37·37	1·247	28·24	1·136	16·95	1·031	4·15
1·434	43·95	1·339	36.74	1·236	27·30	1·124	15·64	1·022	3·03
1·426	43·28	1·328	36·15	1·226	26·36	1·113	14·33	1·014	1·91
1·418	42·61	1·315	34·82	1·211	24·79	1·109	13·25	1·006	·79
1·401	41·60	1·302	33·49	1·197	23·23	1·095	12·18		

Medical Properties and Uses. Diluted phosphoric acid is deemed tonic and refrigerant. It is preferable in point of flavour to the diluted sulphuric acid, and is less apt to disturb the digestive functions. Various properties have been ascribed to it; such as allaying pain and spasm, strengthening the sexual organs, preventing the morbid secretion of bony matter, and correcting phosphatic deposits in the urine. The last two properties are supposed to depend upon its power of dissolving phosphate of calcium. It has been recommended in hysteria, diabetes, and in leucorrhœa when the secreted fluid is thin and acrid. Magnus Hus used it with advantage in the first stage of abdominal or petechial typhus. In diabetes Dr. Paris found it to allay the thirst more effectually than any other acid drink. Dr. A. Judson (*Ann. de Thérap.*, 1871 and 1872, p. 152) asserts that in doses of from one to three drachms it acts as a stimulant, increasing the force and frequency of the pulse, and causing headache and cerebral confusion. The dose is from twenty drops to a teaspoonful, largely diluted with water.

Off. Prep. Ammoniæ Phosphas, *Br.;* Syrupus Ferri Phosphatis, *Br.* B.

ACIDUM SULPHURICUM AROMATICUM. *U. S.*, *Br.* *Aromatic Sulphuric Acid.* *Elixir of Vitriol.*

"Take of Sulphuric Acid *six troyounces;* Ginger, in moderately fine powder, *a troyounce;* Cinnamon, in moderately fine powder, *a troyounce and a half;* Alcohol *a sufficient quantity.* Add the Acid gradually to a pint of Alcohol, and allow the liquid to cool. Mix the Ginger and Cinnamon, and, having put them into a percolator,

* British Pharmacopœia. † U. S. Pharmacopœia.

pour alcohol gradually upon them until a pint of tincture is obtained. Lastly, mix the diluted acid and the tincture." *U. S.*

"Take of Sulphuric Acid *three fluidounces*, or 2419 grains by weight; Rectified Spirit *two pints* [Imperial measure]; Cinnamon Bark, in coarse powder, *two ounces* [avoirdupois]; Ginger, in coarse powder, *one ounce and a quarter* [avoird.]. Mix the Sulphuric Acid gradually with the Spirit, add the Cinnamon and Ginger, macerate for seven days, agitating frequently, then filter." *Br.*

The U. S. acid is somewhat stronger than the British. The latter has the sp. gr. 0·927; and "6 fluidrachms [Imp. meas.] or 304·2 grains by weight of it require for neutralisation 830 grain-measures of the *volumetric solution of soda*, corresponding to 10·91 per cent. of anhydrous sulphuric acid. Six fluidrachms [Imp. meas.], therefore, correspond to 33·2 grains of anhydrous acid." *Br.*

Properties. Aromatic sulphuric acid is a reddish-brown liquid, of a peculiar aromatic odour, and, when sufficiently diluted, of a grateful acid taste. It has been supposed by some to contain ether or sulphovinic acid, its main ingredients justifying such a suspicion; but the late Dr. Duncan, of Edinburgh, who originally held this opinion, satisfied himself that the alcohol and sulphuric acid, in the proportions here employed, do not generate a single particle of ether; and Prof. Attfield has shown that there is no sulphovinic acid in the officinal drug. (*Pharm. Journ.*, vol. x. p. 471.) It must, therefore, be viewed merely as sulphuric acid diluted with alcohol, and containing the essential oils of ginger and cinnamon.

Medical Properties and Uses. This valuable preparation, commonly called *elixir of vitriol*, is a simplification of *Mynsicht's acid elixir*. It is tonic and astringent, and affords the most agreeable form of sulphuric acid for administration. It is very much employed in debility with night-sweats, in loss of appetite, and in the convalescence from fevers, especially those of the intermittent type. It is often given in conjunction with cinchona, the taste of which it serves to cover, and the efficacy of which it increases by promoting the solubility of its febrifuge principles. In hæmoptysis and other hemorrhages, when not attended with obvious inflammation, it frequently proves useful by stopping the flow of blood. It has been recommended in epidemic dysentry and as a preventive in epidemic cholera (*New Jersey Med. and Surg. Reporter*, ix. 199; *Philada. Med. Times*, iii. 649), and is very useful in serous diarrhœa. The dose is from ten to thirty drops in a wineglassful of water, repeated two or three times a day. Care must be taken that the teeth are not injured by the acid.

Off. Prep. Infusum Cinchonæ Flavæ, *U.S.*; Infusum Cinchonæ Rubræ, *U. S.* B.

ACIDUM SULPHURICUM DILUTUM. *U.S.*, *Br.* *Diluted Sulphuric Acid.*

"Take of Sulphuric Acid *two troyounces*; Distilled Water *a sufficient quantity*. Add the Acid gradually to *fourteen fluidounces* of Distilled Water, and mix them. Then filter through paper, and pass sufficient Distilled Water through the filter to make the Diluted Acid measure a pint. The sp. gr. of this acid is 1·082." *U. S.*

"Take of Sulphuric Acid 7 *fluidounces* [Imperial measure]; Distilled Water *a sufficiency*. Dilute the Acid with 77 fluidounces of the Water, and when the mixture has cooled to 60° add more Water, so that it shall measure 83½ fluidounces. Or as follows:

"Take of Sulphuric Acid 1350 grains, Distilled Water *a sufficiency*. Weigh the Acid in a glass flask, the capacity of which, to a mark on the neck, is one pint [Imp. meas.], then gradually add Distilled Water until the mixture, after it has been shaken and cooled to 60°, measures a pint [Imp. meas.]. Sp. gr. 1·094. Six fluidrachms [Imp. meas.] or 359 grains by weight require for neutralisation 1000 grain-measures of the *volumetric solution of soda*, corresponding to 10·14 per cent. of anhydrous sulphuric acid. Six fluidrachms, therefore, correspond to 40 grains of the anhydrous acid (one eq. of SO_3)." *Br.*

The direction to filter, in the U. S. process, would be unnecessary were the acid chosen with due attention to the officinal description in the Materia Medica. But as the sulphuric acid of the shops often contains insoluble substances which are pre-

cipitated on its dilution, the caution is in practice often necessary to avoid impurity in the preparation. In the old formula a fluidounce of acid was added to thirteen fluidounces of water. The result is very nearly the same.

This preparation is sulphuric acid, diluted to such an extent as to make it convenient for prescription. It is not exactly coincident in strength as directed in the two Pharmacopœias, the U. S. acid being somewhat weaker than the British; but the difference is not so great as to be of practical importance. The strong acid is added gradually to the water, to guard against the too sudden production of heat, which might cause the fracture of the vessel. During the dilution, when commercial sulphuric acid is used, the liquid becomes slightly turbid, and in the course of a few days deposits a grayish-white powder, which is sulphate of lead, and from which the diluted acid should be poured off. This noxious salt is thus got rid of; but sulphate of potassium, another impurity in the strong acid, still remains. The presence of a little sulphate of potassium will do no harm; but, if it should be fraudulently introduced into the strong acid to increase its specific gravity, its amount may be ascertained by saturating the acid, after dilution, with ammonia, and expelling by a red heat the sulphate of ammonium formed. Whatever sulphate of potassium is present will remain behind.

Medical Properties and Uses. Diluted sulphuric acid is tonic, refrigerant, and astringent. It is given in typhoid fevers, and often with advantage. In the convalescence from protracted fevers, it acts beneficially as a tonic, exciting the appetite and promoting digestion. As an astringent, it is employed in colliquative sweats, passive hemorrhages, and diarrhœas dependent on a relaxed state of the mucous membrane of the intestines. In calculous affections attended with phosphatic sediments it is the proper remedy, being preferable to muriatic acid, as less apt, by continued use, to disorder the stomach. Locally it is used as an ingredient in gargles for ulcerated sorethroat and for checking excessive ptyalism, and as a wash for cutaneous eruptions and ill-conditioned ulcers. The dose is from ten to thirty drops, three times a day, in a wineglassful of plain or sweetened water. It is added with advantage to infusions of cinchona, the organic alkalies of which it tends to hold in solution. As it is apt to injure the teeth, it is best taken by sucking it through a quill. It is much less used in the United States than the elixir of vitriol, which possesses nearly the same medical properties. (See *Acidum Sulphuricum Aromaticum.*) An elegant form for giving it is the officinal Compound Infusion of Roses.

In 1851, attention was called by Mr. Buxton, of London, to the remarkable efficacy of diluted sulphuric acid in several forms of diarrhœa, especially choleraic diarrhœa. In October, 1853, Dr. H. W. Fuller, of St. George's Hospital, published a paper in the London *Medical Times and Gazette*, in which he strongly recommends it in choleraic diarrhœa, from his own experience and that of his friends in more than ninety cases without a single failure. The dose employed was half a fluidrachm, diluted with water, given every twenty minutes in ordinary cases, every quarter of an hour in severe cases. The vomiting, purging, and cramps usually ceased after the third or fourth dose. For bilious diarrhœa the acid is not a suitable remedy.

Pharm. Uses. In preparing Aconitia; Antimonium Sulphuratum; Aqua Acidi Carbonici, *U. S.;* Atropia; Ferri et Quiniæ Citras, *U. S.;* Potassii Bicarbonas, *U. S.;* Potassæ Permanganas, *Br.;* Quiniæ Valerianas, *U. S.;* Strychnia, *U. S.*

Off. Prep. Atropiæ Sulphas, *Br.;* Beberiæ Sulphas, *Br.;* Cinchoniæ Sulphas, *U. S.;* Infusum Rosæ Acidum, *Br.;* Infusum Rosæ Compositum, *U. S.;* Morphiæ Sulphas, *U. S.;* Quiniæ Sulphas, *Br.;* Strychniæ Sulphas, *U. S.* B.

ACIDUM SULPHUROSUM. *U. S., Br. Sulphurous Acid.*

"Take of Sulphuric Acid *eight troyounces;* Charcoal, in coarse powder, *a troyounce;* Distilled Water *thirty-six fluidounces.* Pour the Acid upon the Charcoal, previously introduced into a matrass, and shake them together. Connect the matrass with a washing bottle, and this, by means of a bent glass tube reaching nearly to the bottom of it, with a two-necked bottle containing the Distilled Water. To the other neck of this bottle attach another bent tube, and let it dip slightly into a solution of carbonate of sodium. All the joints having been properly luted, apply heat to the matrass until gas ceases to be evolved, preventing the temperature of the Distilled

Water from rising, by means of cold water applied to the bottle containing it. Lastly, pour the Sulphurous Acid into half-pint bottles, which must be well stopped, and kept in a cool place." *U. S.*

"Take of Sulphuric Acid *four fluidounces;* Wood Charcoal, broken into small pieces, *one ounce;* Water *two fluidounces;* Distilled Water *twenty fluidounces.* Put the Charcoal and the Sulphuric Acid into a glass flask, connected by a glass tube with a wash-bottle containing the two fluidounces of Water, whence a second tube leads into an [Imperial] pint bottle containing the Distilled Water, to the bottom of which the gas-delivery tube should pass. Apply heat to the flask until gas is evolved, which is to be conducted through the Water in the wash-bottle, and then into the Distilled Water, the latter being kept cold, and the process being continued until the bubbles of gas pass through the solution undiminished in size. The product should be kept in a stoppered bottle, in a cool place." *Br.*

The processes of the two Pharmacopœias are essentially the same, and both based upon that of Wittstein. The sp. gr. of the U. S. preparation is about 1·035, of the British, 1·04. Of the latter "34·7 grains mixed with an ounce of distilled water and a little mucilage of starch do not acquire a permanent blue colour with the *volumetric solution of iodine* until 1000 grain-measures of the latter have been added." *Br.*

The rationale of the process is simple. When the sulphuric acid (SO_3) and charcoal are heated together, the former gives up an equivalent of its oxygen to the latter, and is thus converted into sulphurous acid gas, which, having been passed first through a wash-bottle containing a little water to absorb impurities, is received into the distilled water, by which it is absorbed until the water becomes saturated. To prevent the escape of the noxious gas into the atmosphere, the excess, which escapes absorption, is in the U. S. process received into a solution of carbonate of sodium, and condensed. In the Br. process, the point of saturation is roughly indicated by the bubbles, formed by the escape of the gas from the distilled water, being equal in size to those formed in the wash-bottle. If there be any difficulty in getting the solution up to the officinal strength the proportionate amount of sulphuric acid and of charcoal should be increased, and care exercised that the gas pass through the water in an abundant stream. The direction to keep the acid in well-stopped bottles, in a cool place, is necessary in consequence of the strong tendency of the gaseous acid to escape and to undergo oxidation. An incidental advantage of the U. S. process is the production of sulphite of sodium. Old sulphurous acid often contains sulphuric acid, which may be *nearly* all removed by the cautious addition of sulphite of barium and the removal by filtration of the precipitated sulphate.

According to Mr. W. L. Scott (*Pharm. Journ.*, Oct., 1869, p. 217), the best results are obtained when sulphuric acid containing 75 per cent. of anhydrous acid is employed; when a too concentrated acid is used a part of it is entirely reduced and sulphur deposited, while a too dilute acid causes the evolution of sulphuretted hydrogen. The same authority also affirms that a purer gas is obtained by placing a little sulphite of lead and a few pieces of charcoal in the wash-bottles.

Prof. F. C. Calvert gives a process for preparing this acid on a large scale, by which he avoids all the inconveniences usually attendant on its manufacture, and has prepared thousands of gallons daily of a saturated solution. It consists in burning sulphur in a small furnace, and conducting the acid gas, through earthenware tubes, surrounded with water so as to cool them. The gas is then made to ascend through a wooden tube 40 feet high and about 4 feet wide, filled with pumice stone previously washed first with muriatic acid and then with water. A certain amount of water is introduced into the tube from above, which, in its descent, meets and dissolves the gas, and runs out saturated from the bottom of the tube into an air-tight reservoir. (*Pharm. Journ.*, xvii. 512.)

Properties. The officinal sulphurous acid is a very strong solution of sulphurous acid gas. The pure acid is an irrespirable gas, of a suffocating odour familiar to every one as that of burning sulphur, which is converted into it by combustion. If inhaled in the concentrated state, it proves fatal. Cold reduces it to a colourless liquid, which, according to M. Is. Pierre, boils at 32° F. (*Journ. de Pharm.*, 4e sér., xvii. 435.) It consists of one eq. of sulphur, and two eqs. of oxygen (SO_2), has the sp. gr. 2·21,

liquefies at 14° F., has a strong acid reaction, extinguishes burning bodies, has the power of bleaching many coloured substances, and has a strong affinity for oxygen, with which it combines in the presence of water, forming sulphuric acid. Water at 65° takes up about 50 volumes of the gas, and the solution has the sp. gr. 1·04. (*Brande and Taylor.*)

The following table, founded on the researches of Mr. Scott (*Pharm. Journ.*, xi. 218), gives the strength of acids of various specific gravity.

Per cent. of SO_2.	Sp. gr. at 60°.	Per cent. of SO_2.	Sp. gr. at 60°.	Per cent. of SO_2.	Sp. gr. at 60°.
5	1·0275	7	1·0377	9	1·0474
5·5	1·0302	7·5	1·0401	9·5	1·0497
6	1·0328	8	1·0426	10	1·0520
6·5	1·0353	8·5	1·0450		

Sulphurous acid sometimes exists as an impurity in muriatic, acetic, and other acids; according to P. Schweitzer, the minutest quantity may be detected by dissolving zinc in the suspected acid; when, if sulphurous acid be present, the odour of sulphuretted hydrogen will be at once perceived. (*Chem. News*, xxiii. 293.)

Officinal sulphurous acid (*Acidum Sulphurosum*) is a colourless liquid, having the smell of burning sulphur, and a sulphurous somewhat astringent taste. Its sp. gr. as indicated by the Pharmacopœias has been mentioned. When exposed to the air it slowly absorbs oxygen, with the formation of sulphuric acid, and thus acquires a sour taste, and the property of changing vegetable blues to red. When kept in closed vessels exposed to the sunlight, a portion of it is decomposed, sulphur being deposited and sulphuric acid formed by the union of the liberated oxygen with other portions of the acid. (*Am. Journ. of Pharm.*, xlii. 352.) It should be entirely volatilized by heat. "When saturated with ammonia, and treated with an excess of chloride of barium, it affords a clear or nearly clear solution on the addition of muriatic acid in excess." (*U. S.*) This shows the absence of sulphuric acid. It decolorizes iodine by producing hydriodic acid, and on this fact is based the test of the Br. Pharmacopœia before given. It decomposes the bone phosphate of calcium.

Medical Properties and Uses. Sulphurous acid has been introduced into use in consequence of its fatal influence upon the lower forms of animal and vegetable life. It is supposed to be thus destructive by its anti-oxygenizing influence; suffocating organic beings by denying them the oxygen necessary to their existence; but it probably acts also by a physiological property independently of its mere chemical effect. It is perhaps by the same property that it prevents fermentation, destroying the microscopic organisms essential to that process. In reference to its parasiticide property, it was brought before the notice of the profession by Dr. Jenner of London; though to Prof. Graham, we believe, belongs the first suggestion of its applicability to such purposes. In pyrosis and in cases of sarcinæ ventriculi it may be taken internally; but one of the sulphites, as sulphite of sodium, is perhaps preferable for the purpose, as it yields the acid always by decomposition in the stomach. Dr. Robt. Bird affirms that it is a powerful antipyretic. (*Amer. Journ. Med. Sci.*, lviii. 236.) As an external application, it is used in psora, the different forms of porrigo, trichosis of the scalp, pityriasis versicolor, and the thrush of children; all parasitic affections, either animalcular or cryptogamous, and all of which generally yield to it, if proper care be taken, by previous removal of the scabs or scales, to bring it into contact with the morbific cause. The dose for internal use is a fluidrachm, largely diluted with water. When locally used it should be diluted with two or three measures of water or of glycerin, and applied as a lotion, or by cloths wet with it, or in the form of cataplasm. Dr. James Dewar, of Kirkaldy, has found very great advantage from the inhalation of sulphurous acid, in the form of the fumes of burning sulphur, in typhus and typhoid fevers, scarlatina, diphtheria, catarrhal fever, hay fever which is checked at once, gout, and rheumatism. (*N. O. Med. and Surg. Journ.*, Jan. 1867, p. 523; from *Dub. Med. Press*, Sept. 5, 1866.) Dr. Hjatelin believes that he arrested an epidemic of small-pox by the free use of the acid as a disinfectant. (*British Med. Journ.*, 1871, vol. ii. p. 519.) According to Rabuteau (*Neues Re-*

pert., xviii. 307), in the system sulphurous acid and the sulphites are converted into sulphuric acid and sulphates. W.

ACIDUM TANNICUM. *U. S., Br. Tannic Acid.*

"Take of Nutgall, in fine powder, Ether, each, *a sufficient quantity*. Expose the Nutgall to a damp atmosphere for twenty-four hours, and then mix it with sufficient Ether, previously washed with water, to form a soft paste. Set this aside, covered closely, for six hours; then, having quickly enveloped it in a close canvas cloth, express it powerfully between tinned plates, so as to obtain the liquid portion. Reduce the resulting cake to powder, and mix it with sufficient Ether, shaken with one-sixteenth of its bulk of water, to form again a soft paste, and express as before. Mix the liquids, and expose the mixture to spontaneous evaporation, until it assumes a syrupy consistence; then spread it on glass or tinned plates, and dry it quickly in a drying closet. Lastly, remove the dry residue from the plates with a spatula, and keep it in a well-stopped bottle." *U. S.**

The British Pharmacopœia has abandoned its former process, and adopted a new one in close conformity with the above, both being essentially the process of Leconnet, which has been substituted, in the existing Pharmacopœias, for that of Pelouse previously employed in both.

While the discarded process yields the tannic acid probably in a somewhat purer state than the present, it is less easy of performance, and much less productive; and the product of the existing formula is sufficiently pure for all practical purposes. The addition of a little alcohol, 8 per cent. for example, to the ethereal menstruum still further increases the product, and, we are informed, is practised to a considerable extent; but we doubt the propriety of this deviation from the officinal directions, as the resulting product may not be in all respects identical with the officinal. There appear to be two colouring principles in galls, one soluble in ether and not in alcohol, the other in alcohol and not in ether. Hence, while the tannic acid, in whichever way procured, is yellowish, that obtained by ether has a greenish tint, while that by the addition of alcohol is slightly brownish. The U. S. process is the same with that proposed by a commission of distinguished French pharmaceutists for the last edition of the Codex. In consequence of the mode in which the acid is dried, in thin layers, on tinned or glass plates, and equally exposed to heat above and below, it froths up on the escape of the ether, and concretes in a soft, cellular, friable form, which is strikingly characteristic of the preparation made in strict accordance with the formula.

From a superficial examination of this process, it might appear that the result can be nothing more than an ethereal extract; but it is necessary that the ether employed should contain water, as it is directed to be washed; and yet the quantity of water is so small that it can hardly operate by its mere solvent power. The circumstances attendant upon the process of Pelouse afford the means of a satisfactory explanation, which was first suggested by M. Beral. In this, the powdered galls are submitted to percolation by watered ether, and the liquid which passes divides itself into two layers, a heavier which sinks to the bottom and a lighter which floats upon the surface. It is the heavier which contains the tannic acid, and from which it is obtained by evaporation. The most probable explanation is that ether, water, and tannic acid unite to form a definite compound, in which the affinities are too feeble to resist the tendency of the ether to rise in vapour, and which is, therefore, decomposed by its evaporation. The proportion of the menstruum to the galls is very small, much smaller than would be employed to obtain an extract; and the whole or nearly the whole of both liquids is probably occupied in the formation of the definite compound referred to, thus leaving little or none to act merely as solvents. Hence the exclusion from the resulting acid, in great measure, of the other soluble constituents of the galls; and the slight amount of impurity really present in the acid is probably owing to the

* For the preparation of tannin from Chinese galls Oscar Rothe proposes the following as a superior process. Macerate eight parts of the powdered galls with twelve of ether and three of strong alcohol for two days, decant, renew the menstruum, and finally express. Mix the liquids, and after standing decant from the sediment, add twelve parts of water, recover the alcohol and ether by distillation, rapidly filter the aqueous solution, and quickly evaporate by means of a steam bath; dry, and pulverize the residue. (*Amer. Journ. of Pharm.*, xlii. 403.)—*Note to the fourteenth edition.*

action of that small quantity of the menstruum not occupied in forming the liquid compound. Opinion is not altogether united in this explanation; but it is that which appears to the author best to account for the phenomena of the case. It has been stated that the tannic acid, obtained by either of the officinal processes, has a more or less yellowish tint. From this, according to F. Kummel, it may be freed by the percolation, through recently ignited animal charcoal, of its solution in a mixture of ether and alcohol. It has, too, a slight odour which, according to Prof. Procter, is derived from a volatile odorous principle existing in galls, which he has succeeded in separating from the acid by the action of benzole. From 30 to 35 per cent. of tannic acid is obtained from galls by Pelouze's method; while that of Leconnet is said to yield 60 per cent.

The term *tannin* was originally applied to a principle or principles* existing in many vegetables, having a very astringent taste, and the properties of producing a white flocculent precipitate with solution of gelatin, and a black precipitate with the salts of sesquioxide of iron. As obtained, however, from different plants, it was found to exhibit some difference of properties; and chemists have recognised two kinds, one existing in oak bark, galls, &c., distinguished by producing a bluish-black precipitate with the salts of sesquioxide of iron, and the other existing in Peruvian bark, catechu, &c., and characterized by producing a greenish-black or dark-olive precipitate with the same salts. The former is the one which has received most attention, and from an examination of which the characters of tannin have generally been given. It is the substance described in this article. It will probably be found that the latter is essentially distinct from the tannin of galls, and different in different vegetables. One striking peculiarity of the tannin of galls is its facility of conversion into gallic acid, which is wanting in the other varieties. Since the publication of the experiments of M. Pelouze in relation to tannin, this substance has been universally admitted to rank with the acids, and is now, therefore, denominated *tannic acid.* The ordinary variety procured from galls is called, for the sake of distinction, by some *gallotannic acid,* and by others *quercitannic acid.* According to Pettenkofer, it is found only in perennial plants, indicating some relation to the production of woody fibre. (*Buchner's Neues Repert.*, iii. 74–76.)

Properties. Pure tannic acid is solid, uncrystallizable, white or slightly yellowish, inodorous,† strongly astringent to the taste, without bitterness, very soluble in water, much less soluble in alcohol and ether, especially when anhydrous, and insoluble in the fixed and volatile oils. It may be kept unchanged in the solid state; but its aqueous solution, when exposed to the air, gradually becomes turbid, and deposits a crystalline matter, consisting chiefly of gallic acid. During the change, oxygen is absorbed, and an equal volume of carbonic acid disengaged. But according to M. E. Robiquet, this change does not always take place, and, when it does happen, is ascribable to the presence of pectase in the tannin. (See *page* 997.) If the solution of tannic acid be boiled for a long time, the pectase loses its property of acting as a ferment, and the solution may be kept indefinitely without change. (*Journ. de Pharm.*, Avril, 1853, p. 246.)

Exposed to heat, tannic acid partly melts, swells up, blackens, takes fire, and burns with a brilliant flame. Thrown on red-hot iron, it is entirely dissipated. Its solution reddens litmus, and it combines with most of the salifiable bases. It forms with potassa a compound but slightly soluble, and is, therefore, precipitated by this alkali or its carbonates from a solution which is not too dilute, though a certain excess of alkali will cause the precipitate to be redissolved. Its combination with soda is much more soluble; and this alkali affords no precipitate, unless with a very concentrated solution of tannic acid. With ammonia its relations are similar to those with potassa. Baryta, strontia, lime, and magnesia, added in the state of hydrates, form

* For the different varieties of tannic acid, see *Neues Repertor. für Pharm.*, xviii. p. 261.

† Commercial tannic acid often has a decided odour, which Prof. Procter, after a practical investigation, believed to be owing chiefly to the presence of the odorous principle of the galls, though sometimes to matter derived from the ether with which it is prepared. (*Am. Journ. of Pharm.*, Jan. 1865, p. 53.) According to M. Heinz, the odour is due to a greenish resinous principle, which may be separated by dissolving the acid in twice its weight of hot water, adding one-fourth part of ether, agitating slowly, allowing the coagulated colouring matter to precipitate, filtering, and evaporating. (*Journ. de Pharm.*, xv. 308.)

with it compounds of little solubility. The same is the case with most of the metallic oxides, when presented, in the state of salts, to a solution of the tannate of potassium. Many of the metallic salts are precipitated by tannic acid even in the uncombined state, especially those of lead, copper, silver, uranium, chromium, mercury, teroxide of antimony, and protoxide of tin. With the salts of sesquioxide of iron it forms a black precipitate, which is a compound of tannic acid and the sesquioxide, and is the basis of ink. It does not disturb the solutions of the pure salts of protoxide of iron. Several of the alkaline salts precipitate it from its aqueous solution, either by the formation of insoluble compounds, or by simply abstracting the solvent. Chlorate of potassium when rubbed up with it explodes with great violence, and several serious accidents have occurred during the attempt to dispense such a mixture.

Tannic acid unites with all the vegetable organic alkalies, forming compounds which are for the most part of a whitish colour, and but very slightly soluble in water; though they are soluble in the vegetable acids, especially the acetic, and in alcohol, and in this latter respect differ from most of the compounds which tannic acid forms with other vegetable principles. On account of this property of tannic acid, it has been employed as a test of the vegetable alkalies; and it is so delicate, that it will throw down a precipitate from their solution, even when too feeble to be disturbed by ammonia.

It has an affinity for several acids, and when in solution affords precipitates with the sulphuric, nitric, muriatic, phosphoric, and arsenic acids, but not with the oxalic, tartaric, lactic, acetic, or citric. The precipitates are considered as compounds of tannic acid with the respective acids mentioned, and are soluble in pure water, but insoluble in water with an excess of acid. Hence, in order to ensure precipitation, it is necessary to add the acid in excess to the solution of tannic acid. Strecker. however, denies that the precipitates are compounds of the tannin with the acid, and maintains that they are merely tannin imbued with free acid. (*Chem. Gaz.*, No. 287, p. 370.)

When tannic acid, iodine, and water are mixed, a reaction takes place, by which the water is decomposed; its hydrogen forming with the iodine hydriodic acid, which combines with a portion of the tannic acid and remains in solution; while the oxygen of the water combines with another portion of the tannic acid, to form a compound. which, being insoluble, is precipitated. The iodized solution thus obtained is capable of dissolving more iodine, and holding it in permanent solution, however much diluted. (Socquet and Guilliermond, *Journ. de Pharm.*, xxvi. 280.) Iodine in a liquid containing tannic acid cannot be detected by starch; but if the liquid be placed in a watch-glass, sulphate of iron added, and the glass covered with a starched paper, the tannic being precipitated by the iron, the blue colour soon appears. (*Am. Journ. of Pharm.*, xlvii. p. 398.)

Tannic acid precipitates solutions of starch, albumen, and gluten, and forms with gelatin an insoluble compound, which is the basis of leather.

Its ultimate constituents are carbon, hydrogen, and oxygen; and its formula, according to Liebig, is $C_{18}H_8O_{12}$ or $C_{18}H_5O_9 + 3HO$. Mulder, however, from recent investigations, considers it isomeric with gallic acid, and gives its formula $C_{28}H_9O_{17} + HO$; and both Julius Loewe and Hugo Schiff have recently confirmed the correctness of this formula. (*Am. Journ. of Pharm.*, xxv. p. 223; xlvii. p. 208.) Strecker looks upon it as a compound of gallic acid and grape sugar, the latter of which is destroyed in the spontaneous change that moistened galls undergo by time. (See *Acidum Gallicum*, page 997.) He gives as its formula $C_{54}H_{19}O_{31}$ for the anhydrous acid, which, by the addition of 3 eqs. of water, becomes the hydrated acid $C_{54}H_{22}O_{34}$, differing from Liebig's by 2 eqs. of water. (*Chem. Gaz.*, No. 287, p. 370.) M. E. Robiquet denies the complex nature ascribed to tannic acid by Strecker, and maintains that, when transformed into gallic acid by the pectic ferment or by sulphuric acid,* it is simply by a molecular change, and not by the destruction of one of its constituents. (*Journ. de Pharm.*, xxvi. 31.) But, whether consisting of glu-

* The tannic acid of the European alder, when boiled with sulphuric acid, splits into alnic red and sugar. (*Am. Journ. of Pharm.*, xlii. 402.)

cose and gallic acid, or simply resolvable by certain agencies, through a new arrangement of its molecules, into these substances, it will equally rank among the glucosides; differing in this respect essentially from the varieties of tannic acid which precipitate the salts of iron greenish-black, as the tannin of rhatany and catechu.* Hugo Schiff, however, asserts that it is not a glucoside; that glucose exists in commercial tannic acid as an impurity, and is not a necessary part of it, and that it is a "first anhydride," consisting of two molecules of gallic acid, and consequently of digallic acid. (*Chem. News*, xxix. p. 73; also *Am. Journ. of Pharm.*, xlvi. p. 234.)

Medical Properties and Uses. Tannic acid being the chief principle of vegetable astringents, is capable of exerting on the system the same effects with this class of medicines, and may be given in the same complaints. It has an advantage over the astringent extracts in the comparative smallness of its dose, which renders it less apt to offend an irritable stomach. In most of the vegetable astringents, it is associated with more or less bitter extractive, or other principle which modifies its operation, and renders the medicine less applicable than it otherwise would be to certain cases, in which there is an indication for pure astringency without any tonic power. Such is particularly the case in the active hemorrhages; and tannic acid, in its separate state, is in these cases preferable to the native combinations in which it ordinarily exists. Dr. Porta, an Italian physician, employed it with great success in the treatment of uterine hemorrhage, and published the results of his experience in 1827. M. Cavalier afterwards used it successfully in the same complaint, and found it effectual also in a case of bleeding from the rectum. It is, without doubt, a useful remedy in most forms of hemorrhage, after a sufficient reduction of arterial action by depletory measures. In diarrhœa it is probably more beneficial than ordinary astringents, as less liable to irritate the stomach and bowels. It has been found beneficial in colliquative sweats, in cases of chronic catarrh with excessive and debilitating expectoration, in the advanced stages of hooping-cough, and in cystirrhœa. The dose for ordinary purposes is from two to five grains, but in urgent cases it may be increased to ten grains. The only disadvantage which has been experienced from it, when taken in excess, is obstinate constipation. It has been used with advantage by Dr. P. Garnier, in very large doses, in the dropsy of Bright's disease. He gave from half a drachm to a drachm, in divided doses, through the day, and found its curative influence, beginning on the second day, to be manifested by copious diuresis with a return of the urine to a healthy state, by perspiration, ready alvine evacuation, and a restoration of appetite, without any unpleasant effect. (*Arch. Gén.*, Janv. 1859, p. 36.) Locally, it may be used for all the purposes to which galls or other vegetable astringents are applicable; as for hemorrhages, relaxation of the uvula, chronic inflammation of the fauces, diphtheria, toothache, aphthæ, excessive salivation, leucorrhœa, gleet, gonorrhœa, flabby and phagedenic ulcers, piles, chilblains, &c. As a wash it may be used in solution, in the proportion of five grains to a fluidounce of water. A Belgian surgeon, M. Hairion, recommends a strong solution, made in the proportion of one part of tannic acid to three of distilled water, for application to various ophthalmic affections; as acute and chronic inflammation, ulcers and specks on the cornea, swelling of the conjunctiva, &c. (*Journ. de Pharm.*, xviii. 449.) An ointment may be made from it by rubbing two scruples first with twenty minims of water into a paste, and then with an ounce of lard. A solution in glycerin, which dissolves it freely, has been recommended by Dr. Wm. Bayes, of Brighton, England, as a powerful styptic, and an excellent local application in diseases of the mucous surfaces requiring an astringent impression. In affections of the rectum it may be used in the form of a suppository. In diseases of the uterus it has been recommended in the form of a cylindrical pencil about an inch long and two lines thick, made with

* Various plans have been proposed of estimating the quantity of tannic acid, which is an object of importance to tanners, as enabling them to judge of the value of their tanning materials; but on this point we must content ourselves, from want of space, with referring to the *Am. Journ. of Pharm.* (Sept. 1859, p. 427; March, 1861, p. 164; Nov. 1863, p. 519; and July, 1864, p. 314). See also a paper by Mr. John Watts in the *Pharm. Journ. and Trans.* (March, 1867, p. 515); also one by H. R. Procter, in the *Chem. News*, July, 1874, p. 51; and one by M. M. A. Muntz and Ramspacher (*Journ. de Pharm.*, xx. p. 287).

4 parts of the acid to 1 part of tragacanth, with a little crumb of bread to give the mixture due flexibility. (*Journ. de Pharm.*, Fév. 1, 1860, p. 128.) It is affirmed (*Philad. Med. Times*, v. 326) that coryza may be cured at once in the adult by the use of a powder, as a snuff, containing about three per cent. of tannic acid; and in the infant by the introduction into the nostril, on a cylinder of paper, of a still weaker ointment of the acid.

Dr. B. W. Richardson, of London, has given the name of *styptic colloid* to a liquid prepared by himself, consisting of ether saturated with tannic acid and a colloidal substance, such as xyloidine or gun-cotton. The preparation of it is slow, but not difficult. First, tannin, as pure as can be obtained, is digested in absolute alcohol for several days; then pure ether is added until the thick alcoholic mixture is rendered quite fluid; and, finally, the colloidal substance is introduced until it ceases readily to dissolve. When applied on wounded or abraded surfaces, it soon loses the ether and alcohol, and a firm coating is left, in which, besides the tannin and colloidal substance, are the blood and secretions from the surface, with albumen coagulated, forming a covering for the part by which the air is excluded. The liquid is applied by means of a camel's-hair brush, and sometimes by means of cotton saturated with it, to the edges of wounds closed by stitches, to ulcerated surfaces, cancerous sores, necrosis, and bleeding parts. If it be desired to make a special impression on the diseased surface, as by carbolic acid, creasote, iodine, morphia, &c., the agent may be incorporated with the styptic fluid. (*Pharm. Journ. and Trans.*, July, 1867, p. 29; also *Am. Journ. of Pharm.*, July, 1867.)

Given largely to a dog, tannic acid caused the urine to become dark-brown and opaque; and the secretion gave evidences of the presence of gallic and pyrogallic acids. (*Chem. Gaz.*, No. 136, p. 231.) Hence it is probable that, when absorbed, it undergoes a change into one or both these acids, and that it is through these that it produces its effects on the system.

Pharm. Uses. In preparing Digitalinum, *Br.*

Off. Prep. Glyceritum Acidi Tannici, *U. S.;* Glycerinum Acidi Tannici, *Br.;* Suppositoria Acidi Tannici; Trochisci Acidi Tannici; Unguentum Acidi Tannici, *U. S.** W.

* The following table, founded upon the researches of Mr. Henry K. Bowman (*Am. Journ. of Pharm.*, 1869, p. 194), gives the percentage of tannin in a number of vegetable drugs and substances.

Alum root (Heuchera Americana),		American alder aments (Alnus serrulata)	1·50
First sample	20·40	Black birch (Betula lenta)	3·30
Second sample	18·50	Catechu, No. 1	49·40
Blackberry root (Rubus villosus)	9·75	" No. 2	40·20
Trailing arbutus (Epigæa repens)	3·50	" No. 3	32·80
Kino (Pterocarpus marsupium),		Oak bark, young (Quercus alba)	11·21
First sample	57·61	" ordinary (Quercus alba)	6·34
Second sample	39·18	New Jersey tea (Ceanothus Americanus)	9·21
Green tea (Thea viridis)	16·75	Uva ursi (Arctostaphylos uva ursi),	
Black tea (Thea bohea)	13·25	First sample	6·11
Dogwood bark (Cornus Florida)	3·00	Second sample	6·33
Yarrow (Achillea millefolium)	4·15	Comptonia asplenifolia, leaves	8·20
Hemlock spruce bark (Abies Canadensis)	7·13	Pipsissewa (Chimaphila umbellata)	4·15
Witch-hazel bark (Hamamelis Virginica)	8·10	Cranesbill (Geranium maculatum),	
Marsh rosemary (Statice Caroliniana),		First sample	13·41
First sample	18·06	Second sample	17·25
Second sample	14·43	Sumach bark (Rhus glabrum),	
Rhatany (Krameria triandra)	22·79	First sample	8·75
Red rose (Rosa gallica)	5·49	Second sample	14·55
Bistort (Polygonum bistorta)	21·00	Sumach berries	1·90
Best galls (Quercus infectoria)	80·07	Tormentil root (Tormentilla erecta),	
White galls (Quercus infectoria)	30·72	First sample	30·90
Good commercial powdered galls (Quercus infectoria)	52·39	Second sample	23·46
Common agrimony (Agrimonia eupatoria)	4·75	Hops (Humulus lupulus)	3·67
American alder bark (Alnus serrulata)	4·00	Pomegranate rind (Punica granatum)	23·83
		Bark of pomegranate root	2·94

ACONITIA. *U.S., Br.*

Aconitia.

"Take of Aconite Root, in moderately fine powder, *forty-eight troyounces;* Diluted Sulphuric Acid *a fluidounce and a half;* Alcohol, Stronger Water of Ammonia, Stronger Ether, Distilled Water, each *a sufficient quantity.* Digest the powder in eight pints of Alcohol, in a close vessel, at the temperature of 120°, for twenty-four hours. Introduce the mixture into a cylindrical percolator, and gradually pour Alcohol upon it until twenty-four pints of the liquid have slowly passed. Distil off the alcohol from the filtered liquid until this is reduced to the measure of a pint. Then add to the concentrated liquid a pint of Distilled Water, to which has been added the Diluted Sulphuric Acid, and mix thoroughly. Remove from the liquid the fixed oil and resin which separate on standing, and evaporate it to four fluidounces. When the liquid has cooled, pour it into a glass-stoppered pint bottle, and wash it, by agitation and decantation, with six fluidounces of Stronger Ether, to remove the remainder of the fixed oil and resin. Now add Stronger Water of Ammonia until, after agitation, it remains in slight excess. Next, treat the resulting mixture with six fluidounces of Stronger Ether, and, having closed the bottle, agitate briskly for a few minutes. Allow the liquid to stand until it separates into two layers, the lighter being an ethereal solution of Aconitia. Decant this carefully, and treat what remains, twice successively, with the same quantity of Stronger Ether, decanting each time as before. Mix the several ethereal solutions in a porcelain capsule, and allow the mixture to evaporate spontaneously to dryness. Lastly, reduce the dry residue to powder, and keep it in a well-stopped bottle." *U. S.*

"Take of Aconite Root, in coarse powder, *fourteen pounds* (avoird.); Rectified Spirit, Distilled Water, Solution of Ammonia, Pure Ether, Dilute Sulphuric Acid, of each *a sufficiency.* Pour upon the Aconite Root three gallons of the Spirit, mix them well, and heat until ebullition commences; then cool, and macerate for four days. Transfer the whole to a displacement apparatus, and percolate, adding more Spirit, when requisite, until the root is exhausted. Distil off the greater part of the spirit from the tincture, and evaporate the remainder over a water-bath until the whole of the alcohol has been dissipated. Mix the residual extract thoroughly with twice its weight of boiling Distilled Water, and, when it has cooled to the temperature of the atmosphere, filter through paper. To the filtered liquid add Solution of Ammonia in slight excess, and heat them gently over a water-bath. Separate the precipitate on a filter, and dry it. Reduce this to coarse powder, and macerate it in successive portions of the Pure Ether with frequent agitation. Decant the several products, mix, and distil off the ether until the extract is dry. Dissolve the dry extract in warm Distilled Water acidulated with the Sulphuric Acid; and, when the solution is cold, precipitate it by the cautious addition of Solution of Ammonia diluted with four times its bulk of Distilled Water. Wash the precipitate on a filter with a small quantity of cold Distilled Water, and dry it by slight pressure between folds of filtering paper." *Br.*

The process of the U. S. Pharmacopœia, which is a modification of that of Headland, published in a note in a preceding edition of the U. S. Dispensatory, was substituted in 1860 for the former U. S. process, because, in consequence of the amount of water employed, and the use of animal charcoal, which absorbed much of the alkaloid, that formula had proved unproductive. In the present, the powdered root is exhausted with alcohol by percolation, most of the alcohol distilled off, and the residue treated with very dilute sulphuric acid, by which the native salt is converted into the sulphate. After the removal of the resinous and oily matters that separate, the solution of the sulphate is concentrated, and washed with ether, which, without dissolving the sulphate, which is insoluble in that menstruum, removes the remaining oil and resin. The addition of ammonia now decomposes the sulphate, separating the alkaloid, which in this state is dissolved out by repeated agitation with ether; and the process is completed by mixing the ethereal solutions, and allowing them to evaporate spontaneously. The points in which this process differs from that of Headland, are the

use of percolation to exhaust the root instead of boiling with alcohol, and the washing with ether before the addition of ammonia, by which the resin and colouring matter are removed. The latter modification originated in a suggestion of Prof. Procter in a communication to the *Am. Journ. of Pharm.* (March, 1861, p. 102).

In the British process, the root is exhausted with alcohol by a combination of maceration and percolation, which experience has shown to be unnecessary; the resulting tincture is wholly deprived of its alcohol by distillation and evaporation; and the residue thoroughly exhausted by boiling water. The solution thus obtained is treated with ammonia; and the precipitate, which contains the alkaloid, having been dried and powdered, is exhausted by ether. Lastly, the impure aconitia obtained by distilling off the ether, is purified by solution in water acidulated with sulphuric acid, and precipitation by ammonia. This process was given to the Pharmacopœia Committee of the British Council by a manufacturer who had been in the habit of preparing the alkaloid. (*Garrod.*)*

It is highly probable that more or less of the aconella discovered by the Messrs. Smith of Edinburgh in aconite root, and now believed to be identical with narcotina, is contained in most of the aconitia of commerce. It appears to us that it must contaminate the product of the British process, and, if not present in the U. S. aconitia, must have been removed by the preliminary washing with ether. If great care is taken, in the preparation of aconitia, to avoid the slightest excess of sulphuric acid, beyond what is necessary for the solution of this alkaloid, the aconella will be left behind; and on the same principle it may be separated from aconitia when existing in it. Should a mixture of the two be decolorized by animal charcoal, the aconitia would be liable to be absorbed, and the aconella to be left. (Messrs. Smith, *Pharm. Journ.*, Jan. 1864, p. 319.) Whichever process is used, care should be taken not to employ the ammonia in great excess, as it diminishes the product probably by dissolving the aconitia. Into the aconitia of commerce at least two alkaloids have entered, besides aconella already spoken of. The English aconitia has been frequently in great part composed of an alkaloid, pseudo-aconitia,† originally discovered by Von Schroff, of Vienna.

Pure aconitia may exist in an amorphous or in a crystalline form. The officinal product is always amorphous, but even of amorphous aconitia there are two varieties, the hydrated and the anhydrous. When, as in the officinal processes, the alkaloid is dried at ordinary temperature, it retains 20 (Hager) or 25 (Hottot) per cent. of water; but when dried at the temperature of the water-bath it is anhydrous, and is then *not* soluble in fifty parts of boiling water. (Hager, *Amer. Journ. of Pharm.*, xlvii. 210.)

Officinal aconitia is inodorous, and of a bitter and acrid taste, producing a benumb-

* A process has recently been published by M. E. Hottot, of France, which is believed by the author to yield the alkaloid pure. The powdered root is macerated for eight days in alcohol of 85°; the liquid is separated by percolation; slaked lime is added, and the mixture shaken from time to time; the liquid is filtered, precipitated by a slight excess of sulphuric acid, and evaporated to a syrupy consistence; twice or three times its weight of water is added to the residue, the mixture allowed to rest, and the green oil which rises to the surface and solidifies at 68° F. removed; the liquid having been passed through a moist filter to separate the last portion of oil, is treated with ammonia, and raised to the boiling point; the aconitia, which is deposited in a compact mass, and contains much resin, is washed, and treated with pure ether, and the ethereal solution allowed to evaporate; the residue is dissolved in water acidulated with sulphuric acid, and precipitated by ammonia; the coagulum which forms is collected on a filter, dried, and dissolved in ether; the ethereal solution is evaporated to dryness, the residue treated with a very little dilute sulphuric acid, and the solution precipitated by dilute solution of ammonia added drop by drop. The first portion deposited, being coloured, is separated, and the precipitation continued till the ammonia is in slight excess. The precipitate now formed is washed until freed from ammoniacal odour, and dried at a low temperature. Ten kilogrammes (about 26 lbs. troy) of the root yield a mean product of from 4 to 6 grammes (℥i to ℥iss) of the alkaloid, which is perfectly white. (*Ann. de Thérap.* 1864, p. 46.)—*Note to the twelfth edition.*

† *Pseudo-aconitia* has largely entered into the commercial English aconitia because the English manufacturers have, on account of its superior yield, employed to a great extent an aconite root from Nepaul, believed to be derived from A. ferox. Mr. Groves has shown that the chief alkaloid of this root is pseudo-aconitia, originally discovered by Von Schroff, of Vienna. Like aconitia it may be obtained in an amorphous or in a crystalline form. According to Flückiger the most distinguishing characters separating it from aconitia are the absence of all bitterness and its ready solubility. It is, however, very much less soluble in ammonia than is aconitia. For further particulars the reader is referred to *Pharm. Journ.*, Oct. 1873, p. 294. (*Note to the fourteenth edition.*)

ing impression on the tongue. It is unalterable in the air, and fusible by a gentle heat. It has been usually considered as not volatilizable, being decomposed at a high temperature, with the escape of ammonia, and by a continuance of the heat entirely dissipated. This statement, however, is contradicted by the results obtained by Mr. Guy, who found it to melt at 140°, and to sublime unchanged at about 400°. (*Pharm. Journ. and Trans.*, Feb. 1868, p. 374.) It is sparingly soluble in water, requiring for solution 150 parts of cold and 50 of boiling water. (*Phillips.*) Alcohol, ether, and chloroform dissolve it readily. It restores the blue colour of litmus reddened by acids, and neutralizes the acids, forming crystallizable salts. The solution of these salts produces a white precipitate with bichloride of platinum, a yellowish with terchloride of gold, and a yellowish-brown with free iodine. Aconitia is precipitated from the solution by the caustic alkalies, but not by carbonate of ammonium, or the bicarbonates of potassium and sodium. Its received formula is $C_{60}H_{47}NO_{14}$. A spurious substance has sometimes been sold under the same name, which is nearly or quite inert; and at best the alkaloid is apt to be of uncertain strength, as found in the shops.*

Crystallized aconitia was first made known by the researches of Mr. Groves (*Pharm. Journ. and Trans.*, 2d ser., viii. 121), but has since been very elaborately studied by Duquesnel. The methods of obtaining it differ, but, according to Patrouillard (*Journ. de Pharm.*, 4e sér., xix. 151), that of Duquesnel gives much the larger yield.† It occurs in regular rhombic tables, sometimes having the angles modified so as to look like hexagons, or else in small, short, four-sided prisms; it is anhydrous, nearly insoluble in water, insoluble in glycerin, but soluble in alcohol, ether, acetic acid, and benzine, and freely so in chloroform, inodorous, of an intensely bitter taste, followed by the characteristic tingling, not volatile at 100° C., and forms with most acids crystallizable salts. The formula, as obtained in the laboratory of the École de Pharmacie, is $C_{54}H_{40}NO_{20}$ or $C_{27}H_{40}NO_{10}$; that of amorphous aconitia, as given by Stahlschmidt, being $C_{60}H_{47}NO_{14}$ or $C_{30}H_{47}NO_7$. The reactions of crystallized aconitia are elaborately given by M. Duquesnel, but for details the reader is referred to *Pharm. Journ.*, ii. 1872, p. 623. The only peculiar colour reaction which it has is obtained with difficulty, by dissolving in dilute phosphoric acid and evaporating; at a certain degree of concentration a violet coloration appears.

Aconitia exists in the root in combination with aconitic acid.

Medical Properties and Uses.—This vegetable principle exercises a powerful influence over the animal economy. One-fiftieth of a grain dissolved in alcohol destroyed a sparrow in a few minutes; and the same quantity, administered to an elderly female, is said to have nearly proved fatal. Dr. Garrod has repeatedly known large dogs to be killed by the 50th of a grain; more than half an hour usually elapsing before death. (*Med. Times and Gaz.*, Feb. 1864, p. 146.) In a case of poisoning by aconitia, reported by Dr. Golding Bird, though two grains and a half were taken, the patient ultimately recovered. But, as vomiting almost immediately ensued, there is reason to believe that much of the poison was thus discharged from the stomach. Besides extreme general prostration, indicated by a cold pale surface, and a scarcely perceptible action of the heart, the prominent symptoms were convulsive vomiting, recurring every minute or two, and fearful spasms of the throat, resembling those of hydrophobia, upon any attempt at swallowing. There was no paralysis, the pupils were sensible to light, and the intellect remained perfectly clear. The remedies were

* M. O. Zinoffsky gives, in the *Pharm. Journ. and Trans.*, 1873, vol. iv. p. 442, a method for the quantitative estimation of aconitia.

† The method of Duquesnel is as follows. 100 parts of the powdered roots having been mixed with one part of tartaric acid, and the whole exhausted by repeated percolation with cold alcohol, the liquid is evaporated at a low temperature on a water-bath to the consistence of a fluid extract. To this distilled water is added, and the precipitated resinous and oily matters removed by filtration. The solution of tartrate of aconitia is then precipitated with a slight excess of bicarbonate of potassium, agitated with washed ether, and the two fluids separated with the syphon. The ethereal solution, one-fourth of its volume of light petroleum (sp. gr. 0·650) having been added to it, is then allowed to evaporate spontaneously. The crystals thus obtained may be purified by dissolving in water acidulated with nitric acid, decolorizing as rapidly as possible with animal charcoal at a temperature of 50° C., adding to the filtered liquid an excess of the bicarbonate of potassium, and proceeding as before. Patrouillard suggests the use of the bicarbonate of sodium instead of that of potassium, on account of the greater insolubility of its tartrate. (*Note to the fourteenth edition.*)

the hot bath, mustard to the epigastrium, and enemata of oil of turpentine, laudanum, and nutriment. (*Lond. Med. Gaz.*, Jan. 1847.) Dr. Van Praag found, in his experiments with aconitia on the lower animals, that it lessens cerebral power, paralyzes the nerves of voluntary motion, dilates the pupil, retards respiration, is uncertain in its influence on the pulse, and destroys life either suddenly by asphyxia, or more slowly by exhaustion.

The observations of M. Hottot, from experiments on himself, are deserving of notice, from the great care with which they appear to have been made. From doses gradually increased to 3 milligrammes (·046 gr.), M. Hottot experienced, immediately, over the whole mucous membrane of the mouth, a sensation of acrimony and heat, which rapidly extended to the throat, and somewhat later to the stomach. This feeling became more and more intense, with burning and numbness of the lips, tongue, and pharynx, and a profuse salivation. To these local effects were soon added general phenomena, at first uneasiness, weakness, heaviness of head, then nausea and frequent yawning, oppression, marked muscular debility, tingling over different parts of the body, but especially in the face and limbs, and a slightly excited pulse. After a time the weakness increased, headache and often lancinating pains of the face supervened, and the nausea was attended with vomiting. These were followed by increased muscular prostration, still more manifest tinglings, numbness of the limbs, swollen features, reduced pulse, difficult breathing, painful burning in the throat, and copious sweats. Later still, general prostration came on, the least effort produced exhaustion, the breathing became deep and slow, and the pulse was sensibly lowered. There was no sleep, and the pupil was moderately dilated; but the intelligence remained sound. These symptoms continued from ten to sixteen hours, and were then gradually relieved, the most persistent being irritation of the throat, heaviness of head, and general lassitude. The effects were precisely those of aconite itself. Duquesnel found that in frogs crystallized aconitia paralyzes the motor nerves and also the heart. Aconitia is little used internally as a remedy. M. Hottot, however, has employed it to obtain the effects of aconite, giving it in the form of pills, each containing the fifth of a milligramme ($\frac{1}{333}$ of a grain), or in a tincture containing one-sixteenth of a grain in the drachm. The quantity taken daily was of the pills from 2 to 10, of the tincture from 10 to 40 drops, in divided doses. Gubler, who seems familiar with the action of this alkaloid, states that it is rarely proper to exceed the quantity in a day of two milligrammes, taken in four doses, or about the $\frac{1}{180}$ of a grain for a dose. (*Ann. de Thérap.*, 1865, p. 82.) But the internal use of so powerful a medicine is hazardous, and should not, we think, be encouraged, as very slight errors might lead to the most serious effects; and we can quite as conveniently use the tincture of aconite root.

Dr. Turnbull was the first to recommend the external use of aconitia; and his favourable report has been abundantly confirmed by others. By this writer it is said to produce in the skin a sensation of heat and prickling, followed by numbness; and the effect continues, according to the quantity applied, from two to twelve hours or more. He found it not to act as a rubefacient, or at least but slightly so. Applied much diluted and in minute quantity to the eye, it causes contraction of the pupil, with an almost intolerable sense of heat and tingling. Dr. Turnbull employed it with benefit in neuralgia, gout, and rheumatism. He recommends it either in alcoholic solution, in the proportion of a grain to a fluidrachm, or in the form of an ointment, made by rubbing two grains of the alkaloid first with six drops of alcohol, and then with a drachm of lard. These proportions are sufficiently large to begin with, but may be gradually increased to four or five, or even eight grains to the drachm. The application should be made by friction over the part affected, to be continued till the peculiar sensation above described is produced, and may be repeated three or four times, or more frequently, during the day. No good can be expected unless the sensation alluded to be experienced in a greater or less degree. Care should be taken not to apply the medicine to an abraded surface, or to a mucous membrane, for fear of dangerous constitutional effects. It has gradually come into extensive use, and has the advantages, as an external remedy, over other preparations of aconite, of greater neatness and precision.

Off. Prep. Unguentum Aconitiæ, *Br.* W.

ÆTHEREA.

Ethers.

Ethers are peculiar, fragrant, sweetish, very volatile, and inflammable substances, generated for the most part by the action of acids on alcohol. Their composition varies with the acid employed in their formation. Sometimes this merely acts as a chemical agent on the alcohol, without entering into the composition of the ether generated; in which case the ether may be supposed to consist, according to the views that may be adopted of its constitution, either of ethylen (etherine), C_4H_4, and water, or of ethyl, C_4H_5, and oxygen. In other instances, the ethylen theory being admitted for the present, the acid employed unites with ethylen and water (the ether just mentioned), or with ethylen only. On the basis of these differences of composition, the medicinal ethers may be divided into three kinds: 1. those consisting of ethylen and water; 2. those consisting of an acid, ethylen, and water; and 3. those composed of an acid and ethylen only. Hydric ether is the only medicinal ether of the first kind, nitrous ether is an example of the second, and muriatic ether of the third. In medicine, the hydric and nitrous ethers, and their modifications, are those most commonly employed; though occasionally the muriatic and acetic have been used. In conformity with the new arrangement of the U. S. Pharmacopœia, we shall consider under this heading only the ethers themselves, transferring to the Spirits those Preparations which are formed by a mixture of the ethers and alcohol, and officinally denominated Spirits; as the *Spirit* and *Compound Spirit of Ether*, and the *Spirit of Nitrous Ether*.

Ethers, from their extreme inflammability, should never be decanted in the vicinity of flame. Hence it is prudent not to pour them out near a lighted candle. They should be kept in accurately stopped bottles, in a cool place; otherwise they are liable to considerable loss by evaporation.* B.

ÆTHER. *U.S., Br.* ÆTHER SULPHURICUS. *Ed., Dub. Ether. Sulphuric Ether. Hydric Ether. Hydrate of Ethylen. Oxide of Ethyl.*

"Take of Stronger Alcohol *six pints;* Sulphuric Acid *thirty-six troyounces;* Potassa *three hundred and sixty grains;* Distilled Water *three fluidounces.* To two pints of the Alcohol, contained in a six-pint tubulated retort, gradually add the Acid, stirring constantly during the addition. By means of a cork fitted to the tubulure, adapt a long funnel-shaped tube, with the lower end drawn out so as to form a narrow orifice, and reaching nearly to the bottom of the retort, and also a thermometer tube, graduated from 260° to 300°, with its bulb reaching to the middle of the liquid. Having placed the retort on a sand-bath, connect it with a Liebig's condenser, and this with a well-cooled receiver. Then raise the heat quickly until the liquid boils, and attains a temperature between 266° and 280°. By means of a flexible tube, connected with the stop-cock of an elevated vessel containing the remainder of the Alcohol, introduce that liquid into the retort, through the funnel-shaped tube, in a continuous stream; the quantity supplied being so regulated, that the temperature of the boiling liquid shall continue between the degrees mentioned. After all the Alcohol has been added, proceed with the distillation until the temperature rises to 286°, when the process should be discontinued. To the distilled liquid add the

* The following table from a paper in the *Pharm. Journ. and Trans.*, Oct. 1870, gives the weight of various measures of several ethereal fluids.

Name of Liquid.	Specific Gravity.	Weight of 16 fluidounces.		Weight of 20 fluidounces.		Weight of 1 gallon.		
		oz.	*grs.*	*oz.*	*grs.*	*lbs.*	*oz.*	*grs.*
Æther, B. P.	0·735	11¾	10	14	56	7	5¾	...
Æther purus, B. P.	0·720	11½	14	14	29	6	14¼	31
Sp. Æther. Sulph.	0·809	12½	94	.....	...	7	15	66
Sp. Chloroform	0·871	13¾	87	17¼	90	8	11¼	105
Sp. Æther. Nitros.	0·845	13½	15	16¾	81	8	7¼	41

Potassa, previously dissolved in the Distilled Water, and shake them occasionally together. At the end of twenty-four hours, pour off the supernatant liquid, introduce it into a retort, and, with a gentle heat, distil into a well-cooled receiver three pints, or until the liquid attains the specific gravity 0·750. Lastly, keep the Ether in a well-stopped bottle." *U. S.*

"Take of Rectified Spirit *fifty fluidounces* [Imp. meas.]; Sulphuric Acid *ten fluidounces* [Imp. meas.]; Chloride of Calcium *ten ounces* [avoird.]; Slaked Lime *half an ounce* [avoird.]; Distilled Water *thirteen fluidounces* [Imp. meas.]. Mix the Sulphuric Acid with twelve fluidounces of the Spirit in a glass matrass capable of containing at least two pints [Imp. meas.], and, not allowing the mixture to cool, connect the matrass by means of a bent glass tube with a Liebig's condenser, and distil with a heat sufficient to maintain the liquid in brisk ebullition. As soon as the ethereal fluid begins to pass over, supply fresh Spirit through a tube into the matrass in a continuous stream, and in such quantity as to equal the volume of the fluid which distils over. For this purpose use a tube furnished with a stop-cock to regulate the supply, connecting one end of the tube with a vessel containing the Spirit raised above the level of the matrass, and passing the other end through a cork fitted into the matrass. When the whole of the Spirit has been added, and forty-two fluidounces have distilled over, the process may be stopped. Dissolve the Chloride of Calcium in the Water, add the Lime, and agitate the mixture in a bottle with the impure ether. Leave the mixture at rest for ten minutes, pour off the light supernatant fluid, and distil it with a gentle heat until a glass bead of specific gravity 0·735 placed in the receiver begins to float. The ether and spirit retained by the chloride of calcium, and by the residue of each rectification, may be recovered by distillation and used in a subsequent operation." *Br.*

The preparation of ether embraces two stages; its generation, and its subsequent rectification to remove impurities. The formulas agree in obtaining it by the action of sulphuric acid on alcohol. In the United States process, which is adopted, with modifications, from that of the French Codex, one-third of the alcohol taken is mixed with the acid, and, while still hot from the reaction, distilled from a glass retort, by a heat quickly applied, into a refrigerated receiver. When the heat of the mixture has risen to between 266° and 280°, the remainder of the alcohol is allowed to enter the retort in a continuous stream, the supply being so regulated that the heat shall be maintained between the degrees mentioned. By a complicated reaction which will be explained presently, the acid converts the alcohol into ether; and, were it not that the acid becomes more and more dilute as the process proceeds, it would be able to etherize an unlimited quantity of alcohol. Although the acid, before it becomes too dilute, is capable of determining the decomposition of a certain amount of alcohol, yet it is not expedient to add this amount at once; as a considerable portion of it would distil over undecomposed with the ether. The proper way of proceeding, therefore, is that indicated in the formula; namely, to commence the process with the use of part of the alcohol, and, when the decomposition is fully established, and a portion of ether has distilled, to add the remainder in a gradual manner, so as to replace that which, every moment of the progress of the distillation, is disappearing by its conversion into ether.

In the U. S. process of 1850, the point at which the distillation should cease was determined by the proportion of the ether distilled to that of the alcohol employed, or by the appearance of white vapours in the retort, which indicate the generation of other products beside the ether; but, in the present plan, arrangements having been made by which the temperature can be determined, the degree of heat has been adopted as a better criterion; as it is only when the temperature exceeds the point of 286° indicated, that the production of injurious impurities is to be apprehended. The modifications of the old process were made in conformity with suggestions by Dr. Squibb, contained in a paper published in the *Proceedings of the American Pharmaceutical Association* for the year 1858 (p. 390). The direction in the former process to reserve a small portion of acid, to be added gradually with the reserved alcohol, upon the supposition that the acid in the retort might be too much weakened to perform its part duly, has been found upon trial to result in no practical

advantage. As the proper proportion between the acid and alcohol is that which requires for ebullition a temperature somewhat above 266°, or that at which the ether is formed, there is an obvious propriety in supplying the alcohol just so rapidly as may be sufficient to maintain this temperature in the liquid of the retort. If the alcohol be supplied so rapidly as to reduce the temperature below the point mentioned, alcohol will distil over in undue proportion; if too slowly supplied, the temperature will rise so high as to produce other reactions in the materials than that required for etherification, and various other products will result. The rising of the temperature to 286°, after all the alcohol has been added, is, therefore, an indication that the process should be suspended. Nevertheless, the caution to check the process when white vapours appear in the retort is not amiss, as affording an additional security that it shall not be carried too far. At the temperature of 320°, there would be generated sulphurous acid, heavy oil of wine, olefiant gas, and a large quantity of resino-carbonaceous matter, blackening and rendering thick the residuary liquid; all of them products arising from the decomposition of a portion of sulphuric acid, alcohol, and ether.

The *British* process is that of the late Edinburgh Pharmacopœia slightly modified. The principles are the same as those of the U. S. process; but the directions about temperature are wanting; and the regulation of the supply of alcohol, and the cessation of the operation, are made to depend on the less reliable method of determining the measure of liquid, in the first place in the retort, and in the second place in the receiver; as in the U. S. process of 1850.

In both processes, whatever care may be taken in conducting them, and to stop them in due time, yet the ether obtained is contaminated with sulphurous acid, heavy oil of wine, alcohol, and water; and hence its purification becomes necessary. This is conducted in different ways, according to the two Pharmacopœias. The U. S. Pharmacopœia directs for this purpose an aqueous solution of potassa, the British a saturated solution of chloride of calcium (muriate of lime), to which a portion of recently slaked lime has been added. In both cases, the crude ether is agitated with the purifying agent, and submitted to a new distillation at a gentle heat, called the *rectification.*

The purifying substances are potassa for sulphurous acid and water, and water for alcohol in the U. S. formula; lime for acid, and a saturated solution of chloride of calcium for alcohol and water, in the British. The British substances for purifying are stated by Dr. Christison to be convenient, and to act perfectly and promptly. The chloride of calcium solution, after having been used, yields on distillation a further portion of ether of the officinal density; and, by concentrating it, filtering while hot, and separating the crystals of sulphite of calcium which form on cooling, the chloride may be recovered for future operations.

The process for forming ether is conducted with most advantage on a large scale. At Apothecaries' Hall, where the operation is performed in this way, the apparatus employed is thus described by Mr. Brande. It "consists of a leaden still, heated by means of high pressure steam carried through it in a contorted leaden pipe. A tube enters the upper part of the still for the purpose of suffering alcohol gradually to run into the acid. The still-head is of pewter, and is connected, by about six feet of tin pipe, with a very capacious condensing apparatus, duly cooled by a current of water. The receivers are of pewter, with glass lids, and have a side tube to connect them with the delivering end of the condensing pipe." (*Manual of Chemistry*, edition of 1848.) For an account of the apparatus used in the U. S. Naval Laboratory for obtaining ether by steam on a large scale, see an article by E. R. Squibb, M. D., contained in the *Am. Journ. of Pharm.* for Sept. 1856.

Properties of Officinal Ether. Notwithstanding the officinal directions for purifying ether, it is not absolutely pure as obtained by either of the formulas here given. Both contain a considerable portion of alcohol, the U. S., according to Dr. Squibb, 25 per cent. of 88 per cent. alcohol, the British, according to the Pharmacopœia, 8 per cent. of alcohol by measure. In both, there is a little of the light oil of wine. They should, however, be free from various impurities, which are too often found in commercial ether, the result of careless operation, or the employment of imperfect

processes. As both Pharmacopœias give special directions for the purification of ether, we shall postpone an account of the chemical and remedial properties of the medicine till the pure preparation is treated of. (See *Æther Fortior.*) In the mean time, it will be proper to indicate the means of determining the genuineness and purity of the proper officinal ethers. Commercial ether varies in sp. gr. from 0·733 to 0·765. The impurities found in it are excess of alcohol, water, sulphurous and other acids, heavy oil of wine, and various fixed substances.

The U. S. ether should have the sp. gr. 0·750, and, if heavier than this, must contain too much alcohol or water. When shaken with an equal bulk of water it should not lose more than from one-fifth to one-fourth of its volume. The statement that water takes up only one-tenth has been shown by Dr. Squibb to be erroneous. If it take up more than one-fourth, the ether must contain too much of alcohol or of water, or both. If the alcohol be in excess, it may be removed by agitating the liquid with twice its bulk of water, which unites with the alcohol, forming a heavier stratum, from which the ether may be poured off. The ether, however, takes up about one-tenth of water, which may be removed by agitation with fresh-burned lime, and subsequent distillation. An easy method for detecting and measuring any alcohol present in ether, was given by the Edinburgh College; namely, to agitate it, in a minim measure, with half its volume of a concentrated solution of chloride of calcium. This will remove the alcohol; and the reduction of the volume of the ether, when it rises to the surface, will indicate the amount. Heavy oil of wine may be discovered by the ether becoming milky upon being mixed with water. If the ether is pure, it wholly evaporates in the air, leaving no solid residue. All non-volatile impurities are thus detected. It should not redden litmus, showing the absence of acids. The point of ebullition is also an indication of the strength of the ether. When evaporating from bibulous paper, it should offer only a slight degree of foreign odour, aromatic and free from pungency, and should leave the paper, when dry, nearly or quite odourless. This test proves the absence of volatile impurities, except a slight and not inadmissible proportion of light oil of wine. (*Squibb.*)

The British ether should have the sp. gr. 0·735. Fifty measures, agitated with an equal volume of water, are reduced to 45 by an absorption of 10 per cent. It boils below 105°. It is, therefore, considerably stronger than the U. S. ether. In other respects, it should answer to the tests above given.

In the impure state in which ether is afforded by the U. S. Pharmacopœia, though it may answer for external application, and may even be given by the mouth, yet for purposes of inhalation, which is now the chief use of ether, it is scarcely fitted without further purification; and the same is true, though in a less degree, of the English preparation. Hence the propriety of the adoption, in the U. S. Pharmacopœia, of the *Stronger Ether.*

Pharm. Uses. In preparing Acidum Tannicum; Ceratum Sabinæ, *U. S.;* Extractum Ergotæ Liquidum, *Br.;* Extract. Filicis Liquid., *Br.;* Extract. Mezerii Æthereum, *Br.;* Extract. Stramonii, *Br.;* Oleoresina Capsici, *U. S.;* Oleoresina Cubebæ, *U. S.;* Oleoresina Filicis, *U. S.;* Oleoresina Lupulinæ, *U. S.;* Oleoresina Piperis, *U. S.;* Tinctura Opii Deodorata, *U. S.*

Off. Prep. Æther Fortior, *U. S.;* Æther Purus, *Br.;* Collodium, *Br.;* Liquor Epispasticus, *Br.;* Spiritus Ætheris, *Br.;* Spiritus Ætheris Compositus, *U. S.* B.

ÆTHER FORTIOR. *U. S.* ÆTHER PURUS. *Br. Stronger Ether. Pure Ether.*

"Take of Ether, Water, each, *three pints;* Chloride of Calcium, in fine powder, Lime, in fine powder, each, *a troyounce.* Shake the Ether and the Water thoroughly together, and, when the Water has subsided, separate the supernatant ether. Agitate this well with the Chloride of Calcium and the Lime in a well-stopped bottle, and allow the mixture to stand for twenty-four hours. Then decant the ether into a retort, and, having adapted thereto a Liebig's condenser, distil a pint and a half of Stronger Ether into a receiver refrigerated with ice-cold water. Lastly, keep the liquid in a well-stopped bottle. By continuing the distillation, a portion of weaker ether may be obtained." *U. S.*

"Take of Ether, Distilled Water, of each, *two pints* [Imperial measure]; Lime,

recently burned, *a quarter of an ounce* [avoirdupois]; Chloride of Calcium, *four ounces* [avoird]. Put the Ether with one pint [Imp. meas.] of the Water into a bottle, and shake them together; allow them to remain at rest for a few minutes, and, when the two liquids have separated, decant off the supernatant ether. Mix this with the remainder of the Water, and again, after separation, decant as before. Put now the washed ether, together with the Lime and Chloride of Calcium, into a retort to which a receiver is closely attached, let them stand for 24 hours, then distil with the aid of a gentle heat. Sp. gr. not exceeding 0·720." *Br.*

These formulas are essentially the same; the U. S. limiting the amount distilled by the measure, the British by the sp. gr. The ether is first shaken with the water, in order that the latter, by its superior affinity for alcohol, may take it from the former; and afterwards with the chloride of calcium and lime, to separate from the ether the water with which it has itself united in the first step of the process. Of course, the lime, for this purpose, must be in its freshly calcined state, so that it may have had no opportunity to absorb water from the air. The subsequent distillation is intended still further to strengthen the ether, the less volatile liquids being left in the retort. The lime answers the further purpose of neutralizing any sulphurous or other acid which the ether may have happened to contain. The weaker ether obtained at the end of the process may be kept for subsequent purification. It will be noticed that this separate process accomplishes more perfectly what is effected by the British formula for ether.

Even thus prepared, however, the ether, though sufficiently pure for all pharmaceutical or remedial purposes, is not absolutely pure, still containing a little alcohol. To meet the intentions of the U. S. process, it must have the sp. gr. 0·728 (0·720, *Br.*), must lose not more than from one-tenth to one-eight of its bulk by agitation with water, and must *boil actively* when a test-tube, half filled with it, is held enclosed in the hand, and a small fragment of glass is dropped into it. "Half a fluidounce of it, evaporated from a porcelain plate by causing it to flow to and fro over the surface, yields a faintly aromatic odour as the last portions pass off, and leaves the surface without taste or smell, but covered with a deposit of moisture." (*U. S.*) This last is Dr. Squibb's test to indicate the very minute proportion of light oil of wine that is still contained in the ether, and the absence of all other contaminating volatile impurities. The ether must not redden litmus; as the presence of acid matter would indicate that it had been badly prepared, or had been too long kept.

Properties. Ether is a colourless, very limpid liquid, of a strong and sweet odour, and hot pungent taste. When perfectly pure it has the sp. gr. 0·713, boils at 95°, and forms a vapour which has the density of 2·586. It is not frozen by a cold of 166° below zero. (*Faraday.*) It is a very volatile liquid, and, when of the sp. gr. 0·720, boils at about 98°. Its extreme volatility causes it to evaporate speedily in the open air, with the production of considerable cold. Its inflammability is very great, and the products of its combustion are water and carbonic acid. In consequence of this property the greatest care should be used not to bring it in the vicinity of flame, as, for example, a lighted candle. One of the great advantages of using steam as the source of heat is that it obviates, in a great measure, the danger of its accidental inflammation. When too long kept it undergoes decomposition, and is converted in part into acetic acid. It dissolves iodine and bromine freely, and sulphur and phosphorus sparingly. Its power to dissolve corrosive sublimate makes it a useful agent in the manipulations for detecting that poison. It is also a solvent of volatile and fixed oils, many resins and balsams, tannic acid, caoutchouc, and most of the organic vegetable alkalies. It does not dissolve potassa and soda, in which respect it differs from alcohol. It was formerly believed that when water dissolves more than a tenth of its volume, the ether is shown to contain an undue quantity of water or alcohol, or of both; but according to Dr. Squibb this is not correct, water readily taking up one-fourth of its volume of ether. Ether unites in all proportions with alcohol. According to Prof. R. Boettger, water may be detected in ether by agitating the suspected liquid with bisulphide of carbon; if water be present the mixture becomes milky and turbid, otherwise it remains clear. A small piece of hydrate of potassium immersed in ether becomes coated with a yellowish film and

imparts a yellowish colour to the liquid, after standing twenty-four hours, if any alcohol be present. (*Am. Journ. of Pharm.*, Dec. 1872.)

Composition and Theory of its Production. Ether consists of four eqs. of carbon, five of hydrogen, and one of oxygen, and its empirical formula is C_4H_5O. In volumes it consists of four volumes of carbon vapour, five volumes of hydrogen, and half a volume of oxygen, condensed into one volume. Its approximate constituents may be considered to be one eq. of ethylen (etherine) and one of water; or, in volumes, one volume of ethylen vapour and one volume of aqueous vapour, condensed into one volume. This view makes it a hydrate of ethylen (C_4H_4+HO). The sp. gr. of its vapour, calculated on this constitution in volume, is 2·5817, which is very near 2·586, the number obtained by experiment. By most chemists, however, the constituents of the ethylen, together with the hydrogen of the alleged water, are supposed to form a peculiar radical, consisting of C_4H_5, to which the name of ethyl has been given. On this view, ether is an oxide of ethyl (C_4H_5+O). The view is confirmed by Dr. E. Frankland, who has isolated ethyl by acting on iodide of ethyl with zinc. As described by him, *ethyl* is a colourless, inflammable gas, of the sp. gr. 2, incondensible at zero, but condensible, under a pressure of 2·25 atmospheres at 37·5°, into a colourless, mobile liquid. Ether was formerly called *sulphuric* ether, in allusion to the sulphuric acid employed in its preparation; but it contains no sulphuric acid, and an identical ether may be obtained by the action of other substances on alcohol. Hence the epithet sulphuric is improperly applied to it; and, accordingly, its name was changed from *Æther Sulphuricus* to *Æther* in the U. S. and Br. Pharmacopœias of 1850 and 1851. Those who consider ether as a compound of ethylen and water, call it hydric ether, or hydrate of ethylen; but its more probable constitution is expressed by the name, oxide of ethyl; and this view of its nature will be adopted in our subsequent remarks.

With a view to determine in what manner sulphuric acid acts upon alcohol in order to convert it into ether, it is necessary that a comparison should be instituted between the composition of the two latter fluids. Now alcohol is a hydrated oxide of ethyl, and ether is oxide of ethyl without water. It follows, therefore, that, to convert alcohol into ether, it is only necessary to abstract the water of the former. The agent in effecting this abstraction is evidently the sulphuric acid, which is known to have a strong affinity for water; but its action is not direct as originally supposed, but intermediate, as was first pointed out by the late Mr. Hennell. This chemist found that, when two eqs. of sulphuric acid and one of alcohol were merely mixed, the acid lost a portion of its saturating power, and a new acid was formed, to which he gave the name of *sulphovinic acid* (see *Part* III.) (the *etherosulphuric acid* of Liebig). In view of its composition it may be called a bisulphate of alcohol, or, which is the same thing, a bisulphate of ether with one eq. of water, that is, a double sulphate of ether and water. When one eq. of this compound is heated it is decomposed; two eqs. of sulphuric acid with one eq. of water remain in the retort, while one eq. of ether distils over.

If the original proportion of acid and alcohol continued the same throughout the whole of the distillation, all the alcohol would be resolved into ether and water; but, during the progress of the process, the alcohol is constantly diminishing, and of course the relative excess of the acid becoming greater; and at last a point of time arrives when the excess of acid is so great that the generation of ether ceases. As these results depend upon the relative deficiency of the alcohol, while the acid remains unchanged in amount, it is easy to understand why it is advantageous to introduce alcohol gradually into the distilling vessel during the progress of the distillation; for, by this addition, the proper proportion of the alcohol to the acid is maintained. But the decomposing power of the acid has its limit; as it becomes at last too dilute to act upon the alcohol, notwithstanding that a considerable portion of water, towards the close of the distillation, passes over with the ether.

The above theory of etherification was called in question, in 1851, by Prof. Graham, of London, who succeeded in producing ether without distillation, or the formation of sulphovinic acid, by using a larger proportion of alcohol than is ordinarily employed. The reaction was made to take place in sealed glass tubes heated for a short

time to a temperature between 284° and 352°. The sulphuric acid appeared to act by mere contact with the alcohol, in determining the production of ether, without combining with anything. For another theory of etherification see an article by M. E. Robiquet, in the *Journal de Pharmacie et de Chimie* for Sept. 1854.

Medical Properties and Uses. Ether is a powerful diffusible stimulant, possessed also of expectorant, antispasmodic, and narcotic properties. In low fevers attended with subsultus tendinum, it proves beneficial as a stimulant and antispasmodic. In these cases it is frequently conjoined with laudanum. It is useful also in nervous headache unattended with vascular fulness, and generally in nervous and painful diseases which are unaccompanied by inflammation. In nausea it is given as a cordial; and in cramp of the stomach and flatulent colic it sometimes yields prompt relief. Given alone, or mixed with oil of turpentine, it relieves the pain and spasm caused by the passage of biliary calculi. According to Mr. Brande, a small teaspoonful of ether, mixed with a glass of white wine, is often an effectual remedy in sea-sickness. In a case of chronic functional vomiting, Dr. Galante, of Arpino, found ether, given in capsules, of singular efficacy. Ether has recently received a new application from Dr. Lortet, of France. He uses it for the expulsion of the tapeworm, first administering a large dose of the ether, which renders the worm insensible, and thus disables it from holding its place in the bowels, and following this with a purgative medicine which expels the parasite. He gives 20 grammes (about 5 drachms) of ether at one dose, and two hours afterwards 30 grammes (between 7 and 8 drachms) of castor oil. He has found the remedy successful in all the cases, though not yet numerous in which he has tried it. (*Ranking's Abstract*, xlv. 75; from *Gaz. Med. de Paris.*) This dose of ether is very large; and the probability is that, by giving it at the same time as the purgative, and thoroughly mixed with it, the latter might convey it immediately into the intestines, where the worms are seated, and thus render a much smaller quantity sufficient. When externally applied ether may act either as a stimulant or refrigerant. Thus, it operates as a powerful rubefacient, and may even vesicate, when its evaporation is repressed; but, when this is allowed to take place freely, it is refrigerant in consequence of the cold which it produces. In the latter way it has been employed in strangulated hernia, dropped on the tumour and allowed to evaporate. Dr. J. Nunn, of Savannah, Ga., praises its effect as a local anæsthetic in recent burns, applied, *guttatim*, from a bottle, while the part is subjected to a stream of air. (*Charleston Med. Journ.*, Sept. 1855.) It sometimes produces immediate relief when dropped into the ear in earache. It may sometimes be used with great effect as a styptic in local hemorrhage. A case is related in which excessive bleeding from the socket of an extracted tooth, which had failed to yield to various other remedies, was checked at once by directing into the bleeding cavity the spray of ether by means of an atomizer. (*Lancet*, May 16, 1868, p. 641.) Another external employment of ether, introduced by Dr. B. W. Richardson, of London, is by the direction of its spray, by means of the atomizer or other similar instrument, upon any exposed portion of the body, to produce such a degree of cold in the part as to render it perfectly insensible, and thus enable the surgeon to operate upon it without causing pain. (See Dr. Wood's *Treatise on Therapeutics and Pharmacology*, 3d ed., ii. 15.) For external use, the unrectified ether is sufficiently pure. The dose of ether is from fifty drops to a teaspoonful, to be repeated frequently when the full effect of the remedy is desired. When used habitually, the dose must be much increased to produce a given effect. It may be perfectly incorporated with water or any aqueous mixture, by first rubbing it up with spermaceti, employed in the proportion of two grains for each fluidrachm of the ether. (*Durand.*)

A *syrup of ether* is directed by the French Codex. MM. J. Regnault and Adrian, after a thorough investigation of the solubility of ether in solutions of sugar, offer the following formula. Take of sugar 440 parts, distilled water 490 parts, alcohol at 90° 50 parts, pure ether 20 parts. Put into a bottle, shake, and preserve. The whole of this might be given at a dose, if the parts taken are represented by grains. (*Journ. de Pharm.*, Janv. 1868.)

Ether is conveniently administered in capsules, each containing four or five minims of *pure* ether, according to the plan of M. Clertan, of Dijon. These capsules are

made of sugared gum. (See *Capsules of Gelatin* in *Part* III.) *Capsules of ether*, also called *pearls of ether*, are inodorous, will keep for a year at least without loss, and furnish the means of introducing ether into the stomach, without irritating the mouth and throat. In a few seconds after they arrive in the stomach, they burst and diffuse their effects with singular rapidity. Analogous effects are produced when they are introduced into the rectum or vagina. Ether may be gelatinized by the process of M. Grimault. This consists in briskly shaking, in a stoppered bottle, four measures of ether, free from alcohol and acid, with one measure of white of egg. *Gelatinized ether* is an opaline trembling jelly, which may be spread with the greatest facility. It may be used as a local anæsthetic, applied to the seat of pain, spread on linen, and covered with a piece of cloth or of sheet caoutchouc. Gelatinized ether will not keep, but must be prepared at the time it is wanted.

Etherization. Ether may be exhibited by inhalation. Many years ago, its use in this way was proposed by Drs. Beddoes, Pearson, and Thornton, of England, in certain diseases of the lungs. As early as 1805, the late Dr. Warren, of Boston, employed ethereal inhalation to relieve the distress attending the last stage of pulmonary inflammation. About the year 1812, in Philadelphia, at a time when the nitrous oxide was the subject of popular lectures, the vapour of ether was frequently breathed from a bladder for experiment or diversion; and its effects in producing transient intoxication, analogous to that caused by the nitrous oxide, were observed. It was not, however, until October, 1846, that attention was particularly drawn to ethereal inhalation as a remedy for pain. In that month, Dr. Warren, of Boston, was applied to by Dr. W. T. G. Morton, dentist of that city, to ascertain by trial whether an agent which he had successfully employed to render painless the extracting of teeth, would be equally successful in preventing the pain of surgical operations. This agent was the vapour of ether. Dr. Warren acceded to this request, and shortly afterwards, at the Massachusetts General Hospital, performed a severe operation, without pain to the patient, under the influence of ether, administered by Dr. Morton. A few days subsequently, Dr. C. T. Jackson, of Boston, in conversation with Dr. Warren, claimed to have first made known to Dr. Morton the use of ethereal vapour for the prevention of pain in dental operations.

From this beginning, the employment of ether by inhalation for the prevention and removal of pain, has spread throughout the civilized world. The effect produced, called *etherization*, probably takes place through the medium of the blood. It is sometimes partial, suspending sensibility, without abolishing consciousness; so that the patient, without feeling pain, is aware of everything that is passing around him. At other times, a perfect unconsciousness is produced.

Etherization is usefully resorted to in all severe operations, not merely as a remedy for pain, but as a means of preventing the shock which the system would otherwise suffer as a consequence of pain. Under full etherization, even the actual cautery may be extensively applied, without causing the least suffering. In many cases, the incidental power of ethereal vapour as a relaxing agent is usefully brought into play; as in the treatment of strictures of the urethra and œsophagus, strangulated hernia, retention of urine, dislocations, fractures, anchylosis, &c. In all these cases, the necessary surgical manipulations are very much interfered with by the muscular contractions excited by pain. This is particularly the case in dislocations, and in fractures attended with shortening of the limb. In partial anchylosis, etherization enables the surgeon in many cases to break up the adhesions, without pain to the patient, or resistance from the muscles. In lithotomy and lithotrity, the inordinate contraction of the muscular coat of the bladder is prevented or diminished. In short, in most cases in which the necessary surgical measures are likely to involve severe pain, or to encounter resistance, as in children, etherization may be usefully employed.

Etherization has been employed for the detection of feigned diseases, by suspending the operation of the will; in neuralgia, as a palliative; in tetanus, and in the spasms produced by an overdose of strychnia, as an antispasmodic; in asthma and chronic bronchitis, as an expectorant; and in dysmenorrhœa, as an anodyne and relaxing remedy. Dr. Warren found it useful in relieving the agonizing sufferings which often attend the latter complaint. In midwifery it is extensively employed as a safe

agent; and, while it does not seem materially to interfere with the due contraction of the uterus, it promotes the relaxation and lubricating secretions of the soft parts. In vivisections, humanity calls for the use of ether vapour, or other anæsthetic agent.

Ethereal vapour is most conveniently inhaled through a soft sponge, hollowed out on one side to receive the projection of the nose, and saturated with ether of the purest quality. The sponge, thus prepared, is applied over the nostrils, through which the inhalation should be made in preference to the mouth. When the inhalation is thus conducted through a sponge, the ethereal vapour is copiously mixed with air, and there is no fear of inducing asphyxia. At first a short cough is generally produced, but this soon disappears; and, after the lapse of from two to five minutes, and the expenditure of about two fluidounces of ether, the quantity being very variable in different cases, the patient becomes insensible, and appears as if in a deep, almost apoplectic sleep. The usual signs of the full effect of the ether are the closure of the eyelids, muscular relaxation, and inability to answer questions. During the whole process of etherization, the fingers should be kept on the pulse; and, if it become feeble and very slow, the sponge should be removed until the circulation becomes more free. At first there is redness, afterwards paleness of the face and neck, succeeded by cold perspirations. Should the etherization prove excessive, or convulsions supervene, an event which rarely happens, the ether must be immediately withdrawn, and cold water freely applied. This is the mode of proceeding in surgical operations; in midwifery cases, partial etherization is often sufficient. In a few cases persons become unmanageable under the influence of the ethereal vapour; and hence the propriety of a preliminary trial of its effects on a patient, before subjecting him to a surgical operation. In a few instances etherization has produced alarming remote effects. Dr. F. D. Lente has reported three cases of this kind. (*New York Journ. of Med.*, Nov. 1856.) Sometimes death has ensued; but the instances are extremely rare, in which a fatal result could be clearly traced to the direct influence of ether. The Boston Society for Medical Improvement, having, by a committee, examined carefully into the subject of death from the inhalation of ether, declare, through their committee, that, though the reported cases of death which had been ascribed to this cause amounted to 41, yet in no one of the cases investigated by them was the fatal result fairly ascribable to etherization. (*Boston Med. and Surg. Journ.*, May 28, 1868, p. 272.)*

Pharm. Uses. In preparing Aconitia; Atropiæ Sulphas, *U. S.;* Digitalinum, *Br.;* Oleoresina Zingiberis, *U. S.*

Off. Prep. Collodium, *U. S.;* Collodium cum Cantharide, *U. S.;* Oleum Ætherеum, *U. S.* B.

CHLOROFORMUM PURIFICATUM. *U. S.* CHLOROFORMUM. *Br., U. S.* 1850. *Purified Chloroform.*

"Take of Commercial Chloroform *one hundred troyounces;* Sulphuric Acid *twenty troyounces;* Stronger Alcohol *twelve fluidrachms;* Carbonate of Sodium *five troyounces;* Lime, in coarse powder, *half a troyounce;* Water *ten fluidounces.* Add the Acid to the Chloroform, and shake them together occasionally during twenty-four hours. Separate the lighter liquid, and add to it the Carbonate of Sodium previously dissolved in the Water; agitate the mixture thoroughly for half an hour, and set it aside; then separate the Chloroform from the supernatant layer, and mix it with the Alcohol. When the mixture has separated into two transparent layers, transfer the Chloroform into a dry retort, add the Lime, and distil, by means of a water-bath, into a well-cooled receiver, taking care that the temperature in the retort does not rise above 153°, until one troyounce of residue is left. Keep the distilled liquid in well-stopped bottles." *U. S.*

"Take of Chlorinated Lime *ten pounds* [avoirdupois]; Rectified Spirit *thirty fluidounces* [Imperial measure]; Slaked Lime *a sufficiency;* Water *three gallons* [Imp. meas.]; Sulphuric Acid *a sufficiency;* Chloride of Calcium, in small fragments,

* For recent cases of real or alleged death from ether, see *New Remedies*, 1873; *Boston Med. and Surg. Journ.*, 1870, p. 377, also Nov. 1873; *New York Med. Journ.*, March, 1871, p. 379; *London Lancet*, May, 1875, p. 119, also July, 1873, p. 36; *Med. Times and Gaz.*, Sept. 1875, p. 281. (*Note to the fourteenth edition.*)

two ounces [avoird.]; Distilled Water *nine fluidounces* [Imp. meas.]. Place the Water and the Spirit in a capacious still, and raise the mixture to the temperature of 100°. Add the Chlorinated Lime and five pounds [avoird.] of the Slaked Lime, mixing thoroughly. Connect the still with a condensing worm encompassed by cold water, and terminating in a narrow-necked receiver; and apply heat so as to cause distillation, taking care to withdraw the fire the moment the process is well established. When the distilled product measures fifty ounces, the receiver is to be withdrawn. Pour its contents into a gallon [Imp. meas.] bottle half filled with Water, mix well by shaking, and set at rest for a few minutes, when the mixture will separate into two strata of different densities. Let the lower stratum, which constitutes crude chloroform, be washed by agitating it in a bottle with three [fluid]ounces of the Distilled Water. Allow the Chloroform to subside, withdraw the water, and repeat the washing with the rest of the Distilled Water, in successive quantities of three [fluid]-ounces at a time. Agitate the washed Chloroform for five minutes in a bottle with an equal volume of Sulphuric Acid, allow the mixture to settle, and transfer the upper stratum of liquid to a flask containing the Chloride of Calcium mixed with half an ounce of Slaked Lime, which should be perfectly dry. Mix well by agitation. After the lapse of an hour connect the flask with a Liebig's condenser, and distil over the pure Chloroform by means of a water-bath. Preserve the product in a cool place, in a bottle furnished with an accurately ground stopper. The lighter liquid which floats on the crude Chloroform after its agitation with water, and the washings with Distilled Water, should be preserved, and employed in a subsequent operation." *Br.*

In the U. S. Pharmacopœia of 1850 a process was given for preparing chloroform; but as this is never made on a small scale by the apothecary, but purchased of the manufacturer, it was very properly transferred, at the next revision, to the Materia Medica Catalogue. But, as the chloroform of commerce is often impure, and, though fitted for external use, and for various pharmaceutical purposes, is, in this impure state, unfit for use as a respiratory anæsthetic agent, it was deemed advisable to introduce a formula by which its purification, if required, might be readily effected. This process is the first of those above given. The process of the British Pharmacopœia is for the preparation of the chloroform *ab initio*, with directions which secure its purity if complied with. In this process, the reaction by which the chloroform is produced takes place between the chlorinated lime and the alcohol; the slaked lime, which is added in accordance with the directions in the late Dublin Pharmacopœia, being intended probably to lessen the production of the chlorinated pyrogenous oil, the amount of which is greater, according to Soubeiran and Mialhe, in proportion to the relative excess of the chlorine to the lime employed. The use of this earth is stated by some chemists to give rise to Dutch liquid, $C_4H_4Cl_2$, and to increase the product at the expense of its purity. As first distilled, the chloroform is very impure, and is directed to be washed first with ordinary water, and afterwards with distilled water, which separate alcohol, chlorine, and probably other contaminating substances. In consequence of the density of the chloroform and its insolubility in water, it readily subsides, forming a distinct layer which may be easily separated. The crude product, after having been freed from alcohol by the washing with water, is purified from the chlorinated pyrogenous oil, which comes over with the chloroform, by agitation with an equal volume of sulphuric acid, which ought to be *pure* and *colourless*, and at least of the density 1·840. The oil is charred and destroyed by the acid, which becomes yellow or reddish-brown, and is partially changed into sulphurous acid. To remove the latter acid, as well as any water present, the chloroform, which floats on the surface of the acid, is removed and agitated well with chloride of calcium and slaked lime, and then again submitted to distillation. According to Gregory and Kemp, of Edinburgh, by whom the use of sulphuric acid for this purpose was proposed, chloroform is effectually purified from the pyrogenous oil by agitation with this acid if strong and pure. So long as a ring, darker than the rest of the acid, appears, after rest, at the line of contact between the acid and the chloroform, the agitation must be repeated; and the oil is known to be fully separated when the acid remains colourless. Deutoxide of manganese has been employed to separate the sulphurous acid; but, in this case, the chloroform is apt to become, after the lapse of a few weeks

of a delicate pink colour, which sometimes disappears and then returns. This coloration depends upon the presence of manganese, and forms an objection to the use of the deutoxide as a purifier.

In the U. S. process the method of purification is somewhat different. Instead of equal measures of the impure chloroform and sulphuric acid and an agitation for only 5 minutes, the commercial chloroform is shaken occasionally for 24 hours with but one-sixth of its weight of the acid. To remove any water and acid that may be present, instead of chloride of calcium and lime, a little stronger alcohol is mixed with the chloroform, and then carbonate of sodium previously heated to redness, and the mixture is distilled to dryness.

It sometimes happens that the chloroform purified with sulphuric acid, though apparently pure at first, will not keep; but, after some time, becomes so loaded with chlorine and muriatic acid as to be altogether unfit for respiration. Dr. Christison ascertained that, if the sulphuric acid employed contains hyponitric acid, the chloroform changes in less than 24 hours. The idea has been entertained that it would be necessary to abandon sulphuric acid as a purifying agent; but experience has shown that, with certain precautions, it may be safely used; and its efficiency in getting rid of the empyreumatic impurity is so great that it is still much employed for the purpose. The British Council endeavours to escape the difficulty by using a large quantity of the acid, and allowing but very brief contact; while, in the U. S. process, the same end is arrived at by employing a comparatively small quantity of the acid, with a much longer period for its operation. In any case, however, the acid should be strong and pure, and especially free from any of the nitrogen acids; and care should afterwards be taken to remove every particle of the sulphuric or sulphurous acid, as is done in the officinal processes, by lime and carbonate of sodium. Dr. Squibb attributes the fact, that chloroform purified by concentrated sulphuric acid does not keep well, to the very purity attained. He believes that perfectly pure chloroform is prone to decomposition, and is rendered more stable by the addition of a small proportion of alcohol, so as to reduce its density to the officinal standard, 1·49. This he effects by adding alcohol in the proportion of ten drops to each fluidounce of good chloroform of maximum density. (See his paper on Chloroform in the New York *American Medical Monthly* for July, 1857.) This recommendation is carried into effect in the U. S. process, and explains the addition of alcohol before distillation. Dr. Gregory also attributes the tendency to decomposition to its purity, and to the action of sunlight; having found that those portions which he had purified with the greatest care were soonest decomposed under the influence of light.

As chloroform of great purity is often to be purchased in the market, it is not necessary for the apothecary to apply the officinal process of purification to every parcel that he may meet; but it is in the highest degree incumbent on him to sell none for inhalation which is not so pure as to stand the tests given in the Pharmacopœia, and if he can obtain none so pure, then to purify it himself. All pure specimens, moreover, should be kept distinct, and labelled with the officinal title of Purified Chloroform, for the sake of distinction.

Chloroform may be made by the action of chlorinated lime on pyroxylic spirit (wood spirit); but when thus prepared it is largely contaminated with a chlorinated pyrogenous oil, analogous to that already mentioned as being found in small proportion in chloroform prepared from alcohol. Chloroform, thus prepared, called *methylic chloroform*, is purified with too much difficulty to be advantageously substituted for that made with alcohol, called by Soubeiran *normal chloroform.* In Great Britain chloroform is now obtained by the use of methylated spirit; and the preparation, when properly purified, is stated to answer every purpose to which it is applied equally well with that obtained by the use of alcohol. (See *Methylic Alcohol* in *Part* III.)

Messrs. Duncan and Flockhart, druggists of Edinburgh, manufactured chloroform on a large scale, in a peculiar apparatus, using the proportions of 20 parts of chlorinated lime, about 3·75 parts of rectified spirit, and 60 parts of water. They employed two large wooden barrels as a still, and a third as a receiver, and into the former threw steam, which furnished both sufficient heat and water for the process. Sixty pounds of chlorinated lime were used by them at each distillation; and they were

able to manufacture three hundred ounces of chloroform a day. The heavy layer of the distillate, constituting the impure chloroform, was purified by them by mixing it with half its measure of strong sulphuric acid, gradually added, and distilling the mixture, when cool, in a leaden retort, from as much carbonate of barium by weight as of acid used by measure. The product was finally distilled from quicklime, after having stood over the earth, and been repeatedly shaken with it, for a day or two. Though sulphuric acid is used in this long-tried process, it may be presumed that the chloroform made by it is not liable to undergo the change which takes place in that prepared by Gregory's process. It will be observed, however, that the product, after the action of the sulphuric acid, is successively distilled from baryta and lime.*

Pettenkofer inferred, from numerous experiments on the manufacture of chloroform, that very different quantities are obtained, on different occasions, from the same amount of materials, and the same process. The yield is less, the longer the mixture is allowed to stand before distillation, and is greater when the heat of the mixture is between 135° and 167° F. than at either a lower or higher temperature. When the latter degree is exceeded, the chloroform contains more chlorine. (*Buchner's Neues Repert.*, x. 103.)

Discovery and History. Chloroform was discovered by Mr. Samuel Guthrie, of Sackett's Harbor, N. Y., in 1831, and about the same time by Soubeiran in France, and Liebig in Germany. Guthrie obtained it by distilling a gallon from a mixture of three pounds of chlorinated lime and two gallons of alcohol of the sp. gr. 0·844, and rectifying the product by redistillation, first from a great excess of chlorinated lime, and afterwards from carbonate of potassium. (*Silliman's Journal*, vol. xxi., Jan. 1832, p. 64.) In a subsequent letter to Professor Silliman, dated Feb. 15th, 1832, Mr. Guthrie states that the substance which he had obtained, "distilled off sulphuric acid, has the specific gravity of 1·486, or a little greater, and may then be regarded as free from alcohol; and if a little sulphuric acid which sometimes contaminates it be removed by washing it with a strong solution of carbonate of potassium, it may then be regarded as *absolutely pure*." (*Ibid.*, vol. xxii., July, 1832, p. 105.) It is thus evident that Mr. Guthrie obtained, in a pure state, the substance now called chloroform; but he erroneously supposed his product to be the well-known oily liquid of the Dutch chemists, which it greatly resembles, and for the preparation of which he believed he had fallen on a cheap and easy process. Under this impression, he called the substance, in his communications, *chloric ether*, one of the names by which the *Dutch liquid*, or *bichloride of ethylen*, is designated. He was induced to make the preparation from noticing, in Professor Silliman's Elements of Chemistry, a reference to the Dutch liquid as a grateful diffusible stimulant, when properly diluted with alcohol and water. In relation to the anticipated importance of chloroform, Mr. Daniel B. Smith, of this city, held the following language in July, 1832. "The action of this ether on the living system is interesting, and may hereafter render it an object of importance in commerce. Its flavour is delicious, and its intoxicating qualities equal to or surpassing those of alcohol. It is a strong diffusible stimulus, similar to the hydrated ether, but more grateful to the taste." (*Journ. of the Philad. Col. of Pharm.*, iv. 118.)

Properties. Chloroform is a limpid, colourless, volatile, neuter liquid, having a bland ethereal odour, and hot, aromatic, saccharine taste. It neither reddens nor bleaches litmus paper. It is but slightly soluble in water; one hundred parts of that liquid taking up but one part of chloroform. Its sp. gr. is from 1·49 to 1·494 (*U. S.*), 1·49 (*Br.*); but when of this density it contains a small proportion of alcohol. It boils at 140°. But Gregory has obtained it of the density 1·5 at 60°; and according to Schering (*Am. Journ. of Pharm.*, xlii. 319) the pure chloroform prepared from chloral has a density at 59° F. of 1·5022, and boils at 144·5°. It is not inflammable, but renders the flame of an alcohol lamp yellow and fuliginous. It burns, however, with a smoky flame, when mixed with an equal volume of alcohol. When pure, it has no action on potassium, except to cover the surface of the metal with

* In the *Am. Journ. of Pharm.* for Jan. 1862 (p. 25), is an account by Prof. Procter of the method employed by Messrs. Rogers and Crew, of Philadelphia, wholesale manufacturers of chloroform, and the apparatus used by them.

small bubbles of gas. Chloroform is a powerful antiseptic. It does not, like creasote, coagulate albumen. It is scarcely acted on by sulphuric acid in the cold, but dissolves readily in alcohol and ether. The alcoholic solution, when moderately diluted with water, forms an aromatic, saccharine liquid of a very grateful taste. A strong alcoholic solution is decomposed by abundance of water, the chloroform separating and subsiding, and the alcohol uniting with the water. It is liable to decomposition by sunlight, or even diffused daylight; and hence the propriety of keeping it in bottles, covered with dark paper, in a rather dark place. Chloroform has extensive solvent powers, being capable of dissolving caoutchouc, gutta-percha, mastic, elemi, tolu, benzoin, and copal. Amber, sandarac, lac, and wax are only partially soluble. It also dissolves iodine, bromine, the organic alkalies, the fixed and volatile oils, most resins, and fats. It dissolves sulphur and phosphorus sparingly. It possesses the power of dissolving a large quantity of camphor, and furnishes the means of administering that medicine in an elegant form. As a general solvent, it has the advantage over ether of not being inflammable; the inflammability of the latter being the cause of frequent accidents. For an extensive list of substances, soluble, insoluble, and partly soluble in chloroform, see a paper by M. Lepage, of Gisors, France, copied into the *Am. Journ. of Pharm.* for April, 1852, p. 147.* It has been found by J. B. Barnes that chloroform has the power of preventing the alcoholic, lactic, and other fermentations, probably by killing the organisms that provoke these processes. Twenty minims preserved sixteen ounces of malt, to which two drachms of yeast had been added, as long as the experiment lasted. The same quantity kept fresh eight fluidounces of milk in a warm place for five days. Mucilage and infusions were preserved for weeks with one minim or even less to the ounce. Similar results were reached by Mr. F. J. Barrett and others. (*Pharm. Journ. and Trans.*, Dec. 1874, pp. 441, 442, 455.) The active properties of chloroform forbid its use as a preservative of medicinal infusions, but from milk it could always be removed by boiling. A. Munz (*Pharm. Journ. and Trans.*, 1875, p. 967) proposes the employment of chloroform as a test between chemical and living ferments, since he has found it to have no effect upon the former, though absolutely destructive to the latter.

Composition. Chloroform is composed of three eqs. of chlorine and one of formyl, and is, therefore, the terchloride of formyl. As formyl is a bicarburet of hydrogen, the formula of chloroform is C_2HCl_3. Its composition was first accurately determined by Dumas in 1835, by whom it was called chloroform from its relation to formic acid ($CHCl_3$), being formic acid with its three eqs. of oxygen replaced by three of chlorine. When first obtained by Liebig, he supposed it to consist exclusively of chlorine and carbon; and hence the origin of the erroneous name, sometimes applied to it, of *perchloride of carbon.*

The rationale of the formation of chloroform has not been well made out. If alcohol be considered a bihydrate of ethylen, $C_4H_4 + 2HO$, it may be presumed to be generated by the removal from the ethylen of two eqs. of carbon, and the substitution of three eqs. of chlorine for three of hydrogen. Thus $C_4H_4 - C_2H_3 + Cl_3 = C_2HCl_3$.

Impurities and Tests. Chloroform is liable to contain alcohol and ether, both of which lower its specific gravity. If it have a less density than 1·38, it will float instead of sinking in a mixture of equal weights of concentrated sulphuric acid and water, after it has cooled. M. Mialhe has proposed the following test for the presence of alcohol. Drop into distilled water a small quantity of the chloroform. If pure, it will remain transparent at the bottom of the glass; but, if it contain even a

* The following table of the solubility of the several alkaloids and their salts in chloroform, prepared with great care by A. Schlimpert, may be of some practical use. At 64° F. 100 parts of chloroform dissolve

Morphia	1·66	Sulphate of cinchonia	3·00	Caffeina	11·00
Acetate of morphia	1·66	Quinoidia	25·30	Digitaline	1·25
Quinia	15·00	Veratria	11·60	Brucia	14.00
Sulphate of quinia	0·00	Atropia	33·00	Aconitia	22·00
Muriate of quinia	11·10	Strychnia	14·10	Santonin, pure	23·00
Cinchonia	2·50	Nitrate of strychnia	6.60	Santonin, impure	33·30

(*Am. Journ. of Pharm.*, March, 1860, p. 160; from *Archiv. der Pharm.*, Nov. 1859, p. 151.)—*Note to the twelfth edition.*

small proportion of alcohol, the globules will acquire a milky appearance. Soubeiran's method was to agitate almond oil and chloroform together in a tube. If the chloroform is pure it remains clear, if it contains as much as 5 or 6 per cent. of alcohol, it becomes milky. (*Journ. de Pharm.*, Août, 1860, p. 95.) Prof. Procter detected alcohol by adding the suspected chloroform to an oxidizing mixture of bichromate of potassium and sulphuric acid. If alcohol be present, the deep-orange colour of the chromic mixture will gradually become green; if absent, no change of colour will take place. (*Am. Journ. of Pharm.*, May, 1856, p. 213.) Alcohol may be detected by potassium or sodium, which colours the chloroform containing this impurity, and gives rise to sharp acid fumes. In the test proposed by M. A. Blachey (*Journ. de Pharm.*, 4e sér., ix. 269), advantage is taken of the solubility of caustic potash in alcohol and its insolubility in chloroform. The suspected liquid having been agitated with a lump of the caustic potash is poured off, and shaken up with water. The two liquids having been allowed to separate by standing, the water is drawn off and a few drops of a strong solution of sulphate of copper added to it, when, if alcohol has been contained in the chloroform, the oxide of copper will be precipitated. The most sensitive test is probably a compound discovered by M. Roussin, the binitrosulphuret of iron, a little of which agitated with chloroform and then allowed to stand, if there be the least proportion of alcohol, will produce a brown tint, deeper in proportion to the quantity, while the chloroform if pure will remain unchanged. To obtain this compound it is sufficient to mix nitrate of potassium and hydrosulphate of ammonium in solution, and to add a solution of protosulphate of iron, stirring constantly, until the liquid has but a slightly alkaline reaction, then evaporating to dryness, treating the residue with etherized alcohol on a filter, and evaporating the liquor so that it may crystallize. (*Journ. de Pharm.*, Sept. 1858, p. 208.) A. C. Oudemans, jr., affirms that the percentage of alcohol may be correctly estimated by the power of the suspected liquid to dissolve cinchonia (*Amer. Journ. of Pharm.*, 1873, 223), and gives the table inserted in the note below.* The most injurious impurities are the chlorinated pyrogenous oils, already alluded to. These are different as obtained from methylic or normal chloroform. The oil, obtained by Soubeiran and Mialhe from methylic chloroform, is an oleaginous, yellow liquid, lighter than water, and of a peculiar nauseous empyreumatic odour, perceptible in the methylic chloroform itself. In commercial chloroform it is sometimes present to the amount of 6 per cent. It is easily set on fire, and burns with a smoky flame, chlorine being among the products of its combustion. The oil procured from normal chloroform, which contains it in the amount of about one-fifth of 1 per cent. only, is essentially different from the methylic chloroform oil. It is heavier than water, and has an acrid, penetrating odour, unlike that of the other oil. When the vapour of these oils is inspired or even smelt, it causes, according to Dr. Gregory, distressing sickness and headache. These pyrogenous oils are detected and removed by *pure* and *strong* sulphuric acid. Chloroform, when pure, upon being mixed with an equal volume of this acid, does not colour it; but, when contaminated with these oils, gives the acid a colour, varying from yellow to reddish-brown, according to the amount of impurity. Alcohol also is detected and removed by sulphuric acid. In applying this test, several fluidounces of chloroform should be used; as a slight change of colour cannot be

* Percentage of Alcohol.	Percentage of Cinchona, by weight, at 17° C.	Difference between it and pure Chloroform.	Percentage of Alcohol.	Percentage of Cinchona, by weight, at 17° C.	Difference between it and pure Chloroform.
0	0·28	0	6	3·39	40
1	0·90	62	7	3·79	36
2	1·46	56	8	4·15	33
3	1·99	53	9	4·48	28
4	2·49	47	10	4·76	...
5	2·96	43	11	.....	...

The cinchonia is best prepared by precipitating a weak alcoholic solution of a pure salt of the alkaloid by ammonia. (*Note to the fourteenth edition.*)

easily seen in a test tube. A still more delicate test of the oily impurities, according to Dr. Gregory, is the smell which they leave. If chloroform, thus contaminated, be poured upon the hand, it quickly evaporates, leaving the oily impurities, recognisable by their offensive odour, now no longer covered by that of the chloroform. The pure substance, rubbed on the skin, quickly evaporates, and scarcely leaves any smell. Chloroform sometimes contains Dutch liquid, which may be discovered by adding an alcoholic solution of potassa; when the mixture, if this impurity be present, will heat, and give off a permanent gas, which is chloride of acetyl, C_4H_3Cl. (*Geuther.*)* Fuming nitric acid, heated with chloroform to 90° C. for 120 hours, forms a new substance, chloropicrine. (*Journ. de Pharm.*, 4e sér., xv.)

Certain conclusions of Prof. John M. Maisch upon the subject of chloroform, drawn from a series of practical and experimental observations, are worthy of notice. Chloroform may be made of the sp. gr. 1·5, or perhaps somewhat heavier, and this is its density when pure; but it will not keep so well as when of the officinal strength from 1·490 to 1·494. When pure, or even of the sp. gr. of about 1·49, it is quickly decomposed in direct sunlight, and more slowly in diffused daylight; and the presence of water, however small in quantity, favours the decomposition. The products of its decomposition are muriatic acid and phosgene gas. If, however, it be perfectly excluded from the light, it will keep indefinitely; Wiggers having preserved some unaltered for fifteen years. According to Schacht, moreover, pure chloroform will resist even sunlight, if in a perfect vacuum. To prevent the decomposition of chloroform the most effectual means is the addition of alcohol. If reduced by this to the sp. gr. 1·480 or 1·484, it will keep well in diffused daylight, and, for a time at least, even in the sun's rays, if perfectly free from moisture. At the sp. gr. 1·475 or lower, it remains unaffected whether in diffused light or in the sun, and whether the bottles be damp or dry. The measures, therefore, to secure chloroform from decomposition are two, either of which will answer; first, to keep it perfectly secluded from light, from the moment of rectification; or, secondly, to reduce the sp. gr. to 1·475 by alcohol, as suggested by Dr. Squibb. Sulphuric acid will not decompose chloroform in the dark; in the light it evolves muriatic acid. One of the best criteria of its purity is a constant boiling point. When of the sp. gr. 1·496, it boils at 152·6° F. A slight acid reaction in chloroform is not easily detected, as litmus is quite insoluble in that fluid. It is best observed by allowing a few drops of chloroform to evaporate spontaneously with one drop of an aqueous solution of litmus duly neutralized. The colour will be changed to reddish. After becoming acid, chloroform may be readily regenerated, by agitating it with solution of carbonate of sodium, and distilling from a little unslaked lime. From what has been said above, chloroform to be kept for use should have the sp. gr. 1·475, and if denser than this, should be brought to it by the addition of alcohol. It is best kept in cork-stoppered bottles. As the cork is not acted on by chloroform, if it become yellow and softened, it will indicate the presence of an acid, and thus act as a test. (*Am. Journ. of Pharm.*, July, 1868, p. 289.)

Boettger states that chloroform altered by the sun's rays, containing muriatic acid and having a chlorinous odour, may be restored and made fit for inhalation by agitation with a few fragments of caustic soda, and that the fluid may be kept exposed to light, if protected in the same way. (*Ibid.*, Sept. 1866, p. 473; from *Journ. de Pharm.*, Avril, 1864.) M. Jaillard (*Journ. de Pharm.*, 4, sér. xxii., p. 305) states that he has frequently found both muriatic and formic acid in chloroform exposed for sale. He employs nitrate of silver as a test, using an excess of the reagent; he filters out the precipitated chloride, and boils, when, if formic acid be present, black metallic silver is deposited.

Officinal Tests. The U.S. Pharmacopœia directs that purified chloroform should have a sp. gr. not less than 1·490 nor exceeding 1·494; should boil at 140°; when dropped into water should sink in the form of transparent globules without milkiness; should produce no warmth, sensible to the hand at the moment when mixed, in a bottle closed by a glass stopper, with an equal measure of officinal sulphuric acid,

* In relation to chloroform, see the paper of Soubeiran and Mialhe, *Journ. de Pharm.*, July, 1849, copied into the *Am. Journ. of Pharm.*, xxi. 313; also the paper of Dr. Gregory, *Chem. Gaz.*, May 15, 1850.

and that, when the liquids have separated on standing, and have been allowed to remain in contact for 24 hours, no colour should be imparted to either, or but a faint yellowish tinge to the acid, forming the lower layer. The Pharmacopœia directs, moreover, that when 3 or 4 fluidrachms are evaporated from a porcelain plate, by causing them to flow to and fro over the surface, the last portions should have a slightly aromatic odour, without pungency or empyreuma, while the plate is covered with a film of moisture, without odour or taste. These tests imply the presence of but a minute proportion of alcohol, and the total absence of chlorine and those volatile and empyreumatic substances which constitute the most injurious impurities of chloroform. A heat that would be felt through the bottle, on the admixture of sulphuric acid with chloroform, would evince the presence of too much alcohol or water. The want of discoloration from the contact of the two liquids shows the absence of empyreumatic oily matter; but a very slight discoloration might proceed from the alcohol present, and would not, therefore, be a material objection. A colour bordering on that of madeira wine would imply an objectionable amount of impurities. The volatile impurities are less volatile than chloroform, and would consequently be the last to escape on the evaporation of the liquid. Chloroform, therefore, leaves a foreign odour behind it when allowed to evaporate from the hand, and especially when from a porcelain plate, in the amount and manner indicated; and if it stand this test well, it may be considered as free from any noxious volatile impurity. The slight foreign aroma without pungency, which is given out under these circumstances, is of no injurious significance.* It is stated that chloroform made from chloral may be distinguished from other chloroform by its remaining colourless when the sulphuric acid test is employed, and by its leaving no aromatic residue when evaporated, evidences of its absolute purity. It has been claimed that this chloral chloroform does not undergo decomposition, but this has been proven not to be correct. (*Am. Journ. of Pharm.*, xlii. p. 409.)

Medical Properties, &c. When taken *internally*, chloroform acts as a sedative narcotic, probably operating through the nervous system, independently of vascular action or congestion. It has been detected by Ragsky in the blood, and by Dr. Snow, of London, in different parts of the body after death.† In 1848 Dr. H. Hartshorne tried its physiological effects in the dose of seventy-five drops on himself, and found it to produce drowsiness and a general diminution of sensorial power, without exhilaration, or acceleration of the pulse. Since then he has used it internally in a number of cases, and finds it a safe anodyne and soporific, altogether free from the dangerous effects which sometimes follow the inhalation of its vapour. In the dose of a fluidrachm, its soporific effect is about equal to that of thirty-five drops of laudanum. Dr. Hartshorne has given it in doses of from fifty to seventy-five drops every half hour for several hours together. The vehicle used by him is orgeat syrup, in the proportion of two fluidounces to each fluidrachm of the chloroform. When mixed with mucilage of gum arabic, the mixture requires agitation immediately before swallowing each dose.‡ Dr. G. Wilson Murdock (*Am. Journ. of Pharm.*, xlii. 561) takes one part of chloroform and two of glycerin, adds the chloroform very slowly and rubs up carefully; then allows it to stand for twenty-four hours, separates a little chloroform which will have collected at the bottom, and rubs it up again with a third of the glycerin; after which no further separation occurs. This, when used, may be diluted with water to any extent.

Chloroform, as prepared by Mr. Guthrie, was used internally as early as 1832 by Professor Ives and Dr. Nathan B. Ives, of New Haven, in asthma, spasmodic cough, scarlet fever, and atonic quinsy, with favourable results. (*Silliman's Journ.*, xxi.

* Much is due to Dr. Squibb for the precision given to the tests for chloroform; and the reader may profitably consult his remarks on the subject in a paper in the *Proceedings of the Pharmaceutical Association*, A. D. 1858, p. 402.

† In relation to the detection of chloroform in the body after death, see the paper of M. Duroy, of Paris, in the *Journ. de Pharm.*, Avril, 1851.

‡ The Society of Pharmacy, of Paris, has given its sanction to the following formula; the French weights being turned into the nearest English weights and measures. Take of chloroform ℥ss to ℥j; sugar ℥iij; gum arabic ℥j to ℥ij; water f℥iijss. Rub the chloroform with the sugar in a mortar, then add the gum, and, lastly, by degrees, the water. In this recipe alcohol, which is often inadmissible, is avoided.

406, 497.) It was employed by Dr. Formby, of Liverpool, in hysteria, in 1838; by Mr. Tuson, of London, in cancer and neuralgic affections, in 1843; and by M. Guillot, of Paris, in asthma, in 1844. Dr. L. Dalton, of Logan, Ohio, has found it to possess antiperiodic powers, and by him and other physicians it has been employed successfully in intermittent diseases. Half a drachm to a drachm should be given every hour, for two or three hours, preceding the expected return of the paroxysm. Dr. Aran has employed it for four years with success in lead colic, administered by the mouth and rectum, and applied to the abdomen. (See *Dublin Journ. Med. Science*, August, 1875.) In these cases it probably acts by relaxing the intestinal spasm. It has been found very effectual in hiccough. One of the authors of this work has frequently used it with advantage for the relief of neuralgic and other painful affections, in the dose of from forty to eighty drops, suspended in water by means of gum arabic or yelk of egg. This dose may be repeated, if necessary, at intervals of one or two hours, until some effect on the system is produced. Chloroform has been used internally, with benefit, by Dr. Osburn, of Dublin, in hypochondriasis, and by Dr. Gordon, physician to the Hardwicke Fever Hospital, to allay nervous irritation and procure sleep. A disadvantage connected with the internal use of chloroform is its liability to sicken the stomach, an effect which may sometimes arise from the presence of pyrogenous oil. An incidental advantage is said to be, that it entirely covers the bitterness of other medicines. In severe tic douloureux Dr. Bartholow, of Cincinnati, recommends deep injections of chloroform in the immediate vicinity of the nerves. M. Dauzats, of Cordova, Spain, has used chloroform, with highly favourable results, in the destruction of the larvæ of insects, which sometimes make great ravages in the nostrils, pharynx, &c. Simple inhalation of chloroform is sometimes sufficient to destroy the insects in large numbers; but it is always prudent to employ injections composed of equal parts of chloroform and water, which may be considered infallible. If chloroform is not at hand, ether may be substituted. (*Ann. de Thérap.*, 1867, p. 43.)

External Use. Mr. Tuson employs it in cancer, senile gangrene, and sloughing ulcers, and, as an injection and gargle, in discharges from the uterus and foul ulcers of the throat, with the effect of relieving pain, destroying fetor, and promoting the separation of diseased parts. It has also been employed externally, with benefit, in a painful wound of the forearm implicating the radial nerve; by Dr. Legroux in a painful affection of one of the lower extremities, consequent to a cancerous tumour of the pelvis; by Mr. Higginson in labour, applied to the perineum when painfully stretched, and in dysmenorrhœa, brought in contact with the os uteri by means of a sponge; by Dr. Watson in swelled testicle and acute spinal tenderness; by Dr. Hays and Dr. Bond in neuralgia; by the late Dr. I. Parrish in the supra-orbitar pain of rheumatic ophthalmia, and in syphilitic ulceration at the root of the nail; by M. Devergie in papulous eruptions, made into an ointment in the proportion of a fluidrachm to ten drachms of lard; by Prof. Back in the itch; and by M. Chapell in fissure of the anus. It has also been used with success by Dr. Venat, of Bordeaux, in the form of injection, in the commencement of acute gonorrhœa, as an abortive treatment. Dr. Rauch, of Iowa, has employed chloroform topically with decided benefit in neuralgia, colic, and other painful affections. For some purposes he found it useful to incorporate it with olive oil and solution of ammonia, which formed a mixture having effects less transient than those of the uncombined substance. Incorporated in equal measure with the white of eggs, and applied on lint to the gums, it is said to afford great relief in toothache. As a wash, injection, and gargle, Mr. Tuson prepared chloroform diluted with water, in the proportion of one or two drachms to the pint; but, for application to the sound skin, it is generally used undiluted, by means of soft linen, covered with oiled silk to prevent evaporation. Employed in this state it should be pure; as, according to Mialhe, when mixed with absolute alcohol, it acquires caustic properties. Dr. Augustus Waller, in a series of experiments, has determined that chloroform easily travels through dead skin by diffusion; and that, both in men and animals, the pure substance, as well as chloroformic solutions, readily pass through the skin, and may produce constitutional effects.

(*London Practitioner*, Dec. 1869.) In clinical medicine the local use of chloroform is very extensively practised.

M. Fournié has found that the vapour from a mixture of equal measures of glacial acetic acid and chloroform is even more effectual, as a local anæsthetic, than that of pure chloroform; producing complete insensibility of the skin in five minutes, if applied from a bottle heated simply by the hand. (*Pharm. Journ.*, Jan. 1862, p. 385; from *Comptes Rendus.*)

Chloroform may be gelatinized by agitating it with an equal weight of white of egg in the cold. In three hours it takes the gelatinous form. A stronger preparation may be made by shaking together, in a bottle, four parts of chloroform and one of white of egg, and placing the mixture in water at 140°. In four minutes the gelatinization is completed. *Gelatinized chloroform* may be applied to the skin, spread on linen, or by friction.

Chloroform, in vapour, may be used as a topical application to the rectum. M. Ehrenreich employed it with success in tenesmus. A drachm may be vaporized by the heat of warm water from a bottle, fitted with a flexible tube, inserted into the bowel. It may be applied to the skin in the form of a vapour douche, according to the method of Dr. Hardy, of Dublin. (See *Ranking's Abstract*, No. 19, p. 287.) Prof. Langenbeck, of Berlin, prefers chloroform to tincture of iodine, as an injection for the radical cure of hydrocele.

A third method of using chloroform is by *inhalation*. The first case we have met with in which it was thus employed is related by Professor Ives, of New Haven, under date of the 2d of Jan. 1832. The case was one of pulmonic disease, attended with general debility and difficult respiration, and was effectually relieved. (*Silliman's Journ.*, vol. xxi., Jan. 1832, p. 406.) In March, 1847, the action of the pure substance by inhalation was tried on the lower animals, by M. Flourens, and its effects on the spinal marrow described. In November of the same year, Dr. Simpson, of Edinburgh, after experimenting with a number of anæsthetic agents in order to discover a substitute for ether, tried chloroform at the suggestion of Mr. Waldie, and, having found its effects favourable, brought it forward as a new remedy for pain, by inhalation in surgery and midwifery. The advantages which he conceived it to possess over ether were the smallness of the dose, its more prompt action, more agreeable effects, less tenacious odour, greater cheapness, and greater facility of exhibition.

The usual effects produced by a full dose of chloroform, administered by inhalation, are the rapid production of coma, relaxation of the muscles, slow and often stertorous breathing, upturning of the eyes, and total insensibility to agents which ordinarily produce acute pain. The effect on the heart's action is variable. Sometimes frothing of the mouth takes place, and, more rarely, convulsive twitches of the face and limbs. The insensibility is generally produced in one or two minutes, and usually continues for five or ten minutes; but the effect may be kept up for many hours, provided the inhalation be cautiously renewed from time to time. The immediate effects of the agent are followed by a drowsy state, sometimes by quiet sleep. As a general rule, no recollection is retained of anything that occurred during the state of insensibility. Experience has shown that the effects, here described as those of a full dose of chloroform by inhalation, cannot be induced without danger to life. Hence all prudent surgeons will be content with an impression short of the abolition of all consciousness. It is generally admitted that, at a certain stage of anæsthesia, there is insensibility to pain, while consciousness to a certain extent remains; and it is this condition that the surgeon should aim to produce. According to Mr. Skey, chloroform had been administered up to 1854, in 9000 cases in St. Bartholomew's Hospital, without a single accident, a fact which must be taken as proof of its careful employment in that institution. The delicate operation of extracting the cataract has been facilitated by its use, in the hands of Mr. Bowman, of London; and, in general, the performance of operations on the eyeball is greatly assisted by the insensibility produced, especially in children. In partial anchylosis, in which the surgeon proposes to break up the adhesions by force, chloroform, like ether, takes off the muscular resistance, and renders the manipulations painless. It is asserted to be an advantage of chloroform

in surgical operations, that less blood is lost. If this assertion should prove to be true, there will be greater necessity of delaying the dressings until reaction shall have taken place. The question whether the use of chloroform in the major operations of surgery is favourable or otherwise to recovery, has been examined by an appeal to statistics. Dr. Simpson, of Edinburgh, thinks the percentage of recoveries has been increased by its use; while Dr. Arnott, basing his opinions on the results of operations in the London hospitals, holds the contrary belief.

The opinion of the profession as to the advantages and disadvantages of chloroform, when compared with ether as an anæsthetic in operative surgery, is not unanimous, but on one point all seem to be agreed, namely, that it is far more dangerous to life than ether. According to Dr. Snow, of London, the vapour in the air breathed by the patient should not exceed 6 per cent. Dr. Gilman, of New York, thinks that chloroform has a more sudden and powerful effect than under ordinary circumstances, when inhaled immediately after bleeding; a fact which he explains by the increased power of absorption produced by the loss of blood. (*N. Y. Med. Times*, Oct. 1852.)

As chloroform is powerfully sedative, and ether powerfully stimulant, it was very naturally supposed that, by combining them, the depressing effects of the former might be counteracted by the latter; but experience has not altogether confirmed the suggestion of theory in this case; as fatal effects have followed the joint administration of the two anæsthetics. (*Boston Med. and Surg. Journ.*, Oct. 1869.) This result may be in part explained by the more rapid volatilization of the chloroform, which may cause it to reach the surface of absorption with comparatively little admixture of the ethereal vapour, as suggested by Mr. Robert Ellis. (*Med. Times and Gaz.*, March 9, 1867.)

Sometimes chloroform produces unpleasant remote effects; such as abolition of smell, perversion of taste, and loss of tonicity in the bladder and rectum. Two cases, illustrative of these effects, in which chloroform was inhaled in excess, are related by Dr. Happoldt in the *Charleston Med. Journ.* for Jan. 1856.

In midwifery, chloroform has been extensively employed to relieve pain and facilitate labour, since it was first recommended by Dr. Simpson. Its effects are similar to those of ether; and each agent has its exclusive advocates among those practitioners of midwifery who are willing to use anæsthetics. According to Dr. Atthill, of Dublin, the use of chloroform produces a tendency to post-partum hemorrhage. Dr. Robert Lee, of London, has cited seventeen cases, in which it was supposed to produce various pernicious effects in labour. (*Lancet*, Dec. 24, 1853.) Notwithstanding exceptional cases of injury, it is every year growing in favour as an anæsthetic in parturition. The profession is unanimous as to its great utility in instrumental labours.

The dose of chloroform for inhalation is a fluidrachm, equivalent to 220 drops or more, to be repeated in two minutes, if the desired effect should fail to be produced. The most convenient inhaler is a handkerchief, loosely twisted into the form of a bird's nest, which, after having been imbued with the chloroform, is held to the mouth and nose. The use of this simple inhaler ensures a due admixture of atmospheric air with the vapour of the chloroform. The moment insensibility is produced, which should be brought on *gradually*, the inhalation should be suspended; and, if consciousness return too soon, it should be cautiously renewed. In all cases an experienced assistant should attend to the administration of the chloroform and to nothing else, watching the state of the respiration and pulse. The moment there is the least snoring or failure of the pulse, the vapour should be withdrawn. As shown by Claude Bernard, the hypodermic use of morphia greatly prolongs the anæsthesia caused by chloroform. Chloroform should not be administered to persons subject to epilepsy, affected with organic disease of the heart, or predisposed to syncope.*

Chloroform, as ordinarily prepared, is apt to produce, when inhaled, headache, nausea, and even vomiting. Perfectly pure chloroform, according to Soubeiran and Mialhe, does not produce these disagreeable effects, which are plausibly attributed to the presence of the pyrogenous oils. Dr. Simpson, however, finds that the purest

* For rules laid down by M. Baudens for the administration of chloroform, see the *Am. Journ. of Med. Sci.* for Jan. 1854, p. 208; and for those given by M. Robert, surgeon to the Hospital Beaujon, see *Ranking's Abstract*, No. 19, p. 116.

chloroform that he uses not unfrequently causes vomiting; but Dr. Gregory attributes this effect, when following the use of the pure substance, to its administration after a full meal, which should always be avoided.

Chloroform having proved to be a relaxing agent and remedy for pain, when used by inhalation in surgery and midwifery, it was natural that its effects should be tried in the same way in spasmodic and painful diseases. Accordingly it has been inhaled in hiccough, chorea, hooping-cough, hysteria, the paroxysm of asthma, angina pectoris, nephritic colic, tetanus, poisoning from strychnia, hydrophobia, and the paroxysm of tic douloureux, and generally with decided advantage. In Germany it has been praised in bronchitis and pneumonia as an expectorant and calming remedy. It has been employed also with success for the reduction of strangulated hernia. Mr. R. J. Mackenzie, of Edinburgh, bears testimony to its good effects, used by inhalation, in spasmodic stricture of the urethra, attended with retention of urine. Sometimes the urine is caused to flow at once; and, when this is not the case, the passage of the catheter is facilitated. Dr. Cain, of Charleston, found it very useful in spasmodic obstruction of the bowels, promptly relieving pain, and favouring the action of enemata. As a soporific it has been given beneficially in delirium tremens, and in the noisy forms of chronic insanity.

Much has been said in relation to the dangers attendant upon the inhalation of chloroform, and, certainly, very many more deaths have been reported from its use than from that of ether. According to the published statistics,* death occurs in about one in 3000 inhalations. Chloroform is unquestionably a more powerful agent than ether, and acts not only differently, but in a much smaller dose. The comparative smallness of its dose is certainly a ground of danger, when its administration falls into reckless or incompetent hands; but, more than this, it has been abundantly shown that no care and no restriction of the dose will prevent a fatal result; even the previous safe inhalation has been found to be no guarantee against death. In view of the greater danger from the use of chloroform as an anæsthetic, the governors of the Massachusetts General Hospital have prohibited the use of any other agent than ether in surgical operations.

When the effects of chloroform inhalation proceed too far, the remedies are, placing the patient at an angle of 45°, with the head downward, or even completely inverting the person, cold air fanned upon the face, cold water poured upon the head, sinapisms to the feet, frictions and heat to the body and extremities, and ammonia to the nostrils. If respiration ceases, the tongue should be seized with the artery-forceps, and pulled forward from off the glottis, and artificial respiration vigorously performed. When the patient can swallow, strong coffee may be given with advantage. Dr. Halfourd has proposed the injection of liq. ammonia into the veins, and it has been successfully practised in one or two cases. Galvanic electricity, passed through needles inserted in different parts of the body, is recommended by M. Abeille, of Ajaccio, as a powerful means of recalling sensibility; and it is highly probable that the electro-magnetic battery would prove useful. When an overdose is taken by the mouth, the same remedies may be employed, with the addition of the stomach-pump, when vomiting cannot be produced. In a case of suicide by swallowing chloroform, in which death took place in about thirty-four hours, the lining membrane of the larynx and trachea was found inflamed, the bronchi was loaded with a dirty-gray purulent fluid, the lungs were inflamed as in the first stage of pneumonia, and the brain and its membranes congested. In another fatal case, reported by Dr. J. Williams, of the Philadelphia Hospital, Blockley, in which the patient survived thirty-seven hours, no morbid appearances were observed worthy of note.

In relation to the preparations, consisting of chloroform and alcohol, which have been used under the name of "chloric ether," the reader is referred to *Spiritus Chloroformi* in *Part* II.†

* See *Med. Times and Gaz.*, 1870; *Pacific Med. Journ.*, June, 1869.

† *Chlorodyn.* An empirical preparation under this name has been extensively used in London, and has recently acquired some general notoriety from having been the reputed cause of death in a case of accidental poisoning in England, and as having produced very threatening symptoms in another case, in which the patient was saved. From a formula published in the *Am. Journ. of Pharm.*, March, 1860 (p. 181), it would appear to consist of chloroform, chloric ether (so called), tincture of capsicum, oil of peppermint, muriate of morphia, hydrocyanic acid (Scheele's), per-

Pharm. Uses. In preparing Atropia.

Off. Prep. Linimentum Chloroformi; Liquor Gutta-perchæ, *U. S.;* Mistura Chloroformi, *U. S.;* Spiritus Chloroformi; Tinctura Chloroformi Composita, *Br.* B.

OLEUM ÆTHEREUM. *U. S. Ethereal Oil.*

"Take of Stronger Alcohol *two pints;* Sulphuric Acid *fifty-five troyounces;* Distilled Water *a fluidounce;* Stronger Ether *a sufficient quantity.* Add the Acid slowly to the Alcohol, mix them thoroughly, and allow the mixture to stand for twelve hours. Decant the clear liquid from the sediment into a tubulated retort, of such capacity that the mixture shall nearly fill it. Adapt a thermometer tube to the tubulure by means of a cork, so that the bulb shall be deeply immersed in the liquid, and, having attached a Liebig's condenser, distil, by means of a sand-bath, at a temperature between 302° and 315°, until the liquid ceases to come over, or until a black froth begins to arise in the retort. Separate the yellow ethereal liquid from the distillate, and expose it for twenty-four hours, in a shallow capsule, to evaporate spontaneously. Then transfer the remaining liquid to a wet filter; and, when the watery portion has drained off, wash the oil which is left, while on the filter, with the Distilled Water. When this also has drained off, transfer the oil to a graduated measure, by perforating the point of the filter, and add to it an equal volume of Stronger Ether. The Ethereal Oil, obtained by this formula, measures about six fluidrachms." *U. S.*

In the late consolidation of the British Pharmacopœias, this valuable remedy was omitted, partly on account of the uncertainty as to its special antispasmodic virtues, partly from its expensiveness when properly made and its liability to spontaneous change, and partly, moreover, because not only is it often adulterated, but other compounds are substituted for it. (*Med. Times and Gaz.*, March, 1864, p. 248.) It is, however, retained in the U. S. Pharmacopœia, with certain modifications in the process, which, it is hoped, may enable it to yield a larger and more reliable product.

In the existing U. S. formula, the first change to be noticed is the direction, after the mixture of the acid and alcohol, to decant the clear liquid from the sediment, which is sulphate of lead, deposited by the acid on account of its dilution. According to Dr. Squibb, the presence of the sulphate of lead in the retort causes the mixture to froth over, and thus necessitate a suspension of the process so much sooner, as greatly to lessen the amount of product the materials are capable of affording. The increase of oil resulting from this simple modification of the process is said to be one-third. Another new feature is the introduction of a thermometer into the retort, whereby the important point is obtained of properly regulating the temperature, which, in order to the due reaction of the materials, should not fall below 312° nor rise above 322°. Again, the washing of the oil with solution of potassa has been omitted, because the alkali was found to decompose a portion of the oil, and the sulphurous acid, which it was intended to neutralize, can be separated by the washing with distilled water now directed. By wetting the filter, the oil is prevented from passing along with the water. Finally, the oil is now ordered to be diluted with an equal measure of stronger ether, as this has been found to contribute greatly to its preservation.

When alcohol is distilled with a large excess of sulphuric acid, the same products are generated as those mentioned, in the article upon ether, as being formed towards the close of the distillation of that liquid. (See *page* 1027.) These were stated to be sulphurous acid, heavy oil of wine, olefiant gas, and resino-carbonaceous matter. In the U. S. process such an excess of sulphuric acid is employed for the purpose of obtaining the oil. The product of the distillation is generally in two layers, one, consisting of water holding sulphurous acid in solution, and the other, of ether containing the heavy oil of wine. According to the experience of Dr. Squibb, the sp. gr. of these two layers is so nearly equal, that sometimes one and sometimes the other is uppermost; so that the direction in the old formula to separate the supernatant liquor is incorrect, and has been superseded by the present, to separate the yellow ethereal

chloric acid, tincture of Indian hemp, and molasses; and of these powerful medicines, moreover, in such proportions as to make one shudder at the idea of its unregulated use. (*Note to the twelfth edition.*)

Other formulas for this nostrum will be found in the *American Journal of Pharmacy* (Jan. 1865, p. 17), and in the same journal for May, 1868, p. 210. (*Note to the thirteenth edition.*)

liquid; the colour and other sensible properties being considered sufficiently distinctive. After separation, the liquid is exposed for twenty-four hours to the air, in order to dissipate the ether by evaporation; and the oil which is left is washed with water to deprive it of all traces of sulphurous acid.

The nature and mode of formation of heavy oil of wine are not well understood. It has been explained, in a preceding article, that, in the early stage of the distillation of a mixture of sulphuric acid and alcohol, sulphovinic acid, or the double sulphate of ether and water, is formed. During its progress this is decomposed so as to yield ether. When, however, the alcohol is distilled with a large excess of sulphuric acid, the sulphovinic acid is decomposed so as to form a small quantity of the heavy oil of wine, now considered to be a double sulphate of ether and ethylen, having the formula $C_4H_5O,SO_3 + C_4H_4,SO_3$. It is conceived to be generated from two eqs. of sulphovinic acid (double sulphate of ether and water), which are resolved into one eq. of heavy oil of wine, two of sulphuric acid, and three of water. When the heavy oil is gently heated with four parts of water, sulphovinic acid is reproduced, and the separated ethylen floats on the surface as an oily substance, called, when thus isolated, light oil of wine. *Light oil of wine*, as thus obtained, is a pale-yellow oil, supposed to have the formula C_4H_4. As ordinarily procured in the process for preparing ether, it contains a portion of that substance. When the pure light oil of wine is kept, it deposits a stearoptene, isomeric with itself, called concrete oil of wine, or oil of wine camphor; after which the oil is changed, and takes the name of etherole. *Etherole* is a pale-yellow oily liquid, having an aromatic odour. Its sp. gr. is 0·921, boiling point 536°, and freezing point 31° below zero. It communicates a greasy stain to paper. *Concrete oil of wine*, sometimes called *etherine*, crystallizes in long, transparent, brilliant, tasteless prisms, soluble in alcohol and ether, insoluble in water, fusible at 230°, boiling at 500°, and having the sp. gr. 0·980. Dr. Squibb takes a different view of the composition of ethereal oil, and believes it, instead of a sulphate or double sulphate, to be a sulphovinate of a carbohydrogen base; and for this reason, that it fails, especially when pure and recent, to give any of the characteristic reactions of sulphuric acid or the sulphates. (*Am. Journ. of Pharm.*, Jan. 1861, p. 58.)*

Properties. The undiluted *ethereal oil* (*heavy oil of wine*) is a yellowish neutral liquid, possessing an oleaginous consistency, a penetrating aromatic odour, and rather sharp and bitter taste. It boils at 536°. Its sp. gr. is, according to the U. S. Pharmacopœia of 1850, 1·096; according to the London College, after Mr. Hennell's results, 1·05. The density obtained by Dr. Squibb, U. S. Navy, by following the old formula of the U. S. Pharmacopœia exactly, was 1·129. By Dumas and Serullas its density is stated to be as high as 1·133, which is probably the more correct number for the *pure* oil. When dropped into water it sinks, assuming the form of a globule. It dissolves sparingly in cold water, moderately in hot water, and readily in alcohol and ether. It is devoid of acid reaction, the sulphuric acid present in it being completely neutralized by the ether and ethylen united with it. The sulphuric acid present is not precipitated by the usual reagents for this acid; because they furnish a base, which, replacing the ethylen, gives rise to one of the salts of sulphovinic acid, all of which are soluble in water and hydrous alcohol. The U. S. ethereal oil of the existing Pharmacopœia is the proper oil diluted with an equal volume of stronger ether. This gives it an ethereal odour in addition to that characteristic of the pure oil, and considerably reduces its sp. gr., which is now stated at 0·91. The process by which the officinal oil of wine is formed yields but a small product, being, according to the Pharmacopœia, only about six fluidrachms, or somewhat more than a fortieth, by measure, of the alcohol employed.

* Valuable papers have been contributed by Mr. C. Lewis Diehl and Prof. John M. Maisch, on this officinal preparation; the former to the *Proceedings of the American Pharmaceutical Association* for 1864; the latter to the *American Journal of Pharmacy* (March, 1865, p. 160), to which we refer those especially concerned in its manufacture. In Mr. Diehl's paper valuable suggestions are made in reference to the mode of reheating so as properly to regulate the temperature. An important practical fact is stated by Prof. Maisch, that the ethereal oil, in contact with water, undergoes a decomposition into light oil of wine and sulphovinic acid, rapidly and completely if the water is hot or if solution of an alkali or alkaline carbonate is used, and more slowly with cold water. Hence the inference that the washing of the ethereal oil, directed at the close of the U. S. process, should be completed as rapidly as possible. (*Note to the thirteenth edition.*)

In the officinal ethereal oil, the heavy oil of wine, that is, the double sulphate of ether and ethylen, is not only diluted with an equal measure of ether, but is mixed also with variable proportions of free light oil of wine (ethylen) in addition to that present in it as one of the essential constituents of the heavy oil. This fact accounts for the different densities assigned to the heavy oil.

The heavy oil undiluted is liable to spontaneous change by time, being not only rendered brown, but chemically altered so as to separate into two layers. But this tendency is in great measure obviated, in the officinal ethereal oil, by the preservative influence of the ether. It may be kept long without other appreciable change than the acquisition of a brown hue, which does not interfere with its medical virtues. It should not, when tested by dry litmus paper, evince the presence of any free acid.

The article, sold in our shops as ethereal oil, is too often a mixture of alcohol and ether, containing but a trace of the oil. Four samples of so-called ethereal oil, as imported from England, were examined by Mr. E. N. Kent, of New York, and found to have the composition above stated. (*N. Y. Journ. of Pharm.*, i. 65.) The ethereal oil is used only for the preparation of the Compound Spirit of Ether or Hoffmann's anodyne, which, when properly made, is a very valuable medicine; and it is much to be regretted that due attention has not been paid by the manufacturing chemists to the furnishing of a good ethereal oil to the apothecary. It is necessarily an expensive preparation; but this does not justify the substitution for it of a cheaper and nearly worthless article under the same name.

Off. Prep. Spiritus Ætheris Compositus, *U. S.* B.

ALOE.

Preparation of Aloes.

ALOE PURIFICATA. *U. S.* *Purified Aloes.*

"Take of Socotrine Aloes *twenty-four troyounces;* Stronger Alcohol *four fluidounces.* Heat the aloes, by means of a water-bath, until it is completely melted. Then add the Alcohol, and, having stirred the mixture thoroughly, strain it through a fine sieve, which has just been dipped into boiling water. Evaporate the strained mixture by means of a water-bath, constantly stirring, until a thread of the liquid becomes brittle on cooling. Lastly, break the product when cold into pieces of a convenient size, and keep it in a well-stopped bottle." *U. S.*

Aloes, even of good quality, is so often mixed as found in the market with various accidental impurities, such as fragments of wood, vegetable remains, pieces of leather, and earthy matter, that it has been thought advisable to have an officinal process by which it may be freed from these, should its purification be found necessary in any particular instance. This is especially the case with Socotrine aloes, which, from the want of proper supervision in its preparation, is probably more liable to these impurities than the Cape or Barbadoes aloes; but, as these are also sometimes impure, there seems to be no good reason why they should have been officinally excluded from the benefits of the process.

The use of alcohol in the formula is simply to render the melted aloes more liquid, and thus facilitate the straining; and it is subsequently got rid of by evaporation; but care should be taken not to use too great a heat, or to continue it too long, for fear of impairing the virtues of the drug.

Thus prepared, aloes is in angular fragments, brittle, of a brownish or reddish-brown colour, and of the agreeable aromatic odour of Socotrine aloes. It is nearly all soluble in alcohol.*

Off. Prep. Pilulæ Aloës et Myrrhæ, *U. S.;* Extractum Colocynthidis Compositum, *U. S.;* Suppositoria Aloës, *U. S.* W.

* Since the revision of the first portion of this book the constitution of aloes has been investigated by Mr. Craig. (*Pharm. Journ.*, April, 1875.) He finds its most important constituents to be a volatile oil, present in minute quantity and giving its odour to the drug, aloin about 25 per cent., and resin. The latter he believes not to be oxidized aloin, because it yields about 20 per cent. ash, whilst aloin gives none. His experiments lead him to believe that the drug owes its purgative properties to aloin. The resin he has found inert. (*Edin. Med. Journ.*, June, 1876.)—*Note to the fourteenth edition.*

ALUMEN.

Preparations of Alum.

ALUMEN EXSICCATUM. *U.S., Br. Dried Alum.*

"Take of Alum, in coarse powder, *four troyounces.* Place it in a suitable vessel, and subject it to a temperature not exceeding 400° until the residue weighs two troyounces and one hundred and twenty grains; then reduce it when cold to fine powder." *U. S.*

"Take of Alum *four ounces.* Heat the Alum in a porcelain dish, or other suitable vessel, till it liquefies, then raise and continue the heat, not allowing it to exceed 400°, till aqueous vapour ceases to be disengaged, and the salt has lost 47 per cent. of its weight. Reduce the residue to powder, and preserve it in a well-stoppered bottle." *Br.*

The object of these processes is to obtain the alum free from its water of crystallization, without otherwise in the least decomposing it. For this purpose a certain degree of heat is necessary; and yet, if the heat be too great, the salt itself is decomposed, and the desired end is not attained. If the alum employed be the potassa-alum, the old indefinite directions will generally be sufficient to secure the requisite result, as this salt will resist a heat short of redness; but this is not the case with the ammonia-salt, which is now the officinal alum. To guard against failure from this cause, the Pharmacopœias now prescribe 400° as the highest heat to be employed, and check the operation when nearly all the water has been driven off, as indicated by the weight of the residue. Prof. John M. Maisch has satisfactorily determined by experiment that, whichever alum may be used, this temperature is quite high enough; and the direction of the Pharmacopœias, as to the weight of the residue, ensures that a sufficient heat will be employed. By the officinal process there is left behind half a drachm or about 4 per cent. of the water of crystallization, when potassa-alum is used; and Prof. Maisch has ascertained that this in no degree injures the properties of the dried salt. (*Am. Journ. of Pharm.*, Jan. 1860, p. 21.) But as the officinal alum contains a somewhat larger proportion of water, the limitation as to the quantity expelled still further secures against the employment of too great a heat.

Properties. Dried alum, sometimes called *alumen ustum* or *burnt alum*, is in the form of an opaque white powder, possessing a more astringent taste than the crystallized salt. Before pulverization, it is a light, white, opaque, porous mass. During the exsiccation, alum loses from 41 to 46 per cent. of its weight in dissipated water. Dried alum resists the action of water for a long time, showing its altered aggregation. It is, however, if properly prepared, at length wholly dissolved by cold water, while 6 parts of boiling water dissolve it in a short time; and this may be considered as a sufficient test that the salt has not been decomposed. (*Maisch.*) In composition it differs from crystallized alum merely in the absence of water.

Medical Properties and Uses. Dried alum has been given in obstinate constipation, with the effect of gently moving the bowels, and affording great relief from pain. (See *Alumen.*) The dose is from five to ten grains or more. Its principal medical use is as an escharotic for destroying fungous flesh. B.

ALUMINII SULPHAS. *U.S. Sulphate of Aluminium.*

"Take of Alum, Carbonate of Sodium, each, *four troyounces;* Sulphuric Acid *a troyounce and one hundred and fifty grains;* Water *a sufficient quantity.* Dissolve the salts separately, each in six fluidounces of boiling Water, and pour the solution of the Alum gradually into that of the Carbonate of Sodium; then digest with a gentle heat until the evolution of carbonic acid ceases. Collect upon a filter the precipitate formed, and wash it with water, until the washings are no longer affected by chloride of barium. Next, with the aid of heat, dissolve the precipitate in the Sulphuric Acid, previously diluted with half a pint of Water, and, having filtered the solution, evaporate it until a pellicle begins to form. Then remove it to a water-bath, and continue the evaporation, with constant stirring, until a dry salt remains. Lastly, preserve this in a well-stopped bottle." *U. S.*

In the above process the soda of the carbonate unites with the sulphuric acid of the tersulphate of aluminium, with the escape of the carbonic acid, and the precipitation of the alumina in the form of a hydrate; while the undecomposed sulphate of ammonium of the alum, and the newly formed sulphate of sodium, remain in solution. The alumina is then washed in order to separate any portion of the sulphates adhering to it, the absence of which is shown by the non-action of chloride of barium on the washings. It now remains to unite the hydrate of alumina and sulphuric acid, which is effected by heating them with water; and the salt, which is formed in solution, is obtained by evaporating the solution to dryness. It may also be obtained from the solution by the addition of alcohol, which precipitates it. In the process the several substances are used in very nearly saturating proportions. Sulphate of aluminium may be prepared also by the process of MM. Huria and Brunel, which consists in exposing, in an iron cylinder, sulphate of aluminium and ammonium (ammonia-alum), first dried to separate its water of crystallization, to a cherry-red heat. Sulphate of aluminium remains in the cylinder, and the volatilized products are collected in water. The chief of these is sulphite of ammonium, which serves for the preparation of a fresh portion of alum, after having been changed into the sulphate by oxidation in the air. (*Chem. Gaz.*, Sept. 15, 1852, p. 359.) It is now also obtained in enormous quantities, for use in the place of alum as a mordant in dyeing, as one of the by-products in the manufacture of soda from cryolite.

Sometimes pure sulphuric acid exists in sulphate of aluminium. It may be recognised by the salt imparting a strongly acid reaction to alcohol, also by the fact that the dark violet colour imparted to decoction of logwood by sulphate of aluminium changes to brown in the presence of free acid. (*Amer. Journ. of Pharm.*, Nov. 1873.)

Properties. As procured by the officinal process, sulphate of aluminium is in the form of a white powder. It may, however, be obtained in lamellar crystals. As seen in commerce, it is usually in flattened crystalline cakes, which appear as though formed by the cooling of soft masses of minute crystals. It has a sour, as well as sweet and very astringent taste, is soluble in twice its weight of water, and has an acid reaction. It consists of one eq. of alumina, which is a sesquioxide of aluminium, and three eqs. of sulphuric acid ($Al_2O_3 3SO_3$), and, when crystallized, contains 18 eqs. of water. The salt is, therefore, a tersulphate of aluminium. It is known to be a sulphate by giving a precipitate with chloride of barium insoluble in nitric acid, and a salt of alumina by forming octohedral crystals of alum when its solution is evaporated with sulphate of potassium or ammonium. In consequence of its strong affinity for potassa, it is coming into use in the arts as a means of separating that alkali. (*Waltl.*)

Medical Properties and Uses. This salt is used only externally, as an astringent and antiseptic. The salts of alumina generally have the property of opposing animal putrefaction; but the sulphate is practically preferred. It has been used extensively in the Philadelphia Hospital, Blockley, at the suggestion of Dr. Dunglison, as an antiseptic and detergent application to ulcers, and with favourable results. The late Dr. Pennypacker reported several cases in which it proved useful. The strength of the solution employed varied from ʒijss to ʒiij of the salt to fʒvi of water, according to the state of the ulcer. Dr. G. Johnson, of Georgia, found the solution attended with the happiest effects, used as an injection in fetid discharges from the vagina. (*Med. Exam.*, vi. 63 and 112.) M. Homolle employs a saturated solution with much advantage as a mild caustic in enlarged tonsils, nasal polypi, nævi, scrofulous and cancerous ulcers, diseases of the os uteri, and various chronic enlargements. He applies it daily by means of a hair pencil. He has sometimes found the solution to answer still better by the addition of oxide of zinc. Solution of sulphate of aluminium is capable of dissolving a considerable quantity of recently precipitated gelatinous alumina. Such a solution, impregnated with benzoin, has been proposed by M. Mentel as a hemostatic, under the name of *benzinated solution of alumina.* It resembles the styptic liquid of Pagliari. It is prepared by saturating, with gelatinous alumina, a solution made of eight ounces of sulphate of aluminium dissolved in a pint of water. To the saturated solution six drachms of bruised amygdaloid benzoin are added, and the whole is kept at a temperature of about 150° for six hours, with occasional agitation; so that the liquid, after filtration, may have about

the density 1·26. This liquid, put in a cool place for several days, so as to deposit some crystals of alum, forms the benzinated solution, remarkable for its very sweet odour, and astringent balsamic taste. Benzinated solution of alumina, diluted in the proportion of from two to five fluidrachms to the pint of water, has been found useful as an injection in leucorrhœa, and in ulcerations of the neck of the uterus, accompanied by fetid discharges. (See *Am. Journ. of Pharm.*, March, 1857, p. 128.)

The aqueous solution of sulphate of alumina was found by M. Gannal to be effectual in preserving bodies for dissection, when injected into the blood-vessels. In summer the bodies were preserved fresh for twenty days or more; in winter, for three months. For use in winter, a quantity of the solution, sufficient for injecting one body, may be made by adding a pound, avoirdupois, of the salt to a quart of water; in warm weather, the solution must be stronger. B.

AMMONIUM.

Preparations of Ammonium.

In the present edition of the U. S. Pharmacopœia, all the liquid preparations of ammonia are arranged under other heads; and we follow the example of that work in making a similar disposition of them here. Hence, the reader will find the *Water of Ammonia* (Solution of Ammonia, U. S. 1850) under the AQUÆ or *Waters; Solution of Acetate of Ammonium* under the LIQUORES or *Solutions;* and the *Spirit* and *Aromatic Spirit of Ammonia* under the SPIRITUS or *Spirits.*

AMMONII BENZOAS. *U. S.* AMMONIÆ BENZOAS. *Br.* *Benzoate of Ammonium.*

"Take of Benzoic Acid *two troyounces;* Water of Ammonia *three fluidounces and a half,* or *a sufficient quantity;* Distilled Water *four fluidounces.* Dissolve the Acid in three fluidounces and a half of the Water of Ammonia, previously mixed with the Distilled Water; evaporate with a gentle heat, occasionally adding Water of Ammonia, if necessary, to maintain a slight excess of the alkali; then set aside to crystallize, and dry the crystals without heat." *U. S.*

"Take of Solution of Ammonia *three fluidounces* [Imperial measure], or *a sufficiency;* Benzoic Acid *two ounces* [avoirdupois]; Distilled Water *four fluidounces.* Dissolve the Benzoic Acid in three fluidounces of Solution of Ammonia previously mixed with the Water; evaporate at a gentle heat, keeping ammonia in slight excess; and set aside that crystals may form. $NH_4O,C_{14}H_5O_3$ or $NH_4C_7H_5O_2$." *Br.*

Although the amount of ammonia ordered in the formula is in excess, yet, from the feeble affinity between the constituents, and the consequent escape of ammonia during the evaporation, a portion of the acid benzoate would be formed, if it were not that a little solution of ammonia is from time to time added during or near the close of the evaporation, so as to maintain the alkali in slight excess. The crystals, for the same reason, should be dried without heat. If slightly evaporated, and then allowed to cool, the solution becomes a mass of crystals, retaining so much water as to render it necessary to dry them by bibulous paper.

Properties. Benzoate of ammonium is in minute, white, shining, thin, four-sided laminar crystals, with a slight odour of officinal benzoic acid, and a bitterish, saline, somewhat balsamic taste, and slightly acrid but persistent after-taste. It is soluble in water and alcohol, and, when heated, sublimes without residue; but is probably changed into the acid benzoate. Gmelin states that, if the solution be boiled, the salt is converted into the acid benzoate, which crystallizes in feathery tufts of needles. (*Handbook,* xii. 38.) According to Lichtenstein, it deliquesces in the air. It consists of one eq. of ammonia, one of benzoic acid, and two eqs. of water; one of the eqs. of water being derived from the acid and the other from the base, so that its formula is $NH_3,C_{14}H_5O_3+2HO$. But the Br. Pharmacopœia, considering hydrated ammonia as oxide of ammonium, gives the formula $NH_4O,C_{14}H_5O_3$. It gives a copious yellow precipitate with the salts of sesquioxide of iron; and is known to contain benzoic acid and ammonia, by depositing the former when the solution is acidulated with muriatic acid, and giving off the latter when it is heated with potassa. (*Br.*)

According to Mr. Squire, it is the acid salt that is commonly met with in the shops, which is less soluble than the officinal salt, requiring 60 parts of water and 12 of alcohol for solution. This is a decided objection to it.

Medical Properties and Uses. Benzoate of ammonium is a slightly stimulant diuretic, but acts chiefly through its benzoic acid, being decomposed by the gastric acids, which combine with the ammonia, while the benzoic acid is absorbed, and passes out through the kidneys in the form of hippuric acid. Under benzoic acid, it has been stated that the proportion of urea is diminished at the same time, giving rise to the supposition that the nitrogen of the hippuric acid is derived from that source. Dr. Garrod suggests that, as the elements of hippuric acid are the same as those of benzoic acid and glycocoll, the hippuric acid may be formed by a direct combination of these substances. The salt has been found useful as a diuretic in defective action of the kidneys, as an alterative to the mucous membrane of the urinary passages in chronic inflammation of that tissue, and as a solvent of the phosphatic deposits, through the hippuric acid into which it is converted. It has been employed in gouty affections with a view to the removal of the deposits of urate of sodium about the joints; but it has been shown to have no effect on the elimination of uric acid. The salt does not appear to produce any injurious effects even in considerable quantities. (Garrod, *Med. Times and Gaz.*, Feb. 1864, p. 146.) The dose is from 10 to 30 grains, which may be taken dissolved in water. W.

AMMONII BROMIDUM. *U. S.*, *Br.* *Bromide of Ammonium.*

"Take of Bromine *two troyounces;* Iron, in the form of wire and cut in pieces, *a troyounce;* Water of Ammonia *four fluidounces and a half;* Distilled Water *a sufficient quantity.* Add the Iron and then the Bromine to half a pint of Distilled Water, contained in a glass flask having the capacity of two pints; loosely cork the flask, and agitate the mixture until the odour of Bromine can no longer be perceived, and the liquid assumes a greenish colour. Mix the Water of Ammonia with half a pint of Distilled Water, and add it to the mixture in the flask; agitate the mixture, and heat it by means of a water-bath for half an hour; then filter, and, when the liquor ceases to pass, wash the precipitate on the filter with boiling distilled water. Evaporate the solution, in a porcelain capsule, until a pellicle begins to form, then stir it constantly with a glass rod, at a moderate heat, until it granulates." *U. S.*

In the British Pharmacopœia no directions whatever are given for the preparation of bromide of ammonium. The salt may be made by dissolving bromine in water of ammonia; but, in accordance with the researches of Prof. Procter, the U. S. Pharmacopœia prefers the method of first forming bromide of iron, precipitating with water of ammonia, separating by filtration the oxide of iron, and obtaining by evaporation the bromide of ammonium from the solution. This process, it will be seen, is completely parallel with that by which bromide of potassium is officinally prepared. According to Prof. Procter, a still better method consists in adding to bromine and water sufficient solution of hydrosulphate of ammonium (sulphuret of ammonium) to discharge the colour, filtering to separate the sulphur, and then evaporating to dryness.

Properties. Bromide of ammonium may be obtained in colourless crystals, but the officinal salt is a white, granular powder. Whether in crystal or powder, on exposure to the air it gradually becomes yellowish, in consequence of a partial decomposition, by which hydrobromic acid appears to be liberated, as it now changes litmus red. The salt has a saline, pungent taste. Exposed to heat, it sublimes unchanged. It is soluble in 1·5 parts of water, and in 13 parts of alcohol; and is incompatible with acids, acid salts, and spirit of nitrous ether. (*Squire.*) Both the U. S. and Br. Pharmacopœias direct that it should preserve a brownish colour, and give no tint of blue when mixed with mucilage of starch and chlorine, thus proving the absence of an iodide.

"If a solution containing ten grains of the salt be mixed with a solution of seventeen grains of nitrate of silver, and the mixture be shaken until the yellow precipitate which forms shall separate in flocculi from the clear liquid, the further addition of nitrate of silver will cause a cloud in the liquid." *U. S.*

Medical Uses. This bromide probably produces on the system effects analogous to those of bromide of potassium, and has been thought by some practitioners preferable

in certain cases. Attention was called by Dr. Gibb to its value as a therapeutic agent. He has found it peculiarly applicable to functional nervous diseases, more especially those of the ganglionic system, and considers it also as having some influence over affections of the mucous membranes and the skin. In epilepsy he has experienced decided advantage from it; and in the milder forms of ovaritis it sometimes acts almost as if by magic. He has also found it remarkably beneficial in strumous ophthalmia in the young, and believes that it tends to promote the absorption of fatty matter. He gave it in doses varying from two to ten grains three times a day. (*Lancet*, Jan. 3, 1863, p. 12.)

Others have borne testimony to its efficiency in epilepsy; and it has been recommended in sleeplessness when dependent on nervous disorder. Good might be expected from it in various forms of hysteria. The dose is from two to twenty grains. In acute rheumatism, Prof. J. M. Da Costa gives a drachm to a drachm and a half of it in a day, well diluted, with great advantage. A solution containing five grains in a fluidounce of water may be used as a gargle in relaxation of the larynx. W.

AMMONII CHLORIDUM PURIFICATUM. *U. S. Purified Chloride of Ammonium.*

"Take of Chloride of Ammonium, in small pieces, *twenty troyounces;* Water of Ammonia *five fluidrachms;* Water *two pints.* Dissolve the Chloride of Ammonium in the Water, in a porcelain dish, with the aid of heat; add the Water of Ammonia, and continue the heat for a short time; filter the solution while hot, and evaporate to dryness, with constant stirring, at a moderate heat, until it granulates."

The object of this process is to free the drug from chloride of iron, which is a frequent impurity of the crude salt, derived from the subliming vessels. As thus purified, chloride of ammonium is a snow-white, crystalline powder, soluble in two and a half parts of cold, and in its own weight of boiling water; it is soluble in alcohol, has a faint acid reaction, and is not discoloured by tannic acid. W.

AMMONII IODIDUM. *U. S. Iodide of Ammonium.*

"Take of Iodide of Potassium, in coarse powder, *four troyounces;* Sulphate of Ammonium, in coarse powder, *a troyounce;* Boiling Distilled Water *two fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix the salts, add them to the Boiling Water, stir well, and allow the mixture to cool; then add a fluidounce of Alcohol, mix well, and reduce the temperature, by a bath of iced water, to about 40°; throw the mixture into a cooled glass funnel, stopped with moistened cotton, and, when the clear solution has passed, pour upon the salt a fluidounce of a mixture containing two parts of Water and one part of Alcohol. Lastly, evaporate the solution rapidly to dryness, stirring constantly; and preserve the residue in a well-stopped bottle." *U. S.*

This salt has been long known, very much used in the arts, and to some extent in medicine, but became officinal first in the recent revision of the Pharmacopœia. It was formerly prepared according to the method of Mr. Jno. A. Spencer, of London, the formula for which is as follows. Add to a portion of iodine, placed in a flask with a little water, a solution of hydrosulphuret of ammonium, until the mixture loses its red colour, and is turbid from the separation of sulphur only. Shake the flask, which causes the sulphur, for the most part, to agglomerate; and, having poured off the liquid, boil it until all odour of sulphuretted hydrogen and of ammonia is lost. Then filter the liquid, and, constantly stirring, evaporate it, first with a naked flame until it becomes pasty, and then in a water-bath until it forms a dry salt. In 1864 (*Am. Journ. of Pharm.*, May, 1864) Dr. Jacobson proposed a plan in which double decomposition between the sulphate of ammonium and the iodide of potassium was brought about. Mr. James F. Babcock, in a communication to the *American Pharm. Association*, at its meeting in 1866, stated that on trial of the first of the above processes, and of all others in which sulphuretted hydrogen or an alkaline sulphuret was employed, the resulting iodide of ammonium retained a portion of sulphur, which caused its colour to change with time to yellow and ultimately to brown, and rendered it unfit for the accurate preparations required in photography. Having tried also other formulas, which he found objectionable on the score of time, cost, &c., he at length satisfied himself that the process of Dr. Jacobson above described was the best in use, and with slight modifications would yield an absolutely pure product.

In a former edition of the Dispensatory may be found the exact process finally adopted by Mr. Babcock. It is substantially that which is now officinal, and is in close accord with that of Dr. Jacobson. The object of the first steps of the process is sufficiently evident. After the double decomposition has occurred, the alcohol is added to complete the precipitation of the sulphate of potassium; the pouring of alcohol upon the cotton filter is to completely remove from the sulphate all of the iodide. As made by the officinal process, iodide of ammonium always contains a minute proportion of sulphate of potassium.

Properties, &c. Iodide of ammonium is a granular deliquescent salt, very soluble in water and in alcohol, and of a taste like that of iodide of potassium, but a little more pungent. It is beautifully white at first, but becomes, in a few weeks, yellowish, and at last even brown. It may, however, be easily restored by dissolving the coloured salt in water, treating the solution with a little sulphuretted hydrogen water, until it is rendered colourless, filtering, and evaporating to dryness. (See *Am. Journ. of Pharm.*, March, 1853, p. 134.) "Nitric acid liberates iodine, and solution of potassa liberates ammonia. When the salt is dissolved in starch-water, if chlorine water be added, a blue colour will be produced." *U. S.*

Medical Properties. Iodide of ammonium is employed, both externally and internally, as a resolvent, and resembles closely, in its action, iodine and iodide of potassium. Dr. B. W. Richardson, of London, has prescribed it, in the dose of from one to three grains, with considerable success, in secondary syphilis, chronic rheumatism, incipient phthisis, and in a variety of forms of scrofulous disorder, attended with glandular enlargements. Dr. Richardson found a liniment, made by dissolving half a drachm of the iodide in an ounce of glycerin, very efficacious in enlarged tonsils, applied every night with a large camel's-hair brush, and his practice has been followed to some extent by other members of the profession. Externally, this salt has been used as a substitute for iodide of potassium. By Dr. Pennock it is considered as a good remedy in certain cases of lepra and psoriasis, in the form of ointment, applied by friction in the quantity of half an ounce, morning and evening. The proportions employed are from a scruple to a drachm of the salt to an ounce of lard; the weaker preparation being used when the disease is recent, the stronger when it is chronic. As the iodide is decomposed by the air, the ointment should be kept in well-stopped bottles. For internal use, the dose of iodide of ammonium is from three to five grains. W.

AMMONIÆ PHOSPHAS. *Br.* *Phosphate of Ammonia.*

"Take of Diluted Phosphoric Acid *twenty fluidounces;* Strong Solution of Ammonia *a sufficiency.* Add the Ammonia to the Phosphoric Acid, until the solution is slightly alkaline, then evaporate the liquid, adding more Ammonia from time to time, so as to keep it in slight excess, and when crystals are formed on the cooling of the solution, dry them quickly on filtering paper placed on a porous tile, and preserve them in a stoppered bottle. $2NH_4O,HO,PO_5$ or $(NH_4)_2HPO_4$." *Br.*

This is a new officinal of the Br. Pharmacopœia. The process differs somewhat from that of the Pharmacopœia of 1864, though aiming at the same result. The salt is formed by the direct union of its constituents. In the former process the mother-waters were made to yield an additional portion of the salt by the addition of more solution of ammonia; but this provision has been abandoned in the present edition of the Pharmacopœia. The variety of phosphoric acid employed in this formula is the tribasic, which forms three salts with ammonia, one containing 3 eqs. of ammonia without basic water, which may be called the subphosphate, the second, two eqs. of ammonia and one of basic water, forming the neutral phosphate, and the third, one eq. of ammonia and two of basic water, forming the acid phosphate. The second of these is the one intended by the British Council, and is represented by the formula $2NH_4O,HO,PO_5$. To prepare it, a constant excess of ammonia must be maintained, and this is done by compliance with the process, if the materials are of due strength. Without such a precaution, more or less of acid phosphate would be generated, in consequence of the escape of the alkali.

Properties. The officinal salt of the Br. Pharmacopœia is in transparent colourless prisms, soluble in water, and insoluble in alcohol. When heated with caustic potassa it evolves ammonia; and a solution of it gives with nitrate of silver a yellow pre-

cipitate, indicating that the acid is the tribasic phosphoric acid. "If 20 grains be dissolved in water, and solution of ammonio-sulphate of magnesium be added, a crystalline precipitate falls, which, when well washed on a filter with solution of ammonia, diluted with an equal in volume of water, dried, and heated to redness, leaves 16·08 grains." (*Br.*) The residue is pyrophosphate of magnesium, and its amount indicates the quantity of phosphoric acid contained in the salt.

The foregoing description is that given of its salt by the Br. Pharmacopœia; but it does not exactly correspond with that of the neutral salt ordinarily received, leading to the inference that it may be a mixture. The salt commonly found in the shops is either the neutral or acid phosphate, or a mixture of the two. The neutral salt ($2NH_4O,HO,PO_5+HO$) may be made by saturating the excess of acid in superphosphate of calcium by means of carbonate of ammonium. Phosphate of calcium is precipitated, and phosphate of ammonium obtained in solution, which, being duly concentrated by a gentle heat, affords the salt in crystals upon cooling. The method of obtaining the superphosphate of calcium is given under the head of phosphate of sodium. (See *Sodii Phosphas.*) This variety of phosphate of ammonium is a white salt, crystallizing in six-sided tables, derived from oblique quadrangular prisms, efflorescent, soluble in alcohol, and in 4 parts of cold water. The solution has an alkaline somewhat saline taste, and an alkaline reaction, and gives out ammonia when heated. (Bridges, *Fownes' Chem.*, Am. ed., p. 234.)

The acid phosphate ($NH_4O,2HO,PO_5+4HO$) is obtained by boiling a solution of either of the other salts so long as ammonia escapes, and then crystallizing. Its crystals are four-sided prisms, permanent in the air, of an acid taste and reaction, and soluble in 5 parts of cold water. (*Bridges.*) In a specimen of the common phosphate of ammonium of the shops which came under our notice, we recognised both the tabular crystals of the neutral phosphate with two eqs. of ammonia, having a saline slightly acrid taste, and neutral in reaction, and the prism of the acid salt, with a sour and saline taste and decided acid reaction. W.

Medical Properties and Uses. This salt was first brought to the notice of the profession, as a remedy for gout and rheumatism, by Dr. T. H. Buckler, of Baltimore, in a paper published in the *Am. Journ. of the Medical Sciences* for Jan. 1846. In this paper a number of cases of these diseases are reported, which were treated mainly by this remedy by Dr. Buckler and several of his medical friends, and with apparently good effects. Dr. Buckler was led to employ the salt on theoretical grounds. He conceived that the "matter of gout" consisted of two salts, the urates of sodium and calcium, existing in the blood; and that the phosphate of ammonium, by reacting with them, would give rise to soluble salts. The new salts formed, if the double decomposition should take place, would be urate of ammonium, and the phosphates of sodium and calcium. Unfortunately for this theory, as furnishing the means of eliminating uric acid, urate of ammonium is not more soluble than urate of sodium. Nevertheless, apart from all theory, the therapeutic powers of phosphate of ammonium deserve to be investigated. Since the publication of Dr. Buckler's paper, several practitioners, both in this country and in Europe, have employed the remedy with apparently useful results in chronic gout, and certain urinary diseases. The dose of the salt is from ten to forty grains, three or four times a day, dissolved in a tablespoonful of water. B.

AMMONII VALERIANAS. *U. S. Valerianate of Ammonium.*

"Take of Valerianic Acid *four fluidounces;* Chloride of Ammonium, Lime, each, *a sufficient quantity.* From a mixture of Chloride of Ammonium, in coarse powder, and an equal weight of Lime, previously slaked and in powder, contained in a suitable vessel, obtain gaseous ammonia, and cause it to pass, first through a bottle filled with pieces of Lime, and afterwards into the Valerianic Acid, in a tall, narrow, glass vessel, until the Acid is neutralized. Then discontinue the process, and set the vessel aside that the Valerianate of Ammonium may crystallize. Lastly, break the salt into pieces, drain it in a glass funnel, dry it on bibulous paper, and keep it in a well-stopped bottle." *U. S.*

This was a new officinal of the U. S. Pharmacopœia of 1860. Much difficulty was experienced by manufacturing chemists in procuring a crystallized valerianate of ammonium, until, after a series of experiments, Mr. B. J. Crew, of Philadelphia, ascertained

that it was necessary to employ the monohydrated valerianic acid, as the ordinary acid with three eqs. of water could not be successfully used for the purpose. The officinal formula is based upon that of Mr. Crew, published in the *Am. Journ. of Pharm.* (March, 1860, p. 109). In this formula the monohydrated valerianic acid, procured by a special process (see *Acidum Valerianicum*, page 75), is saturated with gaseous ammonia obtained in the usual manner from a mixture of muriate of ammonium and lime. The saturation is known to have been effected when litmus paper is no longer acted on. During the operation heat is developed sufficient to prevent premature crystallization, and, when the saturation is completed, nothing more is necessary than to allow the solution to cool. Crystallization soon begins, and in a few hours the contents of the vessel become a nearly solid mass of crystals.

Properties. Thus prepared, valerianate of ammonium is in snow-white, pearly, four-sided, tabular crystals, perfectly dry, of an offensive odour like that of valerianic acid, and a sharp sweetish taste. Instead of deliquescing, whenever exposed to the air, as happened to the salt formerly procured, it undergoes this change only in a moist atmosphere, and effloresces when the air is dry. It is very soluble both in water and alcohol. Exposed to heat it is in great measure volatilized unchanged; but a small portion, by giving off a part of its ammonia, is converted into the acid valerianate. Its formula, viewed as a salt of hydrated ammonia, is $NH_3HO,C_{10}H_9O_3$, as a salt of oxide of ammonium $NH_4O,C_{10}H_9O_3$. It is known to be a salt of ammonia by giving off this gas when treated with potassa, and of valerianic acid by the separation of this acid, and its appearance on the surface in the form of an oil, when the salt is decomposed in solution by a mineral acid. W.

Medical Properties. Valerianate of ammonium is not poisonous. Given to dogs in the dose of 150 grains, it produced no inconvenience. As a therapeutic agent it was first brought to the notice of the profession, in 1856, by M. Déclat, of Paris, who published a paper in that year, going to show its remarkable efficacy in the treatment of neuralgia. The preparation which he used was a solution of valerianate of ammonium of uniform strength, made according to the recipe of M. Pierlot, an apothecary of Paris, which had been extensively given to the epileptics of the Salpêtrière and the Bicêtre. Since then it has been used in various diseases, principally of the nervous system; such as hysteria, epilepsy, chorea, &c. The favourable report of its efficacy in neuralgia, made by M. Déclat, has been confirmed by practitioners in Paris, London, and Dublin. The dose of the salt is from two to eight grains, dissolved in water. As now prepared, it may be made into pills without inconvenience; and, properly coated so as to conceal their disagreeable odour, they are probably the best form for the administration of the salt. M. Pierlot made his solution, mentioned above, by dissolving *a drachm* of valerianic acid in *thirty-two drachms* of distilled water, saturating the solution with carbonate of ammonium, and adding to the salt formed, *two scruples* of the alcoholic extract of valerian. According to M. Pierlot, the latter addition is necessary in order to preserve the preparation from change; for a simple solution of the ammoniacal salt is rapidly decomposed. It will keep still better if the extract, when added to the solution, be mixed with a fluidounce of diluted alcohol, while but 24 drachms of distilled water are used, so as to preserve the measure. The solution of M. Pierlot is neutral, of a brown colour, and a strong odour of valerian. It contains 1-25th of its weight of the pure salt. The dose is from six to thirty drops, given in water or on a lump of sugar. (*Ann. de Thérap.*, 1857, p. 55.)* B.

ANTIMONIUM.

Preparations of Antimony.

In arranging the Preparations of Antimony, it has been deemed expedient to follow the example of the Pharmacopœias, in placing them in a strictly alphabetical

* *Elixir of Valerianate of Ammonium.* Various attempts have been made to prepare a formula for the exhibition of valerianate of ammonium, which shall in some measure cover its offensiveness. The following, which has been considerably used in this city, under the name above given, is perhaps as suitable as any that has been proposed. Take of Valerianate of Ammonium ℥i; Fluid Extract of Vanilla f℥ss; Compound Tincture of Cardamom f℥vi; Curaçoa f℥ij; Water f℥iv. Mix. Dose, a teaspoonful three times a day.

order; and, as relates to the *Solution of Terchloride of Antimony* and the *Wine of Antimony*, to obey the same authority in transferring them, the one to the *Solutions*, the other to the *Wines*, where they properly belong through the character of their menstrua.

ANTIMONII ET POTASSII TARTRAS. *U. S.* Antimonium Tartaratum. *Br.* Antimonium Tartarizatum. *Ed., Dub. Tartrate of Antimony and Potassa. Tartrated Antimony. Tartarized Antimony. Tartar Emetic.*

"Take of Oxide of Antimony, in very fine powder, *two troyounces;* Bitartrate of Potassium, in very fine powder, *two troyounces and a half;* Distilled Water *eighteen fluidounces.* To the Water, heated to the boiling point in a glass vessel, add the powders, previously mixed, and boil for an hour; then filter the liquid while hot, and set it aside that crystals may form. Lastly, dry the crystals, and keep them in a well-stopped bottle. By further evaporation the mother-water may be made to yield more crystals, which should be purified by a second crystallization." *U. S.*

"Take of Oxide of Antimony *five ounces* [avoirdupois]; Acid Tartrate of Potash, in fine powder, *six ounces* [avoird.]; Distilled Water *two pints* [Imperial measure]. Mix the Oxide of Antimony and Acid Tartrate of Potash with sufficient Distilled Water to form a paste, and set aside for twenty-four hours. Then add the remainder of the Water and boil for a quarter of an hour, stirring frequently. Filter, and set aside the clear filtrate to crystallize. Pour off the mother-liquor, evaporate to one-third, and set aside that more crystals may form. Dry the crystals on filtering paper at the temperature of the air." *Br.*

This preparation is a double salt, consisting of tartrate of potassium, united with tartrate of teroxide of antimony. The principle of its formation is exceedingly simple, being merely the saturation of the excess of acid in the bitartrate (cream of tartar) with the teroxide. The officinal processes consist in boiling a mixture of cream of tartar and of pure teroxide obtained by a distinct process. (See *Antimonii Oxidum.*) This conforms with the formula of the late Dublin Pharmacopœia, and is an improvement of the U. S. formula of 1850, in which the *oxychloride of Antimony, or powder of Algaroth*, was the form of oxide used, and was prepared from the sulphuret as the first step of the process.

In the late London formula the teroxide used was in the form of disulphate of antimony, which was originally proposed by the late Mr. Phillips, so early as 1811. It was prepared in the following manner. By gently heating sulphuric acid with tersulphuret of antimony, the metal was teroxidized at the expense of part of the acid, sulphurous acid was evolved, and sulphur set free. By gradually increasing the heat until dryness was produced, the whole of the sulphurous acid was driven off, the free sulphur was burnt out, and nothing remained but the teroxide, united with sulphuric acid in the form of tersulphate of teroxide of antimony. This, by continued washing, was converted into the anhydrous disulphate of the teroxide ($2SbO_3,SO_3$). (*Phillips.*) The disulphate was then mixed with cream of tartar in the proportion of nine parts by weight to ten, and the mixture boiled with water in the usual manner. This process is an eligible one, and has the merit of being economical. According to Mr. Phillips, it affords "a very pure and beautiful salt."

In the preparation of tartar emetic several circumstances should be taken into view. The cream of tartar should not be in excess; as in that case it is apt to crystallize, upon cooling, with the tartar emetic. To avoid such a result it is better to have a slight excess of antimonial oxide. No rule is applicable to the determination of the proper proportion of water, except that it should be sufficient to dissolve the tartar emetic formed. The hot filtration, directed in the U. S. Pharmacopœia, may be conveniently performed by means of the tin apparatus, devised by Dr. Hare for filtering liquids at the point of ebullition. (See *page* 958.) The U. S. Pharmacopœia boils for an hour; the British for fifteen minutes. In all cases the salt should be obtained in well-defined crystals, unmixed with those of cream of tartar, as the best index of its purity. The practice of some manufacturing chemists of boiling the filtered liquor to dryness, whereby an impure mass is obtained, consisting in part only of the antimonial salt, is very reprehensible.

It is not easy to decide as to the relative eligibility of the different forms of antimonial oxide, used for preparing tartar emetic. The preference, however, was given to the oxychloride (*powder of Algaroth*) by Berzelius; and M. Henry, an eminent pharmaceutist of Paris, after a careful comparison of the different processes, declared also in its favour. This testimony in favour of the oxychloride induced the revisers of our national Pharmacopœia, in 1830, to adopt it for making tartar emetic; but it was subsequently abandoned, and the pure oxide adopted in its place, in conformity with the Dublin formula, which is that of the Br. Pharmacopœia; so that the two Pharmacopœias are in accordance in the mode of preparing this important salt.

M. Henry has given a process for preparing tartar emetic with the oxychloride on a large scale; and, as his formula may be useful to the manufacturing chemist, we subjoin it, turning the French weights into the nearest *apothecaries'* weights and measures. Take of prepared sulphuret of antimony, in very fine powder, three pounds four ounces; muriatic acid, marking 22° (sp. gr. 1·178), eighteen pounds and a half; nitric acid, two ounces and a half. Introduce the sulphuret into a glass matrass, of a capacity double the volume of the mixture to be formed; and add to it from three to five pounds of the acids previously mixed; so that the sulphuret may be thoroughly penetrated by them; then add the remainder of the acids. Place the matrass on a sand-bath, and heat the mixture gradually to ebullition, avoiding the vapours, which are disengaged in large quantity. Continue the heat until the vapours given off are so far deprived of sulphuretted hydrogen as not to blacken white paper moistened with solution of acetate of lead; after which allow the liquor to cool, and to remain at rest until it has become clear. Decant the clear liquor, and, in order to procure the portion of liquid which may be retained by the moist residue, add to this a small portion of muriatic acid, and again decant. Mix the decanted liquids, which consist of a solution of terchloride of antimony, and add them to a large quantity of water, in order that the oxychloride may be precipitated; taking care, during their addition, to stir constantly in order that the precipitated powder may be more minutely divided, to facilitate its subsequent washing. To determine whether the water has been sufficient to decompose the whole of the terchloride, a part of the supernatant liquid, after the subsidence of the powder, is to be added to a fresh portion of water; and, if a precipitate take place, more water must be added to the mixture, so as to obtain the largest possible product of oxychloride. The precipitation being completely effected, wash the powder repeatedly with water, until this no longer affects litmus, and place it on linen to drain for twenty-four hours. The quantity of oxychloride thus obtained will be about three pounds and a half in the moist state, or two pounds nine ounces when dry. Assuming it to be this quantity, mix it with three pounds eleven ounces of cream of tartar in fine powder, and add the mixture to two gallons and five pints of boiling water, contained in an iron kettle. Concentrate the liquor rapidly until it marks 25° of Baumé's hydrometer for salts, and then filter. By repose the liquor furnishes a crop of very pure crystals, which require only to be dried. The mother-waters are treated in the following manner. Saturate the excess of acid with chalk, filter, and concentrate to 25°. By cooling a second crop of crystals will be obtained; and by proceeding in a similar manner, even a third crop. But these crystals are somewhat coloured, and must be purified by recrystallization.*

In relation to the above process, it may be observed that the proportion of oxychloride and cream of tartar must be adjusted according to the numbers given, on the assumption that the former is dry; but it by no means follows that the whole of the oxide should be dried. To proceed thus would be a waste of time. The mode of proceeding is to weigh the whole of the moist oxide, and afterwards to weigh a small part of it, and ascertain how much this loses in drying. Then, by a calculation, it is easy to determine how much the whole of the moist oxide would weigh in the dry state.

Tartar emetic is not usually prepared by the apothecary, but made on a large scale by the manufacturing chemist. Different processes are pursued in different manu-

*For still another method of preparing tartar emetic, which we omit from want of space, see *Journ. de Pharm.*, 4e sér., xi. p. 404. (*Note to the fourteenth edition.*)

factories; and it is not material what plan is adopted, provided the crystals of the antimonial salt are carefully purified. In an extensive manufactory in London, antimony ash (see *page* 133) is employed for boiling with the cream of tartar, and it is stated to form the cheapest material for making tartar emetic. (*Pereira's Mat. Med.*) Mohr prefers the use of a *moist* oxide, prepared by adding gradually an intimate mixture of one part, each, of tersulphuret of antimony and nitrate of potassium, to a boiling mixture of one part of sulphuric acid and two of water. The liquid is boiled down nearly to dryness and allowed to cool. The grayish-white mass, thus formed, is then washed thoroughly with water. The details of this process are given by Soubeiran, by whom it is praised, in the *Journ. de Pharm.*, 3e sér., iii. 327.

Properties, &c. Tartrate of antimony and potassium was discovered in 1631 by Adrian de Mynsicht. It is in the form of transparent, colourless crystals, which possess a nauseous, metallic, styptic taste, and have usually the form of rhombic octohedrons. When prepared from the oxychloride it crystallizes in tetrahedrons. As it occurs in the shops, it is in the form of a white powder, resulting from the pulverization of the crystals. The crystals, when exposed to the air, effloresce slightly, and become white and opaque. They are insoluble in alcohol, but dissolve in proof spirit or wine.* (See *Vinum Antimonii.*) They are soluble in about 15 parts of water at 60° (in 20 parts, U. S., 21·8, Br.), and between 2 and 3 parts of boiling water. The late Dr. Perceval, of Dublin, alleged that good tartar emetic dissolves in twelve parts of water, and this statement agrees nearly with the results of Brandes, who found it to be soluble in 12·65 parts of water at 70°. Its aqueous solution slightly reddens litmus, and undergoes decomposition by keeping. If one-fifth of its bulk of alcohol be added to the water, the decomposition is prevented. It is incompatible with acids, alkalies and their carbonates, some of the earths and metals, chloride of calcium, and acetate and subacetate of lead. It is incompatible also with astringent infusions and decoctions, as of rhubarb, cinchona, catechu, galls, &c.; but these substances, unless galls be an exception, do not render it inert, though they lessen its activity to a greater or less extent.

Characteristics and Tests of Purity. Tartar emetic, when pure, exhibits its appropriate crystalline form. A crystal or two, dropped into a solution of hydrosulphuric acid, will be covered with an orange-coloured deposit of tersulphuret of antimony; and hydrosulphuric acid gas causes an orange-red precipitate with its solution. One hundred grains of the salt, dissolved in water, yield forty-nine grains of tersulphuret with this test. (*Lond. Pharm.*, 1851.) "Twenty grains dissolve without residue in an [Imperial] fluidounce of distilled water [437·5 grains] at 60°; and the solution gives with sulphuretted hydrogen an orange precipitate, which, when washed and dried at 212°, weighs 9·91 grains." (*Br.*) Entire solubility in water is not a character belonging exclusively to the pure salt, for, according to the late Mr. Hennell, tartar emetic may contain 10 per cent. of uncombined cream of tartar, and yet be wholly soluble in the proper proportion of water. (*Phillips.*) This being the case, the character, given in the U. S. and Br. Pharmacopœias, of entire solubility in 20 or 21·8 parts of water, is not to be depended upon. A dilute solution is not precipitated by chloride of barium or nitrate of silver, nor rendered blue by ferrocyanide of potassium. A solution, containing one part of the salt in forty of water, is not disturbed by an equal volume of a solution of eight parts of acetate of lead in thirty-two of water and fifteen of acetic acid. This test is adopted in the U. S. Pharmacopœia from the Edinburgh, and is intended to show the absence of uncombined bitartrate of potassium; for, when the acidulated acetate is used as here directed, it does not form the white tartrate of lead with the pure antimonial salt, but only with the bitartrate, when this happens to be present. The acidulated acetate is said to be capable of detecting 1 per cent. of this impurity in tartar emetic; but Dr. Christison finds difficulties in using this test which render it too precarious for practice. Mr. Hennell's method of detecting uncombined bitartrate, is to add a few drops of a solution of car-

* Alcohol precipitates it from its aqueous solution, and Mr. T. S. Wiegand proposes as a convenient method of obtaining it in fine powder, to boil an ounce of it in four times its weight of water, and to pour the solution into a pint and a half of 95 per cent. alcohol. (*Am. Journ. of Pharm.*, Sept. 1858, p. 407.)

bonate of sodium to a boiling solution of the antimonial salt. If the precipitate formed is not redissolved, no bitartrate is present.

The impurities found in tartar emetic are uncombined cream of tartar from faulty preparation or fraudulent admixture, tartrate of calcium, iron, sulphates, and chlorides. The mode of detecting cream of tartar has been indicated above. Tartrate of calcium is derived from the cream of tartar, which always contains this impurity. It is apt to form on the surface of the crystals of tartar emetic in crystalline tufts, which are easily brushed off. Iron is sometimes present, especially when the antimonial salt has been prepared from glass of antimony. It is detected by a blue colour being *immediately* produced by ferrocyanide of potassium, added after a little acetic acid. If the blue colour be *slowly* produced, it may arise from reactions on the iron of the ferrocyanide itself. If much iron be present, the solution of the tartar emetic will be yellow instead of colourless. Sulphates are detected by chloride of barium. The presence of a chloride is shown by a precipitate being produced by nitrate of silver, added to a dilute solution. According to Serullas, tartar emetic, except when well crystallized, and all the other antimonial preparations usually contain a minute proportion of arsenic, derived from the native tersulphuret of antimony, which almost always contains this dangerous metal. Very recently, however, Mr. Thos. Williams (*Pharm. Journ. and Trans.*, July, 1874, p. 63) has examined a number of samples of various antimonial preparations and found them remarkably free from arsenic. For the mode of detecting this impurity, see *Acidum Arseniosum*. Tartar emetic should always be bought by the apothecary in good crystals, in which state the salt is pure, or very nearly so, and entirely free from arsenic. Its powder is perfectly white; and, when it is yellowish-white, iron is probably present. It is said that some druggists ignorantly prefer a tartar emetic which is yellowish-white in powder.

It has been already stated, in general terms, that tartar emetic in solution is incompatible with acids and alkalies, and with some of the earths; but this salt is so important, that some details in regard to the effects of particular reagents, included under these titles, seem to be necessary. Muriatic and sulphuric acids, added to a solution of the antimonial salt, not too dilute, throw down a white precipitate of terchloride or subsulphate of antimony, mixed with cream of tartar, which is redissolved by an excess of the precipitant. Nitric acid throws down a subnitrate, which is taken up by an excess of it. When caustic potassa is added to a tolerably concentrated solution, it produces at first no effect, then a precipitate of teroxide, and afterwards the solution of this precipitate, if the addition of the alkali be continued. Lime-water acts in a weaker solution, and throws down a white precipitate, consisting of the mixed tartrates of calcium and antimony. Carbonate of potassium affects still weaker solutions, throwing down a white precipitate of teroxide; but this test does not act in solutions containing less than a quarter of a grain to the fluidounce. Ammonia, both pure and carbonated, precipitates a solution of tartar emetic, throwing down the pure teroxide. To these reagents may be added infusion of galls, which, when fresh and strong, causes a dirty, yellowish-white precipitate of tannate of teroxide of antimony.

Composition. Tartar emetic consists of two eqs. of tartaric acid 132, one of potassa 47·2, one of teroxide of antimony 153, and two of water 18 = 350·2. It is evident that it contains tartaric acid and potassa in the proportion to form bitartrate of potassium or cream of tartar; and, accordingly, it may be viewed as a compound of one eq. of cream of tartar, and one of antimonial teroxide. The excess of acid in the bitartrate may be considered as united with the teroxide; and on that view it is a double salt, composed of tartrate of potassium, with tartrate of teroxide of antimony. The U. S. name assumes it to be a double salt. According to the view of the bibasic character of tartaric acid, which now prevails, tartar emetic consists of one eq., each, of teroxide of antimony, potassa and tartaric acid, with two eqs. of water ($SbO_3,KO,C_8H\ O_{10}+2HO$); the equivalent number of the acid being doubled.

Medical Properties and Uses. Tartrate of antimony and potassium is the most important of the antimonials, and is capable of fulfilling numerous indications in disease. Its general action is that of a sedative to the circulation; while, on the contrary, it excites most of the secretions. According to the dose, and the peculiar circumstances under which it is administered, it acts variously as an alterative, diaphoretic, diuretic,

expectorant, purgative, and emetic. In *minute* doses it is employed with a view to its alterative effects, and has been found useful in diseases of the skin. In such doses it has been given with alleged benefit in various chronic pulmonary affections, but especially in phthisis. In phthisical cases it was prescribed in this way, in 1818, by Lanthois, of Montpellier, and sometimes with advantage; and afterwards with encouraging results, by others. In the beginning of phthisis, the remedy, in these minute doses, may have exercised an ameliorating effect by its influence on the bronchial inflammation which so constantly attends this disease. In *small* doses, mostly associated with saline remedies, such as nitre or sulphate of magnesium, and assisted by copious dilution, it is frequently resorted to in febrile complaints, for the purpose of producing perspiration, which is often freely induced, especially if the remedy gives rise to nausea. If the surface be exposed to cool air, so as to constrict the pores, the tendency will be to the kidneys, with the effect of producing an increased flow of urine. It also proves useful, on many occasions, in pulmonary and bronchial disease as an expectorant; and with a view to its action in this way, it is conjoined with squill, ammoniac, and similar remedies. In *full* doses it acts as an emetic, and is characterized by certainty, strength, and permanency of operation. It remains longer in the stomach than ipecacuanha, produces more frequent and longer-continued efforts to vomit, and exerts a more powerful impression on the system. The nausea and attendant prostration are often very considerable. As an emetic its use is indicated where the object is not merely to evacuate the stomach, but to agitate and compress the liver and other abdominal viscera. By the extension of its action to the duodenum, it often causes copious discharges of bile, and may thus prove useful when there is a morbid excess of that secretion. It is employed as an emetic in jaundice, hooping-cough, and croup, and in several diseases of the nervous system, such as mania, amaurosis, tic douloureux, &c. In efforts to reduce old dislocations, its relaxing power over the muscles when it nauseates has been taken advantage of, to facilitate the operation. Tartar emetic often incidentally produces purging. In reference to this tendency, practitioners are in the habit of adding it to purgatives, the operation of which it promotes in a remarkable degree. It is contraindicated in diseases of great debility, in the advanced stages of febrile affections, and in fevers with irritability of stomach.

Of late years, on the continent of Europe, and to some extent in Great Britain and this country, tartar emetic has been given in *large* doses, with a view to its sedative, or, as it is usually termed, *contrastimulant* operation. This practice originated with Rasori, professor of clinical medicine at Milan, who published his views in 1800. The principal diseases in which it has been thus used are pneumonia, pleurisy, bronchitis, acute rheumatism, especially of the joints, articular dropsies, chorea, hydrocephalus, and apoplexy. The medicine is directed in doses, varying from a grain to two grains or more, every two hours, dissolved in a small quantity of water; the patient being restricted in the use of drinks whilst under its operation. It is stated that, when the remedy is thus given in diseases of high action, it seldom produces vomiting, an effect which the author of the practice wished to avoid. The power of the system to bear large doses of tartar emetic, during the existence of acute diseases, was considered by Rasori to depend upon the coexisting morbid excitement, and the capability of bearing them was expressed by the term *tolerance*. It is in pneumonia especially that the contrastimulant practice has most advocates. It is admitted to have the effect of lowering the force and frequency of the pulse, and the rapidity of the respirations; and, in not a few instances, produces marked remedial effects. In pleurisy and bronchitis, the advantages of the same practice are less decided. Though we are disposed to admit the controlling influence of tartar emetic, when thus exhibited, in the diseases named; yet we by no means think that its use should supersede blood-letting, or even form our chief reliance. In cases, however, in which blood-letting, both general and local, has no effect, or has been carried as far as the circumstances of the case will warrant, tartar emetic, administered on the contrastimulant plan, may be found useful. In croup the remedy proves efficacious not merely by the free vomiting which it produces, but, if given in large doses, on the contrastimulant principle. If the tolerance cannot be otherwise established, laudanum may be conjoined with the antimonial, in

order to bring it about. In the treatment of articular dropsies, the decided benefit derived from large doses of tartar emetic is fully shown by M. Gimelle, who has reported twenty-eight successful cases. The medicine was gradually increased from four grains to sixteen or twenty daily, and, generally, the tolerance was established on the first day. The effusion was absorbed in a space of time varying from eight to sixteen days. Tartar emetic has been used with success in delirium tremens; the antimonial being sometimes given alone, at other times conjoined with opium or laudanum. This practice originated with the late Dr. Joseph Klapp, of this city. Dr. Lange, of Königsberg, recommends tartar emetic in cases of uræmia, particularly when it supervenes on the exanthemata, giving it in solution in the dose of about a quarter of a grain every quarter or half hour. (*Ann. de Thérap.*, 1866; p. 115.) Dr. Parker has employed it with much advantage for the promotion of uterine contraction, in protracted delivery dependent on inertia of the uterus. It relaxes the os uteri and perinæum, increases the mucous secretion of the vagina, and augments the contractile force of the longitudinal and transverse fibres. He gives it in small doses every ten or fifteen minutes till nausea supervenes. (*Ibid.*, 1865, p. 184.)

Tartar emetic, in the form of enema, has been used with great benefit, in rigidity of the os uteri, by Dr. James Young, and by Dr. H. R. Storer, of Boston. The formula employed by Dr. Young was one grain of the antimonial salt to six fluidounces of warm water.

Externally, tartar emetic is often employed as a counter-irritant, mixed with lard, or cerate, or in the form of a plaster. (See *Unguentum Antimonii* and *Emplastrum Antimonii.*) It causes, after a longer or shorter interval, a burning sensation, accompanied by a peculiar and painful pustular eruption. This mode of producing counter-irritation is serviceable in a number of diseases; but particularly in deep-seated pains, spinal irritation, hooping-cough, and chronic inflammation of the chest threatening consumption. Care must be taken, when the salt is applied by means of a plaster, that the pustular inflammation does not proceed too far; as, in that event, it produces deep and very painful ulcerations, difficult to heal. According to M. Guérin, inflamed parts exhibit a condition of tolerance to the local effects of tartar emetic, evinced by the absence of pustulation. In support of this view, he asserts that he has treated hundreds of cases of acute arthralgia with tartar emetic ointment with the best effects, mostly without the production of any eruption; and when the pustules were produced, the benefit accrued before they appeared. When no pustulation follows, M. Guérin supposes that the antimony acts by absorption.

Tartar emetic is generally given in solution, and in an amount which varies with the object in view in its administration. Its dose as an alterative is from the thirty-second to the sixteenth of a grain; as a diaphoretic or expectorant, from the twelfth to the sixth of a grain; and as a nauseating sudorific, from a quarter to half a grain; repeated, according to circumstances, every hour, two, or four hours. With a view to its alterative effect, a pint of water, containing from one-quarter to half a grain, may be taken daily as drink. If required to act as a purgative, a grain may be dissolved in half a pint of water with an ounce of Epsom salt, and two tablespoonfuls of the solution given every two or three hours. As an emetic the full dose is from two to three grains; though it is usually given in the dose of a grain, dissolved in a tablespoonful of water, repeated every ten or fifteen minutes till it vomits; the operation being aided by warm water or chamomile tea. It is often conjoined with ipecacuanha, in the proportion of one or two grains to twenty of that emetic. For convenient administration in small doses, the Pharmacopœias direct it dissolved in wine. It is given very conveniently to children in dilute aqueous solution, which, being nearly tasteless, is readily taken by them. In all cases it should be used with caution; as it sometimes acts even in small doses with unexpected violence.

Effects as a Poison. The symptoms of acute poisoning by tartar emetic are an austere metallic taste; nausea; copious vomiting; frequent hiccough; burning pain in the stomach; colic; frequent stools and tenesmus; fainting; small, contracted, and accelerated pulse; coldness of the skin; sometimes intense heat; difficult respiration; loss of sense; convulsive movements; very painful cramps in the legs; prostration, and death. Ten grains is the smallest dose reported to have proved fatal. To the

above effects is sometimes added difficulty of deglutition. Occasionally vomiting and purging do not take place; and, when they are absent, the other symptoms are aggravated. Sometimes a pustular eruption is produced, like that caused by the external application of the antimonial; as in a case reported by Dr. J. T. Gleaves, of Tennessee. These are the effects, observed in different cases, on the healthy economy; but doses which, taken in health, would prove fatal, are sometimes borne with safety in certain morbid states of the system, attended with acute inflammation.

The effects of slow poisoning by tartar emetic on inferior animals have been carefully studied by Dr. B. W. Richardson, of London, and Dr. Nevins, of Liverpool. All the surfaces absorb the solution of the salt, and the metal is found in all the tissues after death, except that of the brain; but most abundantly in that of the liver. The elimination of the poison is effected by all the secreting organs, but especially by the kidneys. The tolerance of antimony is attributed by Dr. Richardson to the eliminating action of these glands. The pathological appearances are general congestion, marked fluidity of the blood, and intense vascularity of the stomach and sometimes of the rectum, but without ulceration. No other pulmonary lesion occurs but simple congestion. (See *Am. Journ. of Med. Sci.*, Jan. 1857, p. 266.) The general results obtained by Dr. Richardson are confirmed by the experiments of Dr. Nevins. (*Pharm. Journ.*, Feb. 1857, p. 415.)

In treating a case of poisoning by tartar emetic, if it is found that the patient has not vomited, immediate recourse must be had to tickling the throat with a feather, and the use of abundance of warm water. Usually, however, the vomiting is excessive and distressing; and here it is necessary to use remedies calculated to decompose the poison, and to allay the pain and irritation. To effect the former object, astringent decoctions and infusions, such as of Peruvian bark and common tea, are recommended as antidotes. These, however, act but imperfectly, accordingly to M. Toulmouche, who found that a decoction of cinchona had usually no power in lessening the emetic effect of this antimonial. Similar observations had been made by Dr. Clutterbuck. (*Pereira.*) The decoction of galls acts more decidedly; but M. Toulmouche accords the preference to the galls in substance. A case of poisoning with half an ounce of tartar emetic, successfully treated with copious draughts of green tea and large doses of tannin, is reported by Dr. S. A. McCreery, of the U. S. Navy. (*Am. Journ. of Med. Sci.*, Jan. 1853, p. 131.) Galls no doubt act by their tannin, which forms, with the antimonial part of the salt, the insoluble and probably inert tannate of antimony. To stop the vomiting and relieve pain, laudanum should be given, either by the mouth or by injection, and to combat consecutive inflammation, leeches to the epigastrium and other antiphlogistic measures may be resorted to.

After death from suspected poisoning by tartar emetic, it is necessary to search for the poison in the body. The contents of the stomach should be digested in water, acidulated with muriatic and tartaric acids. The former acid will serve to coagulate organic matter; the latter to give complete solubility to the antimony. The solution obtained, after having been filtered, should be subjected to a stream of sulphuretted hydrogen, which, if tartar emetic be present, will throw down the orange-red tersulphuret of antimony, distinguished from tersulphuret of arsenic and all other precipitates by forming with hot muriatic acid a solution, from which, when added to water, a white curdy precipitate of oxychloride of antimony (powder of Algaroth) is thrown down. Sulphuretted hydrogen is by far the most delicate test for tartar emetic.

Sometimes the antimony cannot be found in the stomach and bowels, and yet may exist in other parts. When it leaves the alimentary canal, it has been found by Orfila especially in the liver and kidneys, and their secretions. The mode of extracting the antimony, recommended by Orfila, is to carbonize the dried viscera with pure concentrated nitric acid in a porcelain capsule, to boil the charred mass obtained for half an hour with muriatic acid, assisted with a little nitric acid, to filter the liquor, and introduce it into Marsh's apparatus. Antimoniuretted hydrogen will be formed, which, being inflamed, will deposit the antimony on a cold surface of porcelain as a black stain, distinguishable from the similar stain produced by arsenic by its less volatility, and by its forming, with hot muriatic acid, a solution which affords a white precipitate of oxychloride of antimony when added to water.

Reinsch's process is a good one for separating antimony from the tissues, and was first used for that purpose by Dr. Alfred Taylor, of London. The tissues are boiled in muriatic acid, and a bright slip of copper is immersed in the hot solution. The metallic film, deposited on the copper, must be proved to be antimony. This is done by Dr. Odling by first boiling the coated copper in a solution of permanganate of potassium, with a little excess of potassa, for a few minutes, whereby the antimony becomes oxidized and dissolved, and then passing sulphuretted hydrogen through the filtered and acidulated solution. The characteristic orange-red precipitate of tersulphuret of antimony is produced, which may be tested for antimony as above mentioned. Mr. H. H. Watson has simplified Dr. Odling's process by dispensing with the use of the permanganate of potassium. He subjects the coated copper slip, in a tube, to a boiling very dilute solution of caustic potassa, the metal being alternately drawn out of and immersed in the solution, by the aid of a copper wire, until the whole of the coating is oxidized and dissolved. The solution is then treated as directed by Dr. Odling. (*Med. Times and Gaz.*, July, 1857, page 613.)

Off. Prep. Emplastrum Antimonii, *U. S.;* Syrupus Scillæ Compositus, *U. S.;* Unguentum Antimonii, *U. S.;* Unguent. Antimonii Tartarati, *Br.;* Vinum Antimoniale, *Br.;* Vinum Antimonii, *U. S.* B.

ANTIMONII OXIDUM. *U. S., Br. Oxide of Antimony.*

"Take of Sulphuret of Antimony, in very fine powder, *four troyounces;* Muriatic Acid *eighteen troyounces;* Nitric Acid *a troyounce and one hundred and twenty grains;* Water of Ammonia *a fluidounce and a half;* Water, Distilled Water, each, *a sufficient quantity.* Introduce the Sulphuret into a flask, of the capacity of two pints, and, having added the Muriatic Acid, digest, by means of a sand-bath, until effervescence ceases. Then, having removed the flask from the sand-bath, add the Nitric Acid gradually; and, when nitrous acid vapours cease to be given off, and the liquid has grown cold, add to it half a pint of Water, and filter. Pour the filtered liquid gradually into twelve pints of Water, constantly stirring, and allow the precipitate to subside. Decant the supernatant liquid, and wash the precipitate twice by decantation, using, each time, eight pints of Water. Then transfer it to a muslin filter to drain, and, after the draining is completed, wash it with Water until the washings cease to have an acid reaction. Next introduce it into a suitable vessel, and subject it to the action of the Water of Ammonia for two hours; at the end of which time, transfer it to a moistened muslin filter, and wash it with Distilled Water as long as the washings produce a precipitate with nitrate of silver. Lastly, dry the precipitate upon bibulous paper with the aid of a gentle heat." *U. S.*

"Take of Solution of Chloride of Antimony *sixteen fluidounces;* Carbonate of Soda *six ounces* [avoirdupois]; Water *two gallons* [Imperial measure]; Distilled Water *a sufficiency.* Pour the Antimonial Solution into the Water, mix thoroughly, let the precipitate settle, remove the supernatant liquid by a siphon, add one gallon [Imp. meas.] of Distilled Water, agitate well, let the precipitate subside, again withdraw the fluid, and repeat the process of affusion of Distilled Water, agitation, and subsidence. Add now the Carbonate of Soda previously dissolved in two pints [Imp. meas.] of Distilled Water, leave them in contact for half an hour, stirring frequently, collect the deposit on a calico filter, and wash with boiling distilled water until the washings cease to give a precipitate with a solution of nitrate of silver acidulated by nitric acid. Lastly, dry the product at a heat not exceeding 212°." *Br.*

In the U. S. formula the solution of terchloride is prepared as the first step of the proceedings; in the British is taken already formed, as the result of a distinct process. When tersulphuret of antimony is digested with muriatic acid, an interchange of principles takes place; the hydrogen of the acid uniting with the sulphur of the antimonial, and escaping as sulphuretted hydrogen, while the chlorine and antimony combine to form terchloride of antimony which is held in solution. The effect of the nitric acid is supposed to be to render the oxide whiter, by decomposing any remaining sulphuretted hydrogen, and thus preventing it from contaminating the product. Though the result thus far is an aqueous solution of the terchloride, this cannot be diluted beyond a certain degree without decomposition. Hence, if largely diluted, as when poured into an excess of water, decomposition

takes place, and a white powder is precipitated, formerly called *powder of Algaroth* (see *Part* III.), which is an oxychloride, having usually the formula $2SbO_3.SbCl_3 + HO$. The terchloride is in part decomposed by the water, the elements of which convert it into muriatic acid and teroxide. The muriatic acid remains in solution, while two eqs. of teroxide fall in union with one eq. of terchloride, forming the oxychloride of the above formula. The composition of the powder, however, is not uniform; as it contains more teroxide, the greater the proportion of water used in the decomposition. (E. Baudrimont, *Journ. de Pharm.*, Juin, 1856, p. 438.) The oxychloride is first washed with abundance of water to separate adhering muriatic acid, and then acted upon by a solution of alkali (ammonia, *U. S.*, carbonate of sodium, *Br.*) to decompose the terchloride, with the effect of adding to the amount of teroxide; after which the teroxide only requires to be washed with water in order to render it pure. The last washing separates the chloride of ammonium or of sodium resulting from the decomposition of the terchloride; and the water of this washing is tested, in both formulas, by nitrate of silver, until the presence of a chloride ceases to be indicated.

Properties. Teroxide of antimony is a heavy, grayish-white powder, permanent in the air, insoluble in water, but readily soluble in muriatic or tartaric acid, or in a boiling solution of bitartrate of potassium. Heated in close vessels it becomes yellow, fuses at a full red heat, and finally sublimes in crystalline needles. When cooled from a state of fusion it forms a fibrous crystalline mass. Heated in open vessels it suddenly becomes red hot, and, by the absorption of oxygen, changes into antimonious acid, which differs from the teroxide in being insoluble in muriatic acid, less fusible, and not volatile. This oxide is the active ingredient of all the medicinal preparations of antimony. It is frequently impure from the presence of antimonious acid, in which case it is not *entirely* soluble in muriatic acid. If it contain terchloride, which it is apt to do from the imperfect action of the alkaline solutions employed in its purification, its solution in tartaric acid will be precipitated by nitrate of silver. When antimonious acid is substituted for it, the fraud may be detected by the spurious preparation being entirely insoluble in muriatic acid. Teroxide of antimony consists of one eq. of antimony 129, and three of oxygen $24 = 153$.

Medical Properties. This oxide, which must not be confounded with the powder of Algaroth, has the general therapeutic properties of the antimonials. It deserves more attention than has been paid to it; and its effects, comparatively with those of tartar emetic, should be carefully studied. It is probable that its sedative operation would be found to be the same, with less nausea and disturbance of the stomach. Like antimonial powder, it is unequal in its effects, sometimes vomiting, at other times being apparently inert. This inequality of action is plausibly explained by the state of the stomach as to acidity, the presence of acids giving the medicine activity; and this explanation is confirmed by the experiments of Dr. Osburn, of Dublin, with the Dublin oxide. As to the French Codex oxide, prepared by boiling the oxychloride with a solution of bicarbonate of potassium, the inequality is attributed by M. Durand, of Caen, to the presence of more or less terchloride, which is separated with difficulty. Objecting to the Codex oxide, M. Durand proposes to prepare the teroxide by precipitating tartar emetic with ammonia in excess. Thus obtained it contains no terchloride, and does not vomit. (*Journ. de Pharm.*, 3e sér., ii. 364.) The dose of teroxide of antimony is three grains, every two or three hours, given in powder with syrup or molasses, or in pill made with confection of roses or other suitable excipient. It was introduced into the existing edition of the U. S. Pharmacopœia, to be used in the preparation of tartar emetic.

Off. Prep. Antimonii et Potassii Tartras, *U. S.;* Antimonium Tartaratum, *Br.;* Pulvis Antimonialis, *Br.* B.

ANTIMONII OXYSULPHURETUM. *U. S. Oxysulphuret of Antimony. Kermes Mineral.*

"Take of Sulphuret of Antimony, in very fine powder, *a troyounce;* Carbonate of Sodium *twenty-three troyounces;* Water *sixteen pints.* Dissolve the Carbonate of Sodium in the Water previously heated to the boiling point, and, having added the Sulphuret of Antimony, boil for an hour. Then filter rapidly into a warm

earthen vessel, cover this closely, and allow the liquid to cool slowly. At the end of twenty-four hours, decant the supernatant liquid, drain the precipitate on a filter, wash it with boiled water previously allowed to become cold, and dry it without heat. Lastly, preserve the powder in a well-stopped bottle, protected from the light." *U. S.*

Though very long in use as a medicine, and much employed on the Continent of Europe, it was only recently that this preparation was admitted into the U. S. Pharmacopœia, having been superseded by the precipitated sulphuret, which was supposed to have very similar if not identical properties.

Kermes mineral, according to Thenard, may be obtained by treating the tersulphuret of antimony in three ways; 1st with a boiling solution of the carbonated alkalies, 2d with a boiling solution of the caustic alkalies, and 3d with the carbonated alkalies at a red heat. These several processes give brown powders, which vary in their shade of colour, and which, though usually considered as identical, differ in composition. The kermes obtained by means of the carbonated alkalies in solution is an oxysulphuret, that is, a compound of hydrated tersulphuret of antimony with the teroxide; while the product, when either the caustic alkalies in solution, or the carbonated alkalies at a red heat are used, is essentially a hydrated tersulphuret, though containing occasionally a little oxysulphuret. It is the first of these methods that has been adopted in the U. S. process. It is in fact the formula of Cluzel, as published in former editions of the U. S. Dispensatory (see 11th ed. p. 926), and is substantially the same with that given in the French Codex of 1837.

The rationale of the formation of kermes by this process is as follows. A portion of the carbonate of sodium is converted, by a transfer of carbonic acid, into caustic soda and sesquicarbonate. By a double decomposition taking place between a part of the tersulphuret of antimony and the caustic soda, sulphuret of sodium and teroxide of antimony are formed. The undecomposed portion of the tersulphuret then dissolves in the solution of sulphuret of sodium, and the teroxide in that of the remaining carbonate of sodium. The tersulphuret and teroxide, being both more soluble in these menstrua hot than cold, precipitate together as the liquid cools, and constitute this variety of kermes. Thus obtained it is light, velvety, of a dark reddish-purple colour, brilliant in the sun, and of a crystalline appearance. It consists, according to M. Henry, jun., of tersulphuret of antimony 62·5, teroxide 27·4, water 10, and soda a trace; proportions which correspond most nearly with two eqs. of tersulphuret, one of teroxide, and six of water. From the presence of so large a proportion of teroxide of antimony in this variety of kermes, it must be far more active than the other kinds, and ought, therefore, to be preferred for medical use.

Kermes, when obtained by means of the caustic alkalies, may be formed by the use of either potassa or soda. When the former alkali is selected, it may be prepared by boiling, for a quarter of an hour, two parts of the tersulphuret of antimony with one part of caustic potassa dissolved in twenty-five or thirty parts of water, filtering the liquor, and allowing it to cool; whereupon the kermes precipitates. In this process one portion of the tersulphuret, by reacting with a part of the potassa, gives rise to teroxide of antimony and sulphuret of potassium. A second portion dissolves in the solution of sulphuret of potassium formed, and a third forms an insoluble compound with a part of the teroxide. The remainder of the teroxide unites with the undecomposed potassa, forming a compound, which, being but sparingly soluble, is only in part dissolved. The hot filtered liquor, therefore, contains this compound dissolved in water, and tersulphuret of antimony dissolved in the solution of sulphuret of potassium. By refrigeration, the tersulphuret in a hydrated state falls down, free or nearly free from teroxide, this latter being still held in solution by means of the caustic alkali.

Kermes may be obtained by the third method, that is, in the dry way, by the use of the carbonated alkalies at a red heat. If carbonate of potassium* is selected, the process is as follows. Rub together two parts of tersulphuret of antimony and one of carbonate of potassium, fuse the mixture in a crucible by a red heat, reduce the

* According to the researches of M. A. Terreil (*Journ. de Pharm.*, 4e sér., xix. 131), carbonate of potassium if absolutely pure will not yield kermes by the moist way, but by the dry way will give a larger yield than will carbonate of sodium. (*Note to the fourteenth edition.*)

fused mass to powder, boil it with water, and strain. As the strained liquor cools the kermes is deposited. The rationale of its formation is nearly the same with that of the formation of the second variety of kermes. An inferior kermes, prepared in the dry way, and intended for use in veterinary medicine, is directed in the French Codex of 1837 to be prepared by fusing together, well mixed, 500 parts of tersulphuret of antimony, 1000 of carbonate of potassium, and 30 of washed sulphur, reducing the fused mass to powder, and boiling it with 10,000 parts of water. The liquor, upon cooling, lets fall the kermes, which must be washed with care and dried.

The officinal oxysulphuret is an insipid, inodorous powder, of a purplish-brown colour, and soft and velvety to the touch. By the action of air and light it gradually becomes lighter coloured, and at last yellowish-white. It is readily and wholly dissolved by muriatic acid, with escape of hydrosulphuric acid gas, and is partly soluble in a hot solution of potassa, leaving a residue soluble in tartaric acid. It is sometimes adulterated with sesquioxide of iron. In Paris, in 1849, a number of the shops contained a spurious kermes of very handsome appearance, which was little else than this oxide. Kermes mineral first came into use as a remedy in France about the beginning of the last century. Its mode of preparation was possessed as a secret by a French surgeon named La Ligerie. In 1720, the recipe was purchased by the French government and made public. Its remedial properties will be considered under the following head. B.

ANTIMONIUM SULPHURATUM. *U. S.*, *Br.* Antimonii Sulphuretum Præcipitatum. *U. S.* 1850, *Dub.* Antimonii Oxysulphuretum. *Lond.* Antimonii Sulphuretum Aureum. *Ed.* *Sulphurated Antimony. Precipitated Sulphuret of Antimony.*

"Take of Sulphuret of Antimony, in very fine powder, *six troyounces;* Solution of Potassa *four pints;* Distilled Water, Diluted Sulphuric Acid, each, *a sufficient quantity.* Mix the Sulphuret of Antimony with the Solution of Potassa and twelve pints of Distilled Water, and boil the mixture over a gentle fire for two hours, constantly stirring, and occasionally adding Distilled Water so as to preserve the same measure. Strain the liquid immediately through a double muslin strainer, and drop into it, while yet hot, Diluted Sulphuric Acid so long as it produces a precipitate. Then wash the precipitate with hot water to remove the sulphate of potassium, dry it, and rub it into a fine powder." *U. S.*

"Take of Black Antimony *ten ounces* [avoirdupois]; Solution of Soda *four pints and a half* [Imperial measure]; Diluted Sulphuric Acid, Distilled Water, of each, *a sufficiency.* Mix the Black Antimony with the Solution of Soda, and boil for two hours with frequent stirring, adding Distilled Water occasionally to maintain the same volume. Strain the liquor through calico, and, before it cools, add to it by degrees the Diluted Sulphuric Acid till the latter is in slight excess. Collect the precipitate on a calico filter, wash with Distilled Water till the washings no longer precipitate with chloride of barium, and dry at a temperature not exceeding 212°." *Br.*

There are three forms of tersulphuret of antimony containing more or less teroxide; the *kermes mineral* already described; the *golden sulphur*, which is produced when, after the spontaneous subsidence of kermes mineral in the process for obtaining it, an acid is added to the liquid; and the *precipitated sulphuret*, which is made by precipitating the liquid before it has begun to deposit the kermes, and may be considered as consisting of the other two combined in one.

Golden sulphur (*sulphur auratum antimonii*) is prepared, according to the French Codex of 1837, by precipitating the solution remaining after the deposition of the kermes, in the formula in which one of the caustic alkalies is employed in the first stage of the process, as in the above formula, instead of a carbonate as in the one preceding it. The liquor, when caustic potassa has been used, consists *at first* chiefly of tersulphuret of antimony, dissolved in solution of sulphuret of potassium, but in part also of teroxide, dissolved in solution of potassa. By the action of the oxygen of the air on the liquor, however, the sulphuret of potassium has part of its potassium gradually converted into potassa, and thus passes to a higher state of sulphuration; and, consequently, the addition of an acid, while it throws down the tersulphuret and

teroxide of antimony with disengagement of sulphuretted hydrogen, will separate at the same time the excess of sulphur which the sulphuret of potassium has gained. This excess of sulphur, combining with a portion of the tersulphuret of antimony, produces the pentasulphuret of that metal (*Gmelin*); and the resulting golden sulphur is a mixture of tersulphuret and teroxide of antimony, with more or less of the pentasulphuret. It is in the form of a powder of a golden-yellow colour. As it is partially decomposed by light, it should be kept in opaque vessels. It may be worth while to mention that the so-called *kermes liquor*, left after the use of the carbonated alkalies in solution, gives but little golden sulphur; while the liquors resulting from the two other processes yield it in abundance.

From the explanations above given, the reader is prepared to understand that the method of preparing sulphurated antimony of the U. S. and Br. Pharmacopœias, combines the process for forming kermes mineral by means of a *caustic alkali*, with that for obtaining golden sulphur; for while the refrigeration of the solution acting alone would cause the precipitation of the variety of kermes which contains little or no antimonial oxide, the sulphuric acid added would throw down more or less of the golden sulphur. But the question here arises, how far this golden sulphur would be identical with that obtained from the kermes liquor which has been kept for some time. From the explanations above given in relation to golden sulphur, it may be inferred as probable that the precipitate by acids, if thrown down immediately, while the solution is hot, as directed by the Pharmacopœias, and before the air has had time to act, would consist exclusively of tersulphuret and teroxide; but, if thrown down from kermes liquor which had been kept, would contain more or less of the pentasulphuret, according to the length of time which had elapsed. If these views be admitted, it follows that the so-called golden sulphur must be variable as to the pentasulphuret it contains, according to the greater or less change which the kermes liquor may have undergone by time, before being used for furnishing the precipitate.

Formerly, all the Pharmacopœias noticed in this work used a solution of caustic potassa in preparing precipitated sulphuret of antimony; but at present the British Council, following the London College, employs a solution of caustic soda. The use of soda, however, does not alter the theory of the process.

Properties of the Precipitated Sulphuret of Antimony (*Sulphurated Antimony, U. S., Br.*). This substance is a reddish-brown insoluble powder, tasteless when pure, but having usually a slightly styptic taste. When treated with twelve times its weight of muriatic acid of the sp. gr. 1·16, with the aid of heat, it is nearly all dissolved, with effervescence of sulphuretted hydrogen. The residue burns with the characters of sulphur, and leaves a scanty ash. The solution obtained, when added to water, is decomposed, giving rise to a white powder of oxychloride of antimony (powder of Algaroth). The solution, filtered from the powder, yields an orange-red precipitate with bihydrosulphate of ammonium, proving the presence of a portion of antimony, not thrown down by the water. A dark-coloured precipitate, produced by this test, shows the presence of contaminating metals, probably lead and copper. Water in which this preparation has been boiled, should not yield a white precipitate with chloride of barium or oxalate of ammonium. The non-action of these tests shows the absence of sulphuric acid and lime. When pure, precipitated sulphuret of antimony is completely soluble in a hot solution of potassa; but, as it is found in the shops, a white matter is usually left undissolved. When boiled with a solution of cream of tartar, about 12 per cent. of teroxide is dissolved; but, according to H. Rose, this method of determining the proportion of the teroxide cannot be relied on. Exposed to heat it takes fire, and burns with a greenish-blue flame, giving off sulphurous acid; while the metal remains behind in the state of a grayish oxide.

The London precipitated sulphuret of antimony, as analyzed by Mr. Phillips, consisted, in the 100 parts, of tersulphuret 76·5, teroxide 12, and water 11·5; proportions corresponding nearly with five eqs. of tersulphuret, one of teroxide, and fifteen of water. It usually contained a portion of pentasulphuret, as shown by the action of muriatic acid, which, when heated with this antimonial, forms the terchloride with disengagement of sulphur. (*Gmelin's Handbook*, iv. 989.) Its active ingredient is the teroxide; and, in reference to its presence the London College called the preparation *oxysul-*

phuret of antimony. The Edinburgh College named it incorrectly *golden sulphuret of antimony;* this name being properly applicable to the precipitate produced by the sole action of acids, and not to that obtained by the action of acids and refrigeration conjointly.

Sulphurated Antimony, in the British Pharmacopœia, is defined to be "sulphide of antimony, SbS_3 or Sb_2S_2, with a small and variable amount of oxide of antimony, SbO_3 or Sb_2O_3," and is described as "an orange-red powder, readily dissolved by caustic soda, also by hydrochloric acid with the evolution of sulphuretted hydrogen and the separation of a little sulphur. Boiled in water with acid tartrate of potassium, the resulting solution is precipitated orange-red with sulphuretted hydrogen. Sixty grains of this preparation, dissolved in hydrochloric acid and dropped into water, give a white precipitate, which, when washed and dried, weighs about fifty-three grains." *Br.* Mr. Wm. Tilden (*Pharm. Journ. and Trans.*, Dec. 1870, 443) asserts that the officinal (Br.) test is not satisfactory, because, if a little too much hydrochloric acid be present, a portion of the antimony will remain in solution as the chloride; and proposes the following substitute. "Fifty grains, moistened with nitric acid, then dried and heated to redness, give a white residue weighing about forty-five grains." Mr. John Moss recently asserted, before the London Pharmaceutical Society, that the British process always yields a dark-reddish or reddish-brown powder; but that the kermes mineral, in English commerce, is golden-yellow or yellowish-red, and must be prepared by some other method. He was confirmed in both statements by Profs. Redwood and Attfield; the latter explaining that the officinal kermes contains the tersulphide, the commercial the pentasulphide of antimony.

Medical Properties. Precipitated sulphuret of antimony (*sulphurated antimony*) is alterative, diaphoretic, and emetic. It is, however, an uncertain medicine, as well from the want of uniformity in its composition, as from its liability to vary in its action with the state of the stomach. It is seldom given alone, but generally in combination with calomel and guaiac, in the form of Plummer's pill, as an alterative in secondary syphilis and cutaneous eruptions, or with henbane or hemlock in chronic rheumatism. (See *Pilulæ Antimonii Compositæ.*) During its use the patient should abstain from acidulous drinks. Its dose as an alterative is from one to two grains twice a day, in the form of pill; as an emetic, from five grains to a scruple.

Kermes mineral, when prepared by means of the carbonated alkalies in the moist way, as it contains between two and three times as much teroxide as the precipitated sulphuret, is a more active preparation, and must be used in a smaller dose. It is sometimes given in large doses as an antiphlogistic remedy in peripneumony and other inflammations of the chest. Prof. Meigs recommends it as an invaluable medicine in childbed fevers, to promote diaphoresis, and to reduce the force of the circulation.

Golden sulphur acts like kermes mineral, but is much weaker, and must be given in a larger dose.

Off. Prep. Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.* B.

AQUA.

Water.

AQUA DESTILLATA. *U. S., Br. Distilled Water.*

"Take of Water *eighty pints.* Distil two pints, using a tin or glass condenser, and throw them away; then distil sixty-four pints, and keep them in glass bottles." *U. S.*

"Take of Water *ten gallons* [Imperial measure]. Distil from a copper still, connected with a block-tin worm; reject the first half gallon, and preserve the next eight gallons." *Br.*

No natural water is sufficiently pure for certain pharmaceutical purposes; and hence the necessity of the above processes for its distillation. It is best to reject the first portion which comes over, as this may contain carbonic acid and other volatile impurities; and the last portion of the water ought not to be distilled, lest it should pass over with an empyreumatic taste. The distillation is usually performed with the ordinary still and worm; but, to avoid any impurity from the worm or the receiver,

the condenser is directed in the U. S. Pharmacopœia to be of tin or glass. In the British formula the worm is ordered to be of block-tin; and the same is undoubtedly contemplated in our officinal process; as the ordinary tin-coated sheet-iron, commonly called tin, would be wholly unfit for the purpose. Mr. Brande states that distilled water often derives from the still a foreign flavour, which it is difficult to avoid. He, therefore, recommends that a still and condenser be kept exclusively for distilling water; or, where this cannot be done, that steam be driven through the worm for half an hour, for the purpose of washing it out before it is used, the worm-tub having been previously emptied. Mr. Mackay, of Edinburgh, cautions against distilling water in a still with a leaden head or leaden worm, for fear of contaminating the water with lead. Even the use of pure tin, which is generally considered unexceptionable, does not give perfect security against impurity; as water distilled from metallic alembics, with the head and worm of this metal, has a peculiar odour which it retains for some time. A portion of distilled water thus prepared, after having been kept for four months in a well-stopped bottle, was found by M. Flech, an apothecary of Kevelaer, to have deposited white flocculi, which proved on examination to consist of oxidized tin; and the water, besides, contained tin in solution and a little ammonia. M. Flech supposes that a part of the water was decomposed; its oxygen uniting with the tin, and its hydrogen in the nascent state with the nitrogen of the air to form ammonia; and he is disposed, moreover, to ascribe to this cause the peculiar odour referred to, which is never perceived when the distillation is performed in glass vessels. (*Journ. de Pharm.*, Fév. 1860, p. 125.)

Properties, &c. Distilled water, as usually obtained, has a vapid and disagreeable taste, and is not perfectly pure; water, to be rendered so, requiring to be distilled in silver vessels. The properties of pure water have already been given under the head of *Aqua*. Distilled water should undergo no change by sulphuretted hydrogen, or on the addition of tincture of soap, subacetate of lead, chloride of barium, oxalate of ammonium, nitrate of silver, or lime-water, and should evaporate without residue. It is uselessly employed in some formulas, but is essential in others. As a general rule, when small quantities of active medicines are to be given in solution, and in the preparation of collyria, distilled water should be directed. The following list contains the chief substances which require distilled water as a solvent: tartar emetic, corrosive sublimate, nitrate of silver, the chlorides of barium and calcium, acetate and subacetate of lead, permanganate of potassium, the sulphates of iron and zinc, sulphate of quinia, sulphate, muriate, and acetate of morphia, and, in general terms, all the alkaloids and their salts. Distilled water is used in preparing the officinal diluted acids, for absorbing gaseous ammonia, and for forming nearly all the officinal aqueous solutions. B.

AQUÆ. *U.S.*

Medicated Waters.

Under this head are included, in the United States Pharmacopœia, all preparations, consisting of water holding volatile or gaseous substances in solution, many of which were formerly obtained by distillation, and some of which still continue to be so. They include the preparations formerly specially designated as "Distilled Waters," having been made by distilling water from plants or parts of plants containing volatile oil. Distilled water is now placed in the Pharmacopœia under the same head; but we have given it the distinct position which it held in the edition of 1850, and which it might very properly, we think, have continued to hold in the present.

The Distilled Waters, as thus defined, hold a much more prominent position in the pharmacy of Europe, particularly of continental Europe, than in that of the United States; and a great deal of thought and elaborate investigation have been bestowed upon the various conditions calculated to furnish the best products in the most convenient method. It would be doing injustice to the subject not to give it a distinct consideration in a work like the present, though its relative want of importance with us will render our remarks comparatively brief.

Many vegetables impart to water distilled from them their peculiar flavour, and more or less of their medical properties. The Distilled Waters chiefly used are those

prepared from aromatic plants, the volatile oils of which rise with the aqueous vapour, and are condensed with it in the receiver. But, as water is capable of holding but a small proportion of the oil in solution, these preparations are generally feeble, and are employed chiefly as pleasant vehicles or corrigents of other medicines.

In the preparation of the Distilled Waters, dried plants are sometimes used, because the fresh are not to be had at all seasons; but the latter, at least in the instance of herbs and flowers, should be preferred if attainable. Flowers which lose their odour by desiccation may be preserved by incorporating them intimately with one-third of their weight of common salt, and in this state afford Distilled Waters of delicate flavour. Indeed, some pharmaceutists prefer the salted flowers in certain instances, believing that the waters distilled from them keep better than when prepared from the fresh flowers. Mr. C. R. Tichborne has discovered a new method of preserving flowers, which is said to answer even better than the use of salt. It consists simply in immersing the fresh flowers in glycerin, which preserves them with all their aromatic properties wholly unimpaired. The flowers, as of the elder, rose, and orange, should be gathered after full expansion, and packed firmly in wide-mouthed bottles or jars, but without crushing them. The glycerin is then to be poured on until it covers them, and the vessel closed. Mr. Tichborne has kept flowers in this way for two years; and at the end of that time procured from them distilled waters, of which the perfume has equalled that of the waters prepared from recent flowers. It is not necessary that the glycerin should be perfectly pure; but it should be without smell. (*Pharm. Journ. and Trans.*, 2d ser., vii. 135.)

The idea at one time prevailed, to a considerable extent, that Waters kept better distilled from dried herbs than from fresh; and the opinion was true in regard to those prepared with the defective alembics of former times, and by a naked fire; but experiment has sufficiently established the fact, that, with a suitable apparatus, and a regulated heat, the fresh herbs yield products which, while they have a more agreeable odour of the plant, keep quite as well as those from dried herbs. (*Journ. de Pharm.*, Mai, 1861, p. 359.)

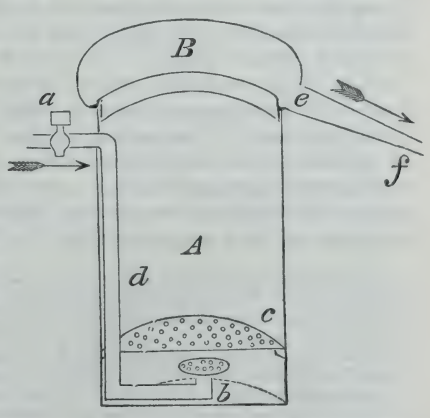
It is necessary to observe certain practical rules in conducting the process of distillation. When the substance employed is dry, hard, and fibrous, it should be mechanically divided, and macerated in water for a short time previously to the operation. The quantity of materials should not bear too large a proportion to the capacity of the alembic, as the water might otherwise boil over into the receiver. The water should be brought quickly to the state of ebullition, and continued in that state till the end of the process. Care should be taken to leave sufficient water undistilled to cover the whole of the vegetable matter; lest a portion of the latter, coming in contact with the sides of the vessel, might be decomposed by the heat, and yield empyreumatic products. Besides, when the operation is urged too vigorously, or carried too far, a slimy matter is apt to form, which adheres to the sides of the alembic above the water, and is thus exposed to igneous decomposition. To obviate these disadvantages, the heat may be applied by means of an oil-bath, regulated by a thermometer, or of a bath of solution of chloride of calcium, by which any temperature may be obtained between 212° and 270°, according to the strength of the solution; or, when the process is conducted upon a large scale, by means of steam introduced under pressure into a space around the still. A convenient mode of applying heat by steam, is by means of a coil of leaden tube placed in the bottom of the still, having one end connected with a boiler, and the other passing out beneath or at the side, and furnished with a stop-cock, by which the pressure may be increased, or the condensed water drawn off at will. If any volatile oil float upon the surface of the Distilled Water, it may be separated.*

* This direction is generally given; but, in a communication to the Pharmaceutical Society of England, Mr. Haselden recommends the excess of oil to be well shaken with the water, and the whole to be transferred to the stock vessel, where it may be allowed to rest, and the oil to separate. He thinks the water keeps better when thus treated; and the full strength is always ensured. The stock vessel he prefers made of stoneware, and furnished with a tap placed two inches from the bottom, whereby the water may be drawn off clear when wanted for the ordinary shop bottles; the oil either rising to the top, or sinking to the bottom of the vessel, according to its specific gravity. (*Pharm. Journ.*, xvi. 14, 15.)—*Note to the eleventh edition.*

From a series of experiments made in Paris in reference to the best mode of applying heat, it was concluded that, as regards the great majority of aromatics, the direct application of steam was preferable, because the Distilled Waters prepared by means of it have a freshness of aroma that is wanting in the others, are always free from the odour of the still, are much more limpid, are less apt to deposit mucilaginous matter, and keep better; but that exceptions to the general rule are afforded by bitter almonds, cherry-laurel leaves, mustard, and horseradish, in all of which the oil does not pre-exist in the plant, but is formed upon contact with water; by woods, barks, and roots, the tissue of which cannot be sufficiently penetrated by steam; and by roses (*Journ. de Pharm.*, Mai, 1861, p. 364.) Later experiments have led to the conclusion that even these substances are most advantageously treated by distillation with steam; and that, in fact, there is no exception to the general rule. All inconvenience and danger in this process are avoided by care to have tubes of large diameter for the supply of the steam, which should be received into a free space reserved, at the bottom of the alembic, by means of a diaphragm pierced with holes. To prevent the loss of vapour, it is sufficient to lute the apparatus by strips of linen or muslin covered with glue or dextrin paste, making two or three turns around the alembic. (*Ibid.*, Juin, 1864, p. 520.)*

But, however carefully the process may be conducted, the Distilled Waters prepared from plants always have at first an unpleasant smoky odour. They may be freed from this by exposure for a short time to the air, before being enclosed in well-stopped bottles, in which they should be preserved. When long kept, they are apt to form a viscid ropy matter, and to become sour. This result has been ascribed to other principles, which rise with the oil in distillation, and promote its decomposition. To prevent this decomposition, the *Edinburgh College* ordered rectified spirit to be added to the water employed in the process of distillation. But this addition is inadequate to the intended object, and is in fact injurious, as the alcohol by long exposure to the air appears to undergo the acetous fermentation. The *London College*, which had previously directed a spirituous addition, abandoned it in the last edition of their Pharmacopœia; and it is not directed in any of the present U. S. or British formulas in which distillation is performed. A better plan is to redistil the Waters. When thus purified, it is said that they may be kept for several years unchanged.

* Distillation by steam having been demonstrated, in France, to be the best method of preparing the Distilled Waters in all instances, we present, in the margin, the figure of a vertical section of Soubeiran's apparatus for this purpose, somewhat modified. A cylindrical tinned copper or iron boiler (*A*), three and a half feet high and two in diameter, is surmounted by an expanded head or capital (*B*) which is furnished with an inner ledge, forming a kind of gutter, intended to receive the liquid condensed on the inner surface of the capital, and opening into the exit tube (*e*). Across the boiler, about six inches from the bottom, is placed a horizontal septum or diaphragm, pierced with numerous small holes. Through the side of the boiler, near the top, a steam pipe (*a d*), provided with a stop-cock (*a*), enters, and, turning immediately downwards, runs along the side of the boiler to the bottom, where it makes a horizontal bend, and, extending to the middle of the base, turns upwards, and opening by a perforated expansion, like the end of the spout of a watering pot, terminates a little beneath the centre of the diaphragm. The material to be distilled, having been previously properly comminuted, and macerated when necessary, is introduced into the boiler, and rests on the diaphragm. The capital having then been applied, and secured by a luting of linen bands coated with dextrin paste, steam from any convenient generator is admitted through the tube at its upper extremity, and passing down, escapes through the expanded termination (*b*) beneath the diaphragm, through the small openings of which it passes, and thus penetrates equably all parts of the material. Loaded with the volatile matters, it then rises into the capital, where a portion being condensed falls into the gutter, and the remainder passes out, with the liquid condensed in the capital, through the exit pipe (*f*), whence it enters into a worm or other suitable condensing apparatus. (*Note to the twelfth edition.*)



Robiquet considers the mucosity which forms in Distilled Waters as the result of a vegetative process, to which the presence of air is essential. He has found that, so long as the water is covered with a layer of essential oil, it undergoes no change; but that the oil is gradually altered by exposure to the air, and, as soon as it disappears, the water begins to be decomposed. He states that camphor exercises the same preservative influence over the Distilled Waters by resisting the vegetation, and that those in which the odour of camphor is developed keep better on that account. Finally, he has observed that the more Distilled Water is charged with volatile oil, the more abundant is the mucosity when it has begun to form. Robiquet unites with Henry and Guibourt, and with Virey, in recommending that all these Waters, when intended to be kept for a considerable time, should be introduced, immediately after distillation, into bottles of a size proportionate to the probable consumption of the water when brought into use; and that the bottles should be quite filled, and then sealed or otherwise well stopped, so as to entirely exclude the air. It is best that they should be small, and be closed with well-fitting glass stoppers. Thus treated, the waters may be preserved without change for many years. (*Journ. de Pharm.*, xxi. 402.) If this plan be not put into operation immediately, the Water should, after introduction into the bottle, be heated to about 212° by placing the bottle in boiling water, and, when it begins to run over, should be carefully enclosed.*

Another mode of preparing the Distilled Waters is to substitute the volatile oil, previously separated from the plant, for the plant itself in the process. This mode is directed in the British Pharmacopœia, in several instances. It is said to afford a more permanent product than the preceding; but does not always preserve the flavour of the plant.

In relation to most of the aromatics, the U. S. Pharmacopœia discards altogether the process by distillation, and directs that water should be impregnated with the volatile oil by trituration with carbonate of magnesium, and subsequently filtered. This is by far the most simple and easy process. The resulting solution is pure and permanent, and is perfectly transparent, the carbonate of magnesium being separated by the filtration. Carbonate of magnesium is preferable to the pure earth; as the latter sometimes gives a brownish colour to the liquid, and requires to be used in larger proportion. But both these substances are dissolved in minute quantities, and are apt to occasion a slight flocculent precipitate. They may also possibly prove injurious by decomposing certain substances given in very small doses, as sulphate of morphia, bichloride of mercury, and nitrate of silver.† The object of the magnesia or its carbonate is simply to enable the oil to be brought to a state of minute division, and thus presented with a larger surface to the action of the solvent. According to Mr. Robert Warington, this object may be better accomplished by porcelain clay, finely powdered glass, or pumice stone, which are wholly insoluble (*Chem. Gaz.*, March, 1845, p. 113); and the London College employed finely powdered silica for the purpose. Chalk and sugar answer the same end; but the latter, by being dissolved with the oil, renders the preparation impure. The *Dublin College* prepared its Waters by agitating an alcoholic solution of the oil with distilled water, and filtering. They consequently contained alcohol, and were liable to the objection, already mentioned, against the medicated waters thus impregnated. They were besides feeble in the properties of their respective oils. In the preparation of the aromatic waters by

* It is of some importance to know the proportion which the aromatic submitted to distillation ought to bear to the amount of distilled water obtained. The following statement upon this point, based upon experiments, is contained in the *Journal de Pharmacie* (Mai, 1861, p. 367). Fresh aromatic plants requiring one part of the plant for one of product; wormwood, black cherry, scurvy-grass, hyssop, cherry-laurel, lavender, balm, mint, peach-leaves, roses, and sage:—fresh and dry aromatics requiring one part of the plant to two of product; bitter almonds, orange-flowers, melilot, horseradish, elder, and tansy;—dry and very aromatic plants requiring one part to four of product; angelica, green anise, juniper berries, chamomile, canella, cascarilla, fennel, sassafras, linden flowers, and valerian. (*Note to the twelfth edition.*)

† A very important observation has been made by Mr. Jno. D. Owens and confirmed by Prof. Maisch, that the alkaloids, when their salts have been dissolved in waters prepared with magnesia, are apt to crystallize out, owing to there being a certain amount of magnesia in the water. It is unnecessary to show the importance of having all such solutions made decidedly acid, and it would seem the duty of the pharmacist to do so, whether directed by the physician or not. (*Note to the fourteenth edition.*)

these processes, it is very important that the water should be pure. The presence of a sulphate causes a decomposition of the oil, resulting in the production of sulphuretted hydrogen and a carbonate; and the aromatic properties are quite lost. (See *Am. Journ. of Pharm.*, xix. 303.) Hence the propriety of the officinal direction to employ distilled water.*

The Distilled Waters are liable to contain various metallic impurities, derived from the vessels in which they are prepared or preserved. The metallic salts which have been found in them are those of iron, zinc, copper, and lead. With ferrocyanide of potassium iron will give a blue colour, zinc and lead white precipitates, and copper a rose-colour followed by chestnut-brown. Sulphuret of sodium causes with the salts of iron, copper, and lead, a brown discoloration more or less deep, followed by precipitates varying from brown to black; with those of zinc, a white precipitate. The Distilled Waters may be freed from these impurities by animal charcoal, previously well purified. The charcoal should be strongly shaken, eight or ten times in the course of a day, with the impure Water, which should then be allowed to rest, and the next day be filtered. Five grains of the charcoal will be sufficient for a gallon of the Distilled Water. (*Journ. de Pharm.*, Nov. 1862, p. 416.) The volatile oils may be recovered from the Waters containing them, or at least may be transferred to a spirituous menstruum, by mixing olive oil with the water, adding a little solution of potassa so as to form a soap, and a consequent emulsion with the liquid, and then neutralizing by an acid. The fixed oil will rise to the surface, bringing the volatile oil along with it. The latter may then be separated from the former by agitation with alcohol. (T. B. Groves, *Pharm. Journ.*, Feb. 1864.) W.

AQUA ACIDI CARBOLICI. *U. S.* *Carbolic Acid Water.*

"Take of Glycerite of Carbolic Acid *ten fluidrachms;* Distilled Water *a sufficient quantity.* Mix the Glycerite of Carbolic Acid with a sufficient quantity of Distilled Water to make the mixture measure a pint." *U. S.*

A drachm of this solution contains about a grain of carbolic acid. The dose is one to two teaspoonfuls. H. C. W.

AQUA ACIDI CARBONICI. *U. S.* *Carbonic Acid Water. Artificial Seltzer Water.*

"By means of a proper apparatus, impregnate Water, contained in a suitable receiver, with a quantity of carbonic acid, equal to five times the bulk of the Water. Carbonic acid may be obtained from Bicarbonate of Sodium or from Marble by means of dilute sulphuric acid." *U. S.*

This preparation, which is peculiar to the United States Pharmacopœia, consists of water highly charged with carbonic acid. Water is found to take up its volume of this acid under the pressure of the atmosphere; and Dr. Henry ascertained that precisely the same *volume* of the compressed gas is absorbed under a higher pressure. From this law, the bulk taken up is constant, the quantity being different in proportion as there is more or less driven into a given space. As the space occupied by a gas is inversely as the compressing force, it follows that the quantity of the acid forced into the water will be directly as the pressure. A double pressure will force a double quantity into a given space, and, therefore, cause a double quantity to be absorbed; a treble pressure will drive a treble quantity into the same space, and cause its absorption; and so on for higher pressures, the *bulk* of the *compressed* gas absorbed always remaining the same. From the principles above laid down it follows that, to saturate water with five times its volume of carbonic acid, as directed in the formula, it must be subjected to a pressure of five atmospheres.

M. Ozouf, of Paris, has put in operation a new mode of preparing carbonic acid, on the large scale, for the manufacture of artificial mineral waters. It consists in the passage of carbonic acid from the vigorous combustion of coke, refrigerated and

* Mr. Haselden prefers the process of distillation from the aromatic itself in the instances of dill, caraway, fennel, cinnamon, and pimento, which are not apt to afford to the distilled water such matter as may cause it to become sour; but he thinks that peppermint, spearmint, and pennyroyal waters may be advantageously prepared by trituration. He advises, however, that these waters should not be filtered, but prepared in quantity, allowed to settle, and drawn off as wanted. (*Pharm. Journ.*, xvi. 14, 15.)—*Note to the eleventh edition.*

washed, through a solution of carbonate of sodium, and heating the solution of bicarbonate of sodium thus formed so as to drive off its carbonic acid, which is collected for use. The solution of the carbonate of sodium thus produced, after refrigeration, is again used in the process, and thus indefinitely. A peculiar arrangement of apparatus is employed for the purpose, which is described in the *Journ. de Pharm. et de Chim.* (Avril, 1868, p. 265).

Carbonic acid water is familiarly called in this country "*mineral water*," and "*soda water;*" the latter name, originally applied to the preparation when it contained a small portion of carbonate of sodium, being from habit continued since the alkali has been omitted. As it is largely consumed both as an agreeable beverage and as a medicine, we give, in a note below, a sketch of an approved apparatus employed in this city for its preparation.*

Carbonic acid water is dispensed in many of the apothecary shops in this country. The fountain is usually placed in the cellar, and the tube proceeding from the fountain is made to pass through the floor and counter of the shop, and to terminate in a stop-cock, by means of which the carbonic acid water may be drawn off at pleasure. In order to have the liquid cool in summer, the tube from the cellar generally terminates in a strong metallic vessel of convenient shape, placed under the counter and surrounded with ice, and from this vessel a separate tube penetrating the counter proceeds.

Properties. Carbonic acid water is a sparkling liquid, possessing an agreeable pungent, acidulous taste. It reddens litmus deeply from its state of concentration, and is precipitated by lime-water. Being impregnated with a large quantity of the acid gas under the influence of pressure, it effervesces strongly when freed from restraint.

* The apparatus referred to in the text consists of a strong egg-shaped copper vessel, tinned on the inside, about eighteen inches long, called a generator, fixed upright in a wooden frame, and surmounted by another upright vessel of similar shape, about nine inches long, communicating with the generator by a short neck, and intended to contain the sulphuric acid. Connected with the generator by a copper tube, and placed by its side, is a strong cylindrical vessel for washing the gas, about fifteen inches long and three and a half in diameter, two-thirds filled with water, and to near the bottom of which the connecting tube passes. Severally communicating with the washing vessel are a mercurial gauge to indicate the pressure, and a strong vessel, called the reservoir or fountain, of about the capacity of eighteen gallons, three-fourths filled with water, the connection of the latter being by a lead or gutta-percha tube, commanded by a stop-cock. The charge of whiting or marble dust, say eight pounds, and the requisite water are added through an opening in the generator, in front of the sulphuric acid vessel, and closed by a screw stopper. The communication between the acid vessel and generator is commanded by a vertical square rod, reaching within the vessel to about two-thirds of its height, and terminating at its lower end in a screw. This rod, when unscrewed, opens a communication between the acid vessel and the generator. The requisite sulphuric acid is added to the acid vessel through an opening at its top, capable of being closed by a screw stopper. Through the axis of this stopper, and revolving within it, but without having any vertical motion, passes the key, in the lower end of which there is a square hole to fit on the square rod. When the acid vessel is to be closed, the screw stopper, with its key, is placed over the opening, in which situation the lower end of the key reaches down a sufficient distance to embrace loosely the square rod. The stopper is now screwed in, and the key, without revolving with the stopper, descends so as duly to embrace the square rod. By turning the handle of the key in the proper direction, the rod is partially unscrewed, the passage to the generator opened, and the acid gradually flows in. From time to time, when the acid is allowed to enter the generator, its contents are briskly mixed by means of an agitator, attached to a horizontal axis, passing air-tight through the short diameter of the generator, and turned by a crank. The stop-cock between the washing vessel and fountain is now partially opened, and the impregnation of the water with the gas begins. As it proceeds, the sulphuric acid is gradually allowed to enter the generator until it is expended, and the stop-cock is from time to time turned, until it is entirely opened. Finally, after the water is fully charged with gas, and the whiting wholly decomposed, the fountain is detached, and the generator freed from the pulpy sulphate of calcium by the assistance of water and the agitator, and its contents allowed to escape through an opening in its most depending part. In the apparatus of the size above described, a single fountain only is charged by one operation, and the carbonic acid water formed contains between nine and ten times its volume of the gas. In this mode of making carbonic acid water, it is perceived that the requisite pressure is obtained by generating the carbonic acid in a confined space.

Numerous other forms of apparatus have been invented for making carbonic acid water. That of Bernhard is figured in the *Am. Journ. of Pharmacy* for Jan. 1856; the figure being taken from *Parrish's Pharmacy*. In this apparatus, the generators and washing vessels are of thickly tinned copper, and the fountains, of cast iron lined with enamel. These fountains are free from objection except for their weight; as also are the stoneware fountains, strengthened with iron bands, which are used in Boston. A less costly apparatus than the above is Nichol's patent combination fountain, figured in the same journal for March, 1856. In this, bicarbonate of sodium is used instead of whiting, and the salt is added to the acid, instead of the acid to the salt. For an account of the small apparatus of Mr. R. Knight, which is made of tin and silver exclusively, see the *Pharm. Journal* for May, 1857.

Hence, to preserve its briskness, it should be kept in strong well-corked bottles, placed inverted in a cool place. Several natural waters are of a similar nature; such as those of Seltzer, Spa, and Pyrmont; but the artificial water has the advantage of a stronger impregnation with the acid gas. Carbonic acid water should be made with every precaution to avoid metallic impurity. Hence the necessity of having the fountain well tinned on the inner surface. Even with this precaution, a slight metallic impregnation is not always avoided, especially in the winter season, when the water is less consumed as a drink, and, therefore, allowed to remain longer in the tubes and stop-cocks. Glass fountains are sometimes used with advantage at this season; and a patent has been taken out for a stoneware fountain, enclosed in tinned copper, which is said to answer a good purpose. When leaden tubes are employed to convey the water, it is liable to be contaminated with this metal, which renders it deleterious. A case of colica pictonum was treated by one of the authors, arising from the daily use of the first draught of carbonic acid water from a fountain furnished with tubes of lead. Tubes of pure tin, enclosed in lead ones to give them strength, are free from objection.

Copper fountains, well tinned, are liable to the objections that the tin lining wears away by use, and that there is no convenient means of inspecting their interior, owing to the solder joint, which permanently unites the two sections of the fountain. To remove the latter objection, the improvement has been proposed by Dr. R. O. Doremus, of New York, to have the two sections with flanges, securely bolted together, with intervening gutta-percha packing, in order to furnish facilities for examining the interior, to determine whether re-tinning is necessary. Sometimes drops of solder and chips of copper are carelessly left in the fountain, and form an additional source of danger. There can be no doubt that carbonic acid water is not unfrequently rendered poisonous by metallic impregnation. Dr. Doremus has proved, by a chemical examination, that lead and copper are sometimes present. (*Am. Journ. of Pharm.*, Sept. 1854, p. 422; from the *Am. Med. Monthly.*) Dr. John T. Plummer, of Richmond, Ind., has found lead. The latter metal is detected by sulphuretted hydrogen, which gives with it a black precipitate, and copper by ferrocyanide of potassium, which causes a brown precipitate. In testing for copper, a few drops of the reagent should be added to a glass of the suspected water, placed on a sheet of white paper, when, if even a minute proportion of copper be present, a brownish discoloration will be seen, upon looking down through the liquid.

Carbonic acid, formerly called *fixed air*, is a colourless gas, of a slightly pungent odour and acid taste. It reddens litmus feebly, and combines with salifiable bases, forming salts called carbonates, from which it is expelled by all the strong acids. It extinguishes flame, and is quickly fatal to animals when respired. All kinds of fermented liquors which are brisk or sparkling, such as champagne, cider, porter, &c., owe these properties to its presence. Its sp. gr. is 1·52. In 1823 it was liquefied by Faraday by a pressure of 36 atmospheres,* and in 1836 solidified by Thilorier, by taking advantage of the cold generated by the sudden gasefaction of the liquid acid, when freed from pressure. It is composed of one eq. of carbon 6, and two of oxygen $16=22$ (CO_2).

Medical Properties and Uses. Carbonic acid water is diaphoretic, diuretic, and anti-emetic. It forms a grateful drink to febrile patients, allaying thirst, lessening nausea and gastric distress, and promoting the secretion of urine. The quantity taken need only be regulated by the reasonable wishes of the patient. It also forms a very convenient vehicle for the administration of magnesia, the carbonated alkalies, sulphate of magnesium, and the saline cathartics generally; rendering these medicines less unpleasant to the palate, and, in irritable states of the stomach, increasing the chances of their being retained. When used for this purpose, six or eight fluidounces will be sufficient.

Carbonic acid gas was observed to act as a local anæsthetic in ulcerated cancer, so early as 1794, by Dr. John Evart, of Bath. In 1834 it was first used by Prof. Mojon, of Geneva, in dysmenorrhœa, and with the most soothing effect. Since then it has been employed with good effect, in certain painful affections of the uterus, by

* For properties of liquid carbonic acid, see *Journ. de Pharm.*, 4e sér., xvii. p. 200.

Prof. Simpson, of Edinburgh, and M. Follin, of Paris. M. Follin, M. Demarquay, and M. Monod have found it particularly useful in relieving the pain in cancer of the uterus and vagina. The first effect of the gas is a sensation of pricking and heat. Another application of carbonic acid by injection is for the production of premature labour. For this purpose it has been successfully employed by Prof. Scanzoni, of Wurzburg, and Prof. Simpson, of Edinburgh. According to Prof. Simpson, the gas is most conveniently generated by mixing, in a bottle, six drachms of crystallized tartaric acid with eight drachms of bicarbonate of sodium, dissolved in six fluidounces of water. B.

AQUA AMMONIÆ. *U. S.* LIQUOR AMMONIÆ. *Br.*, *U. S.* 1850. *Water of Ammonia. Solution of Ammonia.*

"Take of Chloride of Ammonium, in small pieces, Lime, each, *twelve troyounces;* Water *six pints;* Distilled Water *a sufficient quantity.* Pour a pint of the Water upon the Lime, in a convenient vessel; and, after it has slaked, stir the mixture so as to bring it to the consistence of a smooth paste. Then add the remainder of the Water, and mix the whole thoroughly together. Decant the milky liquid from the gritty sediment into a glass retort, of the capacity of sixteen pints, and add the Chloride of Ammonium. Place the retort on a sand-bath, and adapt to it a receiver, previously connected with a two-pint bottle, by means of a glass tube, reaching nearly to the bottom of the bottle, and containing a pint of Distilled Water. Surround the bottle with ice-cold water; and apply heat, gradually increased, until ammonia ceases to come over. Remove the liquid from the bottle, and add to it sufficient Distilled Water to raise its specific gravity to 0·960. Lastly, keep the liquid in small bottles, well stopped." *U. S.*

"Take of Strong Solution of Ammonia *one pint* [Imperial measure]; Distilled Water *two pints* [Imp. meas.]. Mix, and preserve in a stoppered bottle. Sp. gr. 0·959." *Br.*

The title of this preparation was changed, at the revision of the U. S. Pharmacopœia in 1860, from Liquor Ammoniæ to Aqua Ammoniæ, that it might conform in name as well as character with the Waters, among which all the officinal preparations consisting of aqueous solutions of gaseous bodies are included.

The object of the above processes is to obtain a weak aqueous solution of the alkaline gas ammonia. In the U. S. process, the chloride of ammonium is decomposed by the superior affinity of the lime for its acid, ammonia is disengaged, and the lime, combining with the acid, forms chloride of calcium and water. The process differs from that of 1850 in introducing the materials into the retort with a large quantity of water, instead of in the dry state. In both cases the gas is driven over by heat, but in the moist plan is accompanied with more watery vapour than in the dry. If the object were to obtain the water of ammonia in the highest possible state of concentration, there might be some advantage in the dry method; but, as a weak solution is contemplated, the wet method is equally efficient, while in all respects it is more convenient, and productive of better results; for, according to Dr. Squibb, the water of ammonia made by the former officinal process has invariably an empyreumatic odour, from which that made by the present process is free. (*Proceed. of the Am. Pharm. Assoc.*, 1858, p. 407.) The receiver is intended to retain any water holding in solution undecomposed chloride, or the oily matter sometimes contained in the salt, as well as other impurities, which may be driven over by the heat while the pure gas passes forward into the bottle containing the distilled water, which should not fill it, on account of the increase in the bulk of the water during the absorption of the gas. The tube should extend to near the bottom of the bottle, and pass through a cork, loosely fitting its mouth. To prevent the regurgitation of the water from the bottle into the intermediate vessel, the latter should be furnished with a Welter's safety tube. Large bottles are improper for keeping the water of ammonia; as, when they are partially empty, the atmospheric air within them may furnish a little carbonic acid to the ammonia.

In preparing solution of ammonia, equal weights of chloride of ammonium and lime are used for generating the gaseous ammonia. This proportion gives a great excess of lime, compared with the quantity required if determined by the equivalents; but

in practice it is found advantageous to have an excess, as well to ensure the full decomposition of the chloride of ammonium, as to make up for accidental impurities in the lime.

The British Pharmacopœia gives directions for diluting *Liquor Ammoniæ Fortior*, so as to reduce it to the strength of *Liquor Ammoniæ*. This is effected by mixing one measure of their stronger preparation with two measures of distilled water.

Properties. The properties of Aqua Ammoniæ Fortior have already been given. (See *page* 109.) Those of the officinal solution of ammonia, described in this place, are the same in kind, but weaker in degree. It should be quite free from empyreuma. Its sp. gr. in the U. S. Pharmacopœia is said to be 0·960; in the British, 0·959. When of the density 0·960, 100 grains of it saturate 30 grains of officinal sulphuric acid, and contain nearly 10 grains of ammonia. Of the British preparation, "85 grains by weight require for neutralisation 500 grain-measures of the *volumetric solution of oxalic acid*, corresponding to 10 per cent. by weight of ammonia, NH_3. One fluidrachm contains 5·2 grains of ammonia." *Br.* It is incompatible with acids, and with acidulous and many earthy and metallic salts; but it does not decompose the salts of lime, baryta, or strontia, and only partially decomposes those of magnesia. If precipitated by lime-water, the ammonia is partly carbonated. When saturated with nitric acid, it should give no precipitate with carbonate of ammonium, nitrate of silver, or chloride of barium. A precipitate with the first indicates earthy matter; with the second, muriatic acid or a chloride; with the third, sulphuric acid or a sulphate. Commercial solution of ammonia sometimes contains *pyrrol*, *napthalin*, and other soluble impurities. These may be detected by the solution being reddened by nitric acid, and, after having been supersaturated with muriatic acid, by its tinging a slip of fir wood of a rich purple colour, characteristic of pyrrol. (*Maclagan.*) The source of these impurities is coal-gas liquor, from which the ammoniacal compounds are largely obtained.

Composition. Water is capable of absorbing 670 times its volume of ammoniacal gas at 50°, and increases in bulk about two-thirds. But the officinal solution of ammonia is by no means a saturated one. Thus, the ammonia contained in the U. S. preparation is about 10 per cent. The following table gives the percentage of ammoniacal gas in aqueous solutions of different densities.

Specific Gravity.	Ammonia per cent.	Specific Gravity.	Ammonia per cent.	Specific Gravity.	Ammonia per cent.
0·8750	32·50	0·9326	17·52	0·9545	11·56
0·8875	29·25	0·9385	15·88	0·9573	10·82
0·9000	26·00	0·9435	14·53	0·9597	10·17
0·9054	25·37	0·9476	13·46	0·9619	9·60
0·9166	22·07	0·9513	12·40	0·9692	9·50
0·9255	19·54				

Medical Properties and Uses. Water of ammonia is stimulant, sudorific, antacid, and rubefacient. It stimulates more particularly the heart and arteries, without unduly exciting the brain. As a stimulant it is occasionally employed in paralysis, hysteria, syncope, asphyxia, and similar affections. In the same complaints it is often applied to the nostrils with advantage; but, in cases of insensibility, care must be taken not to carry the application too far, for fear of inducing dangerous and even fatal bronchitis. As an antacid, it is one of the best remedies in heartburn, and for the relief of sick headache when dependent on gastric acidity. In these cases it acts usefully also by stimulating the stomach. Mr. Jno. Grantham has derived great advantage in advanced whooping-cough from the steam of boiling ammoniated water. (*New Remedies*, Jan. 1872.) The injection of ammonia into a vein was brought forward by Prof. G. B. Halford, of Melbourne, as a specific against the poison of serpents, and some evidence has been adduced as to its value. As long ago, however, as 1782, Fontana published at Florence a series of experiments showing the uselessness of such injections as a remedy for snake-bite, and recently the subject has been elaborately investigated in India by Dr. Fayrer (*Indian Annals Med. Sci.*, 1872), and by a

Royal Commission (*London Lancet*, Sept. 1874), with the result of completely establishing the truth of the experiments and conclusions of Fontana. In collapse following severe accident, or in sudden cardiac failure from other acute cause, the intravenous injection of aqua ammoniæ has been of the greatest service in arousing the action of the heart. Half a drachm to a drachm diluted in half an ounce to an ounce of water may be slowly thrown directly into a vein. In some cases the drug has been simply used hypodermically. A dose of this solution, given in drunkenness, is said to remove the intoxication in a short time. A case of traumatic tetanus, in the care of Dr. Charbonnier, recovered under the use of six drops of water of ammonia given every half hour. (*Lancet*, July, 1867, p. 26.) It has been recommended by Dr. Guérard as an application to burns, attended with rubefaction or vesication, in order to relieve the pain and hasten the cure. (*Journ. de Pharm.*, Jan. 1849.) As a rubefacient it is employed united with oils in the form of volatile liniment. (See *Linimentum Ammoniæ.*) The dose is from ten to thirty drops, largely diluted with water to prevent its caustic effect on the mouth and throat. When swallowed in an overdose, its effects are those of a corrosive poison. A case is recorded in the *Journal de Pharmacie* (Avril, 1862, p. 324), in which about three fluidounces were swallowed, with a fatal result in eight days, after great suffering, and various local and systemic disorder. Dissection exhibited signs of inflammation and corrosion of the œsophagus and stomach, with great enlargement and softening of the mesenteric glands and kidneys. The best antidotes are vinegar and lemon juice, which act by neutralizing the ammonia, and must be promptly applied to be useful. The consecutive inflammation must be treated on general principles.

Pharm. Uses. To prepare Aconitia, *Br.;* Ammonii Chloridum Purificatum, *U. S.;* Antimonii Oxidum, *U. S.;* Beberiæ Sulphas, *Br.;* Bismuthi Subcarbonas, *U. S.;* Bismuthi Subnitras, *U. S.;* Calcis Phosphas, *Br.;* Calcii Phosphas Præcipitata, *U. S.;* Digitalinum, *U. S., Br.;* Ferri et Quiniæ Citras; Ferri Oxidum Hydratum, *U. S.;* Ferri Pyrophosphas, *U. S.;* Liquor Bismuthi et Ammoniæ Citratis, *Br.;* Liquor Ferri Citratis, *U. S.;* Morphia, *U. S.;* Morphiæ Acetas, *Br.;* Morphiæ Hydrochloras, *Br.;* Quiniæ Valerianas, *U. S.;* Santoninum, *Br.;* Strychnia; Veratria.

Off. Prep. Ammoniæ Benzoas, *Br.;* Ammonii Benzoas, *U. S.;* Ammonii Bromidum, *U. S.;* Ferri et Ammonii Citras, *U. S.;* Ferri et Ammoniæ Citras, *Br.;* Hydrargyrum Ammoniatum; Linimentum Ammoniæ; Linimentum Hydrargyri, *Br.;* Spiritus Ammoniæ Aromaticus, *U. S.* B.

AQUA AMYGDALÆ AMARÆ. *U. S.* *Bitter Almond Water.*

"Take of Oil of Bitter Almonds *sixteen minims;* Carbonate of Magnesium *sixty grains;* Water *two pints.* Rub the Oil, first with the Carbonate of Magnesium, then with the Water, gradually added, and filter through paper." *U. S.**

This preparation has the effects of hydrocyanic acid on the system, and may be used as a vehicle of other medicines in nervous coughs, and various spasmodic affections. It is, however, liable to spontaneous change, and is consequently more or less uncertain. A drop of sulphuric acid added to a pint of it will contribute to its preservation; as will also complete exclusion from the light and air. But the better plan is to prepare it in small quantities, as wanted for use. The dose of it, to begin with, when of full strength, should not exceed half a fluidounce. Under the same name, a preparation has been much used on the continent of Europe, prepared by distilling bitter almonds with water. This when fresh is much stronger than the preparation of the U. S. Pharmacopœia, containing, according to an analysis of Geiger, in 1000 parts, 1·2 parts of anhydrous hydrocyanic acid. But, in consequence either of circumstances in the manner of its preparation, or of changes upon being kept, it is of variable and uncertain strength, and cannot be relied on. It has been prescribed with fatal effects; and the greatest caution, therefore, should be observed by the apothecary not to put up the distilled water instead of the officinal.† W.

* Franz Hübner has employed *peach kernels* with excellent results. From 95 pounds he obtained, by cold expression, 25 pounds of a fixed oil, resembling that of benne seed, and afterwards, by warming, 8 pounds more of a darker oil. From the pressed cake remaining he obtained one hundred and ten pounds of hydrocyanic acid water, of the Prussian Pharmacopœia strength, viz., 6⅔ grs. AgCy from 960 grains of water. (*Amer. Journ. of Pharm.*, xlii. 240.)—*Note to the fourteenth edition.*

† In an experiment performed by M. Mayet, one kilogramme (about two avoirdupois pounds)

AQUA ANETHI. *Br. Dill Water.*

"Take of Dill Fruit, bruised, *one pound* [avoirdupois]; Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

This is seldom if ever used in the United States. W.

AQUA ANISI. *U. S. Anise Water.*

"Take of Oil of Anise *half a fluidrachm;* Carbonate of Magnesium *sixty grains;* Distilled Water *two pints.* Rub the Oil, first with the Carbonate of Magnesium, and then with the Water, gradually added, and filter through paper. Anise Water may also be prepared by mixing ten troyounces of Anise, in coarse powder, with sixteen pints of Water, and distilling eight pints." *U. S.*

This water is used solely as a vehicle. W.

AQUA AURANTII FLORUM. *U. S.* Aqua Aurantii Floris. *Br. Orange Flower Water.*

"Take of Orange Flowers *forty-eight troyounces;* Water *sixteen pints.* Mix them, and distil eight pints." *U. S.*

This preparation is considered by the British Pharmacopœia as an object of importation. According to this authority, it is obtained indiscriminately from the flowers of the bitter and those of the sweet orange tree; and the same is the case with our own officinal standard; though, in Italy and France, where it is largely made, the flowers of the bitter orange are preferred, as yielding the most fragrant product. It may be prepared in the most Southern districts of our country from the fresh flowers; and these might be brought to the North for the same purpose, if previously incorporated with one-third or one-quarter of their weight of common salt. The proper method is to arrange the flowers and salt in successive layers in jars of stoneware or glass. They may also be preserved by means of glycerin. (See *page* 1070.) Notwithstanding, however, the facility of preparing this Water here, it is generally imported from the South of France, whence it often comes in cans of tinned copper.

Orange flower water is nearly colourless, though usually of a pale yellowish tint. From being kept in copper bottles, it sometimes contains metallic impurity, which is said to be chiefly carbonate of lead, derived from the lead used as a solder in making the bottles. The means of detecting metallic impurity are mentioned under the general observations on distilled waters, *page* 1073. If it contain lead, sulphuretted hydrogen will produce with it a dark precipitate. Much colour, offensive odour, or mouldiness indicates impurity derived from the flowers in distillation.

A distilled water of the leaves is also prepared; and sometimes a mixture of the leaves and flowers is employed. But this is a fraud, as the distilled water of the leaves never has the sweet perfume of that of the flowers. (*Journ. de Pharm.*, 4e sér., iii. 249.)

Orange flower water is used exclusively on account of its agreeable odour; though it may possess slight powers as a nervous stimulant.

Off. Prep. Syrupus Aurantii Florum, *U. S.;* Syrupus Aurantii Floris, *Br.;* Trochisci Santonini, *U. S., Br.* W.

of bitter almond cake from which the fixed oil had been separated, having been finely powdered, and mixed with enough water to form a thin paste, was kept for a day at the temperature of 86° F., and then submitted to distillation by means of steam, with the following results. The products of distillation were collected in separate portions successively, each of 500 grammes (about a pint). The first portion was milky, immediately after distillation, but in two hours became clear, without the separation of oil; the others were limpid from the beginning. The first contained 0·250 per cent. of hydrocyanic acid, the second 0·070 per cent., the third 0·030, and the fourth 0·024 per cent. The mean of these (0·093) exceeded the percentage obtained by testing a mixture of the four in equal parts, which was only 0·088, owing to the necessity, in each examination, of slightly passing the point of saturation before catching with the eye the blue tint that indicates it. M. Mayet thinks, from these premises, that 0·08 per cent., or 80 milligrammes for 100 grammes, would be the proper mean to establish in regulating the strength of the bitter almond water, if two parts of product are to be obtained from one of the dry material employed. He would, however, prefer stopping the process when one part and a half had been obtained, in which case a 0·110 per cent. product might be procured, and it would be easy to fix the mean at 0·100 per cent. M. Mayet also satisfied himself that distillation by steam is decidedly preferable in this process to that by the naked fire, provided that *linen coated with dextrin* be employed for luting the apparatus, instead of common paper luting, which does not sufficiently resist steam. (*Journ. de Pharm.*, Juillet, 1861, p. 13.)—*Note to the twelfth edition.*

AQUA CAMPHORÆ. *U. S.*, *Br.* *Camphor Water.*

"Take of Camphor *one hundred and twenty grains;* Alcohol *forty minims;* Carbonate of Magnesium *half a troyounce;* Distilled Water *two pints.* Rub the Camphor, first with the Alcohol, then with the Carbonate of Magnesium, and lastly with the Water gradually added; then filter through paper." *U. S.*

"Take of Camphor, broken into pieces, *half an ounce* [avoirdupois]; Distilled Water *one gallon* [Imperial measure]. Enclose the camphor in a muslin bag, and attach this to one end of a glass rod, by means of which it may be kept at the bottom of a bottle containing the Distilled Water, the other end of the rod terminating just below the stopper of the bottle. Having thus put the Camphor into the Water, close the mouth of the bottle for at least two days, and then pour off the solution when it is required." *Br.*

In these processes the object is to effect a solution of the camphor. Water is capable of dissolving but a small proportion of this principle; but the quantity varies with the method employed. The present British process is still more inefficient than the old formulas of the different Colleges for their *Mistura Camphoræ*, which has received in the late revision a much more appropriate name. In the *London* process the camphor was first rubbed with a little spirit to powder it, and then with water; in the *Edinburgh*, sugar and almonds were used as an intermedium by which the water might be induced to take up the camphor; in the *Dublin*, the spirit of camphor was shaken with water. All of them produced very weak preparations. In the present British process no trouble is taken even to comminute the camphor, or to shake it with the water, which is thus allowed to take up what it may be disposed to do by contact with the camphor contained in a bag; though some ingenuity is exhibited in retaining the latter, which is lighter than water, beneath the surface of the liquid by means of a glass rod. The solution thus effected must be extremely feeble, containing probably less than one part in a thousand, which, according to Berzelius, is taken up by water when triturated with camphor. It is besides of uncertain strength, varying with the size of the fragments of camphor. Mr. J. C. Pooley found that 120 grains of camphor, treated according to the officinal directions, gave, when cut into 4 pieces, 6 grains to half a gallon of water, but in 20 pieces gave 20 grains, or about one part to 1750 of water. (*Pharm. Journ. and Trans.*, 2d ser.; vii. 162.) Our own officinal preparation, when properly made, contains about 50 grains to the pint, or more than 3 grains in each fluidounce. (*Journ. of the Phil. Col. of Pharm.*, iv. 13.) This, however, is denied by Mr. G. F. H. Markoe, who, as the result of his experiments, gives the proportion of camphor in the U. S. preparation as only 2 grains in the fluidounce. (*Amer. Journ. of Pharm.*, March, 1866, p. 168.) Care should be taken to rub all the water, in successive portions, with the mixture of camphor and carbonate of magnesium. The comparative strength of the U. S. preparation is attributable, at least in part, to the minute division effected in the camphor by trituration with the carbonate of magnesium, which is afterwards separated by filtration. The use of the alcohol is simply to break down the cohesion of the camphor, and enable it to be more easily pulverized. This process is much preferable to the British, as it affords a permanent solution, of sufficient strength to be employed with a view to the influence of the camphor on the system; while the other has little more than the flavour of the narcotic, and is fit only for a vehicle of other medicines. Several improvements have been suggested in it, and very probably with propriety some of them might be adopted in the officinal formula. Mr. Wm. B. Addington adds to the camphor just enough alcohol to dissolve, and triturates the liquid with magnesia, during which process he affirms that the alcohol evaporates (*Amer. Journ. of Pharm.*, xlv. 209); and Mr. F. T. Hartzell substitutes for alcohol, ether, a few drops of which enable him to bring the camphor to an impalpable powder. (*Ibid.*, xlvi. 233.) The camphor is separated by a solution of pure potassa, and, according to Dr. Paris, by sulphate of magnesium and several other salts. Sir J. Murray proposes a solution of camphor and bicarbonate of magnesium, which contains three grains of the former and six grains of the latter in each fluidounce.

Camphor water is employed chiefly in low fevers and typhoid diseases, attended with restlessness, slight delirium, or other symptoms of nervous derangement or de-

bility. It is used also to allay uterine after-pains. It has this advantage over camphor in substance, that the latter is with difficulty dissolved by the liquors of the stomach; but it is not applicable to cases where very large doses of the medicine are required. It is usually given in the dose of one or two tablespoonfuls repeated every hour or two hours. W.

AQUA CARUI. *Br. Caraway Water.*

"Take of Caraway Fruit, bruised, *one pound* [avoirdupois]; Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

Distilled caraway water has the flavour and pungency of the seeds, but is seldom used in this country. The preparation employed here is usually made from the volatile oil, in the same manner as cinnamon water. (See *Aqua Cinnamomi.*) W.

AQUA CHLORINII. *U. S.* Liquor Chlori. *Br. Chlorine Water. Solution of Chlorine.*

"Take of Black Oxide of Manganese, in fine powder, *half a troyounce;* Muriatic Acid *three troyounces;* Water *four fluidounces;* Distilled Water *twenty fluidounces.* Introduce the Oxide into a flask, add the Acid previously diluted with two fluidounces of the Water, and apply a gentle heat. Conduct the generated chlorine, by suitable tubes, through the remainder of the Water contained in a small intermediate vessel, to the bottom of a four-pint bottle containing the Distilled Water, and loosely stopped with cotton. When the air has been entirely displaced by the gas, disconnect the bottle from the apparatus, and, having inserted the stopper, agitate the contents, loosening the stopper from time to time, until the gas ceases to be absorbed. Lastly, pour the Chlorine Water into a bottle, of just sufficient capacity to hold it, stop it securely, and keep it in a cool place, protected from the light." *U. S.*

"Take of Hydrochloric Acid *six fluidounces* [Imperial measure]; Black Oxide of Manganese, in fine powder, *one ounce* [avoirdupois]; Distilled Water *thirty-four fluidounces* [Imp. meas.]. Put the Oxide of Manganese into a gas-bottle, and, having poured upon it the Hydrochloric Acid diluted with two [fluid]ounces of the Water, apply a gentle heat, and, by suitable tubes, cause the gas, as it is developed, to pass through two [fluid]ounces of the Water placed in an intermediate small phial, and thence to the bottom of a three-pint bottle containing the remainder of the Water, the mouth of which is loosely plugged with tow. As soon as the chlorine ceases to be developed, let the bottle be disconnected from the apparatus in which the gas has been generated, corked loosely, and shaken until the chlorine is absorbed. Lastly, introduce the solution into a green glass bottle furnished with a well-fitting stopper, and keep it in a cool and dark place." *Br.*

The U. S. and Br. processes are essentially the same; and both were copied from the late Dublin process. The only material variation in the British formula is the somewhat larger proportion of the black oxide of manganese and muriatic acid, to the distilled water; an avoirdupois ounce of the oxide and six fluidounces of the acid having been substituted for half the quantity of each as directed by the Dublin College, while the distilled water used by the former is only thirty-four fluidounces to twenty-four by the latter, of which quantities four fluidounces are taken by each in the preliminary steps of the process, and the remainder used for the absorption of the chlorine. In the U. S. formula, the proportions differ from those of the Dublin, in the use of the troyounce, both for the oxide of manganese and the acid, instead of the avoirdupois ounce for the former and the fluidounce for the latter. The British process differs from both in directing the disconnection of the apparatus for generating the gas, as soon as it ceases to be produced, instead of after the air in the receiving bottle has been displaced by it. Should there be any danger of deficiency of chlorine in the resulting chlorine water, the British process would have the advantage, as it uses not only a larger proportion of the materials for making the gas, but exhausts them.

In the U. S. process, four fluidounces of common water are used in the dilution of the muriatic acid, and for absorbing the impurities in the intermediate vial. The twenty fluidounces of distilled water are placed in a four-pint bottle, which it about one-third fills. In both processes, the chlorine gas is extricated from the muriatic

acid by the deutoxide of manganese* separating the hydrogen,† and is passed, through an intermediate vessel containing a little water for purifying it, into the four-pint bottle, loosely stopped, until the vacant part of the bottle is filled with it to the exclusion of the atmospheric air. The bottle being then corked, is shaken so as to cause the absorption of the gas by the water. Of course the stopper must be from time to time loosened, in order to allow the entrance of air to supply the partial vacuum created by the absorption of the chlorine. The product is about a pint and a quarter of the chlorine water, which is transferred to a bottle just sufficient in capacity to hold it. The chlorine water is directed to be kept secluded from the light, because otherwise it would be apt to be converted partially into muriatic acid, through the union of the chlorine with the hydrogen of the water. In the Br. Pharmacopœia it is ordered to be kept in a green glass bottle, for the purpose, probably, of protecting it from the light; but recent experiments have shown that it is an orange, and not a green colour, which appears to prevent the passage of the chemical rays.

An extemporaneous chlorine water, containing chloride of potassium and free muriatic acid, not more than twenty-four and twelve grains respectively to the pint, may be made as follows. Put in a bottle forty grains of chlorate of potassium, add one-half troyounce of muriatic acid, C. P. When the bottle begins to be filled with chlorine vapors, add one fluidounce of distilled water. Stopper the bottle, and, when the crystals have dissolved, add distilled water to a pint. (*Am. Journ. of Pharm.*, xlii. 208.)

Properties. Chlorine water has a pale yellowish-green colour, an astringent taste, and the peculiar odour of the gas. Like gaseous chlorine it destroys vegetable colours. When cooled to about the freezing point, it forms deep-yellow crystalline plates, consisting of hydrate of chlorine. It is intended to contain at least twice its volume of the gas. It is decomposed by light, with the production of muriatic acid, and the evolution of oxygen, and hence must be kept in a dark place. According to MM. Riegel and Walz, chlorine water, containing two and a half volumes of the gas at 54°, keeps best. The U. S. Pharmacopœia gives as a test of its strength in chlorine, that "when a fluidounce of it is mixed with a solution of 10 grains of pure sulphate of protoxide of iron in two fluidrachms of water, the mixture does not produce a blue precipitate with ferridcyanide of potassium (red prussiate of potassa)." This shows that there is sufficient chlorine in the Water to peroxidize the protoxide of iron of the protosulphate; as, though the protosalts of iron do, the persalts do not produce a blue precipitate with the ferridcyanide. The British solution "immediately discharges the blue colour of a dilute solution of indigo. Its sp. gr. is 1·003, and when evaporated it leaves no residue. When 20 grains of iodide of potassium, dissolved in a [fluid]ounce of distilled water, are added to 439 grains by weight (one fluidounce) of this preparation, the mixed solution acquires a deep-red colour, which requires for its discharge 750 grain-measures of the *volumetric solution of the hyposulphite of soda*, corresponding to 2·66 grains of chlorine." *Br.* This indicates the quantity of chlorine in the solution, by the amount of the hyposulphite required to decolorize an equivalent quantity of iodine, liberated from the iodide of potassium.

Chlorine is an elementary gaseous fluid of a greenish-yellow colour, and characteristic smell and taste. It is a supporter of combustion. Its specific gravity is 2·47, and equivalent number 35·5. When the attempt is made to breathe it, even much diluted, it excites cough and a sense of suffocation, and causes a discharge from the mucous membrane of the nostrils and bronchial tubes. Breathed in considerable quantities, it produces spitting of blood, violent pains, and sometimes death.

Medical Properties and Uses. Chlorine water is stimulant and antiseptic. Internally it has been used in typhus, and chronic affections of the liver; but the diseases in which it has been most extolled are scarlatina, malignant sorethroat, and diph-

* The deutoxide of manganese is of course deoxidized. In manufacturing chlorine on the large scale, it is of great importance to reoxidize the manganese, so that it can be used over again. For methods of doing this and for other improvements in the manufacture of chlorine, see *Chemical News*, Sept. 1867; also March, 1870, p. 121, Sept. 1870, p. 145, and May, 1872, p. 210; *Am. Journ. of Pharm.*, Nov. 1869, p. 538; *Journ. de Pharm.*, Nov. 1875, p. 91. (*Note to the fourteenth edition.*)

† *Deacon's process.* Mr. Henry Deacon, jr., has discovered that chlorine may be made by passing hydrochloric acid vapour and oxygen over sulphate of copper at a temperature from 400° to 700° F., the copper salt coming out unchanged. For details of this process the reader is referred to *Chemical News*, xxii., 1870, p. 157, and *Journ. de Pharm.*, Fev. 1875. (*Note to the fourteenth edition.*)

theria. Mr. Wm. M. Dobie found it more effectual in an epidemic of that disease which appeared in Chester, England, in the autumn of 1866, than any other remedy. (*Edin. Med. Journ.*, March, 1867, p. 829.) It is said, also, by Dr. Althaus, to have been used in a late epidemic of the same disease in Germany with highly satisfactory results. (*Med. Times and Gaz.*, July, 1868, p. 56.) Externally it is employed, duly diluted, as a gargle in smallpox, scarlatina, and putrid sorethroat, as a wash for ill-conditioned ulcers and cancerous sores, and as a local bath in diseases of the liver. It has been used with advantage as an application to buboes and large abscesses, to promote the absorption of the matter. As it depends upon chlorine for its activity, its medical properties coincide with those of chlorinated lime, chlorinated soda, and nitromuriatic acid, under which heads they are more particularly given. The dose of chlorine water is from one to four fluidrachms, properly diluted. It should not be prescribed in mixtures, almost all organic substances causing a rapid disappearance of the chlorine. Even sugar has this action, and glycerin still more markedly. (*Am. Journ. of Pharm.*, xliv. 163.)

Gaseous chlorine has been recommended by Gannal in chronic bronchitis and pulmonary consumption, exhibited by inhalation, in minute quantities, four or six times a day. Its first effect is to produce some dryness of the fauces, with increased expectoration for a time, followed ultimately with diminution of the sputa and amendment. Dr. Christison states that he has repeatedly observed these results in chronic catarrh; and both he and Dr. Elliotson have obtained, in consumption, a more decided improvement of the symptoms by the use of chlorine inhalations than by any other means. The liquid in the inhaler may be formed either of water containing from ten to thirty drops of chlorine water, or of chlorinated lime dissolved in forty parts of water, to which a drop or two of sulphuric acid must be added, each time the inhalation is practised. The inhaler should be placed in water heated to about 100°. B.

AQUA CHLOROFORMI. *Br. Chloroform Water.*

"Take of Chloroform *one fluidrachm* [Imp. meas.]; Distilled Water *twenty-five fluidounces* [Imp. meas.]. Put them into a two-pint stoppered bottle, and shake them together until the Chloroform is entirely dissolved in the Water." *Br.*

This water contains one-half per cent. of chloroform, and is probably fully saturated. The dose is one-half to two fluidounces. W.

AQUA CINNAMOMI. *U. S., Br. Cinnamon Water.*

"Take of Oil of Cinnamon *half a fluidrachm;* Carbonate of Magnesium *sixty grains;* Distilled Water *two pints.* Rub the Oil first with the Carbonate of Magnesium, then with the Water, gradually added, and filter through paper.

"Cinnamon Water may also be prepared by mixing *eighteen troyounces* of Cinnamon, in coarse powder, with *sixteen pints* of Water, and distilling eight pints." *U. S.*

"Take of Cinnamon Bark, bruised, *twenty ounces* [avoirdupois]; Water *two gallons* [Imperial measure]. Distil a gallon [Imp. meas.]." *Br.*

Of these processes, the first one of the U. S. Pharmacopœia is the easier, though the second, which corresponds with the British, may yield a sweeter product. On standing, cinnamon water is apt to precipitate, according to Mr. E. Backhaus; this can be prevented by passing a stream of carbonic acid through the fresh water for a few minutes. Cinnamon water is much used as a vehicle for other less agreeable medicines; but should be given cautiously in inflammatory affections. For ordinary purposes the U. S. preparation is sufficiently strong when diluted with an equal measure of water.*

Off. Prep. Mistura Cretæ; Mistura Guaiaci, *Br.;* Mistura Spiritus Vini Gallici, *Br.* W.

AQUA CREASOTI. *U. S. Creasote Water.*

"Take of Creasote *a fluidrachm;* Distilled Water *a pint.* Mix them, and agitate the mixture until the Creasote is dissolved." *U. S.*

This preparation contains 3·72 minims of creasote in each fluidounce, and affords

* In a letter to the author by Dr. E. Holmes, glycerin is recommended as an excellent intermedium between the oil of cinnamon and water. Ten drops of glycerin will effect a solution of a drop of the oil in a fluidounce of water. (*Note to the thirteenth edition.*)

a convenient method of administering that medicine. The dose is from one to four fluidrachms. It may also be used with advantage as a gargle, lotion, or mixed with cataplasms, to correct fetor, and gently stimulate indolent surfaces. W.

AQUA FŒNICULI. *U. S., Br. Fennel Water.*

"Take of Oil of Fennel *half a fluidrachm;* Carbonate of Magnesium *sixty grains;* Distilled Water *two pints.* Rub the Oil, first with the Carbonate of Magnesium, then with the Water, gradually added, and filter through paper.

"Fennel Water may be prepared by mixing *eighteen troyounces* of Fennel, in coarse powder, with *sixteen pints* of Water, and distilling eight pints." *U. S.*

"Take of Fennel Fruit, bruised, *one pound* [avoirdupois]; Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

Fennel water is an agreeable vehicle for other medicines, and useful when a mild aromatic is indicated. W.

AQUA LAURO-CERASI. *Br. Laurel Water. Cherry-laurel Water.*

"Take of Fresh Leaves of Common Laurel [cherry-laurel] *one pound* [avoirdupois]; Water *two pints and a half* [Imperial measure]. Chop the Leaves, crush them in a mortar, and macerate them in the Water for twenty-four hours; then distil one pint [Imp. meas.] of liquid. Shake the product, filter through paper, and preserve it in a stoppered bottle." *Br.*

As the cherry-laurel is little cultivated in the United States, the Water is not officinal; but from experiments by the late Prof. Procter, there is little or no room to doubt that a preparation, identical in its effects, might be made from the leaves of our common wild cherry, *Cerasus serotina*, were a demand for the medicine to spring up among us. The imported cherry-laurel water, as found in our shops, is generally more or less impaired by age, and cannot, therefore, be relied on.

In the former edition of the Dispensatory it was stated that the best plan of preparing this water is "to thoroughly bruise the leaves, and, having mixed them with at least three times their weight of water, to allow the mixture to stand at a temperature of about 86° F. for at least twelve hours, so that opportunity may be given for those reactions by which the hydrocyanic acid is produced, and then to distil them by means of a current of steam. Without the preliminary maceration the distillation by steam does not afford a satisfactory result; but properly performed, it yields the largest possible product. (*Journ. de Pharm.*, Juillet, 1861, p. 15; and Juin, 1864, p. 523.)" More recent investigations have, however, thrown great doubt upon this statement. Cherry-laurel leaves contain 65 per cent. of water, sufficient to provoke the reactions which result in the formation of a volatile oil and hydrocyanic acid. Water is very prone to hasten the conversion of the volatile oil into benzoic acid by oxidation, and it has been found by Mr. C. Umney (*Pharm. Journ. and Trans.*, x. 467) and by Dr. Moore (*Ibid.*, 604) that the water distilled without previous maceration is somewhat stronger in hydrocyanic acid and decidedly stronger in oil (Umney) than the officinal product. The strength of officinal cherry-laurel water is so uncertain as to render it ineligible. It is really a powerful preparation, being about one-twentieth the strength of the officinal hydrocyanic acid (Br. Ph.), and yet in the shops it varies as 53 to 100 (Umney). The difference depends upon the age of the preparation, the mode of preparing, and the time of year at which the leaves are gathered. M. Garot (*Annuaire de Thérap.*, 1843, p. 45) has found that the leaves yield only half as much in July as in April. Mr. C. Umney obtained 1·26 grains of acid in 1000 grains in March, in July 1·08 grains, and in November 0·64. (*Pharm. Journ. and Trans.*, x. 468.) Dr. Moore, in an elaborate series of experiments, obtained the largest product in July of one year and in October of the next. Mr. Leger (*Ibid.*, June, 1873) has found the maximum percentage in July, and also that different leaves taken from the same bush on the same day vary enormously; young leaves being much richer than old ones. It is evidently impossible to get a uniform cherry-laurel water, except by following the plan of the French Codex* of testing the product

* The following conclusions, in reference to Cherry-laurel water, were arrived at by a committee of pharmaceutists in Paris, appointed to examine the subject of the distilled waters with a view to the revision of the Codex. 1. The whole of the volatile oil and hydrocyanic acid furnished by cherry-laurel leaves, results from a reaction between two substances analogous to the emulsin and

and bringing it to a definite uniform strength; in the French Codex this is 50 milligrammes of acid to a cubic centimetre. The proportion of hydrocyanic acid in the Water diminishes with time. It has been ascertained by M. Deschamps that, if a drop of sulphuric acid be added to a pint of the preparation, it will keep unchanged for at least a year. It is best preserved by the entire exclusion of air and light. M. Lepage found that, preserved in full and perfectly air-tight bottles, both this and bitter-almond water remained unchanged at the end of a year; while if freely exposed to the air, they lost all their hydrocyanic acid and essential oil in two or three months. (*Journ. de Pharm.*, xvi. 346.) In view of the uncertain strength of the Water as obtained from the leaves, it was proposed in France, in reference to the Codex then in preparation, to fix upon a definite proportion of hydrocyanic acid; and the percentage generally adopted was from 0·04 to 0·05. Cherry-laurel water is employed in Europe as a sedative narcotic, identical in its properties with a dilute solution of hydrocyanic acid; but it is of uncertain strength, and should not be allowed to supersede the more definite preparation of the acid now in use. Its fraudulent use in Paris in the preparation of a cordial, in imitation of the genuine cherry cordial, made by fermentation and distillation, and like it called "*kirsch*," has been the subject of no little reprobation. (*Journ. de Pharm. et de Chim.*, 4e sér., i. 33, A. D. 1865.) The dose is from thirty minims to a fluidrachm. W.

AQUA MENTHÆ PIPERITÆ. *U. S., Br. Peppermint Water.*

Take of Oil of Peppermint *half a fluidrachm;* Carbonate of Magnesium *sixty grains;* Distilled Water *two pints.* Rub the Oil, first with the Carbonate of Magnesium, then with the Water, gradually added, and filter through paper.

"Peppermint Water may also be prepared by mixing *eighteen troyounces* of Peppermint with *sixteen pints* of Water, and distilling eight pints." *U. S.*

Take of Oil of Peppermint *one fluidrachm and a half;* Water, *one gallon and a half* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

Off. Prep. Mistura Ferri Aromatica, *Br.* W.

AQUA MENTHÆ VIRIDIS. *U. S., Br. Spearmint Water.*

Both in the U. S. and Br. Pharmacopœias, this is prepared precisely as Peppermint Water, the oil and herb of M. viridis being substituted in the processes for those of M. piperita.

The two mint waters are among the most grateful and most employed of this class of preparations. Together with cinnamon water, they are used in this country, almost to the exclusion of all others, as the vehicle of medicines given in the form

amygdalin of bitter almonds, which can take place only in the presence of water. 2. The quantity of volatile oil furnished by the leaves is always in direct relation to that of hydrocyanic acid. 3. The leaves furnish, by mere contact for 24 hours with cold water, only one-third of the quantity which they can be made to yield. 4. The fermentable matter of the leaves is liable to change, so that the leaves, after being picked, afford less and less of the acid the longer they are kept; and a moist heat favours change; so that complete decomposition takes place in a few hours. 5. Difference in climate, soil, exposure to the sun, and age of the tree, have but a secondary influence on the productiveness of the leaves. 6. The season of the year, however, has a great influence. The younger the leaf, the greater is its yield; so that, while 0·150 per cent. of the acid was obtained from the forming leaves in spring, those of the autumn yielded only 0·132, those of the winter 0·120, and leaves two years old gave only 0·112. 7. Different plants, under apparently the same circumstances, differ greatly in productiveness, so that 0·176 per cent. was obtained from the most productive, and only 0·092 from the least so. 8. The distillation by steam yields the greatest possible product. The committee, therefore, propose the adoption of this method; the bruised leaves being preliminarily mixed with at least three times their weight of water, and exposed to a gradually increasing heat, not to exceed 140° F., when all reaction ceases. 9. Bruising is the best method of comminuting the leaves. 10. As it is impossible to obtain a Water always identical from the leaves, the committee propose to fix a definite strength, and state that the proportion generally adopted is from 0·040 per cent. of acid as the minimum, to 0·050, or one-twentieth of one per cent. as the maximum, which is only one-half the strength proposed for bitter-almond water. 11. Though a change rapidly takes place in this and bitter-almond water exposed to the air, yet in bottles full, and perfectly closed by glass stoppers, the change at the end of a year is scarcely perceptible; and this observation applies to the distilled waters in general. (*Journ. de Pharm.*, Juin, 1864, p. 520.)

For some remarks as to an easy volumetric method of estimating the hydrocyanic acid strength of cherry-laurel and bitter-almond waters, as well as of other liquids containing this acid, together with the figure of a simple instrument for the purpose, see a paper by Dr. W. H. Pile, in the *American Journal of Pharmacy*, March, 1862, p. 130. (*Note to the twelfth edition.*)

of mixture. They serve not only to conceal or qualify the taste of other medicines, but also to counteract their nauseating properties. Peppermint water is generally thought to have a more agreeable flavour than that of spearmint, but some prefer the latter. Their effects are the same. W.

AQUA PIMENTÆ. *Br. Pimento Water.*

"Take of Pimento, bruised, *fourteen ounces* [avoirdupois]; Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

Pimento water is brownish when first distilled, and upon standing deposits a brown resinous sediment. It is used as a carminative in the dose of one or two fluidounces. W.

AQUA ROSÆ. *U. S., Br. Rose Water.*

"Take of Pale Rose *forty-eight troyounces;* Water *sixteen pints.* Mix them and distil eight pints.

"When it is desirable to keep the Rose for some time before distilling, it may be preserved by being well mixed with half its weight of Chloride of Sodium." *U. S.*

"Take of Fresh Petals of the Hundred-leaved Rose *ten pounds* [avoirdupois] (or an equivalent quantity of the petals preserved while fresh with common salt); Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

It should be observed that, in the nomenclature of the U.S. Pharmacopœia, the term "Rose" implies only the petals of the flower. These are usually preferred in the recent state; but it is said that, when preserved by being incorporated with one-third of their weight of common salt, they retain their odour, and afford a water equally fragrant with that prepared from the fresh flower. Indeed, Mr. Haselden prefers the salted roses, believing that the water prepared from them is less mucilaginous, less apt to become sour, and preserves its odour better than that prepared from the fresh flowers. (*Pharm. Journ.*, xvi. 15.) Hence the direction for preserving them in the present U.S. Pharmacopœia. It is not uncommon to employ the whole flower including the calyx; but the product is less fragrant than when the petals only are used, as officinally directed.* Rose water is sometimes made by distilling together water and the oil of roses.

When properly prepared, it has the delightful perfume of the rose in great perfection. It is most successfully made on a large scale. Like the other distilled waters it is liable to spoil when kept; and the alcohol which is sometimes added to preserve it is incompatible with some of the purposes to which the water is applied, and is even said to render it sour through acetous fermentation. It is best, therefore, to avoid this addition, and to substitute a second distillation. This distilled water is chiefly employed, on account of its agreeable odour, in collyria and other lotions. It is wholly destitute of irritating properties, unless when it contains alcohol.†

* A. Monthus states that the petals of the hundred-leaved rose are more odorous the nearer they are to the centre of the flower, and, contrary to what is said in the text, thinks that the calyx should not be rejected in preparing the distilled water. He maintains that so far from injuring the product, it in fact contributes to its preservation, and that the water obtained from the whole flower is less liable to that mucosity, which is the commencement of decomposition. This effect he ascribes to the astringent matter of the calyx, which coagulates the mucilaginous matter of the petals, and thus prevents it from passing over in the distillation. (*Journ. de Pharm.*, Dec. 1863, p. 497.)—*Note to the twelfth edition.*

† *Artificial Rose Water.* Prof. Wagner, of Germany, prepares a distilled water from the *oil of gaultheria*, with an odour so closely resembling that of the rose as to be entitled to this designation. He boils the oil with solution of potassa, thereby obtaining salicylate of potassium, the mother-liquor of which, when distilled with water, yields the preparation in question. (*Chem. Gaz.*, No. 382, p. 352; from *Wagner's Jahresbericht*, A. D. 1856, p. 260.)—*Note to the twelfth edition.*

Milk of Roses. In making this cosmetic it is essential to produce an emulsion which, if it separates after long repose, may be restored by slight agitation. Although other perfumes may be, and are commonly added to it, the scent of roses should predominate and form its characteristic odour. There are three varieties, the English, French, and German. The latter variety should never be employed as a cosmetic on account of containing lead.

English. Almonds (blanched) 1½ ounce; Oil of Almonds and White Windsor Soap, of each, 1 drachm; Rose Water ¾ pint. Make an emulsion; to the strained emulsion add a mixture of Essence or Spirit of Roses ½ fluidrachm; Alcohol 2½ fluidounces; and subsequently of Rose Water q. s. to make the whole measure one pint; more alcohol is apt to cause the separation of the ingredients. Some makers add a few drops of oil of bergamot, with two or three drops each of oil of lavender and otto of roses, dissolved in the alcohol.

Or, Oil of Almonds and White Windsor Soap, of each, 1 ounce; Salts of Tartar ½ drachm; Boiling Water ¼ pint. Triturate, and subsequently agitate until perfectly united. When cold,

Off. Prep. Confectio Rosæ, *U. S.;* Mistura Ferri Composita; Trochisci Bismuthi, *Br.;* Unguentum Aquæ Rosæ, *U. S.* W.

AQUA SAMBUCI. *Br. Elder-flower Water.*

"Take of fresh Elder Flowers, separated from the stalks, *ten pounds* [avoirdupois] (or an equivalent quantity of the flowers preserved while fresh with common salt); Water *two gallons* [Imperial measure]. Distil one gallon [Imp. meas.]." *Br.*

Elder flowers yield very little oil upon distillation; and, if the water be needed, it may be best prepared from the flowers. Mr. Haselden prefers the salted flowers to the fresh, for the reason stated under Rose Water. The preparation is little used in this country. W.

ARGENTUM.

Preparations of Silver.

ARGENTI CYANIDUM. *U. S.* ARGENTI CYANURETUM. *U. S.* 1850. *Cyanide of Silver. Cyanuret of Silver.*

"Take of Nitrate of Silver, Ferrocyanide of Potassium, each, *two troyounces;* Sulphuric Acid *a troyounce and a half;* Distilled Water *a sufficient quantity.* Dissolve the Nitrate of Silver in a pint of Distilled Water, and pour the solution into a tubulated glass receiver. Dissolve the Ferrocyanide of Potassium in ten fluidounces of Distilled Water, and pour the solution into a tubulated retort, previously adapted to the receiver. Having mixed the Sulphuric Acid with four fluidounces of Distilled Water, add the mixture to the solution in the retort, and distil, by means of a sand-bath, with a moderate heat, until six fluidounces have passed over, or until the distillate no longer produces a precipitate in the receiver. Lastly, wash the precipitate with Distilled Water, and dry it." *U. S.*

This preparation was introduced into the U. S. Pharmacopœia for the purpose of being used in the extemporaneous preparation of diluted hydrocyanic acid. (See *page* 998.) By the formula adopted in the Pharmacopœia of 1840, the officinal hydrocyanic acid was added to a solution of nitrate of silver. The expenditure in this way of the officinal acid, which is very weak, and at the same time nicely adjusted to a given strength, was injudiciously directed; and, accordingly, that formula was abandoned, and a new process adopted in the Pharmacopœia of 1850, and continued to the present, in which all the silver contained in a given weight of nitrate of silver, placed in a receiver in solution, is converted into cyanide by hydrocyanic acid, extricated from ferrocyanide of potassium by the action of sulphuric acid. By a double decomposition between the oxide of silver of the nitrate and the hydrocyanic acid, water and cyanide of silver are formed in the receiver, the latter of which precipitates. The materials in the retort are sufficient to produce a little more hydrocyanic acid than is necessary to convert the whole of the silver in the receiver into cyanide; so that the complete decomposition of the nitrate of silver is ensured.

According to Messrs. Glassford and Napier, the best way of obtaining cyanide of silver is to add cyanide of potassium to a solution of nitrate of silver so long as a precipitate is formed.

Properties. Cyanide of silver is a tasteless white powder, insoluble in water and cold nitric acid, but readily soluble, with decomposition, in that acid when boiling hot. It is decomposed by muriatic acid, exhaling the odour of hydrocyanic acid. It is not soluble in potassa or soda, but readily so in ammonia. Its best solvent is cyanide of potassium. When heated it is decomposed, cyanogen being evolved, and metallic

further add Alcohol 2 fluidounces; Spirit of Roses a few drops; Rose Water q. s. to make the whole measure a pint.

French. Tincture of Benzoin (simple) ½ fluidounce; Tincture of Styrax ¼ fluidounce; Spirit of Roses 1 to 2 fluidrachms; Alcohol 2½ fluidounces. Mix, and add gradually, with agitation, Rose Water 16½ fluidounces. Augustin recommends the addition of a little carbonate of potassium (say 1 drachm to the pint) when it is intended to be used as a lotion in acne.

Or, Tincture of Benzoin (simple) 1 fluidrachm; Tincture of Balsam of Peru 20 drops; Rose Water ½ pint. The addition of an ounce of alcohol, in lieu of a like quantity of rose water, improves it.

German. Dilute solution of Diacetate of Lead ½ fluidounce; Lavender Water 2 fluidrachms; Alcohol 2½ fluidounces; Rose Water ¾ of a pint. Mix and agitate. (*Note to the fourteenth edition.*)

silver left. It consists of one eq. of cyanogen 26, and one of silver 108 = 134. It has no medical uses.

Off. Prep. Acidum Hydrocyanicum Dilutum, *U. S.* B.

ARGENTI NITRAS. *U. S., Br. Nitrate of Silver. Nitrate of Silver in Crystals.*

"Take of Silver, in small pieces, *two troyounces;* Nitric Acid *two troyounces and a half;* Distilled Water *a sufficient quantity.* Mix the Acid with a fluidounce of Distilled Water in a porcelain capsule, add the Silver to the mixture, cover it with an inverted glass funnel, resting within the edge of the capsule, and apply a gentle heat until the metal is dissolved, and red vapours cease to be produced; then remove the funnel, and, increasing the heat, evaporate the solution to dryness. Melt the dry mass, and continue the heat, stirring constantly with a glass rod, until free nitric acid is entirely dissipated. Dissolve the melted salt, when cold, in six fluidounces of Distilled Water, allow the insoluble matter to subside, and decant the clear solution. Mix the residue with a fluidounce of Distilled Water, filter through paper, and, having added the filtrate to the decanted solution, evaporate the liquid until a pellicle begins to form, and set it aside in a warm place to crystallize. Lastly, drain the crystals in a glass funnel until dry, and preserve them in a well-stopped bottle. By evaporating the mother-water, more crystals may be obtained." *U. S.*

"Take of Refined Silver *three ounces* [avoirdupois]; Nitric Acid *two and a half fluidounces* [Imperial measure]; Distilled Water *five fluidounces* [Imp. meas.]. Add the Nitric Acid and the Water to the Silver in a flask, and apply a gentle heat till the metal is dissolved. Decant the clear liquor from any black powder which may be present, into a porcelain dish, evaporate, and set aside to crystallise; pour off the clear liquor, and again evaporate and crystallise. Let the crystals drain in a glass funnel, and dry them by exposure to the air, carefully avoiding the contact of all organic substances. Nitrate of Silver must be preserved in bottles furnished with accurately ground stoppers." *Br.*

The two formulas are essentially the same; but that of the U. S. Pharmacopœia is more detailed and precise, with two peculiarities which deserve notice. One of these is the direction to cover the materials in the capsule, during the continuance of the reaction, with a glass funnel. This is in order to economize the nitric acid, a portion of which rises in vapour, and, being condensed on the inner surface of the funnel, falls again into the capsule. The second peculiarity is the fusion of the salt before being dissolved. This would, from the phraseology of the directions, appear to have been intended to get rid of any uncombined nitric acid which might remain in the dry salt. But the effect is probably rather to decompose any nitrate of copper that might have been derived from the silver, which, if coin be employed, always contains it. This accounts for the escape of hyponitric acid vapour. The oxide of copper is got rid of in the subsequent solution.

During the solution of silver in nitric acid, part of the acid is decomposed into nitric oxide which is given off and becomes red fumes by contact with the atmosphere, and oxygen which oxidizes the silver. The oxide formed then combines with the remainder of the acid, and generates the nitrate of silver in solution, which, by due evaporation, furnishes crystals of the salt. The silver should be pure, and the acid diluted for the purpose of promoting its action. If the silver contain copper, the solution will have a greenish tint, not disappearing on the application of heat; and if a minute portion of gold be present, it will be left undissolved as a black powder. The acid also should be pure. The commercial nitric acid, as it frequently contains both muriatic and sulphuric acids, should never be used in this process. The muriatic acid gives rise to an insoluble chloride, and the sulphuric, to the sparingly soluble sulphate of silver.*

* It is desirable that pure silver, free from copper, should be used in this process. As silver coin always contains copper, it should be purified before being employed. For this purpose, according to the method of M. Lienau, it should be dissolved in nitric acid, and the solution precipitated by chlorine water, which throws down the silver only in the form of chloride. The precipitate is to be well washed with chlorine water, then dissolved in solution of ammonia, and precipitated by clean copper wire. The silver is deposited as a black powder, which, when washed with solution of ammonia, is perfectly pure. (See *Am. Journ. of Pharm.*, July, 1862, p. 368.)

Properties. Nitrate of silver is in colourless transparent shining crystals, having the form of rhomboidal plates, sometimes of considerable size. Its taste is bitter and intensely metallic. It is soluble in its own weight of cold water, and in four parts of boiling alcohol. When perfectly pure, it is wholly soluble in distilled water. The solution stains the skin of an indelible black colour, and is itself discoloured by the most minute portion of organic matter, of which it forms a delicate test. The affinity of this salt for animal matter is evinced by its forming definite compounds with albumen and fibrin. The solution also stains linen and muslin in a similar manner; and hence its use in making the so-called indelible ink. To remove these stains, Mr. W. B. Herapath advises to let fall on the moistened spots a few drops of tincture of iodine, which converts the silver into iodide of silver. The iodide is then dissolved by a solution of hyposulphite of sodium, made with half a drachm to a fluidounce of water, or by a moderately dilute solution of caustic potassa, and the spots are washed out with warm water. They are taken out also by a solution of two and a half drachms of cyanide of potassium, and fifteen grains of iodine, in three fluidounces of water. Stains on the skin may be removed by the same reagents.* Nitrate of silver melts at 426°, and on concreting forms the fused nitrate, which is officinal under the name of *Argenti Nitras Fusa.* At about 600° it is decomposed, with evolution of oxygen and hyponitric acid, and the metal is revived. This explains the necessity of guarding against too high a heat during the fusion of the salt. Nitrate of silver is incompatible with almost all spring and river water, on account of a little common salt usually contained in it; with soluble chlorides; with sulphuric, hydrosulphuric, muriatic, and tartaric acids, and their salts; with the alkalies and their carbonates; with lime-water; and with astringent infusions. It is sometimes improperly prescribed in pill with tannic acid, by which it is decomposed. Nitrate of silver is an anhydrous salt, consisting of one eq. of nitric acid 54, and one of protoxide of silver 116 = 170 (AgO,NO_5).

Impurities and Tests. Muriatic acid or a solution of chloride of sodium, added in excess to one of nitrate of silver, should throw down the whole of the silver as a white curdy precipitate darkening on exposure to light, and nothing besides. This precipitate should be entirely soluble in ammonia. If not so, the insoluble part is probably chloride of lead. If the supernatant liquid, after the removal of the precipitate, be discoloured or precipitated by sulphuretted hydrogen, the fact shows the presence of metallic matter, which is probably copper or some remains of lead, or both. The solution, after precipitation by muriatic acid and filtration, should leave no residue when evaporated. A piece of the salt, heated on charcoal by the blowpipe, melts, deflagrates, and leaves behind a whitish metallic coating. After all, the best sign of the purity of nitrate of silver is the characteristic appearance of the crystals. For other tests, see *Argenti Nitras Fusa.*

Medical Properties. Nitrate of silver, as an internal remedy, is deemed tonic and antispasmodic. The principal diseases in which it has been employed are epilepsy, chorea, angina pectoris, and other spasmodic affections. In epilepsy it forms one of our most reliable remedies; but the kind of cases to which it is particularly applicable, and its modus operandi, are not understood. It is said to produce most good in this disease when it acts upon the bowels. Wunderlich has found it specially useful in the affection named progressive locomotor ataxia (*Ann. de Thérap.*, 1863, p. 210); and cases of general progressive paralysis are said by M. E. Bouchut to have been cured by it. M. Bouchut recommends it also in the palsy of the insane. (*Ann. de Thérap.*, 1866, p. 273.) It is among our most efficient remedies in chronic gastritis, attended with pain and vomiting. Dr. J. F. Peebles, of Petersburg, Va., bore testimony to its efficacy in jaundice connected with gastric irritation, given preferably on an empty stomach. (*Am. Journ. of the Med. Sciences*, July, 1849.) Dr. Boudin, of Marseilles, employed it in typhoid fever as a remedy for the inflammation and ulceration of the

* To remove stains produced by nitrate of silver on hands, clothing, &c., cyanide of potassium is usually employed, preceded sometimes by a little tincture of iodine. According to M. Grimm, coloured cotton cloth should have applied a solution of chloride of copper, then be washed in water containing hyposulphite of sodium, and lastly in pure water; to white linen or cotton a dilute solution of permanganate of potassium and hydrochloric acid should be applied, followed by the hyposulphite and abundant rinsing as before. (*Note to the fourteenth edition.*)

ileum, which constitute the most constant lesion in that disease. M. Delioux, of Rochefort, has proposed albuminous injections of nitrate of silver in diarrhœa, formed of half a pint of water, containing the white of one egg, from two to four grains of the nitrate, and an equal weight of common salt. Nitrate of silver is soluble in an excess of an albuminous solution, and when thus prepared is more readily absorbed than when dissolved in water. The common salt promotes its solution without decomposing it. (*Journ. de Pharm.*, xx. 149.) In chronic diarrhœa, especially in that kind attendant on phthisis, Dr. Macgreggor, of Dublin, has found the nitrate of silver, conjoined with opium, a valuable remedy. It has also been used with supposed advantage in cholera infantum, in doses varying from one-sixteenth to one-fourth of a grain, at intervals of two, four, or six hours. Whatever may be the remedial value of this salt internally administered, its occasional effect of producing a slate-coloured discoloration of the skin, which is seldom removed, is a great objection to its use. This effect proves the absorption of the medicine, and is stated to show itself first on the tongue and fauces. According to Dr. Branson, an indication of the approach of discoloration is furnished by the occurrence of a dark-blue line on the edges of the gums, very similar to that produced by lead, but somewhat darker. For this discoloration of the skin a steady course of cream of tartar has been recommended. Dr. L. P. Yandall has reported two cases in which the discoloration of the skin disappeared during a course of iodide of potassium for syphilitic disease. (*New Remedies*, July, 1873.)

Externally, nitrate of silver is occasionally employed in solution as a stimulant and escharotic; but the *fused nitrate*, which is not so pure as the officinal *nitrate* (pure salt in crystals), is generally selected for making solutions. In cases requiring nicety, the officinal nitrate (crystals) should be directed to be dissolved, and distilled water should be selected as the solvent. A solution, made in the proportion of half a grain of the crystals to a fluidounce of distilled water, forms a good mouth-wash for healing ulcers produced by mercury. In the inflammation of the mouth from mercurial salivation, M. Bouchacourt found a concentrated solution of the salt, applied to the gums, base of the tongue, &c., with a camel's-hair brush, very useful. A solution, containing from two to ten grains of the crystals to a fluidounce of distilled water, is an excellent application in ophthalmia with ulcers of the cornea, in fetid discharges from the ear, aphthous affections of the mouth, and spongy gums.

The dose of nitrate of silver (crystals) is the fourth of a grain, gradually increased to four or five grains, three times a day. For internal exhibition, the physician should always prescribe the crystals, which are meant by the name Argenti Nitras in the revised nomenclature of the U. S. Pharmacopœia of 1850, and never direct the fused nitrate (Argenti Nitras Fusa), which is often impure. Nitrate of silver should always be given in pill, in which form, according to Dr. Powell, the system bears a dose three times as large as when given in solution. In the treatment of epilepsy, this physician recommends the exhibition at first of grain doses, to be gradually increased to six grains, three times a day. Its effects vary very much, owing no doubt to the salt being more or less decomposed by the substances used in preparing it in pill, or with which it comes in contact in the stomach. It should not be made up into pill with crumb of bread, as this contains common salt, but with some vegetable powder and mucilage. But, as all organic substances more or less decompose it, M. Vée proposes the use of inorganic matter, such as nitre, or preferably pure silica obtained by precipitating one of the silicates by an acid, and washing it. The least possible proportion of tragacanth may be used to give adhesiveness to the mass. (*Journ. de Pharm.*, Mai, 1864, p. 408.) In view of the fact that chloride of sodium is used with food, and exists, together with phosphates, in the secretions, and that free muriatic acid and albuminous fluids are present in the stomach, it is almost certain that, sooner or later, the whole of the nitrate of silver will be converted into the chloride, phosphate, and albuminate, compounds far less active than the original salt. The experiments of Keller, who analyzed the feces of patients under the use of this salt, confirm this view. Such being the inevitable result when the nitrate is given, the question arises how far it would be expedient to anticipate the change, and give the silver as a chloride ready formed. One of the authors of this work has tried the

chloride in large doses, in two cases of epilepsy, but without advantage. According to Mialhe, nitrate of silver upon entering the stomach is immediately changed into the chloride, and this is quickly converted into a soluble and readily absorbable double chloride, by combining with chloride of sodium or of potassium.

Nitrate of silver, in an overdose, produces the effects of the corrosive poisons. The proper antidote is common salt, which acts by converting the poison into the insoluble chloride of silver.

Off. Prep. Argenti Cyanidum, *U. S.;* Argenti Nitras Fusa, *U. S.;* Argenti Oxidum. B.

ARGENTI NITRAS FUSA. *U.S.* Argenti Nitras. *Br.* Lapis Infernalis. *Fused Nitrate of Silver. Lunar Caustic.*

"Take of Nitrate of Silver *a convenient quantity.* Melt it in a porcelain capsule, and continue the heat cautiously until frothing ceases; then pour the melted salt into suitable silver moulds." *U. S.*

"To obtain the Nitrate in rods, fuse the crystals in a capsule of platinum or thin porcelain, and pour the melted salt into proper moulds." *Br.*

Instead of forming the nitrate of silver, as in the process of 1850, the present U. S. Pharmacopœia takes the salt already formed, and simply melts it with certain precautions. The British process is merely the continuation of that by which the nitrate is obtained in crystals. As the salt while melting sinks into a common crucible, the fusion is performed in one of porcelain or platinum, the size of which should be sufficient to hold five or six times the quantity of the salt operated on, in order to prevent its overflowing in consequence of the ebullition. Sometimes small portions of the liquid are spirted out, and the operator should be on his guard against this occurrence. When the mass flows like oil, it is completely fused, and ready to be poured into the moulds. These should be warmed, but not greased, as organic matter would thus be furnished, which would partially decompose the fused salt.*

Properties. Fused nitrate of silver, as prepared by the above process, is in the form of hard brittle sticks, of the size of a goose quill, at first translucent, but quickly becoming gray or more or less dark under the influence of light, owing to the reduction of the silver, effected probably by organic matter, or sulphuretted hydrogen contained in the atmosphere. That the change does not depend on the sole action of light has been proved by Mr. Scanlan, who finds that nitrate of silver, in a clean glass tube hermetically sealed, undergoes no change by exposure to light. The sticks often become dark-coloured and nearly black on the surface, and, when broken across, exhibit a crystalline fracture with a radiated surface. Fused nitrate of silver, when pure, is wholly soluble in distilled water; but even fair samples of the fused salt will not totally dissolve, a very scanty black powder being left of reduced silver, arising probably from the salt having been exposed to too high a heat in fusion.

Impurities and Tests. Fused nitrate of silver is liable to contain free silver from having been exposed to too high a heat, the nitrates of lead and copper from the impurity of the silver dissolved in the acid, and nitrate of potassa from fraudulent admixture. Free silver will be left undissolved as a black powder, after the action of distilled water. A very slight residue of this kind is hardly avoidable; but, if there be much free silver, it will be shown by the surface of a fresh fracture of one of the sticks presenting an unusually dark-gray colour. (*Christison.*) The mode of detecting lead and copper is explained under nitrate of silver. (See *Argenti Nitras.*) In order to detect nitre, a solution of the suspected salt should be treated with muriatic acid in excess, to remove silver, and with sulphuretted hydrogen, to throw down other metals if they happen to be present. The filtered liquid, if the salt be pure, will entirely evaporate by heat; if it contain nitre, this will be left, easily known by its properties as a nitrate. This impurity sometimes exists in fused nitrate of sil-

* For certain purposes it is desirable to have the nitrate of silver less brittle than in its pure state. Prof. J. L. Smith, of Louisville, Ky., has found that this may be effected by adding a little chloride of silver, which renders the stick tough, without materially impairing its efficiency. Dr. Squibb proposes to accomplish the object by adding 40 grains of muriatic acid, with half a fluidounce of distilled water, to two ounces of nitrate of silver, heating the mixture by means of a sand-bath to dryness, and then melting and casting into moulds. (*Proceedings of the Am. Pharm. Association,* 1858.)—*Note to the twelfth edition.*

ver in large amount, varying, according to different statements, from 10 to 75 per cent. According to Dr. Christison, it may be suspected if the sticks present a colourless fracture. Prof. Pollacci (*Journ. de Pharm.*, 4e sér., xvii. 160) states that if nitrate of silver, after having been heated in a porcelain capsule to redness and cooled, imparts an alkaline reaction to water, it contains nitre. In the Br. Pharmacopœia the following method is given for testing fused nitrate of silver for impurity, without determining its nature. "Ten grains dissolved in two fluidrachms of distilled water give with hydrochloric acid a precipitate, which, when washed and thoroughly dried, weighs 8·44 grains. The filtrate when evaporated by a water-bath leaves no residue." If the weight of the precipitate be greater or less than here stated, there must be some impurity in the nitrate; and any non-precipitable matter, if solid at the temperature of the water-bath, will be left behind when the filtrate is evaporated. In the U. S. Pharmacopœia, the following test, suggested by Dr. Squibb, is given to detect nitre or other saline impurity. "A small portion, rubbed into fine powder with twice its weight of sugar, forms a mixture, which, when burned upon a surface of glass or porcelain, leaves a tasteless residue." If the nitrate is pure, only the reduced metal is left, which is without taste. If it contain only as much as 1 per cent. of nitre, or other saline impurity, the residue will have the sharp alkaline taste of the base of the salt. (*Am. Journ. of Pharm.*, Jan. 1859, p. 50.)

Medical Properties. Fused nitrate of silver should be restricted to external use. The medical properties of the salt, as an internal remedy, are given under the head of the *crystallized* nitrate. (See *Argenti Nitras.*) Externally applied the fused nitrate acts variously as a stimulant, vesicant, and escharotic, and may be employed either dissolved in water, or in the solid state. Dissolved to the extent of from one to five grains in a fluidounce of water, it is used for the purpose of stimulating indolent ulcers, and as an injection for fistulous sores. A drachm of the fused salt, dissolved in a fluidounce of water, forms an escharotic solution, which may often be resorted to with advantage. When used in solution it is most conveniently applied by means of a camel's-hair brush. But fused nitrate of silver is most frequently employed in the solid state; and, as it is not deliquescent nor apt to spread, it forms the most manageable caustic that can be used. When thus employed, it is useful to coat the caustic, as recommended by M. Dumeril, by dipping it into melted engravers' sealing-wax, which strengthens the stick, protects it from change, prevents it from staining the fingers, and affords facilities for limiting the action of the caustic to particular spots. If it is desired, for example, to touch a part of the throat with the caustic, it is prepared by scraping off the sealing-wax with a penknife, to a suitable extent from one end. Another way to strengthen the stick is to cast it around a platinum wire, as recommended by M. Chassaignac; or around a wick of cotton, according to the plan of M. Blatin. By the latter plan, when the stick is broken, the fragments remain attached. If the fused nitrate be rubbed gently over the moistened skin until this becomes gray, it generally vesicates, causing usually less pain than is produced by cantharides. The fused nitrate is also employed to destroy strictures of the urethra, warts and excrescences, fungous flesh, incipient chancres, and the surface of other ulcers. Mr. Higginbottom considers its free application to ulcers, so as to cover them with an eschar, as an excellent means of expediting their cicatrization. He alleges that, if an adherent eschar be formed, the parts underneath heal before it falls off. It has also been used with good effect in the solid state, by Dr. Jewell in leucorrhœa, and by Ricord, Hannay, and others in the gonorrhœa of women. In these cases the pain produced is much less than would be expected. Lunar caustic is frequently used in aqueous solution as a topical remedy in various low forms of inflammation, but particularly in erysipelas, applied both to the inflamed and to the surrounding healthy parts. In some cases it is sufficient to blacken the cuticle; in others it is best to produce vesication. In the treatment of these inflammations, Mr. Ward, of London, finds an ethereal solution, formed by dissolving eight grains of the salt in a fluidounce of common nitric ether, much more convenient and manageable than an aqueous solution. The ethereal solution is readily applied, and quickly dries. The late Dr. J. Wiltbank, of this city, used an aqueous solution of nitrate of silver (from 20 to 40 grains to the fluidounce) in the treatment of superficial burns and scalds,

applied with a camel's-hair brush over the whole surface, first wiped dry, after opening the vesications. If the burn be deep, the entire surface of the ulcer should be touched with the stick. (*Med. Exam.*, March, 1856, p. 144.) In cases of prolapsus ani, Mr. Lloyd, of London, smears the whole surface of the protruded bowel with the solid caustic, and then returns it. Three or four applications, at intervals of a week or fortnight, are generally sufficient to effect a cure. Mr. Lloyd never knew this practice to be attended with bad consequences. Prof. Parker, of New York, uses nitrate of silver for the radical cure of hydrocele. After drawing off the liquid, he introduces, through the cannula, a common probe, the end of which is coated, for half an inch or more, with the caustic. The probe is then carried lightly over the serous surface of the tunica vaginalis, and withdrawn. In smallpox it has been proposed by Bretonneau and Serres to cauterize each pustule, after its top has been removed, on the first or second day of the eruption, in order to arrest its development, and prevent pitting. The fused nitrate also forms an efficacious application to certain ulcerations of the throat, to different forms of porrigo of the scalp, and other skin diseases, to punctured and poisoned wounds, and to chilblains, slowly rubbed over the moistened part. If, unexpectedly, the pain produced by its external use should be excessive, it may be immediately allayed by washing the parts with a solution of common salt, which acts by decomposing the caustic. In the form of ointment, made by mixing one part of the caustic, in powder, with thirty of lard, it has been used in ozæna; a piece of lint, smeared with the ointment, being introduced into the nasal fossa. Dr. Richardson, of New Orleans, obtains the most signal success by the injection of a strong solution (20 to 60 grains to the ounce) in chronic cystitis. First washing out the bladder, he injects about two ounces of the liquid, and, except in the case of very strong solutions, allows it to remain; in eight days he repeats the operation. (*Philad. Med. Times*, v. 735.)

Nitrate of silver, in impalpable powder, mixed with an equal weight of lycopodium, and used by inhalation, has been found beneficial in ulcerated sorethroat, laryngitis, bronchitis, and incipient phthisis, by Dr. W. M. Cornell, of Boston. (*Boston Med. and Surg. Journ.*, Sept. 25, 1850.) The salt, used in this way, has since been successfully employed in the treatment of chronic laryngitis by M. Trousseau, of Paris, and others. The mixture employed consisted of three grains of the nitrate and a drachm of sugar of milk, intimately mixed in fine powder, of which as much as would fill the barrel of a steel pen was inhaled daily. The steel pen, charged with the powder, and attached to the barrel of a quill, is placed on the root of the tongue, and the patient compresses his lips around the quill. Then holding his nose, he makes a deep inspiration, which draws the powder into the larynx. (See *Am. Journ. of Med. Sci.*, Oct. 1855, p. 515.) This plan of applying nitrate of silver to the larynx is much more sure and safe than that of introducing the solution by injection, or by means of a sponge. Dr. Guillon, of France, strongly recommends the insufflation of the powder in pseudomembranous croup, having derived great advantage from it in his own experience. (*South. Med. and Surg. Journ.*, March, 1867, p. 486; from *Revue de Thérap.*) The solution may often be applied to different parts of the throat by means of the atomizer. B.

ARGENTI OXIDUM. *U. S., Br. Oxide of Silver.*

"Take of Nitrate of Silver *four troyounces;* Distilled Water *half a pint;* Solution of Potassa *a pint and a half*, or *a sufficient quantity*. Dissolve the Nitrate of Silver in the Water, and to the solution add Solution of Potassa so long as it produces a precipitate. Wash this repeatedly with water until the washings are nearly tasteless. Lastly, dry the precipitate and keep it in a well-stopped bottle, protected from the light." *U. S.*

"Take of Nitrate of Silver, in crystals, *half an ounce* [avoirdupois]; Solution of Lime *three pints and a half* [Imperial measure]; Distilled Water *ten fluidounces*. Dissolve the Nitrate of Silver in four [fluid]ounces of the Distilled Water, and, having poured the solution into a bottle containing the Solution of Lime, shake the mixture well, and set it aside to allow the deposit to settle. Draw off the supernatant liquid, collect the deposit on a filter, wash it with the remainder of the Distilled Water, and dry it at a heat not exceeding 212°. Keep it in a stoppered bottle." *Br.*

Oxide of silver was introduced into the U. S. Pharmacopœia of 1850, and was

adopted in the Br. Pharmacopœia from the Dublin. In the processes for making it, nitrate of oxide of silver is decomposed by potassa or lime, the oxide being precipitated, and nitrate of potassium or nitrate of calcium, as the case may be, remaining in solution. When thus obtained the oxide is an olive-brown powder. If the potassa used be not wholly free from carbonic acid, the precipitated oxide will be contaminated with some carbonate of silver. According to Mr. Borland, of London, the carbonate is sometimes sold for the oxide. A third process for obtaining this oxide is that of Gregory, which consists in boiling the moist, recently prepared chloride of silver with a very strong solution of caustic potassa (sp. gr. 1·25 to 1·30). In this case, by double decomposition, oxide of silver and chloride of potassium are formed. When thus prepared it is a very dense pure black powder. Oxide of silver is very slightly soluble in water. Exposed to heat it gives out oxygen, and is wholly converted into metallic silver; 29 grains of it yielding 27 of the metal. (*Br.*) It should not effervesce with acids. When its solution in nitric acid is precipitated by chloride of sodium in excess, the supernatant liquid is not discoloured by bihydrosulphate of ammonium. The non-action of this test shows the absence of most foreign metals, especially copper and lead. It parts with its oxygen with great facility, being decomposed by many organic substances, and even causing sulphur to take fire when the two are rubbed together, quite dry, in a mortar. (*Chem. News*, May 7, 1864, p. 217.) Oxide of silver consists of one eq. of silver 108, and one of oxygen 8 = 116.

Medical Properties. This oxide has been proposed as a substitute for nitrate of silver, as having the general therapeutic virtues of the latter, without its escharotic effect, and objectionable property of discolouring the skin. Experience, however, has shown that it will stain the skin. (*N. York Med. Journ.*, June, 1869; *Philad. Med. Times*, vi.) It was first tried as a medicine by Van Mons and Sementini. In 1840 it was employed by Dr. Butler Lane, who considered it to act as a sedative. In 1845 the late Sir James Eyre strongly recommended it in his work on exhausting diseases. Dr. Lane used it with more or less success in nausea, cardialgia, pyrosis, various painful affections of the stomach without organic lesion, dysentery, diarrhœa, night-sweats without other obvious affection, dysmenorrhœa, menorrhagia, leucorrhœa, chronic enlargements of the uterus attended with flooding, &c. The oxide appeared to exert a peculiar control over uterine fluxes. Some of the cases treated required the use of tonics, after the curative influence of the oxide had been exerted. The late Dr. Golding Bird also obtained favourable effects from the use of oxide of silver, and confirmed to a certain extent the results of Dr. Lane, especially as to its valuable powers in menorrhagia. Thus far no case of cutaneous discoloration is known to have occurred; though Dr. Lane gave the oxide repeatedly for two months, and Dr. Bird in more than a hundred cases, in one for four months. Dr. Lane observed one case in which repeated salivation occurred, and Dr. Bird several in which the gums were affected. But, in order to draw any inference from these results, the prescriber should be certain that the medicine is not contaminated with black oxide of mercury. In stomach disease, characterized by a glairy instead of a watery discharge, Dr. Bird derived not the slightest benefit from the oxide, though he used it in thirty cases. In epilepsy it has been supposed by some that the oxide will accomplish all that can be expected from the nitrate, without incurring the danger of discolouring the skin; but experience has proved that this is not the case. In tænia it has been used successfully in two cases by Mr. Whittel. The dose of oxide of silver is a grain, twice or thrice a day, given in pill. In no case did Dr. Lane carry the dose beyond six grains in the twenty-four hours. The pill should not be made with honey, conserve of roses, or other excipient containing glucose; and, indeed, most organic substances, especially in a moist state, deoxidize the oxide, reviving the silver. Indeed, there would seem to be need of great caution in making these pills. Dr. Jackson has recorded a case in which pills of oxide of silver, muriate of morphia, and extract of gentian exploded violently in the pocket of the patient. (*Pharm. Journ. and Trans.*, xi. 552.) Mr. Ambrose Smith recommends, as among the best excipients, gum arabic, or this with a little syrup. (*Proceed. of Am. Pharm. Assoc.*, 1859, p. 308.) Oxide of silver has been used in the form of ointment, composed of from five to ten grains to the drachm of lard, as an application to venereal sores, and to the urethral membrane in gonorrhœa, smeared on a bougie. B.

ARSENICUM.

Preparation of Arsenic.

The officinal liquid preparations of arsenic are, in compliance with the Pharmacopœias, considered under the head of *Liquores* or *Solutions.* (See *Liquor Arsenici et Hydrargyri Iodidi*, *Liquor Potassii Arsenitis*, and *Liquor Sodii Arsenitis*, in *Part* II.) It is only the Iodide of Arsenic that is treated of in this place.

ARSENICI IODIDUM. *U. S.* *Iodide of Arsenic.*

"Take of Arsenic *sixty grains;* Iodine *three hundred grains.* Rub the Arsenic in a mortar until reduced to a fine powder; then add the Iodine, and rub them together until they are thoroughly mixed. Put the mixture into a small flask or a test-tube, loosely stopped, and heat it very gently until liquefaction occurs. Then incline the vessel in different directions, in order that any portion of the iodine, which may have condensed on its surface, may be returned into the melted mass. Lastly, pour the melted iodide on a porcelain slab, and, when it is cold, break it into pieces, and keep it in a well-stopped bottle." *U. S.*

This iodide was introduced into the U. S. Pharmacopœia for the purpose of being used in preparing the solution of iodide of arsenic and mercury. It is made by the direct combination of its constituents, with the aid of a gentle heat.

Properties, &c. Iodide of arsenic is an orange-red, crystalline solid, entirely soluble in water, and wholly volatilized by heat. In composition it is considered to be a *teriodide*, consisting of one eq. of arsenic 75, and three of iodine $378{\cdot}9 = 453{\cdot}9$. It has been used by Biett as an external application in corroding tubercular skin diseases. By the late Dr. A. T. Thomson it was given internally with advantage in lepra, impetigo, and diseases resembling cancer. Dr. F. C. Crane cured a case of what he considered cancer of the breast by its use for nearly eight months. The ointment used by Biett was composed of three grains of the iodide to an ounce of lard. The dose for internal exhibition is an eighth of a grain three times a day, given in pill or solution.

Off. Prep. Liquor Arsenici et Hydrargyri Iodidi, *U. S.* B.

ATROPIA.

Preparations of Atropia.

ATROPIA. *U. S.*, *Br.* *Atropia.*

"Take of Belladonna Root, in fine powder, *forty-eight troyounces;* Purified Chloroform *four troyounces and a half;* Diluted Sulphuric Acid, Solution of Potassa, Alcohol, Water, each, *a sufficient quantity.* Mix the powder with a pint of Alcohol, and, having introduced the mixture into a cylindrical percolator, pour alcohol gradually upon it until sixteen pints have passed. From the liquid, thus obtained, distil off twelve pints of alcohol. To the residue add sufficient Diluted Sulphuric Acid to give it an acid reaction, and, having evaporated the liquid to half a pint, add an equal bulk of Water, and filter through paper. To the filtered liquid add, first a troyounce and a half of the Chloroform, and then Solution of Potassa in slight excess, and shake the whole together at intervals, for half an hour. When the heavier liquid has subsided, separate it, and, having added a troyounce and a half of the Chloroform to the lighter liquid, again shake them together, and separate the heavier from the lighter liquid as before. Add to this lighter liquid the remainder of the Chloroform, and, after agitation, separate the heavier liquid for the third time. Mix the heavier liquids in a capsule, and set the mixture aside until, by spontaneous evaporation, the Atropia is left dry." *U. S.*

"Take of Belladonna Root, recently dried and in coarse powder, *two pounds* [avoirdupois]; Rectified Spirit *ten pints* [Imperial measure]; Slaked Lime *one ounce* [avoird.]; Diluted Sulphuric Acid, Carbonate of Potash, of each, *a sufficiency;* Chloroform, *three fluidounces;* Purified Animal Charcoal, *a sufficiency;* Distilled Water *ten fluidounces.* Macerate the Root in four pints [Imp. meas.] of the Spirit, for

twenty-four hours, with frequent stirring. Transfer to a displacement apparatus, and exhaust the root with the remainder of the Spirit by slow percolation. Add the Lime to the tincture placed in a bottle, and shake them occasionally several times. Filter, add the Dilute Sulphuric Acid in very feeble excess to the filtrate, and filter again. Distil off three-fourths of the Spirit, add to the residue the Distilled Water, evaporate at a gentle heat, but as rapidly as possible, until the liquor is reduced to one-third of its volume and no longer smells of alcohol; then let it cool. Add very cautiously, with constant stirring, a solution of the Carbonate of Potash so as nearly to neutralise the acid, care, however, being taken that an excess is not used. Set to rest for six hours, then filter, and add Carbonate of Potash in such quantity that the liquid shall acquire a decided alkaline reaction. Place it in a bottle with the Chloroform; mix well by frequently repeated brisk agitation, and pour the mixed liquids into a funnel furnished with a glass stop-cock. When the Chloroform has subsided, draw it off by the stop-cock, and distil it on a water-bath from a retort connected with a condenser. Dissolve the residue in warm Rectified Spirit; digest the solution with a little Animal Charcoal; filter, evaporate, and cool until colourless crystals are obtained." *Br.*

The U. S. process is a modification of the one proposed by Prof. Procter in a communication to the American Pharmaceutical Association, published in their *Proceedings* for the year 1860. The root is first exhausted by alcohol, by means of percolation, a large proportion of the alcohol is distilled off, and sulphuric acid is added in slight excess, so as to convert the atropia into the sulphate, and thus enable it to be held in solution in the next step of the process. The liquid is now further concentrated, so as to separate nearly all the alcohol, and then mixed with water to separate resinous and fatty matters. The sulphate of atropia is left in solution. This, after filtration, is treated with chloroform and solution of potassa in slight excess, the latter to separate the atropia from the sulphate, and the former to dissolve it when thus separated; and the repeated agitation with the chloroform is in order that the whole of the atropia may be dissolved. Chloroform is admirably adapted to this purpose, at once by its insolubility in water, and by its extraordinary solvent power over atropia, of which it is capable of taking up 33 per cent. The chloroformic solution sinks to the bottom in consequence of its density, and, having been separated, yields the atropia by spontaneous evaporation. The alkaloid as thus obtained is not pure, still containing resinous and colouring matters; but it was deemed sufficiently so for medical use. This we think unfortunate; for it is impossible, unless the alkaloid be obtained pure or very nearly so, to determine, in any particular instance, unless by a complicated operation, the precise amount of impurity, and consequently the precise strength of the preparation. Had it been deemed advisable to follow the process of Mr. Procter, in all its steps, this result might have been avoided. Though atropia is very soluble in chloroform, the sulphate of that alkaloid is insoluble. Consequently, if the impure solution of the sulphate left after the precipitation of the resinous matter by water, be thoroughly agitated, as suggested by Mr. Procter, with a portion of chloroform, it is deprived of most of its remaining resinous, fatty, and colouring matters, still retaining the alkaloid in the form of sulphate, which, after the removal of the chloroform, it will yield in a comparatively pure state to the subsequent treatment by solution of potassa and chloroform. Though caustic potassa is believed to decompose atropia by prolonged contact, yet, in this instance, its opportunity for any injurious action would be too fugitive to justify apprehension on this score; for it speedily becomes neutralized by the sulphuric acid, while the liberated alkaloid is as quickly seized by the chloroform, and carried out of its sphere of action. But, even with this improvement of the process, the alkaloid, as yielded by the spontaneous evaporation, is not quite free from impurity, and, to be rendered entirely pure and colourless, should be dissolved in alcohol, treated with a little animal charcoal, and then allowed to crystallize by the spontaneous evaporation of the alcoholic solution after filtration. Prof. Procter obtained only about one-third of 1 per cent. of pure atropia from the amount of root used. The use of chloroform as a solvent of atropia, in preparing that alkaloid, was, we believe, first suggested by M. Rabourdin, of Orleans, in France. The application of it to the purification of the impure sulphate

originated with Prof. Procter. As chloroform is too valuable to be lost when it can conveniently be saved, it would be advisable, when it is used in this process, instead of allowing it to escape by spontaneous evaporation, to recover it by distillation with a warm bath, taking care, by using a temperature not exceeding 160° F., to shun any danger of decomposing the atropia.

The British process, as will be seen by comparing it with the notes below, is a combination of the processes of Mein and Rabourdin, the former being followed until after the addition of carbonate of potassium, and the alkaloid thus liberated being taken up by chloroform as in the latter. The use of lime in the earlier stage of the proceedings is to cause a precipitation of various substances which would otherwise embarrass the subsequent operations.*

Properties. Atropia is in silky, prismatic, acicular crystals, which, when quite pure, are colourless, but, as obtained according to our officinal formula, are yellowish-white. It is inodorous, but has a bitter and acrid taste. It is said to melt at 194° F., and at 284° to be volatilized, a portion being unchanged, but the greater part destroyed. According to Dr. Guy, it melts at 150°, and sublimes at 280° (*Pharm. Journ.*, Feb. 1868, p. 374); and, according to Mr. Waddington, the liquid remains perfectly colourless, and the vapour condenses in perfect crystals; showing that the alkaloid does not undergo decomposition at its subliming point. (*Ibid.*, March, 1868, p. 416.) It is inflammable, giving off an odour like that of benzoic acid, and, when burned in the open air, leaving no residue. By distilling it with bichromate of potassium and sulphuric acid, Dr. E. Pfeiffer succeeded in obtaining crystals of benzoic acid. (*Am. Journ. of Pharm.*, May, 1864, p. 226.) Dr. Kraut, by heating it with

* The following is the process employed by Mein for procuring atropia. The roots of plants two or three years old were selected. Of these, in extremely fine powder, 24 parts were digested, for several days, with 60 parts of alcohol of 86 or 90 per cent. The liquid having been separated by strong expression, the residue was treated anew with an equal quantity of alcohol; and the tinctures, poured together and filtered, were mixed with one part of hydrate of lime, and frequently shaken for 24 hours. The copious precipitate which now formed was separated by filtering; and diluted sulphuric acid was added drop by drop to the filtered liquor, till slightly in excess. The sulphate of calcium having been separated by a new filtration, the alcoholic liquid was distilled to one-half, then mixed with 6 or 8 parts of pure water, and evaporated with a gentle heat till the whole of the alcohol was driven off. The residual liquid was filtered, cautiously evaporated to one-third, and allowed to cool. A concentrated aqueous solution of carbonate of potassium was then gradually added, so long as the liquid continued to be rendered turbid; and the mixture was afterwards suffered to rest some hours. A yellowish resinous substance, which opposes the crystallization of the atropia, was thus precipitated. From this the liquid was carefully decanted, and a small additional quantity of the solution of the carbonate was dropped into it, till it no longer became turbid. A gelatinous mass now gradually formed, which, at the end of 12 or 24 hours, was agitated in order to separate the mother-waters, then thrown upon a filter, and dried by folds of unsized paper. The substance thus obtained, which was atropia in an impure state, was dissolved in five times its weight of alcohol; and the solution, having been filtered, was mixed with six or eight times its bulk of water. The liquor soon became milky, or was made so by evaporating the excess of alcohol, and, in the course of 12 or 24 hours, deposited the atropia in the form of light-yellow crystals, which were rendered entirely pure and colourless by washing with a few drops of water, drying on blotting-paper, and again treating with alcohol. From 12 oz. of the root, Mein obtained 20 grs. of the alkaloid. (*Journ. de Pharm.*, xx. 87.)

M. Rabourdin, of Orleans, in France, prepares atropia by means of chloroform in the following manner. To each litre (about 2 pints) of the expressed juice of the fresh leaves, deprived of its albumen by heat and filtration, or to a filtered solution of 60 grammes (about 15 drachms) of extract in 200 grammes of distilled water, 4 grammes of potassa, and 30 grammes of chloroform are added, the whole is shaken for a minute, and then set aside. In half an hour, the chloroform, holding the atropia in solution, is seen at the bottom of the vessel, resembling a greenish oil. The supernatant liquor is decanted, and small portions of water successively added and removed, until no longer rendered turbid. The chloroformic solution is then distilled, by means of a salt-water bath, until all the chloroform has passed. The residue is treated with a little water acidulated with sulphuric acid, which dissolves the atropia, leaving a green resinous matter. The solution is then filtered, the atropia precipitated by carbonate of potassium in slight excess, and the precipitate dissolved in rectified alcohol, which, upon evaporation, yields it in beautiful groups of needles. (*Gaz. Méd. de Paris*, Oct. 19, 1850.)

Mr. W. T. Luxton obtains atropia by adding a little sulphuric acid to a strong decoction of the leaves so as to precipitate the albumen, filtering, and either passing gaseous ammonia through the clear liquor, or suspending in it a lump of carbonate of ammonium. Atropia slowly crystallizes, and in a day or two may be separated on a filter, and deprived of colour by washing with spirit of ammonia. Mr. Luxton obtained between 5 and 6 grains from 1000 of the leaves. (See *Am. Journ. of Pharm.*, xxvii. 156.) For another process of preparing atropia from the leaves see *Journ. de Pharm.*, 1872, i.

An account of the effects of numerous reagents upon the muriate of atropia, by Dr. A. Von Planta, may be found in the *American Journal of Pharmacy* (xxiii. 38).

baryta-water, succeeded in obtaining an uncrystallizable salt, consisting of a peculiar acid and peculiar base, the former of which he calls *atropic acid* and the latter *tropia*. (*Ibid.*, p. 232.) It is said, moreover, that when a little of it, dissolved in a few drops of sulphuric acid, is heated, an odour is given out resembling that of orange flowers. (*Ibid.*, March, 1864, p. 112.) It is soluble in 300 parts of water at 60°, in 8 parts of alcohol (*Geiger and Hesse*), in 25 parts of ether, in 50 parts of glycerin (*Cap and Garot*), and, according to Schlimpert, in a little more than 3 parts of chloroform; and in all these liquids it is more soluble hot than cold. It has a strong alkaline reaction, forms crystallizable salts with acids, and, in solution, gives a lemon-yellow precipitate with terchloride of gold. Heated with potassa or soda it gives out ammonia, and is rendered inert by prolonged contact with the former alkalies. Hinterberger states that an alcoholic solution of atropia, when cyanogen is passed through it, assumes a blood-red colour, and, on spontaneous evaporation, deposits a red syrupy liquid insoluble in water. (*Gmelin.*) The detection of atropia, in small quantity, is a matter of great difficulty, the physiological test being the best. According to Brunner, the best chemical test is the aromatic smell, which is produced by adding this alkaloid and a little water to a hot mixture of sulphuric acid and bichromate of potassium or molybdate of ammonium. (*Pharm. Journ. and Trans.*, iv. 385.) In very dilute solution, the alkaloid produces, when applied to the eye, a speedy and durable dilatation of the pupil. Its composition is represented by the formula $C_{34}H_{23}NO_6$.*

Medical Properties and Uses. The effects of atropia on the system are precisely those of belladonna, whether locally or generally, whether in moderate doses as a remedy, or in excessive quantities as a poison. It is in general, however, somewhat more speedy in its operation, probably in consequence of its easier absorption. Thus, the poisonous action of belladonna is seldom experienced in less than half an hour, while that of atropia shows itself violently in fifteen or twenty minutes. The most prominent effects from the smallest remedial doses are dryness and stricture of the throat, and slight uneasiness of the head, with confusion or giddiness; from somewhat larger doses, dilatation of the pupil, some dimness of vision, frontal headache, slight delirium, flushed face, and sometimes a scarlet rash; from poisonous doses, the above symptoms in a more aggravated form, great dimness or total temporary loss of vision, excessive dilatation of the pupil, intense headache or violent delirium followed by stupor, paralytic sensations, intense redness of the face, neck, &c., at first acceleration but afterwards depression of the pulse, and finally great prostration, profound coma, coldness of the extremities, and death, if relief is not obtained. Sometimes nausea and vomiting are produced, and occasionally diarrhœa. There is often an increased disposition to micturate; and atropia has been detected in the urine of those who have taken it freely. Finally there is often retention of urine from vesical paralysis. The increase of the heart's action by atropia is chiefly due to its paralyzing the peripheral vagi, the inhibitory nerves of the heart; the final cardiac failure which takes place when poisonous doses have been taken is apparently due to a direct depressant action on the heart-muscle. Upon the vaso-motor centres atropia in a moderate dose acts as a stimulant. After poisonous doses there is universal capillary dilatation, which is probably due to a direct action of the alkaloid upon the muscular coats of the arterioles. Upon the spinal cord it acts as a powerful stimulant. Hence the violent convulsions which are sometimes seen in belladonna poisoning. Usually this effect is more or less completely masked by the paralysis of the motor nerves, which is one of the most marked effects of the poison; upon the afferent nerves the poison seems to have but little influence. On all non-striated muscle atropia exerts a very powerful influence, and it is probable, although not certain, that whilst in poisonous amount it lessens and finally paralyzes intestinal movements by a direct action upon the muscular coats, in small doses it increases peristalsis by paralyzing the inhibitory nerves which control this intestinal function. The action of the drug upon the

* For the bearing of atropia under the influence of an electric current, see *Pharm. Journ. and Trans.*, 1870, i. p. 244.

It is stated by H. Bullot that if to an aqueous solution of atropia acidulated with sulphuric acid an aqueous solution of picric acid be added, a precipitate will not form with good English atropia; with that obtained by the method of Simon, there will be a very slight precipitate; with the German alkaloid an abundant yellow precipitate. (*Note to the fourteenth edition.*)

respiratory centres is a very important one, atropia being in moderate doses the most powerful stimulant to the respiratory centre known. The asphyxia of belladonna poisoning is certainly in large measure due to the paralysis of the nerve-trunks, which the poison produces, although it is also probable that the first period of excitation of the respiratory centres is followed by one of depression.

On the glandular system atropia exerts a decided influence; its effect upon the salivary and perspiratory glands being at present best understood. The remarkable action which it has in checking the functional activity of these glands is probably exerted through the nervous system, for in Keuchel's experiments it was distinctly proven that the chorda tympani nerve, excitation of which normally provokes salivation in atropia poisoning, is paralyzed. In a case recorded by Dr. James Andrew two-thirds of a grain of atropia occasioned the most alarming symptoms, which continued for several days (*Ed. Month. Journ. of Med. Sci.*, xiv. 34); and a lady, under the care of M. Roux, of Brignolles, took somewhat more than a grain, with the same alarming symptoms (*Ann. de Thérap.*, 1861, p. 14); though, in both cases, recovery took place under treatment. In a child of three years old less than half a grain was followed by similar dangerous symptoms, and the same favourable result. (*Med. Times and Gaz.*, Dec. 1850, p. 601.) A solution of atropia dropped into the eye produces dilatation of the pupil after ten or fifteen minutes, without causing congestion or inflammation; and the dilatation will usually continue for two or three days. Sometimes it is said that the dilatation is followed by contraction of the pupil, especially when the dose is large. The alkaloid also produces its characteristic constitutional effects when applied to the skin denuded of the epidermis, or to a mucous membrane, as of the rectum, vagina, &c., and especially when injected into the subcutaneous areolar tissue. The remedies for its poisonous operation are the same as those for belladonna; the most prominent being evacuation of the stomach, cold applications to the head, the preparations of opium internally,* and stimulants when the strength is failing. The value of atropia in opium poisoning, which seems unquestionable, is due to its influence on the respiratory centres; it is far from certain that opium is of at all proportionate advantage in poisoning by belladonna, &c. The officinal compound solution of iodine has been given in poisoning by atropia, and with apparent advantage, in one or two cases, though other remedies were employed at the same time. It acts by forming an insoluble compound with the alkaloid. (See *Belladonna.*)

Atropia may be used internally for all the purposes for which belladonna is given, but it is chiefly as a local remedy, for application to the eye, or to the surface of the body, or for subcutaneous injection that it is preferred; and for these purposes it has the advantage over the ordinary preparations of belladonna, of greater precision of dose, quicker action, and greater neatness and cleanness. In ptyalism and in colliquative sweats the most prompt effects can be obtained from the hypodermic use of atropia. The dose to begin with, for internal use, is about one-fiftieth of a grain, which may be gradually increased till some effect is experienced; but it is almost too powerful for prudent employment in this way, especially as all the effects of belladonna may be readily obtained from the extract. Dr. Sieveking found, in a trial upon himself, that one-hundredth of a grain produced brief vertigo followed by dryness of

* In reference to the relative effects of atropia and morphia, hypodermically administered, Drs. S. Weir Mitchell, Keen, and Morehouse have come to the following conclusion, among others, from a series of experiments and observations. Atropia has no power to relieve pain, while morphia acts powerfully, and the more so the nearer it is to the seat of pain; and atropia has no power of diminishing the action of morphia in this respect. Morphia lowers the pulse slightly if at all, while atropia usually lowers it within ten minutes, then accelerates it from twenty to fifty beats within an hour, followed about the tenth hour by a reduction, and within twenty-four hours by a return to the normal state; and morphia has no power to prevent the effect of atropia on the pulse. With the change of the pulse, the respiration is hardly in any degree affected. As regards the eye, the two alkaloids are mutually antagonistic; but the action of atropia is much more durable. The cerebral symptoms produced by the one alkaloid are to a great extent capable of being superseded by the other; but in consequence of the difference in their speed of action, and the longer continued action of the atropia, it is difficult to obtain a perfect neutralization of effect. The dry mouth of atropia is not lessened by morphia. Atropia does not constipate like morphia, and may even relax the bowels. The nausea of morphia is not prevented or removed by atropia. Both alkaloids occasionally cause dysuria, and that caused by one is not relieved by the other. (*Am. Journ. of Pharm.*, Sept. 1865, p. 389.)—*Note to the thirteenth edition.*

the throat, without affection of the viscera, but with nervous depression next day. (*B. and F. Med.-chir. Rev.*, July, 1858, Am. ed., p. 179.) It may be administered dissolved in diluted alcohol, in the proportion of two grains to half a fluidounce, of which four minims, or twice the number of drops, may be given for a commencing dose. If given in pill, the greatest care should be taken to distribute the atropia equally in the pill-mass before dividing it. For application to the eye, one grain may be dissolved in four fluidrachms of distilled water by means of a few drops of acetic acid, of which no more should be used than is necessary to effect the solution. Of this, a single drop, applied to the inner surface of the lower lid, will produce dilatation of the pupil in 15 or 20 minutes. The same solution may be used for subcutaneous injection in the quantity of 8 or 10 drops to commence with, and gradually increased. Mr. T. P. Teale, of Leeds, has obtained the happiest results in the treatment of iritis by the application of a solution of atropia to the eye. It is often alone adequate to the cure. (*Am. Journ. of Med. Sci.*, July, 1867, p. 265.) For application to the sound skin, the form of ointment is most convenient. This may be made by rubbing a grain of the alkaloid first with four minims of alcohol, and then with a drachm of lard. Glycerin and olein also have been recommended as vehicles of atropia for external use; and may be incorporated with it in the same proportion.

When solution of atropia is used locally for dilating the pupil, it may be either dropped into the eye within the lower lid, or may be introduced on small slips of paper previously saturated with the solution and dried, or, what is still more convenient, by means of minute circular discs of gelatin, made by mixing the solution with gelatin and evaporating so as to procure a thin film, which is to be cut into circular pieces. These have the advantage over paper that they do not require to be subsequently removed from the eye.

The external use of atropia is not without danger, unless great caution be observed. A case is on record in which an ointment composed of three grains of the sulphate and two drachms of lard, applied upon a vesicated surface on the neck, produced in a few minutes the most violent symptoms of belladonna poisoning, ending in death in two hours. (*Ann. de Thérap.*, 1867, p. 9.) The solution of atropia or its salts is very apt to have developed in it a fungous growth with consequent decomposition of the alkaloid.

Off. Prep. Atropiæ Sulphas; Liquor Atropiæ, *Br.;* Unguentum Atropiæ, *Br.*

W.

ATROPIÆ SULPHAS. *U. S.*, *Br.* *Sulphate of Atropia.*

"Take of Atropia *sixty grains;* Stronger Ether *four fluidounces and a half;* Sulphuric Acid *six grains;* Stronger Alcohol *a fluidrachm.* Dissolve the Atropia in the Ether; then mix the Acid and Alcohol, and add the mixture, drop by drop, to the ethereal solution until the Atropia is saturated. Allow the liquid to stand until the precipitate formed is deposited. Then decant the ether, and expose the residue to spontaneous evaporation until the salt is dry." *U. S.*

"Take of Atropia *one hundred and twenty grains;* Distilled Water *four fluidrachms;* Diluted Sulphuric Acid *a sufficiency.* Mix the Atropia with the Water and add the Acid gradually, stirring them together until the alkaloid is dissolved, and the solution is neutral. Evaporate it to dryness at a temperature not exceeding 100°." *Br.*

The U. S. is essentially the process of M. Ch. Maitre, which is contained in a note in the 11th edition of the Dispensatory. Atropia being soluble in ether while its sulphate is insoluble in that fluid, a convenient method is afforded for preparing the sulphate with little evaporation. By adding the mixed acid and alcohol to the ethereal solution, the sulphate is formed, and being insoluble in the ether is deposited; while the little left dissolved in the alcohol is obtained by spontaneous evaporation. The quantity of acid added is intended to saturate the alkaloid; but if the saturation should not be exact, it would be easy to render it so by the addition of a little more of the alkaloid or a little more of the acid, as the case may be.

From the great facility with which atropia undergoes change, much caution is necessary in preparing its salts; and the process was arranged in reference to this

caution. Upon the addition of the mixed acid and alcohol to the ethereal solution, the liquid becomes milky, and deposits on the sides of the vessel a copious precipitate, of a viscid appearance, which soon dries upon the decantation of the ether, and the placing of the vessel in a drying room. To succeed with this process, it is necessary that the liquids employed should be carefully freed from water, the sulphuric acid being monohydrated, and that the temperature should be kept as low as possible. There should be no excess of acid; and, if such an excess should be found upon applying the test of litmus paper, the solution should be neutralized by a portion of reserved solution of atropia. (*Am. Journ. of Pharm.*, xxviii. 361; from *Répert. de Pharm.*) In the British process the same object of avoiding decomposition by heat is arrived at by the low temperature at which the evaporation is effected.

Sulphate of atropia, as thus obtained, is a white slightly crystalline powder, having the taste of atropia, very soluble in water and alcohol, but insoluble in ether and chloroform. It should be dissipated by heat, and neutral to test-paper. It is known to be a sulphate by giving a white precipitate, with chloride of barium, and a salt of atropia by its effect in dilating the pupil, when a drop of a weak solution is introduced into the eye.

If it be required to procure the sulphate in the form of crystals, which may sometimes be desirable to avoid adulteration, the process of M. Laneau may be employed. A solution of crystallized atropia in absolute alcohol, in the proportion of 2·89 parts of the former to 4 parts of the latter by weight, having been made with the assistance of a gentle heat, 0·4 parts of sulphuric acid of the sp. gr. 1·85, diluted with 3 parts of absolute alcohol, are to be gradually added, and stirred with a glass rod, until saturation, as shown by test-paper, is effected. The solution is then allowed to evaporate spontaneously, and the thinner the stratum the sooner will the process be completed. The crystals are in colourless needles more or less interlaced. (See *Am. Journ. of Pharm.*, July, 1863, p. 315.)

The effects of the salt on the system are precisely the same as those of atropia, and it may be used in the same dose. Its only advantage over the alkaloid is its solubility in water. The sulphate is recommended by Dr. Fleming, associated in very small doses with sulphate of magnesium, and aromatic sulphuric acid, in habitual constipation. (*Ann. de Thérap.*, 1867, p. 4.) A solution of the salt in the proportion of one part to one hundred of the solvent has been found instantaneously efficacious in the relief of toothache, applied in the quantity of a drop or two to the denuded dental pulp; and it is said, in the same quantity, to produce complete insensibility of the dental nerves, in cases in which an artificial tooth is inserted in a living root. (*Ann. de Thérap.*, 1861, p. 19.)* W.

BARIUM.

Preparation of Barium.

BARII CHLORIDUM. *U. S.* *Chloride of Barium. Muriate of Baryta.*

"Take of Carbonate of Barium, in small pieces, Muriatic Acid, each, *four troy-ounces;* Water *a pint.* Mix the Acid with the Water, and gradually add the Car-

* *Valerianate of Atropia.* This salt has been supposed to have peculiar virtues; though, in consideration of the very minute proportion of the valerianic acid in each dose, it is extremely doubtful whether it is capable, in any appreciable degree, of modifying the influence of the alkaloid. It may be prepared by dissolving 38 parts of pure and dry atropia in 140 parts of alcohol of 85°, and mixing the solution with another made by dissolving 12 parts of pure valerianic acid in 10 parts of alcohol of the same strength; and allowing the mixed liquids to evaporate spontaneously at a heat of from 86° to 100° F. (*Journ. de Pharm.*, Mars, 1864, p. 236.) According to M. Michéa, the valerianate of atropia produces the effects of this alkaloid in smaller doses than the sulphate or even atropia itself. He has often known half a milligramme (about $\frac{1}{130}$ gr.) to produce dryness of the throat and dilatation of the pupils the day after its exhibition, while it is generally not till the expiration of several days that he had been able to obtain the same effect from double the dose of the sulphate given daily. He also found less of the valerianate required than of the sulphate to modify the paroxysms of epilepsy. (*Ann. de Thérap.*, 1864, p. 31.) In the *Journal de Pharmacie* for Nov. 1858 (p. 347) there is a particular account of the chemical properties and mode of procuring of valerianate of atropia in the crystalline form, to which the reader is referred. It is probable that, as in the case of valerianate of ammonium, less difficulty will be found, if our officinal monohydrated valerianic acid is employed. (*Note to the twelfth edition.*)

bonate of Barium. Towards the close of the effervescence apply a gentle heat, and, when chemical action has ceased, filter the liquid, and evaporate so that crystals may form when it cools." *U. S.*

When carbonate of barium is employed for obtaining chloride of barium, as in the officinal process, the reactions are very simple. The muriatic acid displaces the carbonic acid with effervescence; and, by reacting with the baryta, forms chloride of barium and water. The solution of chloride of barium, thus obtained, yields crystals of the chloride by concentration and cooling. Another plan is that which procures it from the sulphate, as directed in the late Edinburgh Pharmacopœia. In this the sulphate, previously ignited and powdered, is mixed with charcoal and exposed to a low white heat, by which its constituents are deoxidized, and sulphuret of barium produced; the oxygen escaping in combination with the carbon as carbonic oxide and acid. The sulphuret of barium, after having been dissolved in water, is decomposed by the addition of muriatic acid; sulphuretted hydrogen being evolved, and chloride of barium formed in solution, from which, in the usual manner, the solid salt is obtained.

Of these processes, that in which the native carbonate is used is the simplest and most convenient; but the carbonate is comparatively a rare mineral, and, as the sulphate in fine powder is a cheap article of commerce, being extensively employed for mixing with white lead, it is almost always used for obtaining chloride of barium and the other barium compounds.

Properties. Chloride of barium is a permanent white salt, possessing a bitter and disagreeable taste. It crystallizes in rhombic tables with beveled edges. It dissolves in about two and a half times its weight of cold water, and in a little more than its own weight at 222°, the boiling point of a saturated solution. It is scarcely soluble in absolute alcohol, but dissolves in rectified spirit. Alcohol, impregnated with it, burns with a yellow flame. When exposed to heat, it decrepitates and loses its water of crystallization, and at a red heat fuses. It is decomposed by the sulphates, oxalates, and tartrates, and the alkaline phosphates, borates, and carbonates; also by nitrate of silver, acetate and phosphate of mercury, and acetate of lead. When pure it does not deliquesce. Its solution is not affected by ammonia, which proves the absence of alumina and sesquioxide of iron, or by sulphuretted hydrogen, which shows that neither copper nor lead is present. After the whole of the barium has been precipitated by an excess of sulphuric acid, the supernatant liquid is shown to be free from lime by the non-action of carbonate of sodium. Lime may be separated by the process of Dr. Wolcott Gibbs, which consists in adding to the solution of the chloride a small portion of the solution of hydrate of baryta, and then passing through it a current of carbonic acid, when the whole of the lime will be thrown down as a carbonate. (Wurtz, *N. Y. Journ. of Pharm.*, i. 164.) If strontia be present, an alcoholic solution of the salt will burn with a red flame. Like all the soluble salts of barium it is poisonous. It consists of one eq. of chlorine 35·5, one of barium 68·7, and two of water 18 = 122·2. It is used in medicine only in solution. The officinal solution, Liquor Barii Chloridi, is treated of among the LIQUORES, or *Solutions*.

Off. Prep. Liquor Barii Chloridi, *U. S.* B.

BEBERIA.

Preparation of Beberia.

BEBERIÆ SULPHAS. *Br.* *Sulphate of Beberia.*

"Take of Bebeeru Bark [Nectandra, *U. S.*], in coarse powder, *one pound* [avoirdupois]; Sulphuric Acid *half a fluidounce* [Imperial measure]; Slaked Lime *three-quarters of an ounce*, or *a sufficiency;* Solution of Ammonia *a sufficiency;* Rectified Spirit *sixteen fluidounces*, or *a sufficiency;* Diluted Sulphuric Acid *a sufficiency;* Water *one gallon* [Imp. meas.]; Distilled Water *a sufficiency.* Add the Sulphuric Acid to the Water; pour upon the Bebeeru Bark enough of this mixture to moisten it thoroughly; let it macerate for twenty-four hours, place it in a percolator, and pass through it the remainder of the acidulated water. Concentrate the acid liquor to the bulk of one pint, cool, and add gradually the Lime in the form of milk of lime, agi-

tating well, and taking care that the fluid still retains a distinct acid reaction. Let it rest for two hours; filter through calico; wash the precipitate with a little cold Distilled Water, and to the filtrate add Solution of Ammonia until the fluid has a faint ammoniacal odour. Collect the precipitate on a cloth, wash it twice with ten ounces of cold water, squeeze it gently with the hand, and dry it by the heat of a water-bath. Pulverise the dry precipitate, put it into a flask with six ounces of the Rectified Spirit, boil, let it rest for a few minutes, and pour off the spirit. Treat the undissolved portion in a similar manner with fresh spirit until it is exhausted. Unite the spirituous solutions, add to them four ounces of Distilled Water, and distil so as to recover the greater part of the spirit. To the residue of the distillation add by degrees, and with constant stirring, Diluted Sulphuric Acid till the fluid has a slight acid reaction. Evaporate the whole to complete dryness on the water-bath, pulverise the dry product, pour on it gradually one pint [Imp. meas.] of cold Distilled Water, stirring diligently; filter through paper; evaporate the filtrate to the consistence of syrup, spread it in thin layers on flat porcelain or glass plates, and dry it at a heat not exceeding 140°. Preserve the product in stoppered bottles." *Br.*

In the above process the bark is exhausted by water acidulated with sulphuric acid; lime is added to separate various inert matters, still leaving the acid in excess, as otherwise it might precipitate the beberia itself; the filtered liquor is treated with ammonia which throws down the beberia; the precipitate is exhausted by alcohol which dissolves the alkaloid; and the solution, having been concentrated, is treated with sulphuric acid so as to form the sulphate, which is obtained by evaporation to dryness. It is obvious that the salt of beberia thus obtained must be very impure, and among other substances probably contains a portion of sipeeria, another alkaloid of the bark. Indeed, Prof. Flückiger has found the commercial article to yield a very trifling amount, less than 25 per cent., of the pure alkaloid. It is in dark-brown translucent scales, yellow when reduced to powder, of a strongly bitter taste, and soluble in water and alcohol. According to the Br. Pharmacopœia, "its watery solution gives with chloride of barium a white precipitate, and with caustic soda a yellowish-white precipitate, which is dissolved by agitating the mixture with twice its volume of ether; and the ethereal solution, separated by a pipette, and evaporated, leaves a yellow translucent residue, entirely soluble in diluted acids." If the whole of the precipitate produced is dissolved by ether, it cannot contain sipeeria, which is insoluble in that menstruum. It is "entirely destructible by heat, and water forms with it a clear brown solution." According to Dr. Flückiger (*Pharm. Journ. and Trans.*, xi. 193, 1869), pure beberia is a white, amorphous powder, whose concentrated watery solution is not precipitated by tartar emetic, but affords abundant white precipitates with phosphate of sodium, nitrate, iodide, or iodohydrargyrate of potassium, perchloride of mercury, platinocyanide of potassium, and nitric or iodic acid. Its acetate yields yellow amorphous precipitates with red or yellow prussiate of potassium, chromate or bichromate of potassium, or bichloride of platinum.

Sulphate of beberia is a tonic, supposed to possess antiperiodic powers, and has been given in intermittent fever and other periodical diseases. It is thought to be useful also in various uterine diseases, as dysmenorrhœa, menorrhagia, and leucorrhœa; and has been recommended in blenorrhœal discharges, and in atony of the kidneys and bladder. (Dr. A. P. Merrill, *Half-yearly Abstract of Med. Sci.*, xlv. 249.) The dose is from two to five grains. (See *Nectandra*, in *Part* I.) W.

BISMUTHUM.

Preparations of Bismuth.

BISMUTHI SUBCARBONAS. *U.S.* BISMUTHI CARBONAS. *Br.* *Subcarbonate of Bismuth. Carbonate of Bismuth.*

"Take of Bismuth, in pieces, *two troyounces;* Nitric Acid *eight troyounces and a half;* Water of Ammonia *five fluidounces;* Carbonate of Sodium *ten troyounces;* Distilled Water *a sufficient quantity.* Mix four troyounces and a half of the Nitric Acid with four fluidounces of Distilled Water in a capacious glass vessel, and, having

added the Bismuth, set the whole aside for twenty-four hours. Dilute the resulting solution with ten fluidounces of Distilled Water, stir it thoroughly, and, after twenty-four hours, filter through paper. To the filtered liquid, previously diluted with unequal measure of Distilled Water, slowly add the Water of Ammonia, constantly stirring. Transfer the whole to a strainer, and after the precipitate has been drained, wash it with two pints of Distilled Water, and drain it again. Then place the precipitate in a proper vessel, add the remainder of the Nitric Acid, and afterwards four fluidounces of Distilled Water, and set the solution aside. At the end of twenty-four hours, filter through paper.

"Dissolve the Carbonate of Sodium in twelve fluidounces of Distilled Water, with the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of nitrate of bismuth, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with Distilled Water until the washings pass tasteless. Lastly, press, dry it on bibulous paper with a gentle heat, and rub it into powder." *U. S.*

"Take of Purified Bismuth, in small pieces, *two ounces* [avoirdupois]; Nitric Acid *four fluidounces* [Imperial measure]; Carbonate of Ammonia *six ounces* [avoird.]; Distilled Water *a sufficiency.* Mix the Nitric Acid with three [fluid]ounces [Imp. meas.] of Distilled Water, and add the Bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and afterwards decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluidounces [Imp. meas.], and add this in small quantities at a time to a cold filtered solution of the Carbonate of Ammonia in two pints [Imp. meas.] of Distilled Water, constantly stirring the mixture as it is formed. Collect the precipitate on a calico filter, and wash it with Distilled Water until the washings pass tasteless. Remove now as much of the adhering water as can be separated from the precipitate by slight pressure with the hands, and finally dry the product at a temperature not exceeding 150°." *Br.*

This preparation was first made officinal in the 1860 edition of the U. S. Pharmacopœia. As metallic bismuth generally contains arsenic, it is very important to provide that this should be left behind, in the processes for making its medicinal preparations. It is on this account that the present formula is so elaborate. The bismuth is first dissolved in nitric acid, a portion of which oxidizes the metal, with the evolution of nitrous vapours, while another portion combines with the oxide produced to form nitrate of bismuth. At the same time the arsenic is also oxidized at the expense of the nitric acid, and unites with a portion of the oxidized metal so as to generate the arseniate of bismuth. Both of these salts, therefore, are contained in the solution, which is very concentrated. Both have the property, when their solution is diluted with water, to separate into two salts, one an insoluble subsalt which is deposited, and the other a soluble supersalt which is held in solution. But the arseniate is more disposed to the change than the nitrate, and requires for the purpose a smaller amount of water of dilution. Hence, the first direction, after the metal has been dissolved, is to add a moderate quantity of distilled water, insufficient to cause the decomposition of the nitrate. From this diluted solution the insoluble subarseniate is slowly deposited, so as, in the course of twenty-four hours, to free it almost if not entirely from the poisonous metal. This is separated by filtration, and the solution is now diluted with a much larger quantity of distilled water, which causes a copious deposition of subnitrate of bismuth. But, in order not to waste the supernitrate remaining in solution, this is decomposed by ammonia, which takes most of the nitric acid, and precipitates the bismuth combined with the remainder in the form of subnitrate. The whole of the precipitated subnitrate, thus freed from arsenic, is redissolved in nitric acid, and the solution of the nitrate now obtained, being diluted with just so much water as to produce a commencing precipitation of subnitrate, is freed by filtering from the small quantity formed, and slowly added to a solution of carbonate of sodium. An interchange of principles takes place; nitrate of sodium and carbonate of bismuth are formed, the former of which remains in solution, and the latter is deposited. This part of the process tends still further to get rid of the arsenic; for if any of the arsenic acid or arseniate of bismuth exist in the solution, the poisonous acid would combine

with the soda, and thus forming a soluble salt, would be retained by the water. Nothing now remains but to wash, dry, and powder the precipitate.

The British process is more simple, because, using bismuth already purified, it is without the preliminary measures taken in the U. S. process to separate the arsenic. It is essentially the same as the method described in the twelfth edition of this Dispensatory (*page* 1025); carbonate of ammonium being used instead of carbonate of sodium for the precipitation of the subcarbonate of bismuth.

Properties. Subcarbonate of bismuth is a white or yellowish-white powder, blackened by sulphuretted hydrogen, without odour or taste, and insoluble in water, whether pure or impregnated with carbonic acid. (*Berzelius.*) Its sp. gr. is about 4. It effervesces with acids, and, when exposed to heat, loses 9·5 per cent. of its weight (*U. S.*), in consequence of the escape of carbonic acid, and is converted into the anhydrous teroxide, of a light-yellow colour. When mixed with sulphuric acid, and subjected to Marsh's test, it should yield no arsenic, or merely a trace. "The nitric acid solution gives no precipitate with diluted sulphuric acid or with solution of nitrate of silver. If to nitric acid mixed with half its volume of distilled water as much carbonate of bismuth be added as the acid will dissolve, one volume of this solution poured into twenty volumes of water will yield a white precipitate." *Br.* If arsenic were present, a precipitate would take place with a much smaller proportion of water. The formula of the subcarbonate is BiO_3,CO_2, or, according to the Br. Pharmacopœia, $2(BiO_3,CO_2),HO$. According to Mr. T. P. Blunt, the commercial subcarbonate of bismuth usually contains an appreciable amount, about 0·1 per cent., of silver.

Medical Properties and Uses. This salt was brought into notice by M. Hannon, of Brussels, who recommends it as a substitute for the subnitrate. He considers it to act for the first few days of its employment as a sedative, and afterwards as a tonic. Like the subnitrate it is applicable to the treatment of gastralgia following the phlegmasias of the digestive organs, and attended with a red tongue, laborious digestion, acid eructations, and spasmodic vomitings. He conceives it, however, to have many advantages over the subnitrate, among which are its more ready tolerance by the stomach, its greater solubility in the gastric juice, its power to neutralize excess of acid in the stomach, and the want of any tendency to constipate. The dose is from 15 to 45 grains, given three times a day just before meals, and gradually increased. It may be taken in a little water. (*Ann. de Thérap.*, 1857, p. 214.) W.

BISMUTHI SUBNITRAS. Bismuthum Album. *Subnitrate of Bismuth. White Bismuth.*

"Take of Bismuth, in pieces, *two troyounces;* Nitric Acid *eight troyounces and a half;* Carbonate of Sodium *ten troyounces;* Water of Ammonia *five fluidounces;* Distilled Water *a sufficient quantity.* Mix four troyounces and a half of the Nitric Acid with four fluidounces of Distilled Water, in a capacious glass vessel, and, having added the Bismuth, set the whole aside for twenty-four hours. Dilute the resulting solution with ten fluidounces of Distilled Water, stir it thoroughly, and, after twenty-four hours, filter through paper.

"Dissolve the Carbonate of Sodium in twenty fluidounces of Distilled Water with the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of nitrate of bismuth, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with Distilled Water until the washings pass tasteless, and drain again as completely as possible. Then place the moist precipitate in a capacious vessel, gradually add the remainder of the Nitric Acid, and afterwards four fluidounces of Distilled Water, and set the solution aside. At the end of twenty-four hours, filter through paper, and to the filtered liquid, previously diluted with four pints of Distilled Water, slowly add the Water of Ammonia, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with two pints of Distilled Water, drain it again, and press out as much of the liquid as possible. Lastly, dry it upon bibulous paper with a gentle heat, and rub it into powder." *U. S.*

"Take of purified Bismuth, in small pieces, *two ounces* [avoirdupois]; Nitric Acid *four fluidounces* [Imperial measure]; Distilled Water *a sufficiency.* Mix the Nitric Acid with three [fluid]ounces of Distilled Water, and add the Bismuth in successive

portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluidounces, and pour it into half a gallon of Distilled Water. When the precipitate which forms has subsided, decant the supernatant liquid, add half a gallon [Imp. meas.] of Distilled Water to the precipitate, stir them well together, and after two hours, decant off the liquid, collect and drain the precipitate in a calico filter, press it with the hands, and dry it at a temperature not exceeding 150°." *Br.*

The U. S. process is new, the British that of the late Dublin Pharmacopœia. The alterations from the old process, in the former, were based upon the wish to get rid of any arsenic that might be present in the bismuth used. This is accomplished by first preparing the carbonate, by adding the nitric acid solution of bismuth to a solution of carbonate of sodium in excess, whereby most of the arsenic is retained in the solution probably as arseniate of sodium, while the insoluble carbonate is precipitated. This is dissolved, with the aid of heat, in nitric acid, so as to make a very concentrated solution of the nitrate, to which, when cold, just so much water is added as to begin to produce a permanent turbidness. The object of this is to allow any arsenic that may be still present to be deposited, which happens for reasons stated in explaining the process for procuring the subcarbonate. (See *page* 1104.) The deposited matter having been precipitated, only the pure nitrate remains in solution, which is made to yield the subnitrate by large dilution with water, and still more completely by the addition of ammonia.

In the British formula, the old method is pursued of simply dissolving the bismuth, which has been previously purified, in nitric acid somewhat diluted, concentrating the solution, and precipitating by adding it to a large quantity of water. When bismuth is added to dilute nitric acid, red fumes are copiously given off, and the metal, oxidized by the decomposition of part of the nitric acid, is dissolved by the remainder so as form a solution of the ternitrate of teroxide of bismuth. It is unnecessary to have the metal in powder; as it dissolves with great facility when added to the acid in fragments. When the solution is completed, the liquor should be added to the water, and not the water to the solution. Immediately on the contact of the solution with the water, four eqs. of the ternitrate are resolved into three eqs. of mononitrate of bismuth (subnitrate) which precipitates, and one eq. of the 9-nitrate which remains in solution. $4(BiO_3.3NO_5) = 3(BiO_3.NO_5)$ and $BiO_3.9NO_5$. In order to have a smooth light powder, which is most esteemed, the precipitate should be well washed to remove every trace of free nitric acid, and dried as speedily as possible. In the use of this formula it is taken for granted that the bismuth has been ascertained to be free from arsenic; and, if it prove upon the application of Marsh's test to be otherwise, means should certainly be employed to purify before using it. Measures for this purpose will be mentioned under Bismuthum Purificatum (*page* 1108). Should the subnitrate or subcarbonate be ascertained to contain arsenic, it may, as suggested by Dr. Herapath, be purified by boiling it with solution of caustic soda or potassa, twice successively, then thoroughly washing the residue, which will be yellow oxide of bismuth, dissolving it again in nitric acid, and precipitating by water as before. (*Chem. News*, Feb. 14, 1863, p. 77.) In the washing of subnitrate of bismuth, the salt is asserted to lose a portion of its nitric acid; and the change may be considerable, if the washing be persevered with so long as the liquid comes away in any degree acidulous. It has been ascertained by Julius Löwe that this effect may be avoided by washing with a very dilute solution of nitrate of ammonium, containing one part in 500 parts of water. (*Chem. Gaz.*, March 15, 1859, p. 119.)

Properties. Subnitrate of bismuth is a heavy powder, of a pure-white colour, a faintly sour smell and taste, and the property of reddening moistened litmus paper. It is slightly soluble in water, and readily so in the strong acids, from which it is precipitated by water. The fixed alkalies dissolve it sparingly, and ammonia more readily. It is darkened by hydrosulphuric acid gas, but not by exposure to light, unless it contains a little silver, or is subjected to the influence of organic matter. If it dissolves in nitric acid without effervescence, it contains no carbonate, and, if the nitric solution is not precipitated by dilute sulphuric acid, it is free from lead. It some-

times contains arsenic, which may be detected by acting on it with pure sulphuric acid, evaporating to dryness, dissolving in hot distilled water, and testing a part of the solution by Marsh's apparatus. By this method M. Lassaigne detected one-sixth of 1 per cent. of arsenic in a sample of subnitrate sold in Paris. M. Glénard proposes two new methods of searching for arsenic in the subnitrate; one merely qualitative, the other quantitative. The first consists in strongly heating a mixture of the suspected salt with acetate of potassium. The least trace of arsenic will be detected by the strong and offensive odour produced, owing to the formation of cacodyl. In the second, the subnitrate of bismuth is heated with pure muriatic acid. If arsenic be present it will rise in vapours in the form of chloride. These should be carefully collected and condensed, and then treated with an excess of sulphuretted hydrogen. The sulphuret of arsenic precipitated will be the measure of the metal. (*Ann. de Thérap.*, 1868, p. 176.) M. Lassaigne has found as much as 27 per cent. of chloride of bismuth in this preparation, when obtained by precipitating, with water, a solution of bismuth in a mixture of nitric and muriatic acid. The same impurity is introduced, to a small extent, by using common water containing chlorides; and subsulphate of bismuth renders the preparation impure, when the water used contains sulphate of calcium. (*Journ. de Chim. Méd.*, Mai, 1855, p. 276.) These facts show the necessity of using distilled water. As regards the origin of the chlorine sometimes existing in commercial subnitrate of bismuth, it is asserted by Mr. R. C. Tichborne to be a common practice with the manufacturer, in order to save the bismuth existing in the mother-liquor, after the deposition of the subnitrate, to precipitate it with chloride of sodium, thus obtaining an insoluble oxychloride of bismuth, which is then added to the previous product. (*Pharm. Journ.*, Feb. 1860, p. 413.) The new metal thallium is said to be present in most specimens of the pharmaceutical preparations of bismuth. For the modes of detecting and separating it, the reader is referred to the *Chemical News* (March 7, 1863, p. 109). Phosphate of calcium has been ascertained to be an occasional adulteration of the subnitrate. A ready method of detecting it, suggested by M. Roussin, has proved to be fallacious, and may lead to false decisions as to the presence of the phosphate, and thus injuriously compromise the reputation of individuals. There can be no difficulty in detecting the adulteration by reliable tests.* Subnitrate of bismuth was called, by the earlier chemists, *magistery of bismuth.* It consists of one eq. of nitric acid 54, one of teroxide of bismuth 237, and one of water $9 = 300$. When heated to redness it loses 20 per cent. of its weight. *U. S.* It is incompatible with iodide of potassium, slowly forming a brick-red iodide of bismuth.

Medical Properties. Subnitrate of bismuth is antispasmodic, absorbent, and slightly sedative and astringent. When its use is too long continued it produces scorbutic symptoms, a proof that it is absorbed. It was first used as a medicine by Dr. Odier, of Geneva. It is principally employed in painful affections of the stomach, such as cardialgia, pyrosis, and gastrodynia, in spasmodic diseases, and in dysentery and diarrhœa. Rayer employed it with advantage in the diarrhœa of phthisis and typhus, and Aran recommended it in the obstinate form of the complaint which sometimes follows typhoid fever. It has been used also in dysentery. M. Monneret particularly insists upon the remarkable efficacy of the medicine, given in very large doses, in chronic gastro-intestinal affections, attended with diarrhœa; a plan of treatment which has been followed by several practitioners with advantage. M. Trousseau has successfully employed subnitrate of bismuth in the diarrhœa of children in the form of enema, in the dose of two scruples, mixed with thick flaxseed tea. M. Monneret uses it thus in much larger doses. He thinks that in diarrhœa its action

* To detect this the following tests may be employed, the first advised by Dr. Redwood (*Pharm. Journ. and Trans.*, 2d ser., x. 165); the second by Mr. Wm. A. Tilden (*Ibid.*, 3d ser., i. 503). To one part of the salt of bismuth dissolved in weak nitric acid add two parts of citric acid; dissolve with the aid of a little water; add an excess of solution of ammonia and boil. Any phosphate present will be thrown down with continuous boiling of the solution.

Dissolve in nitric acid, precipitate the bismuth by sulphuretted hydrogen, filter; from the filtrate expel any free sulphuretted hydrogen by boiling. To a part of the filtrate add molybdate of ammonium, when, if phosphoric acid be present, a yellow precipitate will fall. Neutralize another portion, add acetic acid in excess, then a soluble oxalate; if lime be present its oxalate will precipitate. (*Note to the fourteenth edition.*)

is entirely local; but this view is combated by Dr. Lussanna, who believes that a part of the medicine enters the circulation, though it never passes into the urine. Its use always blackens the stools. The dose of subnitrate of bismuth, usually prescribed, is five grains, gradually increased to fifteen, twice or thrice a day, given in pill, or mixed with sweetened water. Upon the plan of large doses, recommended by M. Monneret, from half an ounce to an ounce is given daily, in divided doses, in the diarrhœa of adults; from half a drachm to a drachm in that of infants; and from a drachm to two drachms in painful affections of the stomach. In these large doses the medicine is said to be perfectly safe; and yet Orfila mentions, as resulting from an overdose, gastric distress, nausea, vomiting, diarrhœa or constipation, colic, heat in the breast, slight rigors, vertigo, and drowsiness. These effects are to be combated by mucilaginous drinks, enemata, and emollient fomentations, and, in case of inflammation, by bleeding, both general and local. The contradictory statements as to the safety of the preparation can be explained only on the supposition that it is sometimes rendered poisonous by the presence of arsenic, chloride of bismuth, or free nitric acid; and a strong motive is thus furnished to the apothecary to prepare the medicine with the greatest care. M. Rodolfi, of Breccia, has found the use of the subnitrate, associated with bicarbonate of sodium and sulphur, to be very efficient in controlling the night sweats of phthisis. Seven or eight grains of the bicarbonate with two or three grains of each of the other ingredients, may be taken every two hours. The favourable effect may be expected in four or five days. (*Journ. de Pharm.*, 4e sér., iii. 468.)

M. Monneret recommends the external use of subnitrate of bismuth as a drying application. In the treatment of ulcers, especially scrofulous ones, provided no risk would be incurred by stopping the discharge, he sprinkles the powder over the whole ulcerated surface. M. E. Caby has used it as a topical application in leucorrhœa, gonorrhœa, and gleet. When used in leucorrhœa, the entire surface of the vagina is dusted with the powder. The injection for gonorrhœa or gleet is made by mixing with water as much of the subnitrate as can be conveniently suspended. Three parts of the salt to twenty of water have been recommended. A portion of the mixture is injected thrice daily, and, each time, retained five minutes. Dr. W. R. Hamilton, of St. Augustine, Illinois, has employed it advantageously for preventing pitting in smallpox. He applies it to the face twice a day, after lubricating the surface with olive oil. (*Am. Journ. of Med. Sci.*, Oct. 1865, p. 563.) The external use of subnitrate of bismuth is attended with no pain. (*Ranking's Abstract*, xx. 188.)

Off. Prep. Trochisci Bismuthi, *Br.* B.

BISMUTHUM PURIFICATUM. *Br.* *Purified Bismuth.*

"Take of Bismuth *ten ounces*, Nitrate of Potash in powder *two ounces*. Put the Bismuth and one ounce of the Nitrate of Potash into a crucible, and heat them to a temperature at which both the metal and the salt are fused. Continue the heat, constantly stirring the contents of the crucible, for fifteen minutes, or until the salt has solidified into a slag over the metal. Then remove the salt, add the remainder of the nitrate of potash to the bismuth in the crucible, and repeat the process as before. Finally, pour the Bismuth while fused into a suitable mould and allow it to cool." *Br.*

A mode of purifying bismuth is given in the U. S. Pharmacopœia in the process for preparing the subcarbonate and subnitrate. (See *pages* 1104 and 1105.) That of the Br. Pharmacopœia is different; consisting in the oxidizement of the arsenic and other contaminating metals that may be present, by means of the nitric acid of the nitre, and their consequent separation from the bismuth, the great mass of which remains behind unaffected. This method was referred to in the twelfth edition of the Dispensatory (p. 1025); where also the plan of M. W. Pierre is mentioned, consisting in the addition of from 2·5 to 5 per cent. of zinc to the bismuth, and strongly heating the mixture in a crucible, with a piece of charcoal to prevent the oxidation of the zinc. Both the arsenic and zinc are driven off. (*Chem. News*, Jan. 16, 1861.) According to Mr. Tilden, the British officinal process is both wasteful of the bismuth and incapable of removing the impurities. (*Pharm. Journ. and Trans.*, ser. 3, i. 505.)

"Dissolved in a mixture of equal volumes of nitric acid and distilled water, it forms

a solution which by evaporation yields colourless crystals, that are decomposed on the addition of water, giving a white precipitate. If the mother-liquors from which the crystals have been separated be added to solution of carbonate of ammonia, the precipitate formed and the solution are free or nearly free from colour" (*Br.*); indicating the total or almost total absence of metals that yield coloured salts, as copper, iron, &c.

Off. Prep. Bismuthi Carbonas, *Br.;* Bismuthi Subnitras, *Br.;* Liquor Bismuthi et Ammoniæ Citratis, *Br.* W.

CADMIUM.

Preparation of Cadmium.

CADMII SULPHAS. *U. S. Sulphate of Cadmium.*

"Take of Cadmium, in small pieces, *a troyounce;* Nitric Acid *two troyounces;* Carbonate of Sodium *three troyounces;* Sulphuric Acid *four hundred and twenty grains;* Distilled Water *a sufficient quantity.* To the Cadmium and two fluidounces of Distilled Water, contained in a glass vessel, add by degrees the Nitric Acid, and, when the action slackens, apply a gentle heat until the metal is dissolved. Filter the solution, and, having dissolved the Carbonate of Sodium in six fluidounces of Distilled Water, mix the solutions thoroughly. Wash the precipitate obtained until the water passes tasteless, and dissolve it in the Sulphuric Acid, diluted with four fluidounces of Distilled Water. Then evaporate the solution to one-third, and set it aside to crystallize. Lastly, dry the crystals on bibulous paper." *U. S.*

A nitrate of cadmium is first formed, in consequence of the greater facility with which nitric acid acts upon that metal than sulphuric acid. The cadmium is oxidized at the expense of a part of the acid, with the production of hyponitric acid fumes, and the resulting oxide unites with the undecomposed part of the acid to form the nitrate. This is then decomposed in solution by carbonate of sodium, with a mutual interchange of principles; the nitric acid of the nitrate of cadmium taking the soda of the carbonate, and forming nitrate of sodium which is retained in solution, while the carbonic acid and oxide of cadmium combine to produce the insoluble carbonate of that metal, which is deposited. This, having been washed, is treated with dilute sulphuric acid, by which the carbonic acid is expelled, and the sulphate of cadmium generated in solution, from which it is obtained by concentration and crystallization.

Properties. Sulphate of cadmium crystallizes in oblique prisms with rhomboidal bases, which are transparent and colourless, and said to resemble those of sulphate of zinc. They have an astringent, slightly acidulous, and austere taste, effloresce on exposure to the air, and are very soluble in water. The solution, even though acidulated, gives with hydrosulphuric acid a yellow precipitate, becoming orange-yellow, of sulphuret of cadmium, which is dissolved by strong muriatic acid, but is insoluble in solutions of potassa or ammonia, and is thus readily distinguished from the sulphuret of arsenic. With hydrosulphate of ammonium it gives a yellow precipitate insoluble in an excess of the hydrosulphate. Ammonia produces a white precipitate, soluble in an excess of the precipitant; carbonate of ammonium a white one insoluble in an excess; ferrocyanide of potassium a white precipitate not dissolved by muriatic acid; and the ferridcyanide a brownish-yellow one soluble in a large excess of that acid. (*Brande & Taylor.*) By these tests sulphate of cadmium is distinguished as a salt of that metal. As a sulphate it is known by yielding a precipitate with chloride of barium not soluble in nitric acid. Zinc precipitates cadmium in the metallic state from the solution. Cadmium suspended in a solution of sulphate of copper precipitates that metal, leaving sulphate of cadmium in solution; and this has been proposed as a method of obtaining the salt. The formula of sulphate of cadmium as commonly given is $CdO,SO_3 + 4HO$; but, according to M. de Hauer, it is said to have eight eqs. of water for every three of the salt, and its formula is $3(CdO,SO_3) + 8HO$. (*Chem. News*, Nov. 29, 1862, p. 268.) W.

Medical Uses. Sulphate of cadmium is said to resemble but to exceed in power sulphate of zinc as an astringent and emetic. Besides these properties, it possesses, according to M. Grimaud, valuable powers as a remedy in syphilis, rheumatism, and gout. As yet it has been used almost exclusively as an astringent and stimulating

remedy in diseases of the eyes and in gonorrhœa. In specks and opacities of the cornea it has been employed successfully by both American and European surgeons. It is used either in solution, in the proportion of from half a grain to four grains to the fluidounce of distilled water, or in the form of ointment, made by mixing two grains with four scruples of fresh lard. M. Fronmüller has employed it, with excellent results, in specks of the cornea, dissolved in rose-water in the proportion of three grains to two fluidounces, conjoined with from half a fluidrachm to a fluidrachm and a half of wine of opium. We have had no experience with sulphate of cadmium as an internal remedy, and can give no authoritative statement as to the proper dose. Nor does this appear to have been well determined; for, while on the one hand we are told that it is ten times as strong as sulphate of zinc, on the other it is said to be used for the same purposes and in the same doses as that salt. (Bouchardat, *Ann. de Thérap.*, 1857, p. 231.) B.

CALX.

Preparations of Lime.

The liquid preparations of lime, *Liquor Calcis* and *Liquor Calcii Chloridi*, have, in conformity with the U. S. Pharmacopœia, been transferred to the *Solutions*. (See *Liquores*.)

CALCII CARBONAS PRÆCIPITATA. *U. S.* CALCIS CARBONAS PRÆCIPITATA. *Br.* *Precipitated Carbonate of Calcium.*

"Take of Solution of Chloride of Calcium *five pints and a half;* Carbonate of Sodium *seventy-two troyounces;* Distilled Water *a sufficient quantity.* Dissolve the Carbonate of Sodium in six pints of Distilled Water. Heat this solution and the Solution of Chloride of Calcium, separately, to the boiling point, and mix them. After the precipitate has subsided, separate it from the supernatant liquid by decantation, and wash it with boiling Distilled Water until the washings cease to be affected by a solution of nitrate of silver. Lastly, dry the precipitate on bibulous paper." *U. S.*

"Take of Chloride of Calcium *five ounces* [avoirdupois]; Carbonate of Soda *thirteen ounces* [avoird.]; Boiling Distilled Water *a sufficiency.* Dissolve the Chloride of Calcium and the Carbonate of Soda each in two pints [Imperial measure] of the Water; mix the two Solutions; and allow the precipitate to subside. Collect this on a calico filter, wash it with boiling Distilled Water until the washings cease to give a precipitate with nitrate of silver, and dry the product at the temperature of 212°." *Br.*

These processes do not essentially differ. In each a mutual interchange of principles takes place, resulting in the production of chloride of sodium which remains in solution, and carbonate of calcium which is deposited. Any peculiar advantage of the preparation must depend on the minute division of its particles. According to Dr. Bridges, this effect is best obtained by employing the solutions at the boiling temperature, a precaution which is observed in both the present officinal processes. (*Am. Journ. of Pharm.*, xvi. 163.) When properly made, it is a very pure carbonate of calcium, in the form of a fine white powder, free from grittiness, insoluble in water, but wholly soluble in dilute muriatic acid with copious effervescence. These properties serve to distinguish it from sulphate of calcium, with which it is sometimes adulterated, and which has even been sold for it. It is known to be a salt of lime by giving a copious white precipitate with oxalate of ammonium, when this is added to its solution in muriatic acid, previously neutralized by ammonia. It is dissolved by nitric acid, giving a clear solution, which if perfectly neutral, and boiled to drive off carbonic acid, gives no precipitate with saccharated solution of lime in excess, or with nitrate of silver, showing the absence of phosphates and chlorides. Its formula is CaO,CO_2, and equivalent number 50. For ordinary use, it probably has no such superiority over prepared chalk as to counterbalance its greater expensiveness. It is preferred by some to chalk in the preparation of tooth-powders. It is frequently sold in the shops under the name of *creta præcipitata*. The dose is from 10 to 40 grains or more.

Off. Prep. Trochisci Bismuthi, *Br.* W.

CALCIS HYDRAS. *Br.* *Slaked Lime.*

"Take of Lime *two pounds* [avoirdupois]; Distilled Water *one pint* [Imperial mea-

sure]. Place the Lime in a metal pot, pour the Water upon it, and when vapour ceases to be disengaged cover the pot with its lid, and set it aside to cool. When the temperature has fallen to that of the atmosphere, put the slaked lime on an iron-wire sieve, and by gentle agitation cause the fine powder to pass through the sieve, rejecting what is left. Put the powder into a well-stopped bottle, and keep it excluded as much as possible from the air. Slaked Lime should be recently prepared." *Br.*

The U. S. Pharmacopœia has no separate formula for this preparation, but directs it to be made when at any time it may be wanted. In the process of slaking, water combines with lime to form a solid hydrate, with the evolution of much heat and the escape of white vapours, which consist of steam holding particles of lime in suspension. By union with water the lime acquires a whiter colour, and, if previously in masses, becomes much softer, swelling up, and breaking into a coarse soft powder or friable lumps. When perfectly dry, it consists of one eq. of each of its constituents, with the formula CaO,HO. For the properties of lime the reader is referred to the head of *Calx*, in *Part* I. Hydrate of lime is used exclusively as a pharmaceutical agent.

Pharm. Uses. In preparing Æther, *Br.;* Atropia, *Br.;* Beberiæ Sulphas, *Br.;* Chloroformum, *Br.;* Liquor Ammoniæ Fortior, *Br.;* Liquor Potassæ, *Br.;* Liquor Sodæ, *Br.;* Potassæ Chloras, *Br.;* Santoninum, *Br.;* Sulphur Præcipitatum, *Br.*

Off. Prep. Liquor Calcis, *Br.;* Liquor Calcis Saccharatus, *Br.* W.

CALCII PHOSPHAS PRÆCIPITATA. *U.S.* Calcis Phosphas. *Br. Precipitated Phosphate of Calcium. Phosphate of Lime.*

"Take of Bone, calcined to whiteness, and in fine powder, *four troyounces;* Muriatic Acid *eight troyounces;* Water of Ammonia *twelve fluidounces*, or *a sufficient quantity;* Distilled Water *a sufficient quantity.* Macerate the Bone in the Acid, diluted with a pint of Distilled Water, until it is dissolved, and filter the solution. Add another pint of Distilled Water, and then, gradually, Water of Ammonia, until the liquid acquires an alkaline reaction. Mix the precipitate obtained, while yet in the state of magma, with twice its bulk of boiling Distilled Water, and pour the whole upon a strainer. Wash the precipitate with boiling Distilled Water until the washings cease to be affected by a solution of nitrate of silver, acidulated with nitric acid. Lastly, dry the precipitate with a gentle heat." *U. S.*

"Take of Bone Ash *four ounces* [avoirdupois]; Hydrochloric Acid *six fluidounces* [Imperial measure]; Water *two pints* [Imp. meas.]; Solution of Ammonia *twelve fluidounces*, or *a sufficiency;* Distilled Water *a sufficiency.* Digest the Bone Ash in the Hydrochloric Acid diluted with a pint of Water, until it is dissolved. Filter the solution, if necessary; add the remainder of the Water, and afterwards the Solution of Ammonia, until the mixture acquires an alkaline reaction; and, having collected the precipitate on a calico filter, wash it with boiling Distilled Water as long as the liquid which passes through occasions a precipitate, when dropped into solution of nitrate of silver acidulated with nitric acid. Dry the washed product at a temperature not exceeding 212°." *Br.**

This preparation, whatever opinion may be entertained of its real powers, has been very properly introduced into the U. S. Pharmacopœia, as it is considerably used, and is by some much esteemed.

The muriatic acid dissolves the phosphate of calcium of the bones, and lets it fall, on the addition of ammonia, in a state of minute division. The ablution is intended to free it from adhering chloride of ammonium. The salt thus obtained is, for the sake of distinction, called *bone phosphate of calcium.* It is a white powder, without taste or smell, insoluble in water, but very soluble in nitric, muriatic, and acetic acids, from which it is precipitated unchanged by ammonia. By an intense heat it is fused, but is not otherwise changed. It consists, according to Mitscherlich, of one equivalent of phosphoric acid and three of lime.

The chemical characteristics of bone phosphate of calcium, besides those mentioned, are that with its solution in dilute nitric acid, oxalate of ammonium produces a white precipitate of oxalate of calcium, and acetate of lead a white precipitate of phosphate of lead; and, if the nitric solution be neutralized as far as possible without causing a

* For an apparatus for preparing *phosphate of calcium* on a large scale, see *Journ. de Pharm.*, Sept. 1, 1875, p. 193.

permanent precipitate of phosphate of calcium, ammoniacal nitrate of silver throws down from it a lemon-yellow precipitate of phosphate of silver. (*Christison's Dispensatory.*) "Ten grains dissolve perfectly and without effervescence in diluted hydrochloric acid, and the solution yields with ammonia a white precipitate, insoluble in boiling solution of potash, and weighing ten grains when washed and dried." *Br.*

Medical Uses. In the form of burnt hartshorn, phosphate of calcium formerly enjoyed a brief popularity in the treatment of rickets and mollities ossium, in which its use seemed to be indicated upon obvious chemical grounds. It has recently been again brought into notice in consequence of the suggestion by Benecke (*London Lancet*, July, 1851), that, as it is essential in animals as well as plants to the formation of cells, it might be found useful in certain pathological states of the system characterized by defective nutrition, such as the scrofulous affections. Upon considerations of this kind, the late Dr. W. Stone, of New Orleans, was induced to employ it in cases of scrofulous ulceration, phthisis, &c., and with considerable supposed advantage. (See *St. Louis Med. and Surg. Journ.*, x. 38.) Subsequently, it has been used by other practitioners, and, in connection with other phosphates, as those of iron, sodium, and potassium, has acquired no little reputation in different forms of scrofula and phthisis. When, however, it is considered that, in ordinary food, there is more of the phosphates than the system has need of, so that they are constantly escaping with the stools; and that in those very disorders in which they are supposed to be indicated they are not unfrequently in excess in the blood and urine, in consequence, probably, of the rapid disintegration of the tissues, it would seem doubtful whether the want, in scrofulous cases, is so much that of materials for cells as of due power to appropriate those materials. In the reported cases, the phosphate of calcium has generally been administered in connection with cod-liver oil or other tonics; to which, there is reason to believe, any benefit experienced is more truly ascribable than to the phosphate. In two of Dr. Stone's cases the good effects began to be experienced at the period when they might have been expected from the oil alone. Dr. Henry Blanc commends highly the mixture of raw meat juice with the phosphate of calcium in phthisis. (*Brit. and For. Med.-chir. Rev.*, Oct. 1874, 503.) Phosphate of calcium is thought to have proved useful by hastening the union of fractured bones; and M. Alphonse Milne-Edwards is said to have shown, by experiments upon dogs and rabbits, that, in these animals, the callus in fractured bones forms more quickly under its use than without it. (*Med. Times and Gaz.*, May, 1856, p. 489.) M. Piorry also has derived material advantage from the phosphate of calcium in two cases of softened bone supposed to have depended on a venereal taint. (See *Am. Journ. of Med. Sci.*, April, 1865, p. 512.) Its use in curvature of the spine and rickety affections in general has also been revived by M. Piorry and others. Though insoluble in water, it is probably in general dissolved by the gastric liquids, in consequence of the acid present in them; and, if desirable, it may readily be administered in solution by the addition of one of the acids mentioned in the above account of its chemical properties. The dose is from ten to thirty grains.*

Off. Prep. Pulvis Antimonialis. *Br.* W.

CRETA PRÆPARATA. *U. S., Br. Prepared Chalk.*

"Take of Chalk *a convenient quantity.* Add a little water to the chalk, and rub it into fine powder. Throw this into a large vessel nearly full of water, stir briskly, and, after a short interval, decant the supernatant liquor, while yet turbid, into another vessel. Treat the coarser particles of the Chalk, remaining in the first vessel, in a similar manner, and add the turbid liquid to that previously decanted. Lastly, set the liquid by that the powder may subside, and, having poured off the water, dry the powder." *U. S.*

* *Syrup of Phosphate of Calcium.* Mr. T. S. Wiegand has proposed a syrup of phosphate of calcium, to be made in the following manner. Take of the precipitated phosphate ℥j, muriatic acid f℥ss, water f℥vij, sugar q. s. Mix the phosphate with a fluidounce of the water; add the acid; filter the resulting solution; then add the remainder of the water, and enough sugar to make twelve fluidounces of syrup; and, finally, strain. (*Am. Journ. of Pharm.*, xxvi. 297.)—*Note to the eleventh edition.*

M. Chevner (*Am. Journ. of Pharm.*, Dec. 1874) having found that tribasic phosphate of calcium is soluble in carbonic acid, has proposed a preparation made by causing the gas to bubble through a milk of gelatinous phosphate for some hours, filtering, and then preserving in tightly corked bottles. (*Note to the fourteenth edition.*)

The Br. Pharmacopœia has abandoned its former process, and is now content with defining the medicine to be "chalk freed from most of its impurities by elutriation, and afterwards dried in small masses, which are usually of a conical form."

The object of the above process is to reduce chalk to a very fine powder. The mineral, previously pulverized, should be rubbed with a little water upon a porphyry slab, by means of a muller of the same material. Having been thus very minutely divided, it is agitated with water, which upon standing a short time deposits the coarser particles, and, being then poured off, slowly lets fall the remainder in an impalpable state. The former part of the process is called *levigation*, the latter *elutriation*. The soft mass which remains after the decanting of the clear liquor is made to fall upon an absorbent surface in small portions, which when dried have a conical shape.* Practically, prepared chalk is generally made on the large scale from *whiting* by the manufacturer. For the particulars of the process the reader is referred to the *Pharm. Journ.* (vii. 416).

Medical Properties and Uses. This is the only form in which chalk is used in medicine. It is an excellent antacid; and, as the salts which it forms in the stomach and bowels, if not astringent, are at least not purgative, it is admirably adapted to diarrhœa accompanied with acidity. It is also sometimes used in acidity of stomach attending dyspepsia and gout, when a laxative effect is to be avoided; is one of the best antidotes for oxalic acid; and has been recommended in rachitis. In scrofulous affections it may sometimes do good by forming soluble salts with acid in the primæ viæ, and thus finding an entrance into the blood-vessels. It is frequently employed as an application to burns and ulcers, which it moderately stimulates, while it absorbs the ichorous discharge, and thus prevents it from irritating the diseased surface, or the sound skin. It is given internally in the form of powder, or suspended in water by the intervention of gum arabic and sugar. (See *Mistura Cretæ.*) It is better fitted for the chalk mixture than the precipitated carbonate of calcium, in consequence of its more impalpable character. The dose is from ten to forty grains or more.

Pharm. Uses. In preparing Acidum Citricum, *Br.;* Acidum Tartaricum, *Br.*

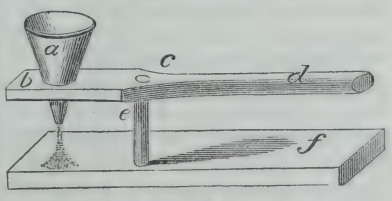
Off. Prep. Hydrargyrum cum Cretâ; Mistura Cretæ; Pulvis Cretæ Aromaticus, *Br.;* Pulvis Cretæ Aromaticus cum Opio, *Br.;* Trochisci Cretæ, *U. S.* W.

TESTA PRÆPARATA. *U. S. Prepared Oyster-shell.*

"Take of Oyster-shell *a convenient quantity.* Free the Oyster-shell from extraneous matter, wash it with boiling water, and, having reduced it to a fine powder, treat this in the manner directed for Prepared Chalk." *U. S.*

Prepared oyster-shell differs from prepared chalk in containing animal matter, which, being very intimately blended with the carbonate of calcium, is supposed by some physicians to render the preparation more acceptable to a delicate stomach. It is given as an antacid in diarrhœa, in the dose of from ten to forty grains or more, frequently repeated. A preparation has been introduced, within a few years, into use in this country, under the name of *Castillon's powders*, consisting of sago, salep, and tragacanth, each, in powder, *a drachm*, prepared oyster-shell *a scruple*, and sufficient cochineal to give colour to the mixture. A drachm of this is boiled in a pint of milk, and the decoction used *ad libitum* as a diet in chronic bowel affections. W.

* Several insoluble substances, besides chalk, are brought habitually into the form of small cones, such as prepared oyster-shell, phosphate of calcium, rust of iron, subnitrate of bismuth, &c. The mode by which this is effected is by the use of a simple implement, consisting of a funnel of tinned-iron, with the neck removed (*a*), fixed at the expanded extremity (*b*) of a piece of wood about a foot long (*c*), having its other end in the form of a handle (*d*), with a stout piece of wood about 4 inches long (*e*), attached perpendicularly to the lower side of it, so as to serve as a support when fixed in a socket. The material to be shaped is introduced in a very soft, almost diffluent state into the funnel, and the instrument, then raised in the hand by the handle, is brought down so that its support shall strike with a gentle shock against a flat surface of chalk stone (*f*), and these little shocks are rapidly repeated. At each one of them a small portion of the soft mass escapes from the mouth of the funnel, and falls on the stone, where it hardens into the shape of a cone; the chalk serving to absorb the moisture rapidly, and thus enabling it quickly to solidify. (*Note to the twelfth edition.*)



CARBO.

Preparation of Charcoal.

CARBO ANIMALIS PURIFICATUS. *U. S., Br. Purified Animal Charcoal.*

"Take of Animal Charcoal, in fine powder, Muriatic Acid, each, *twelve troyounces;* Water *twelve fluidounces.* Pour the Muriatic Acid, previously mixed with the Water, gradually upon the Charcoal, and digest with a gentle heat for two days, occasionally stirring the mixture. Having allowed the undissolved portion to subside, pour off the supernatant liquid, wash the Charcoal frequently with water until the washings cease to afford a precipitate with the nitrate of silver, and dry it." *U. S.*

"Take of Bone Black, in powder, *sixteen ounces* [avoirdupois]; Hydrochloric Acid *ten fluidounces;* Distilled Water *a sufficiency.* Mix the Hydrochloric Acid with a pint of the Water, and add the Bone Black, stirring occasionally. Digest at a moderate heat for two days, agitating from time to time; collect the undissolved charcoal on a calico filter, and wash with Distilled Water till what passes through gives scarcely any precipitate with nitrate of silver. Dry the charcoal, and then heat it to redness in a covered crucible." *Br.*

Animal charcoal, as it is made by charring bones, necessarily contains bone-phosphate and carbonate of calcium, the presence of which does no harm in some decolorizing operations; but, in delicate chemical processes, these salts may be dissolved or decomposed, and thus become a source of impurity. It is on this account that animal charcoal requires to be purified from its calcareous salts; and this is accomplished by dilute muriatic acid, which dissolves the phosphate and decomposes the carbonate. According to Dr. Stenhouse, aluminized vegetable charcoal may be substituted for purified animal charcoal, and is equally efficacious as a decolorizer. (See *page* 229.)

Purified animal charcoal is a dark brownish-black powder. If it contain carbonate of calcium, muriatic acid will cause effervescence, and the solution obtained will give a precipitate with carbonate of ammonium; and if phosphate or sulphate of calcium be present, the acid will dissolve the salt, and yield it as a precipitate on the addition of ammonia. In the Br. Pharmacopœia, it is stated that, when burned at a high temperature, with a little red oxide of mercury and free access of air, it leaves only a slight residue.

It has been shown by Mr. Robert Warington that bitter vegetable substances, including the organic alkalies, are removed from solution by passing through *purified* animal charcoal, especially when the action is assisted by heat. M. Weppen finds that a similar effect is produced by it in removing resins from tinctures, tannic acid and bitter principles from astringent and bitter infusions, and certain metallic salts from their solutions. Purified animal charcoal, thus employed, has been resorted to by M. Lebourdais as an agent for obtaining the active principles of plants. A decoction or infusion of the plant is either boiled with or filtered through the charcoal, which takes up, more or less completely, the bitter and colouring principles. The charcoal, after having been washed and dried, is treated with boiling alcohol, which dissolves the principles taken up. Finally, the alcohol is distilled off, and the principles are obtained in a separate state. In this way digitalin, ilicin, scillitin, columbin, colocynthin, arnicina, strychnia, quinia, and other principles have been obtained by M. Lebourdais. (*Chem. Gaz.*, Nov. 15, 1848.) In relation to the method of M. Lebourdais, see a paper by Mr. J. S. Cobb in the *Am. Journ. of Pharm.* for July, 1851, from the London *Pharmaceutical Journal.* Dr. A. B. Garrod has proposed purified animal charcoal as an antidote to vegetable and animal poisons, with which it appears to combine. According to his experiments, common bone-black has not one-fifth of the power possessed by the purified substance; and vegetable charcoal and lampblack are nearly or quite useless. The amount of the antidote proposed by Dr. Garrod is half an ounce for each grain of a vegetable organic alkali. Dr. Alfred Taylor deems the results of Dr. Garrod inconclusive. Prof. B. H. Rand, of this city, has made some interesting observations in relation to the antidotal powers of purified animal charcoal, and has proved that poisonous doses of the strongest vegetable poisons may be swal-

lowed with impunity, if mixed with that substance. (*Med. Exam.*, Sept. 1848.)* It has also been recommended as an antidote for phosphorus (*N. Y. Med. Record*, Feb. 1874, 68), but its value is very doubtful.

In using animal charcoal for decolorizing active vegetable principles, great caution should be observed, as much loss is often incurred by the absorption of those principles by the charcoal.†

Pharm. Uses. In preparing Acidum Gallicum, *U. S.;* Atropia, *Br.;* Digitalinum; Morphiæ Hydrochloras, *Br.;* Santoninum, *Br.;* Strychnia, *U. S.;* and Veratria.

B.

CATAPLASMATA.

Cataplasms.

Cataplasms or *poultices* are moist substances intended for external application, of such a consistence as to accommodate themselves accurately to the surface to which they are applied, without being so liquid as to spread over the neighbouring parts, or so tenacious as to adhere firmly to the skin. As they are in this country seldom made by the apothecary, they were not deemed by the compilers of the U. S. Pharmacopœia proper objects for officinal direction. The ounce used in the following processes is the avoirdupois.‡

W.

CATAPLASMA CARBONIS. *Br. Charcoal Poultice.*

"Take of Wood Charcoal, in powder, *half an ounce;* Crumb of Bread *two ounces;* Linseed Meal *one ounce and a half;* Boiling Water *ten fluidounces.* Macerate the Bread in the Water for ten minutes near the fire, then mix, and add the Linseed Meal gradually, stirring the ingredients, so that a soft poultice may be formed.

* *Revivification of Animal Charcoal.* To the large manufacturing chemist, and in a less degree to the pharmaceutist, it is an object of some importance to revivify the animal charcoal which has lost its absorbent property, and thus to fit it for future use. This has been done by exposing it to an intense heat, so as to decompose all the organic, and drive off all the volatile principles it may have absorbed; but this will not deprive it of fixed inorganic substances which may contaminate it. Messrs. Leplay and Cusinier, in a paper on the use of animal charcoal in the refining of sugar, offer certain principles and suggest certain practical processes in reference to this agent, which are of general interest, and which have appeared to us to merit a notice here. The absorbing powers of animal charcoal are different for different substances, and do not become exhausted simultaneously. For its revivification after use, different measures are required in accordance with the degree to which its powers may have been lost. There are, indeed, means of increasing these absorbent powers even beyond the degree to which they may have been originally possessed. None of these revivifying measures require a heat above 212°. The following are the practical principles. 1. When animal charcoal is employed in filtering, its first series of absorbing powers are exhausted at furthest in four hours. These are such as affect "viscid, nitrogenous, ammoniacal, sapid, and odorous matters." In regard to these the original power is entirely restored by passing a current of steam through the granulated animal charcoal contained in the filter; and it can be restored indefinitely. 2. The second series of absorbing powers concern free alkalies, as potash, soda, lime, and their salts; and require a much longer time for their exhaustion, to the extent of six or eight times the period required for the first series. These powers are revived by pouring muriatic acid largely diluted with water upon the charcoal in the filter, and afterwards by prolonged washing with water. 3. The third series of absorbing powers embrace colouring principles, and continue thirty or forty times longer than the first. For the restoration of these powers the measure deemed most efficient is washing with weak boiling solutions of the caustic alkalies. All these measures may be applied to the charcoal still contained in the filter, or removed to a special apparatus for the purpose. 4. These methods restore the original properties. To give additional absorbent powers, a solution of biphosphate of calcium is poured upon the animal charcoal still containing its original tribasic phosphate. When these salts meet, a new phosphate is produced with two eqs. of base, which is insoluble in water, has no acid reaction, and possesses very energetic powers of absorption. (See *Am. Journ. of Pharm.*, Nov. 1862, p. 552.)—*Note to the twelfth edition.*

For some valuable statements by Dr. Wallace in reference to the animal charcoal used in sugar-refining in Scotland, for which we have not space here, see a paper in the *American Journal of Pharmacy* (Sept. 1868, p. 425); from the *Transactions of the Philosophical Society of Glasgow;* also various papers in *Chemical News*, xxvii. 1873, xxx. 1874. (*Note to the thirteenth and fourteenth editions.*)

† M. F. M. Raoult recommends very highly pieces of animal charcoal as a means of preventing the dangerous irregular boiling of sulphuric acid when distilled from glass vessels. (*Journ. de Pharm.*, Jan. 1875.)—*Note to the fourteenth edition.*

‡ A poultice, said to be used with great satisfaction in Paris, is made by saturating two superimposed layers of wadding with a solution of Fucus crispus, and drying them in a stove after they have been subjected to strong pressure; a cardboard-like sheet is thus obtained. For use a piece is cut off and soaked in water for fifteen to twenty minutes. It is claimed that it does not sour, is economical, does away with cloths, hence with danger of infection, is perfectly cleanly, and has all the advantages of the ordinary poultice. (*Note to the fourteenth edition.*)

Mix with this half the Charcoal, and sprinkle the remainder on the surface of the poultice." *Br.*

Charcoal, recently prepared, has the property of absorbing those principles upon which the offensive odour of putrefying animal substances depends. In the form of poultice, it is an excellent application to foul and gangrenous ulcers, correcting their fetor, and improving the condition of the sore. It should be frequently renewed. W.

CATAPLASMA CONII. *Br. Hemlock Poultice.*

"Take of Hemlock Leaf, in powder, *one ounce;* Linseed Meal *three ounces;* Boiling Water *ten fluidounces.* Mix the Hemlock and Linseed Meal, and add them to the Water gradually, constantly stirring." *Br.*

This cataplasm may be advantageously employed as an anodyne application to cancerous, scrofulous, syphilitic, and other painful ulcers; but its liability to produce narcotic effects, in consequence of the absorption of the active principle of the hemlock, should not be overlooked. W.

CATAPLASMA FERMENTI. *Br. Yeast Poultice.*

"Take of Beer Yeast *six fluidounces;* Wheaten Flour *fourteen ounces;* Water, heated to 100°, *six fluidounces.* Mix the Yeast with the Water, and stir in the Flour. Place the mass near the fire till it rises." *Br.*

By exposing a mixture of yeast and flour to a gentle heat, fermentation takes place, and carbonic acid gas is extricated, which causes the mixture to swell, and is the source of its peculiar virtues. The yeast cataplasm is gently stimulant, and is sometimes applied with benefit to foul and gangrenous ulcers, the fetor of which it corrects, while it is supposed to hasten the separation of the slough. The carbonic acid may also act as an anæsthetic agent. W.

CATAPLASMA LINI. *Br. Linseed Poultice.*

"Take of Linseed Meal *four ounces;* Olive Oil *half a fluidounce;* Boiling Water *ten fluidounces.* Mix the Linseed Meal gradually with the Water, then add the Oil with constant stirring." *Br.*

The flaxseed meal which remains after the expression of the oil is here employed; but that which has not been submitted to pressure is decidedly preferable, and answers an excellent purpose when mixed with boiling water, without other addition. Fresh lard or olive oil, spread upon the surface of the poultice, serves to prevent its adhesion to the skin, and to preserve its softness.

The use of this and other emollient cataplasms is to relieve inflammation, or to promote suppuration. They act mainly by the sedative influence of their moisture, and by excluding the air. The one most extensively employed, perhaps because its materials are always at hand, is that prepared by heating together milk and the crumb of bread. The milk should be quite sweet, and fresh lard should be incorporated with the poultice. Mush made with the meal of Indian corn also forms an excellent emollient cataplasm. W.

CATAPLASMA SINAPIS. *Br. Mustard Poultice.*

"Take of Mustard, in powder, Linseed Meal, each, *two ounces and a half;* Boiling Water *ten fluidounces.* Mix the Linseed Meal gradually with the Water, and add the Mustard, with constant stirring." *Br.*

The simplest and most effectual mode of preparing a mustard poultice, is to mix the powdered mustard of the shops with a sufficient quantity of warm water to give it a due consistence. When a weaker preparation is required, an equal portion or more of rye or wheat flour should be added. Vinegar never increases its efficiency, and, in the case of the black mustard seed, has been ascertained by MM. Trousseau and Blanc to diminish its rubefacient power. The same may be said of alcohol. A boiling temperature is also injurious by interfering with the development of the volatile oil or acrid principle. (See *Sinapis.*)

These poultices are frequently called *sinapisms.* They are powerfully rubefacient, exciting a sense of warmth in a few minutes, and usually becoming insupportably painful in less than an hour. When removed they leave the surface intensely red and burning; and the inflammation frequently terminates in desquamation, or even

blistering if the application be too long continued. Obstinate ulcers and gangrene also sometimes result from the protracted action of mustard, especially on parts possessed of little vitality. As a general rule, the poultice should be removed when the patient complains much of pain; and in cases of insensibility should not, unless greatly diluted, be allowed to remain longer than one, or at most two hours; as violent inflammation, followed by obstinate ulceration, is apt to take place upon the occurrence of reaction. In children particular care is necessary to avoid this result. The poultice should be thickly spread on linen, and may be covered with gauze or unsized paper in order to prevent its adhesion to the skin. If hairs are present they should be removed by the razor. Sinapisms may be employed in all cases in which it is desirable to produce a speedy and powerful rubefacient impression. W.

CATAPLASMA SODÆ CHLORATÆ. *Br. Chlorine Poultice.*

"Take of Solution of Chlorinated Soda *two fluidounces;* Linseed Meal *four ounces;* Boiling Water *eight fluidounces.* Mix the Linseed Meal gradually with the Water, and add the Solution of Chlorinated Soda, with constant stirring." *Br.*

This is an excellent application to sloughing and other fetid ulcers, to correct the smell, and afford a moderate stimulation. W.

CERATA.

Cerates.

These are unctuous substances consisting of oil or lard, mixed with wax, spermaceti, or resin, to which various medicaments are frequently added. Their consistence, which is intermediate between that of ointments and of plasters, is such that they may be spread at ordinary temperatures upon linen or leather, by means of a spatula, and do not melt or run when applied to the skin. In preparing them, care should usually be taken to select the oil or lard perfectly free from rancidity. In reference to the wax, too, there would seem to be a choice, as experience has shown that cerates made with yellow wax keep longer unchanged than those made with white or bleached wax, probably because there is in yellow wax some principle which corrects the tendency of fatty matters to become rancid. (F. Bringhurst, *Am. Journ. of Pharm.*, Jan. 1869, p. 59.) The liquefaction should be effected by a very gentle heat, which may be applied by means of a water-bath; and during the refrigeration the mixture should be well stirred, and the portions which solidify on the sides of the vessel should be made to mix again with the liquid portion, until the whole assumes the proper consistence. When a large quantity is prepared, the mortar or other vessel into which the mixture may be poured for cooling, should be previously heated by means of boiling water. It has been proposed to substitute paraffin for wax in the preparation of the cerates; but there has yet been too little trial of it to justify a decision upon its merits. It is, we think, unfortunate that this class of preparations has been abandoned in the British Pharmacopœia; the several cerates having been rejected, or transferred to the class of Ointments. Independently of the connection between the name and one of the characteristic constituents of the cerates, there is a ground of difference between them and the ointments in their consistence; that of the cerates being such as to render them especially suitable for spreading on linen, while that of ointments is peculiarly adapted to inunction. W.

CERATUM. Ceratum Adipis. *U. S.* 1860. Ceratum Simplex. *U. S.* 1850. *Cerate. Cerate of Lard. Simple Cerate.*

"Take of Lard *eight troyounces;* White Wax *four troyounces.* Melt them together, and stir the mixture constantly until cool." *U. S.*

We regret the loss of the old name of simple cerate, which always seemed to us very appropriate. Wax was the essential ingredient, while the place of lard might be supplied by olive or almond oil, or any bland fatty matter of a very soft or liquid consistence. Lard, however, is, we think, preferable to olive oil, as it may always be had perfectly sweet, and is the mildest application which can be made to irritated surfaces. In the preparation of this cerate, peculiar care should be taken that the oleaginous ingredient be entirely free from rancidity, and that the heat employed be

not sufficient to produce the slightest decomposition; for the value of the preparation depends on its perfect blandness. To avoid change, it should be put up in small jars, and covered closely with tin foil so as to exclude the air. It is used for dressing blisters, wounds, &c., in all cases in which the object is to prevent the contact of air and preserve the moisture of the part, and at the same time to avoid all irritation. It is sometimes improperly employed as the vehicle of substances to be applied by inunction. For this purpose lard should be used in winter, and simple ointment in summer; the cerate having too firm a consistence.

The simple ointment, Unguentum Simplex, of the British Pharmacopœia is very nearly equivalent to this preparation, but contains some olive oil. It will be described among the ointments. W.

CERATUM CANTHARIDIS. *U.S.* EMPLASTRUM CANTHARIDIS. *Br. Cantharides Cerate. Blistering Cerate. Cerate of Spanish Flies. Cantharides Plaster.*

"Take of Cantharides, in very fine powder, *twelve troyounces;* Yellow Wax, Resin, each, *seven troyounces;* Lard *ten troyounces.* To the Wax, Resin, and Lard, previously melted together and strained through muslin, add the Cantharides, and, by means of a water-bath, keep the mixture in a liquid state for half an hour, stirring occasionally; then remove it from the water-bath, and stir it constantly until cool." *U. S.*

The *British Pharmacopœia* directs of Cantharides, in powder, *twelve ounces* [avoirdupois); Yellow Wax, and Prepared Suet, each, *seven ounces and a half;* Prepared Lard *six ounces;* and Resin *three ounces;* melts the Wax, Suet, and Lard together, by a water-bath, and adds the Resin previously melted; then introduces the Cantharides, mixes the whole thoroughly, and continues to stir the mixture while cooling.

This is the common *blistering plaster* of the shops. As it can be readily spread without the aid of heat, it is properly a cerate, and is, therefore, correctly named in the U. S. Pharmacopœia. It is essentially the same as prepared by the two processes; though the U. S. formula has a decided advantage over the British, in keeping the mixture of the flies and the other ingredients for some time at an elevated temperature, while, in the latter, they are allowed to cool after being mixed with the fatty matters. Care was formerly considered requisite, in making the cerate, not to injure the flies by heat. It was, therefore, recommended that they should not be added to the other ingredients until immediately before these begin to stiffen, after having been removed from the fire; and, though this direction has been omitted, no provision is made for the continued application of heat. From the experiments of Mr. Donovan (*Dublin Med. Press*, Aug. 1840), and those of Professor Procter (*Am. Journ. of Pharm.*, xiii. 302, and xxiv. 296), it may be inferred that the vesicating principle of Spanish flies is not injured or dissipated by a heat under 300° F., and that an elevated temperature, instead of being hurtful, is positively advantageous in the preparation of the cerate. The cantharidin is thus more thoroughly dissolved by the oleaginous matter, and consequently brought more efficiently into contact with the skin, than when retained in the interior of the tissue of the fly. Another advantage, stated by Donovan, is that the moisture, usually existing to a certain extent in all the ingredients of the cerate, is thus dissipated, and the preparation is less apt to become mouldy, or otherwise to undergo decomposition. Instead, therefore, of waiting until the melted wax, resin, and lard begin to stiffen, it is better to add the powder before the vessel is removed from the fire. Mr. Donovan recommends that, as soon as the other ingredients are melted, the powdered flies should be added, and the mixture stirred until the heat is shown by a thermometer to have risen to 250°, when the vessel is to be removed from the fire, and the mixture stirred constantly until cool. At the heat mentioned, ebullition takes place in consequence of the escape of the moisture contained in the materials. In the cerate thus prepared, the active matter has been dissolved by the lard, and the powder may be separated, if deemed advisable, by straining the mixture before it solidifies. Care should be taken that the temperature be not so high as to decompose the ingredients; and it would be better to keep it within 212° by means of a water-bath, as in the U. S. process, than to incur any risk from its excess. Violent irritation and even vesication of the face of the operator

are stated to have resulted from exposure to the vapours of the liquid, at a temperature of 250°. (*Pharm. Journ.*, ii. 391.) From an experiment, however, of Prof. Procter, it appears that, though cantharidin begins to volatilize slightly at 250°, and rapidly rises in vapour and sublimes at from 402° to 412°, yet it is not decomposed unless by increasing the heat considerably above the last-mentioned point. (*Am. Journ. of Pharm.*, xxiv. 296 and 298.) It is desirable that the flies should be very finely pulverized. Powdered euphorbium is said to be sometimes fraudulently added.

The cerate will always raise a blister in ordinary conditions of the system, if the flies are good, and not injured in the preparation. It should be spread on soft leather, though linen or even paper will answer the purpose when that is not to be had. An elegant mode of preparing it for use is to spread a piece of leather, of a proper size, first with adhesive plaster, and afterwards with the cerate, leaving a margin of the former uncovered, in order that it may adhere to the skin. Heat is not requisite, and should not be employed in spreading the cerate. Some sprinkle powdered flies upon the surface of the plaster, press them lightly with a roller, and then shake off the portion which has not adhered; but, if the flies originally employed were good, this addition is superfluous. Prof. Procter was in the habit of applying over the surface with a brush an ethereal tincture of cantharides, which leaves a thin coating of extract, and renders the preparation more certain.

Upon the application of the plaster, the skin should be moistened with warm vinegar or other liquid; and a good rule is to cover the surface of the plaster closely with very thin gauze or unsized paper, which prevents any of the cerate from adhering to the cuticle, and is thought by some to diminish its liability to occasion strangury. In adults, when the full action of the flies is desired, and the object is to produce a permanent effect, the application should be continued for twelve hours, and on the scalp for twenty-four hours. In very delicate persons, however, or those subject to strangury, or upon parts of a loose texture, or when the object is merely to produce a blister to be healed as quickly as possible, the plaster should remain no longer than is necessary for the production of full redness of the skin, which generally occurs in five or six hours, or even in a shorter time. It should then be removed, and followed by a bread and milk poultice, or some other emollient dressing, under which the cuticle rises, and a full blister is usually produced. By this management the patient will generally escape strangury, and the blister will very quickly heal after the discharge of the serum.* In young children, cantharides sometimes produce alarming and even fatal ulceration, if too long applied. From two to four hours are usually sufficient for any desirable purpose. When the head, or other very hairy part, is to be blistered, an interval of ten or twelve hours should, if possible, be allowed between the shaving of the part and the application of the plaster; so that the abrasions may heal, and some impediment be offered to the absorption of the flies. After the blister has been formed, it should be opened at the most depending parts, and, the cuticle being allowed to remain, should be dressed with simple cerate; but, if it be desirable to maintain the discharge for a short time, resin cerate should be used, and the cuticle removed if it can be done without inconvenience. When it is wished that the blistered surface should heal as soon as possible, and with the least inconvenience to the patient, Dr. Maclagan recommends a dressing of cotton wadding; an emollient poultice being first applied for two hours after the removal of the blistering cerate, the cuticle then cut, and the surface afterwards covered with the cotton, with its raw surface next the skin. Should the dressing become soaked, so much of the cotton may be removed as can be done without disturbing the cuticle, and a new batch applied. The cotton

* The late Dr. M. B. Smith, of Philadelphia, informed us that he had frequently employed uva ursi, as a preventive of strangury from blisters, and had never found it to fail. He gave a small wineglassful of the officinal decoction (see *Decoctum Uvæ Ursi*) every hour, commencing two hours after the application of the blister. Camphor is sometimes incorporated with the blistering cerate to prevent strangury, though with doubtful effect. A plan proposed by M. Vée is to spread over the surface of the plaster, when ready for delivery, by means of the finger, a saturated solution of camphor in ether. The ether evaporates, leaving a thin coating of camphor uniformly diffused. (*Journ. de Pharm.*, 3e sér., viii. 68.) The late Dr. Joseph Hartshorne, of Philadelphia, was in the habit, in cases where he apprehended strangury, of directing four grains of opium and twenty of camphor to be mixed with the cerate of a blister of large size, and experienced the happiest effects from the addition.

is to be allowed to remain until the old cuticle spontaneously separates. The effects of an issue may be obtained by employing savine ointment, or the ointment of Spanish flies, as a dressing. If much inflammation take place in the blistered surface, it may be relieved by emollient poultices, or weak lead-water. Where there is an obstinate indisposition to heal, we have found nothing so effectual as the cerate of subacetate of lead, mixed with an equal weight of simple cerate. When deep and extensive ulceration occurs in consequence of general debility, bark or sulphate of quinia should be used, with nutritious aliment.

Various preparations of cantharides have been proposed and employed as substitutes for the cerate. They consist for the most part of cantharidin, more or less pure, either dissolved in olive oil and applied to the skin by means of a piece of paper saturated with it, or incorporated with wax and spread in a very thin layer upon fine waxed cloth, silk, or paper, constituting the *blistering cloth*, *blistering paper*, *vesicating taffetas*, &c., of the shops. The advantages of these preparations are that they occupy less space, are more portable, and, being very pliable, are more easily adapted to irregularities of the surface. Absolutely pure cantharidin is expensive and not requisite; as extracts of cantharides, made with ether, alcohol, or boiling water, will answer every purpose. Henry and Guibourt give the following formula. Digest powdered cantharides in ether, distil off the ether, evaporate the residue by means of a salt-water bath, until ebullition ceases, melt the mass which remains with twice its weight of wax, and spread the mixture upon waxed cloth. The *waxed cloth* may be prepared by spreading upon linen or muslin a mixture composed of 8 parts of white wax, 4 of olive oil, and 1 of turpentine, melted together. An extract of cantharides of a buttery consistence, said to act very efficiently when applied by means of paper greased with it, is prepared by digesting 4 parts of flies with 1 part of strong acetic acid, and 16 of alcohol, straining, filtering, and evaporating at a moderate heat. A preparation which received the favourable report of a committee of the Society of Pharmacy, at Paris, is the following, proposed by M. Dubuison. Four parts of a hydro-alcoholic extract of the flies, made by maceration, are mixed with an aqueous solution of one part of pure gelatin, so as to obtain a solution of suitable consistence, which is then applied upon a piece of extended waxed cloth, care being taken that the brush should always have the same direction. When the first layer has dried, a second and a third are to be applied in the same manner. The gelatin renders the cloth more adhesive and less deliquescent. The hydro-alcoholic extract is preferred to the alcoholic, because it contains less of the green oil, which does not readily mix with the other ingredients. The committee, however, preferred the aqueous extract, as cheaper and more active. This taffeta has been tried, and found to raise blisters in four hours. (*Journ. de Pharm.*, 3e sér., viii. 67.) For very speedy vesication, an infusion of the flies in strong acetic acid is sometimes employed. None of these preparations is likely to supersede the cerate, but the demand for them has been met by introducing into the Pharmacopœia the Charta Cantharidis and the Collodium cum Cantharide.

It is said that the flies, by ebullition with water, are deprived of their property of producing strangury, while their vesicating powers remain unaltered. (*Paris's Pharmacologia.*) Dr. Theophilus Beesley, of Philadelphia, was in the habit of employing a cerate made with cantharides prepared in this manner, and never knew it to produce strangury in more than two or three instances. (*Journ. of the Phil. Col. of Pharm.*, iv. 185.) In a letter addressed to one of the authors by Dr. James Couper, of New Castle, Delaware, a similar method of preparing the flies is recommended as an expedient against strangury, both from his own experience, and that of the late Dr. Groom, of Elkton, Maryland, from whom he derived his knowledge of the plan. Yet there can be no doubt that boiling water extracts cantharidin from the flies; and the cerate made as here recommended must be weaker in the blistering principle than the officinal.*

Off. Prep. Emplastrum Picis cum Cantharide, *U. S.;* Unguentum Cantharidis, *U. S.* W.

* M. E. Delpech (*Amer. Journ. of Pharm.*, xlii. 240) proposes the use of *cantharidate of potassium* in substance or solution. He prepares it by dissolving two parts of cantharides in 150 parts of alcohol, and adding 1·6 parts of caustic potash dissolved in a very little water. The whole becomes a crystalline mass from which the alcohol may be separated by pressure. (*Note to the fourteenth edition.*)

CERATUM CETACEI. *U.S. Spermaceti Cerate.*

"Take of Spermaceti *a troyounce;* White Wax *three troyounces;* Olive Oil *five troyounces.* Melt together the Spermaceti and Wax, then add the Oil previously heated, and stir the mixture constantly until cool." *U.S.*

The direction to heat the oil before adding it to the other ingredients is important. If added cold, it is apt to produce an irregular congelation of the wax and spermaceti, and thus to render the preparation lumpy. The cerate is employed as a dressing for blisters, excoriated surfaces, and wounds, and as the basis of more active preparations. When the ingredients are pure and sweet, it is perfectly free from irritating properties. From experiments made by Mr. J. B. Barnes, of London, it appears that this cerate keeps much better when made of unbleached materials, than when prepared with olive oil and wax previously bleached. (*Pharm. Journ.*, Jan. 1861, p. 352.) W.

CERATUM EXTRACTI CANTHARIDIS. *U.S. Cerate of Extract of Cantharides.*

"Take of Cantharides, in fine powder, *five troyounces;* Stronger Alcohol *two pints and a half*, or *a sufficient quantity;* Resin *three troyounces;* Yellow Wax *six troyounces;* Lard *seven troyounces.* Moisten the Cantharides with two fluidounces of Stronger Alcohol, pack it in a cylindrical percolator, and gradually pour on Stronger Alcohol until the liquid passes nearly colourless. Evaporate the filtered liquid, by means of a water-bath, to the consistence of a soft extract. Mix this with the Resin, Wax, and Lard, previously melted together, and keep the whole at the temperature of 212° for fifteen minutes. Lastly, strain the mixture through muslin, and stir it constantly until cool." *U.S.*

This preparation of the Pharmacopœia of 1860, adopted from a formula of Mr. Wm. R. Warner, published in the *American Journal of Pharmacy* (Jan. 1860, p. 11), was intended as a substitute for the old *Ceratum Cantharidis*, from which it differs mainly in containing an alcoholic extract of the flies instead of the flies themselves. If the percolation be well conducted, so as to exhaust the cantharides, of which the active matter is soluble in alcohol, this cerate ought theoretically to be more effective than the old blistering cerate; as the active principles are separated from the inert matter of the flies which envelops them in the natural state, and must in some measure interfere with their action; and it is said that its superior efficacy has been practically ascertained. It is to be used in the same manner as the cerate of cantharides. W.

CERATUM PLUMBI SUBACETATIS. *U.S.* UNGUENTUM PLUMBI SUBACETATIS COMPOSITUM. *Br. Cerate of Subacetate of Lead. Compound Ointment of Subacetate of Lead. Goulard's Cerate.*

"Take of Solution of Subacetate of Lead *two fluidounces and a half;* White Wax *four troyounces;* Olive Oil *eight troyounces;* Camphor *thirty grains.* Mix the Wax, previously melted, with *seven troyounces* of the Oil. Then remove the mixture from the fire, and, when it begins to thicken, gradually pour in the Solution of Subacetate of Lead, stirring constantly with a wooden spatula till it becomes cool. Lastly, add the Camphor, dissolved in the remainder of the Oil, and mix with the Cerate." *U.S.*

The *British Pharmacopœia* takes *six fluidounces* of the Solution of Subacetate of Lead, *eight ounces* [avoirdupois] of White Wax, *a pint* [Imperial measure] of Oil of Almonds, and *sixty grains* of Camphor, and proceeds in the manner above directed, except that the wax and oil are melted by means of a water-bath, instead of over a fire; and in this respect its directions are more judicious than those of the U. S. Pharmacopœia.

This cerate received the name by which it is commonly known from M. Goulard, by whom it was employed and recommended. It soon begins to assume a yellowish colour, and after a short time becomes so rancid as to be scarcely fit for use. Hence it should be prepared in small quantities at once. The late Mr. Jacob Bell found it more satisfactory when made with yellow wax. (*Pharm. Journ.*, March, 1859, p. 459.) Eggenfels, a German pharmaceutist, recommends the following method of proceeding to prevent its change of colour. The wax and oil are melted in a water-bath; the solution of acetate of lead, previously heated, is added in small portions successively, and the mixture well stirred, and digested for some time; a partial saponification

takes place, and an emulsion afterwards; and the cerate retains its white colour. (See *Am. Journ. of Pharm.*, Sept. 1861, p. 408.) It is used chiefly in excoriations, burns, scalds, and chilblains, and in cutaneous eruptions. We have found it more effectual than any other application to blistered surfaces indisposed to heal; and, on the recommendation of the late Dr. Parrish, have used it in the following combination with advantage in various cutaneous eruptions of a local character. Take of cerate of subacetate of lead, simple cerate, each, *half an ounce;* calomel, powdered opium, each, *a drachm;* mix them. The same preparation, without the opium, was a favourite remedy with the late Prof. Wistar in similar complaints. W.

CERATUM RESINÆ. *U. S.* Unguentum Resinæ. *Br. Resin Cerate. Ointment of Resin. Basilicon Ointment.*

"Take of Resin *ten troyounces;* Yellow Wax *four troyounces;* Lard *sixteen troyounces.* Melt them together, strain the mixture through muslin, and stir it constantly until cool." *U. S.*

"Take of Resin, in coarse powder, *eight ounces;* Yellow Wax *four ounces;* Simple Ointment *sixteen ounces.* Melt with a gentle heat, strain the mixture while hot through flannel, and stir constantly while it cools." *Br.*

The straining is directed in consequence of the impurities which resin often contains. Resin cerate, commonly called *basilicon ointment*, is much used as a gently stimulant application to blistered surfaces, indolent ulcers, burns, scalds, and chilblains. We have found no application more effectual in disposing the ulcers which follow burns to heal.

Off. Prep. Ceratum Sabinæ, *U. S.;* Linimentum Terebinthinæ, *U. S., Br.* W.

CERATUM RESINÆ COMPOSITUM. *U. S. Compound Resin Cerate.*

"Take of Resin, Suet, Yellow Wax, each, *twelve troyounces;* Turpentine *six troyounces;* Flaxseed Oil *seven troyounces.* Melt them together, strain the mixture through muslin, and stir it constantly until cool." *U. S.*

This is somewhat more stimulating than the preceding, but is applicable to similar purposes, particularly to the treatment of indolent ulcers. Under the name of *Deshler's salve*, it is popularly employed in some parts of the United States. It should be kept well protected from the air, in consequence of its liability when exposed to acquire a tough consistence. W.

CERATUM SABINÆ. *U. S.* Unguentum Sabinæ. *Br. Savine Cerate. Ointment of Savine.*

"Take of Fluid Extract of Savine, *three fluidounces;* Resin Cerate *twelve troyounces;* Ether *a sufficient quantity.* Melt the Resin Cerate, add the Fluid Extract of Savine, and, at a moderate heat, stir the mixture constantly until the alcohol has evaporated; then continue to stir until cool." *U. S.*

"Take of Fresh Savine Tops, bruised, *eight ounces;* White Wax *three ounces;* Prepared Lard *sixteen ounces.* Melt the Lard and the Wax together on a water-bath, add the Savine, and digest for twenty minutes. Then remove the mixture, and express through calico." *Br.*

As the savine used in this country is generally brought from Europe in the dried state, we are compelled to resort to a mode of preparing the cerate different from that usually employed in Europe. In the Pharmacopœia of 1850, the dried savine was simply mixed, in powder, with resin cerate previously softened; and the proportion used was one part of the powder to six parts of the cerate. Nor did we find the preparation thus made to be "intolerably acrid and almost caustic," as Dr. Duncan described it. On the contrary, it answered very well the purpose for which it was used, that of maintaining the discharge from blistered surfaces. The process, however, of the present edition of the Pharmacopœia is certainly more elegant than the former, and probably, if the fluid extract has been carefully made, yields a more effective product. A cerate, prepared in the same manner as the former cerate, from the leaves of the red cedar (*Juniperus Virginiana*), is sometimes substituted for that of savine, but is less efficient. Prepared according to the process of the *British* Pharmacopœia, savine cerate has a fine deep-green colour, and the odour of the leaves. It should be kept in closely covered vessels.

Savine cerate is preferable to the ointment of Spanish flies as a dressing for perpetual blisters, from the circumstance that it has no tendency to produce strangury. The white coating which forms, during its use, upon the blistered surface should be occasionally removed, as it prevents the contact of the cerate. It is sometimes applied to seton cords, to increase the discharge. W.

CERATUM SAPONIS. *U. S. Soap Cerate.*

"Take of Soap Plaster *two troyounces;* White Wax *two troyounces and a half;* Olive Oil *four troyounces.* Melt together the Plaster and Wax, add the Oil, and, after continuing the heat a short time, stir the mixture until cool." *U. S.*

This is a much neater preparation than that of the Pharmacopœia of 1850, which was made by boiling the solution of subacetate of lead with soap, and then, after concentration, adding the wax and oil melted together; nor is there any reason to suppose that it is less efficient. Soap cerate is thought to be cooling and sedative; and is used in scrofulous swellings and other instances of chronic external inflammation. It was formerly employed by Mr. Pott as a dressing for fractured limbs; but answers no other purpose in these cases than to yield mechanical support. W.

CERATUM ZINCI CARBONATIS. *U. S. Cerate of Carbonate of Zinc.*

"Take of Precipitated Carbonate of Zinc *two troyounces;* Ointment of Lard *ten troyounces.* Mix them." *U. S.*

This preparation is an imitation of the cerate recommended by Turner, and is intended as a substitute for the former Ceratum Zinci Carbonatis and more recent Ceratum Calaminæ of the U. S. Pharmacopœia, as more reliable, in consequence of the frequent falsification of calamine. It is mildly astringent, and is used in excoriations and superficial ulcerations, produced by the chafing of the skin, irritating secretions, burns, or other causes.* W.

CHARTÆ.

Papers.

This class of preparations, long officinal in the French Codex, was some time since adopted into the British Pharmacopœia, but was not introduced into that of the United States until the last revision.

CHARTA CANTHARIDIS. *U. S.* Charta Epispastica. *Br. Cantharides Paper. Blistering Paper.*

"Take of White Wax *four troyounces;* Spermaceti, *one troyounce and a half;* Olive Oil, *two troyounces;* Canada Turpentine, Cantharides, in powder, each, *half a troyounce;* Water *five fluidounces.* Mix all the substances in a tinned vessel, and boil gently for two hours, constantly stirring. Filter through a woollen strainer without expressing, and keep the mixture in a liquid state by means of a shallow water-bath with an extended surface. Coat strips of paper upon one side only, with the melted plaster, by passing them successively over the surface of the liquid; and cut the strips when dry into rectangular pieces." *U. S.*

"Take of White Wax *four ounces;* Spermaceti *one and a half ounce;* Olive Oil *two fluidounces;* Resin *three-quarters of an ounce;* Canada Balsam *one-quarter of an ounce;* Cantharides, in powder, *one ounce;* Distilled Water *six fluidounces.* Digest all the ingredients, excepting the Canada Balsam, in a water-bath for two hours, stirring them constantly; then strain, and separate the plaster from the watery liquid. Mix the Canada Balsam with the plaster melted in a shallow vessel, and pass strips of paper over the surface of the hot liquid, so that one surface of the

* *Ceratum Calaminæ.* U. S. 1850. *Turner's Cerate.* Though abandoned as an officinal preparation, from the frequent sophistication to which calamine is liable, the preparation is still considerably used, and a formula is, therefore, required. The following is the late officinal process. "Take of Prepared Calamine, Yellow Wax, each, *three ounces;* Lard *a pound.* Melt the Lard and Wax together, and when on cooling they begin to thicken, add the Calamine, and stir the mixture constantly until cool." The uses of this cerate are the same as those mentioned in the text under *Ceratum Zinci Carbonatis.*

paper shall receive a thin coating of the plaster. It may be convenient to employ paper ruled so as to indicate divisions each of which is one square inch." *Br.* The weights employed in this process are avoirdupois, and the measures Imperial.

This is intended as a convenient substitute for the common blistering plaster, and, if equally effectual, will be frequently preferred, from being already spread, as well as for its greater cleanliness and facility of application. The proportion of flies, however, is considerably less. The inference from this would be that it must be very greatly inferior in blistering power, and consequently less certain; but this is a point which must be determined by experience; and it is said that, when properly applied, so as to ensure close adhesion to the skin, it is not less efficient than the British plaster, or the *Cerate of Cantharides* of the U. S. Pharmacopœia. (*Med. Times and Gaz.*, March, 1867, p. 284.)

CHARTA SINAPIS. *Mustard Paper. U. S.*

"Take of Black Mustard, in powder, *ninety grains;* Solution of Gutta-percha *a sufficient quantity.* Mix the Mustard with as much of the Solution as may be necessary to give it a semi-liquid consistence; then apply the whole of the mixture, by means of a suitable brush, to a piece of rather stiff paper, four inches square, so as completely to cover one side of it; and allow the surface to dry. Before being applied to the skin, let the Mustard Paper be dipped for about fifteen seconds in warm water." *U. S.*

"Take of Black Mustard Seeds, in powder, *one ounce;* Solution of Gutta-percha *two fluidounces*, or *a sufficiency.* Mix the Mustard with the Gutta-percha Solution so as to form a semi-fluid mixture, and having poured this into a shallow, flat-bottomed vessel, such as a dinner plate, pass strips of cartridge-paper over its surface, so that one side of the paper shall receive a thin coating of the mixture. Then lay the paper on a table with the coated side upwards, and let it remain exposed to the air until the coating has hardened. Before being applied to the skin, let the Mustard Paper be immersed for a few seconds in tepid water." *Br.*

Owing to the fact that the large manufacturers can put the Mustard Paper upon the market at such low rates, that it pays the apothecary better to buy than to prepare it, Charta Sinapis, so far as we can learn, is never made in the retail shops. Experience has shown that the Mustard Papers, as kept on sale, err rather from over than from too little activity. Moreover, their action cannot be regulated with the same nicety as can that of the mustard poultice. Unless in the case of travellers and of others who must rely upon their own actions, the domestic application is certainly much preferable. The mustard leaves can rarely be borne for more than ten or fifteen minutes. H. C. W.

CINCHONIA.

Preparation of Cinchonia.

CINCHONIÆ SULPHAS. *U. S. Sulphate of Cinchonia.**

"Take of the mother-water, remaining after the crystallization of Sulphate of Quinia, in the process for preparing that salt, *a convenient quantity;* Solution of Soda, Alcohol, Diluted Sulphuric Acid, Animal Charcoal, in fine powder, each, *a sufficient quantity.* To the mother-water add gradually, with constant stirring, Solution of Soda, until the liquid becomes alkaline. Collect on a filter the precipitate formed, wash it with water, and dry it. Then wash it with successive small portions of alcohol, to remove other alkaloids which may be present. Mix the residue with eight times its weight of water, and, having heated the mixture, add gradually Diluted Sulphuric Acid until it is saturated and becomes clear. Then boil the liquid with Animal Charcoal, filter it while hot, and set it aside to crystallize. Lastly,

* *Sulphate of Cinchonidia.* In a report made since the earlier portions of this book were revised, Surgeon-Major Geo. Yates Hunter details his experience with this salt in Bombay. He found it to be very feebly antiperiodic, capable in large doses of controlling very mild intermittents, but useless in the severe malarial attacks of tropical countries. To have any influence, it must be given in three times as large dose as quinine, and is more apt than that drug to cause severe headache and nausea. (*Lancet*, i., 1875, p. 751.)—*Note to the fourteenth edition.*

drain the crystals, and dry them on bibulous paper. By evaporating the mother-liquid, more crystals may be obtained." *U. S.*

In consequence of its greater solubility, Sulphate of Cinchonia remains behind in the mother-waters, when sulphate of quinia crystallizes, in the process for preparing the latter salt. To separate it from other substances contained in the mother-waters, it is decomposed by solution of soda, which is preferable to potassa, as it forms a very soluble salt, with sulphuric acid, whereas the sulphate of potassium, being of difficult solubility, might fall with the precipitated cinchonia. The precipitate may be safely washed with small portions of alcohol, as the alkaloid is almost insoluble in that liquid when cold. It is next reconverted into the sulphate; and the solution, having been boiled with *unpurified* animal charcoal to decolorize it, and at the same time neutralize any possible excess of sulphuric acid which might interfere with the crystallization of the salt, is filtered while hot, and then allowed to stand. It is peculiarly important that there should be no excess of sulphuric acid while the solution is exposed to heat, as, under this influence, the alkaloid is much disposed to become uncrystallizable. Hence the advantage of using unpurified animal charcoal or bone-black, as the carbonate of calcium contained in it neutralizes any excess of the acid. The sulphate of cinchonia, held in solution by the liquid while hot, is deposited by it upon cooling in crystals.

It may be prepared also by first obtaining cinchonia from one of the pale barks; treating this with water acidulated with sulphuric acid, added gradually till the alkaloid is dissolved; then boiling with purified animal charcoal, filtering the solution while hot, and setting it aside to crystallize. By alternate evaporation and crystallization all the sulphate may be obtained.

There are two sulphates of cinchonia. The officinal salt may be considered either as the neutral sulphate, consisting of one eq. of cinchonia 308, one of sulphuric acid 40, and two of water of crystallization 18 = 366; or, according to the view of Liebig, as a *disulphate*, consisting of two eqs. of base 308, one of acid 40, and two of water. By the addition of the necessary quantity of acid, it passes into the higher sulphate (bisulphate, or neutral sulphate, according to the view that may be adopted), which is soluble in less than half its weight of water at 58°. We have always been inclined to the view which considers it as the neutral salt, and this probably now predominates with chemists, so that the salt is properly named sulphate of cinchonia in the Pharmacopœia. It crystallizes in short, oblique, shining prisms with dihedral summits, which melt at 212°, at a somewhat higher temperature lose their water of crystallization, and at a red heat are dissipated without residue. Its taste is very bitter. It is soluble in fifty-four parts of water at common temperatures, and in a smaller quantity of boiling water, and is readily dissolved by alcohol, but very sparingly by ether. The tests by which it may be known as a salt of cinchonia are mentioned under the head of *Cinchona* in *Part* I. (*page* 313). That it is a sulphate will be shown by the white precipitate produced with its solution by chloride of calcium.†

Medical Properties and Uses.—It is now pretty well determined that sulphate of cinchonia has the same remedial properties as sulphate of quinia. That it is equally efficient as an antiperiodic remedy, in a somewhat larger dose, has been established by abundant experience. (See a paper, by Dr. A. P. Turner, in the *Am. Journ. of Med. Sci.*, April, 1864, p. 396.) As a tonic it may be given in the dose of a grain or two, three or four times a day; as an antiperiodic, fifteen grains to half a drachm may be given between the paroxysms. It may be taken in pill or solution. In the latter case, the solution of the salt may be aided by the addition of a little aromatic

† A new test, distinguishing between sulphates of quinia and cinchonia, has recently been announced by M. Palm, of Russia, in the polysulphuret of potassium prepared by boiling solution of potassa with an excess of sulphur. When a solution of this sulphuret is added to a boiling solution of sulphate of quinia, the latter, however small the quantity present, is thrown down as a red terebinthinate mass, which hardens on cooling, and then assumes the appearance of a resin; while with sulphate of cinchonia a white powder is precipitated containing sulphur. (*Journ. de Pharm.*, Mai, 1864, p. 459.)

sulphuric acid, in the proportion, for example, of a minim or two drops for each grain of the salt, in a solution of eight grains to a fluidounce of water. W.

COLLODIUM.

Preparations of Collodion.

COLLODIUM. *U. S.*, *Br. Collodion.*

"Take of Pyroxylon *two hundred grains;* Stronger Ether *twelve fluidounces and a half;* Stronger Alcohol *three fluidounces and a half.* Mix the Ether and Alcohol in a suitable bottle, and, having added the Pyroxylon to the mixture, agitate occasionally until it is dissolved." *U. S.*

"Take of Pyroxylin *one ounce* [avoirdupois]; Ether *thirty-six fluidounces* [Imperial measure]; Rectified Spirit *twelve fluidounces* [Imp. meas.]. Mix the Ether and the Spirit, and add the Pyroxylin. Set aside for a few days, and, should there be any sediment, decant the clear solution. Keep it in a well-corked bottle." *Br.*

Collodion is a solution of gun cotton. On account of the facility with which ether evaporates, it is the better menstruum for remedial purposes; but gun cotton will not dissolve in that liquid when quite pure, and the addition of a little alcohol is necessary. Formerly the U. S. Pharmacopœia directed that the gun cotton be prepared at the time of making the collodion, giving directions for the purpose, but at the last revision the process of the British Pharmacopœia was substantially adopted, a formula for the preparation of pyroxylin being given separately in the Pharmacopœia. (See *Pyroxylin*, *Part* II.)

Collodion is a transparent, colourless liquid, of a syrupy consistence, and ethereal smell. When applied to a dry surface, the ether quickly evaporates, and a transparent film is left, having remarkable adhesiveness and contractility. On account of the great volatility of ether, collodion must be kept in bottles well stopped. When insecurely kept, the liquid thickens and becomes less fit for the use of the surgeon. The thickened liquid sometimes contains acicular crystals, as was first observed by Mr. Higginson, of London, and afterwards by Prof. Leidy, of this city, who examined it with the microscope.

Collodion was first applied to the purposes of surgery by Dr. J. Parker Maynard,* of Boston, when a student of medicine, in January, 1847. It is employed for holding together the edges of incised wounds, for covering ulcers or abraded surfaces with an impervious film not acted upon by water, and for encasing parts which require to be kept without relative motion. It is applied, brushed over the part, or by means of strips of muslin. In whatever way applied, the solvent quickly evaporates, and leaves the solid adhesive material. According to Lepage, gun cotton will dissolve in equal parts of ether and alcohol, forming a solution quite as adhesive as that made with ether alone. As this solution dries more slowly, it may prove preferable to the ethereal solution in certain cases, as the strong contractile power of the collodion coating is an objection to it for some purposes. Hence, at the last edition of the Pharmacopœia, a collodium flexile was made officinal. (See *page* 1128.)

Collodion has been used with advantage by Dr. J. R. Mitchell, of Dublin, and by Dr. Aran, to form an artificial covering to ulcers of the os and cervix uteri, thereby allowing the healing process to go on underneath; by M. Wetzlar, of Aix-la-Chapelle, in chilblains; and by Dr. J. W. Freer, of Illinois, in erysipelas. According to Dr. Christen, of Prague, collodion is useful in erysipelas from local causes only, such as wounds, ulcers, burns, &c., but hurtful in the disease from an internal cause. The same writer condemns its use to prevent pitting in smallpox as positively injurious.

* Dr. Maynard recommends the following formula as the best for surgical purposes. Take of sulphuric acid of sp. gr. 1·850 *two parts*, and of nitric acid of sp. gr. 1·450 *one part*. Mix them, and, having permitted the heat to fall to about 100°, add raw cotton to saturation. Let it macerate for one or two hours; then pour off the acids, wash the cotton till the washings cease to affect litmus paper, and dry thoroughly. The gummy matter thus formed is now to be dissolved in ether of the sp. gr. about ·750, or in a mixture of three parts of pure ether and one part of alcohol of 95 per cent. Two ounces of cotton will make about a pint of collodion. (*Bost. Med. and Surg. Journ.*, Aug. 9, 1866, p. 39.)—*Note to the thirteenth edition.*

In burns collodion has been found highly useful by several practitioners, especially in conjunction with castor oil. Its application produces sharp pain at first. It acts by affording a protective covering to the cutis, and, in superficial inflammation, probably, in part, by expelling the blood from the inflamed vessels through the contractile power of the film. This property of collodion has been taken advantage of in the treatment of chronic entropium, two cases of which, successfully treated by it, have been reported by Mr. William Batten. (*Ranking's Abstract*, No. 23, p. 134.) Dr. J. H. Claiborne has used a thick coating of collodion with decided advantage as a compressing agent for the discussion of buboes. It is said to have proved useful in phlegmasia dolens, and is asserted even to have cured a case of puerperal peritonitis, spread over the surface of the abdomen. (*Med. Times and Gaz.*, Oct. 1859, p. 342.) It sometimes causes the disappearance of nævi materni simply applied to the surface. (Dr. Wm. Badger, *Med. Record*, Oct. 1, 1868, p. 358.) M. Corrigan has employed it for the nocturnal incontinence of children, blocking the urethral orifice with a drop of collodion and removing this in the morning with the fingers. (*Ann. de Thérap.*, 1872, p. 195.)

Mr. Erasmus Wilson has used collodion with decided advantage in certain diseases of the skin. In chapped nipples it has an admirable effect. When applied to ulcers, abrasions, or chaps of the skin, it requires to be diluted with ether, so as to render it nearly as limpid as water. Mr. J. H. Tucker found it useful in stopping the bleeding from leech-bites. M. Sourisseau and Mr. E. H. Durden have used it as a coating for pills, which are thereby deprived of taste; but it is questionable whether the coating would always be dissolved by the gastric liquids.

Dr. Drouet, of France, believes that collodion applied to the abdomen, if resorted to at the commencement of cholera, will arrest the disease when not of an extremely violent nature; and founds his belief upon a considerable experience with the remedy. It is peculiarly effectual in the diarrhœa preceding cholera. He mixes six parts of collodion with one part of castor oil, and, having smeared it over the abdomen, covers it with cotton. (*N. Y. Med. Journ.*, Feb. 1867, p. 388; from *Journ. de Méd. et de Chim. Pratiques.*)

Collodion has been variously medicated, and thus made the vehicle of several important medicines for external application. *Iodized collodion* has been proposed by Dr. C. Fleming, for the purpose of obtaining the specific effects of iodine in a rapid manner, especially on tumours. It is made by dissolving from ten to twenty grains of iodine in a fluidounce of collodion. M. Aran has proposed a *ferruginous collodion*, made of equal parts of collodion and tincture of chloride of iron, as a remedy in erysipelas.* A *caustic collodion* may be prepared by dissolving 4 parts of corrosive sublimate in 30 of collodion. Dr. Macke, of Sorau, has used this preparation for destroying nævi materni. The eschar formed is one or two lines in thickness, and separates in from three to six days, leaving but a trifling cicatrix. (See *Am. Journ. of Pharm.*, May, 1858, for formulas in which collodion is made the vehicle of iodine, belladonna, sulphur, &c.) All these medicated collodions are most conveniently applied by means of a camel's-hair brush.

Collodion has become an important agent in various photographic processes.†

Off. Prep. Collodium Flexile. B.

* *Parvesi's Collodion Styptic.* Collodion, 100 parts; Carbolic acid, 10 parts; Pure tannin, 5 parts; Benzoic acid, 5 parts. Agitate till thoroughly mixed. On evaporation it leaves a brown pellicle, adhering strongly to tissues, and effecting instant coagulation of the blood and albumen. (*Note to the fourteenth edition.*)

† *Silk Collodion.* M. Persoz, the younger prepares, a collodion from silk by bringing it to the condition of the material from which the worm spins its thread. This he does by dissolving silk in a solution of chloride of zinc, and then separating the solvent by means of dialysis. The solution, diluted with water to the consistence of collodion, is put into a gutta-percha vessel having a parchment bottom, which is made to rest on a surface of water. The chloride passes through the parchment, leaving the silk substance in a soft fibreless state. The chloride solution, before being used, should be heated with a little oxide of zinc, to neutralize any excess of acid, and then filtered through fine linen to separate the residual oxide. For prompt action, the chloride should be kept warm. Its separation from the silk requires a few days. The material thus obtained is said to be applicable to photographic purposes. Before it could be used as collodion, it would be necessary to dissolve it in a volatile liquid, which would evaporate spontaneously on application to the surface. (See *Am. Journ. of Pharm.*, March, 1867, p. 182.)—*Note to the thirteenth edition.*

COLLODIUM CUM CANTHARIDE. *U. S.* *Collodion with Cantharides. Cantharidal Collodion.*

"Take of Cantharides, in fine powder, *eight troyounces;* Pyroxylon *one hundred grains;* Canada Turpentine *three hundred and twenty grains;* Castor Oil *one hundred and sixty grains;* Stronger Ether *a pint and a half;* Stronger Alcohol *a sufficient quantity.* Introduce the Cantharides into a cylindrical percolator, and, having pressed it firmly, gradually pour on the Ether. When fifteen fluidounces have passed, set aside the liquid in a close vessel, and continue the percolation with Stronger Alcohol until half a pint more of liquid is obtained. Set this in a warm place for spontaneous evaporation, and, when it is reduced to a fluidounce, mix it with the reserved liquid. Then add the Pyroxylon, the Canada Turpentine, and the Castor Oil to the mixture, and agitate occasionally until they are dissolved. Lastly, keep the solution in a well-stopped bottle." *U. S.*

This was originally proposed by M. Ilisch, of St. Petersburg, Russia. The flies are exhausted successively by ether and alcohol, the ethereal solution is set aside, the alcoholic is allowed to evaporate till reduced from eight fluidounces to one, and the two liquids being then mixed are used as the menstruum for gun cotton. But, considering the character of the menstruum, it appears to us that it must frequently fail to dissolve the cotton; as a larger proportion of alcohol is required for the purpose than will remain when the tincture has been reduced to one fluidounce by evaporation. Had common ether, which always contains a considerable proportion of alcohol, been adopted instead of stronger ether, there would probably have been enough alcohol to render the process effectual, and economy would at the same time have been consulted. Should, therefore, the formula fail in the hands of the operator, we would suggest the substitution of the common ether. The original process of M. Ilisch was to exhaust, by percolation, a pound of cantharides, with a mixture consisting of a pound of ether and three ounces of acetic ether; and in two ounces of this liquid to dissolve 25 grains of gun cotton. Professor Procter states that it has been found more advantageous to exhaust the flies with ether, distil off the ether, and mix the oily residue with collodion already prepared of the proper consistence. (*Am. Journ. of Pharm.*, xxiv. 303); and this is probably a better formula than the officinal. Mr. Charles S. Rand, in a communication to the *American Journal of Pharmacy* (xxii. 18), states that Ilisch's preparation, made with double the proportion of ether, vesicates equally well, and proposes the addition of about 1 per cent. of Venice turpentine, which he has found to prevent the disagreeable and sometimes painful contraction of the collodion upon drying. The preparation may be kept indefinitely, in an opaque glass-stoppered bottle, without change; but, on exposure to the light, the greenish colouring matter of the flies bleaches, and the liquid becomes yellowish.

Cantharidal collodion is a very convenient epispastic remedy. It may be applied to the surface by means of a camel's-hair brush, and, after the evaporation of the ether, which takes place in less than a minute, may be reapplied if the surface should not be well covered. It produces a blister in about the same time as the ordinary cerate, and has the advantages that it is applied with greater facility, is better adapted to cover uneven surfaces, and retains its place more certainly. According to Mr. Rand, if the evaporation of the ether be restrained by a piece of oiled silk immediately after its application, it will act much more speedily. W.

COLLODIUM FLEXILE. *U. S.*, *Br.* *Flexible Collodion.*

"Take of Collodion *a pint;* Canada Turpentine *three hundred and twenty grains;* Castor Oil *one hundred and sixty grains.* Mix them, and keep the mixture in a well-stopped bottle." *U. S.*

"Take of Collodion *six fluidounces* [Imperial measure]; Canada Balsam *one hundred and twenty grains;* Castor Oil *one fluidrachm* [Imp. meas.]. Mix, and keep in a well-corked bottle." *Br.*

The contractility of the collodion film has long been felt as a drawback to its use simply for the purposes of protection. Mr. C. S. Rand, of Philadelphia, proposed to obviate this by dissolving one part of gun cotton and three of Venice turpentine

in twenty parts of ether. To give more flexibility to the film, M. Sourisseau, of Kaiserberg, suggested the addition of one part of elemi to twelve of collodion. According to Mr. Startin, of London, opacity and elasticity may be imparted at the same time, by adding from half a drachm to a drachm of lard, or some similar fatty matter, previously dissolved in ether, to an ounce of collodion. The qualities of softness and elasticity may also be given by combining collodion with castor oil, in the proportion of thirty parts to two, agreeably to the plan of M. Guérsant, who found it useful, thus modified, in erysipelas; and the proportion of castor oil may be increased if thought desirable. This is the method preferred by the French Codex. An elastic collodion, somewhat similar, in which, besides castor oil, Venice turpentine and white wax are ingredients, has been proposed by E. Lauras. (*Pharm. Journ.*, xii. 303.) According to MM. Cap and Garot, the most successful way for obtaining an elastic collodion is to mix two parts of glycerin with one hundred of collodion. *Glycerized collodion* is exceedingly supple, does not crack and scale off from the skin, and accommodates itself to the motions of the part. In order to imitate the colour of the skin, an ethereal tincture of turmeric or saffron may be added, so as to produce the desired tint. Dr. Meller has proposed a solution of shell-lac in highly rectified alcohol, so as to have a gelatinous consistence, as a succedaneum for collodion. Of all these plans, probably that followed in the officinal directions is the best. Dr. Tournie recommends, in superficial cervical adenitis with redness of the skin, painting the part with two or three layers of flexible collodion, renewing every two or three days. (*Med. Times and Gaz.*, Nov. 1874, 540.) W.

CONFECTIONES. *U. S.*, *Br.*

Confections.

Under the general title of Confections, the Pharmacopœias include all those preparations having the form of a soft solid, in which one or more medicinal substances are incorporated with saccharine matter, with a view either to their preservation or more convenient administration. The old division into Conserves and Electuaries has been abandoned; but, as there is some ground for the distinction, we shall make a few general remarks upon each division, before proceeding to the consideration of the individual preparations.

Conserves consist of recent vegetable substances and refined sugar beaten into a uniform mass. By means of the sugar, the vegetable matter is enabled to resist for some time the decomposition to which it would otherwise be exposed in the undried state, and the properties of the recent plant are thus retained to a certain extent unaltered. But, as active medicines even thus treated undergo some change, and those which lose their virtues by desiccation cannot be long preserved, the few conserves now retained are intended rather as convenient vehicles of other substances than for separate exhibition. The sugar used in their preparation should be reduced to a fine powder by pounding and sifting, as otherwise it will not mix uniformly with the other ingredients.

Electuaries are mixtures consisting of medicinal substances, especially dry powders, combined with syrup or honey, in order to render them less unpleasant to the taste, and more convenient for internal use. They are usually prepared extemporaneously; and it is only when their complex nature renders it convenient to keep them ready made in the shops, or some peculiarity in the mode of mixing the ingredients requires attention, that they become proper objects for officinal direction. Their consistence should not be so soft, on the one hand, as to allow the ingredients to separate, nor so firm, on the other, as to prevent them from being swallowed without mastication. Different substances require different proportions of syrup. Light vegetable powders usually require twice their weight, gum-resins two-thirds of their weight, resins somewhat less, mineral substances about half their weight, and deliquescent salts not more than one-tenth. Should the electuary be found, after having been kept for a short time, to swell up and emit gas, it should be beaten over again in a mortar, so that any portion of the sugar which may have crystallized may be again accurately incorporated with the other ingredients. Should it, on the contrary, become dry and hard from

the mutual reaction of its constituents, more syrup should be added, so as to give it the requisite consistence. If the dryness result from the mere evaporation of the aqueous part, water should be added instead of syrup, and the same remark is applicable to the conserves. To prevent the hardening of electuaries, the French writers recommend the use of syrup prepared from brown sugar, which is less apt to crystallize than that made from the refined. Molasses would answer the same purpose; but its taste might be objectionable. Some employ honey, but this is not always acceptable to the stomach. Glycerin might sometimes be used with advantage. W.

CONFECTIO AROMATICA. *U. S. Aromatic Confection.*

"Take of Aromatic Powder *four troyounces;* Clarified Honey *four troyounces*, or *a sufficient quantity.* Rub the Aromatic Powder with Clarified Honey until a uniform mass of the proper consistence is obtained." *U. S.*

The aromatic confection has been abandoned in the Br. Pharmacopœia, probably because readily prepared extemporaneously. It affords, nevertheless, a convenient means of administering the spices contained in it, and an agreeable vehicle for other medicines. The present U. S. formula differs favourably from that of 1850 in the omission of the saffron; and the place of the syrup of orange peel has been economically supplied by using a larger proportion of honey. The confection is given in debilitated states of the stomach. The dose is from ten to sixty grains. W.

CONFECTIO AURANTII CORTICIS. *U. S. Confection of Orange Peel.*

"Take of Sweet Orange Peel, recently separated from the fruit by grating, *twelve troyounces;* Sugar [refined] *thirty-six troyounces.* Beat the Orange Peel with the Sugar, gradually added, until they are thoroughly mixed." *U. S.*

"This confection, like the preceding, has been dropped in the recent consolidation of the British Pharmacopœias. It is sometimes used as a grateful aromatic vehicle or adjunct of tonic and purgative powders. W.

CONFECTIO OPII. *U. S., Br. Confection of Opium.*

"Take of Opium, in fine powder, *two hundred and seventy grains;* Aromatic Powder *six troyounces;* Clarified Honey *fourteen troyounces.* Rub the Opium with the Aromatic Powder, then add the Honey, and beat the whole together until thoroughly mixed." *U. S.*

"Take of Compound Powder of Opium *one hundred and ninety-two grains;* Syrup *one fluidounce* [Imperial measure]. Mix." *Br.*

This confection was intended as a substitute for those exceedingly complex and unscientific preparations, formerly known by the names of *theriaca* and *mithridate*, which have been expelled from modern pharmacy. It was an officinal of the London and Edinburgh Colleges; and, after having been discarded in the first British Pharmacopœia, has been adopted in the present edition. The preparation is a combination of opium with spices, which render it more stimulant, and more grateful to a debilitated stomach. It may be given in atonic gout, flatulent colic, diarrhœa unattended with inflammation, and other diseases requiring the use of a stimulant narcotic. Added to Peruvian bark or sulphate of quinia, it increases the efficacy of this remedy in obstinate cases of intermittent fever. One grain of opium is contained in about thirty-six grains of the U. S. confection, and in about forty grains of the British. W.

CONFECTIO PIPERIS. *Br. Confection of Black Pepper.*

"Take of Black Pepper, in fine powder, *two ounces;* Caraway Fruit, in fine powder, *three ounces;* Clarified Honey *fifteen ounces.* Rub them well together in a mortar." *Br.*

This preparation was intended as a substitute for *Ward's paste*, which acquired some reputation in Great Britain as a remedy in piles and ulcers of the rectum. To do good, it must be continued, according to Mr. Brodie, for two, three, or four months. The dose is from one to two drachms repeated two or three times a day. Its stimulating properties render it inapplicable to cases attended with much inflammation. W.

CONFECTIO ROSÆ. *U. S.* CONFECTIO ROSÆ GALLICÆ. *Br. Confection of Rose. Confection of Roses.*

"Take of Red Rose, in fine powder, *four troyounces;* Sugar [refined], in fine

powder, *thirty troyounces;* Clarified Honey *six troyounces;* Rose Water *eight fluidounces.* Rub the Rose with the Rose Water heated to 150°; then gradually add the Sugar and Honey, and beat the whole together until thoroughly mixed." *U. S.*

"Take of Fresh Red-Rose Petals *one pound;* Refined Sugar *three pounds.* Beat the Petals to a pulp in a stone mortar; add the Sugar, and rub them well together." *Br.*

In the British process the unblown petals only are used, and these should be deprived of their claws; in other words, the rose-buds should be cut off a short distance above their base, and the lower portion rejected. In the last three editions of the U. S. Pharmacopœia, dried roses have been substituted for the fresh, as the latter are not brought to our market. The process is very similar to that of the French Codex. We have been informed, however, that much of the confection of roses made in Philadelphia is prepared from the fresh petals of the hundred-leaved rose and others, by beating them into a pulp with sugar, as in the British process. An excuse for this deviation from the officinal formula is, that the confection thus made has greater adhesiveness than the officinal, and is therefore better fitted for the formation of pills.

This confection is slightly astringent, but is almost exclusively used as a vehicle of other medicines, or to impart consistence to the pilular mass.

Off. Prep. Pilula Aloes Barbadensis, *Br.;* Pil. Aloes et Assafœtidæ, *Br.;* Pil. Aloes et Ferri, *Br.;* Pil. Aloes et Myrrhæ, *Br.;* Pil. Aloes Socotrinæ, *Br.;* Pil. Ferri Carbonatis, *Br.;* Pilulæ Hydrargyri; Pil. Plumbi cum Opio, *Br.* W.

CONFECTIO ROSÆ CANINÆ. *Br.* *Confection of Hips.*

"Take of Hips deprived of their seeds *one pound;* Refined Sugar *two pounds.* Beat the Hips to a pulp in a stone mortar, and rub the pulp through a sieve, then add the Sugar, and rub them well together." *Br.*

This preparation is acidulous and refrigerant, and is used in Europe for forming more active medicines into pills and electuaries. On standing it is apt to become more or less filled with saccharine crystals, and is therefore not so eligible as confection of rose.

Off. Prep. Pilula Quiniæ, *Br.* W.

CONFECTIO SCAMMONII. *Br.* *Confection of Scammony.*

"Take of Scammony, in fine powder, *three ounces;* Ginger, in fine powder, *one ounce and a half;* Oil of Caraway *one fluidrachm;* Oil of Cloves *half a fluidrachm;* Syrup *three fluidounces;* Clarified Honey *one ounce and a half.* Rub the powders with the Syrup and the Honey into a uniform mass, then add the Oils and mix." *Br.* The ounce used in this process is the avoirdupois ounce.

The confection is actively cathartic in the dose of half a drachm or a drachm; but is very little used. The British Pharmacopœia now directs scammony alone in its formula without the alternative of the resin given in the first edition. This is a decided improvement. As this drug is generally found in the market, it has but little more than half the strength of the resin. It is true that the purest and best scammony is much stronger than this, yet it is decidedly weaker than its resin, and the Pharmacopœia itself describes it as containing only from 80 to 90 per cent. of this ingredient. It appears to have been a strange want of precision thus to confound the two, as if they were to be given in the same dose. W.

CONFECTIO SENNÆ. *U. S., Br.* *Confection of Senna. Lenitive Electuary.*

"Take of Senna, in fine powder, *eight troyounces;* Coriander, in fine powder, *four troyounces;* Purging Cassia, finely bruised, *sixteen troyounces;* Tamarind *ten troyounces;* Prune, sliced, *seven troyounces;* Fig, bruised, *twelve troyounces;* Sugar, in coarse powder, *thirty troyounces;* Water *a sufficient quantity.* Place the Purging Cassia, Tamarind, Prune, and Fig in a close vessel with three pints of Water, and digest for three hours by means of a water-bath. Separate the coarser portions with the hand, and rub the pulpy mass, first through a coarse hair sieve, and then through a fine one, or through a muslin cloth. Mix the residue with a pint of Water, and, having digested the mixture for a short time, treat it as before, and add the product to the pulpy liquid first obtained. Then, by means of a water-bath, dissolve the

Sugar in the pulpy liquid, and evaporate the whole until it weighs eighty-four troy-ounces. Lastly, add the Senna and Coriander, and incorporate them thoroughly with the other ingredients while yet warm. The whole should weigh ninety-six troy-ounces." *U. S.*

"Take of Senna, in fine powder, *seven ounces;* Coriander Fruit, in fine powder, *three ounces;* Figs *twelve ounces;* Tamarind *nine ounces;* Cassia Pulp *nine ounces;* Prunes *six ounces;* Extract of Liquorice *three-quarters of an ounce;* Refined Sugar *thirty ounces;* Distilled Water *a sufficiency.* Boil the Figs and Prunes gently with twenty-four [fluid]ounces of Distilled Water in a covered vessel for four hours; then, having added more Distilled Water to make up the quantity to its original volume, mix the Tamarind and Cassia Pulp, digest for two hours, and rub the softened pulp of the fruits through a hair sieve, rejecting the seeds and other hard parts. To the pulped product add the Sugar and Extract of Liquorice and dissolve them with a gentle heat; while the mixture is still warm, add to it gradually the mixed Senna and Coriander powders, and mix the whole thoroughly, making the weight of the resulting Confection seventy-five ounces either by evaporation or by the addition of more Distilled Water." *Br.* The ounce employed in the British process is the avoirdupois ounce.

The confection of senna, when correctly made, is an elegant preparation, and keeps well if properly secured. The present U. S. process differs from the old in preparing the pulps, as suggested in former editions of this Dispensatory, instead of taking them already prepared; and this is no doubt the best plan. The only material difference is the omission of the liquorice root in the present formula, and this is of no other consequence than that its taste may be missed in the confection. It is not uncommon to omit the cassia pulp in the preparation of the confection, as the pods are not always to be found in the market. But, as this is next to senna the most active ingredient, the omission is to be regretted; and there is no doubt that a steady demand for the fruit would be met by an abundant supply from the West Indies.* It has also been proposed to substitute the fluid extract of senna for the crude drug (*Amer. Journ. of Pharm.*, xliii. 123); but as the fluid extract is of such uncertain quality, the leaves themselves are certainly preferable.

This is one of our best and most pleasant laxatives, being admirably adapted to cases of habitual costiveness, especially in pregnant women and persons affected with piles. It is also very useful in the constipation which is apt to attend convalescence from fevers and other acute diseases. The mean dose is two drachms, to be taken at bedtime. W.

CONFECTIO SULPHURIS. *Br.* *Confection of Sulphur.*

"Take of Sublimed Sulphur *four ounces* [avoirdupois]; Acid Tartrate of Potash *one ounce* [avoird.]; Syrup of Orange Peel *four fluidounces.* Rub them well together." *Br.*

This is merely a mode of administering the two laxatives, sulphur and bitartrate of potassium; and the relative proportion of the latter is so small that it can have little effect. The dose is from one to two drachms or more. W.

CONFECTIO TEREBINTHINÆ. *Br.* *Confection of Turpentine.*

"Take of Oil of Turpentine *one fluidounce;* Liquorice Root, in powder, *one ounce* [avoirdupois]; Clarified Honey *two ounces* [avoird.]. Rub the Oil of Turpentine with the Liquorice, add the Honey, and mix to a uniform consistence." *Br.*

Confections might be multiplied indefinitely upon the principle which appears to have been adopted here, that, namely, of giving a convenient formula for the administration of medicines. The effects of this confection are those only of the oil of turpentine. The dose may be from a scruple to a drachm. W.

* Senna has been variously prepared to obtain the effects of this confection, in a more agreeable, or less complex form. Thus, under the name of *medicated prunes* a confection is prepared by mixing prunes with concentrated infusion of senna, and evaporating with a gentle heat to the proper consistence, a little sugar being added to improve the flavour; *senna figs* appear to be made by slitting figs, and impregnating the interior parts with extract or powder of senna; and *senna paste* consists of figs and powdered senna, beaten thoroughly together to the consistence of a confection, and then covered with granulated sugar. (*Note to the eleventh edition.*)

CUPRUM.

Preparation of Copper.

CUPRUM AMMONIATUM. *U.S.* *Ammoniated Copper.*

"Take of Sulphate of Copper *half a troyounce;* Carbonate of Ammonium *three hundred and sixty grains.* Rub them together in a glass mortar until effervescence ceases. Then wrap the Ammoniated Copper in bibulous paper, dry it with a gentle heat, and keep it in a well-stopped glass bottle." *U.S.*

When the two salts above mentioned are rubbed together, a reaction takes place between them, attended with the extrication of the water of crystallization of the sulphate of copper, which renders the mass moist, and with the simultaneous escape of carbonic acid gas from the carbonate (sesquicarbonate) of ammonium, which occasions an effervescence. The colour is at the same time altered, passing from the light blue of the powdered sulphate of copper to a beautiful deep azure. The nature of the chemical changes which take place is not precisely known. One of the views which have been taken is, that the blue vitriol parts with a portion of its acid to the ammonium of the carbonate, thus forming a subsulphate of copper and sulphate of ammonium, which are either mixed together, or chemically united in the form of a double salt, the sulphate of copper and ammonium. According to Phillips, the sulphuric acid of the sulphate of copper unites with the ammonium of a portion of the sesquicarbonate of ammonium; while the carbonic acid of the decomposed sesquicarbonate partly escapes, and partly combines with the oxide of copper; so that the resulting preparation consists of sulphate of ammonium, carbonate of copper, and undecomposed sesquicarbonate of ammonium. It is highly probable that Cuprum Ammoniatum, independently of the excess of sesquicarbonate of ammonium which it may contain, is identical with the crystallized salt obtained by dropping a solution of pure ammonia into a solution of sulphate of copper till the subsalt first thrown down is dissolved, then concentrating, and precipitating by alcohol. Now, from the analysis of this salt by Berzelius, it appears to contain one equivalent of sulphuric acid, one of oxide of copper, two of ammonia, and one of water, which may be supposed to be combined in the form of a double salt—the *cupro-sulphate of ammonium*—consisting of one eq. of sulphate of ammonium, one of cuprate of ammonium, in which the oxide of copper acts the part of an acid, and one of water of crystallization ($NH_3,SO_3+NH_3,CuO+HO$). But as half an ounce of sulphate of copper would require for such a result somewhat less than the same weight of sesquicarbonate of ammonium, there must be a considerable excess of the latter salt, unless dissipated in the drying process. In the uncertainty which exists as to the precise nature of the preparation, the name of *ammoniated copper* appears to be the most appropriate as a pharmaceutical title.

This salt has a beautiful deep azure-blue colour, a strong ammoniacal odour, and a styptic, metallic taste. It is soluble in water, and the solution has an alkaline reaction on vegetable colours; but, unless there is excess of sesquicarbonate of ammonium, the solution deposits subsulphate of copper if much diluted. When exposed to the air it parts with ammonia, and is said to be ultimately converted into sulphate of ammonium and carbonate of copper. This change is apt to occur, to a greater or less extent, while it is drying. It should not, therefore, be prepared in large quantities at a time, and should be kept in well-closed bottles. By heat the whole of it is dissipated, except the oxide of copper. Arsenious acid precipitates a green arsenite of copper from its solution. Potassa, soda, lime-water, and the acids are incompatible with it.

Medical Properties and Uses. Ammoniated copper is tonic, and is thought to exercise an influence over the nervous system which renders it antispasmodic. It has been much employed in epilepsy, in which it was recommended by Cullen. There is good reason to believe that it has occasionally effected cures; but like all other remedies in that complaint it very frequently fails. It has also been used in chorea, hysteria, and worms; and by Swediaur as an injection in gonorrhœa and leucorrhœa. In overdoses it produces vomiting, and the poisonous effects which result from the other preparations of copper. (See *Cuprum.*) It is said, however, to be less apt to excite nausea. The dose is a quarter or half a grain, repeated twice a day, and gradually

increased to four or five grains. It may be given in pill or solution. The medicine should not be very long continued without interruption; according to Cullen, not longer than a month. It has been discarded by the British Council; but surely it must be still used in Great Britain to an extent which would render expedient an officinal regulation of the mode of preparing it. W.

DECOCTA.

Decoctions.

Decoctions are solutions of vegetable principles, obtained by boiling the substances containing these principles in water. Vegetables generally yield their soluble ingredients more readily, and in larger proportion, to water maintained at the point of ebullition, than to the same liquid at a lower temperature. Hence decoction is occasionally preferred to infusion as a mode of extracting the virtues of plants, when the call for the remedy is urgent, and the greatest possible activity in the preparation is desirable. The process should be conducted in a covered vessel, so as to confine the vapour over the surface of the liquid, and thus prevent the access of atmospheric air, which sometimes exerts an injurious agency upon the active principle. The boiling, moreover, should not, as a general rule, be long continued; as the ingredients of the vegetable are apt to react on each other, and thus lose, to a greater or less extent, their original character. The substance submitted to decoction should if dry be either powdered or well bruised, if fresh, should be sliced, so that it may present an extensive surface to the action of the solvent; and previous maceration for some time in water is occasionally useful by overcoming the cohesion of the vegetable fibre. Should the physician not happen to prescribe this preliminary comminution, the apothecary should nevertheless not omit it.

All vegetable substances are not proper objects for decoction. In many the active principle is volatile at a boiling heat, in others it undergoes some change unfavourable to its activity, and in a third set is associated with inefficient or nauseous principles, which, though insoluble, or but slightly soluble in cool water, are abundantly extracted by that liquid at the boiling temperature, and thus encumber, if they do not positively injure, the preparation. In all these instances, infusion is preferable to decoction. Besides, by the latter process, more matter is often dissolved than the water can retain, so that upon cooling a precipitation takes place, and the liquid is rendered turbid. When the active principle is thus dissolved in excess, the decoction should always be strained while hot; so that the matter which separates on cooling, may be mixed again with the fluid by agitation at the time of administering the remedy.

In compound decoctions, the ingredients may be advantageously added at different periods of the process, according to the length of boiling requisite for extracting their virtues; and, should any of them owe its activity to a volatile principle, the proper plan is, at the close of the process, to pour upon it the boiling decoction, and allow the liquor to cool in a covered vessel.

As a general rule, glass or earthenware vessels should be preferred; as those made of metal are sometimes corroded by the ingredients of the decoction, which thus becomes contaminated. Vessels of clean cast-iron or common tin, or of block tin, are preferable to those of copper, brass, or zinc; but iron pots should not be used when astringent vegetables are concerned.

Decoctions, from the mutual reaction of their constituents, as well as from the influence of the air, are apt to spoil in a short time. Hence they should be prepared only when wanted for use, and should not be kept, in warm weather, for a longer period than forty-eight hours.

The present directions for decoctions in the U. S. Pharmacopœia meet, as a general rule, all the requisitions above mentioned, and are remarkably neat and precise. It is, however, to be feared that, in the aim of uniformity, in itself very desirable, the peculiar qualities of the substances submitted to the process, requiring peculiar treatment, have, in some instances, been overlooked. The directions, moreover, are adapted to the wants of the pharmaceutist, and cannot always be conveniently carried out in families, to whom the preparation of this class of medicines must often be

confided. In such instances, it might be better for the physician simply to order the drug to be boiled in a covered vessel, for a certain length of time, or down to a certain amount, in a given quantity of water; as directed in former editions of the U. S. Pharmacopœia. Our list of officinal decoctions had been on former occasions so well freed from useless formulas that, at the recent revision, there did not seem to be sufficient cause to dismiss a single one from the list; while, in the British Pharmacopœia, not less than 17 of this class, formerly directed by the three Colleges, were discarded. These were the Decoctions of *Pipsissewa*, *Pale* and *Red Cinchona*, *Quince Seed*, *Bittersweet*, *Galls*, *Pomegranate Rind*, *Guaiacum Wood*, *Mezereon*, *Myrrh*, *Seneka*, *Tormentil*, *Elm Bark*, and *Uva Ursi*, and the Compound Decoctions of *Barley*, *Flaxseed*, and *Broom*. Of these the Decoction of Elm Bark has been restored in the present edition. W.

DECOCTUM ALOES COMPOSITUM. *Br. Compound Decoction of Aloes.*

"Take of Extract of Socotrine Aloes *one hundred and twenty grains;* Myrrh, Saffron, of each, *ninety grains;* Carbonate of Potash *sixty grains;* Extract of Liquorice *one ounce* [avoirdupois]; Compound Tincture of Cardamoms *eight fluidounces;* Distilled Water *a sufficiency.* Reduce the Extract of Aloes and Myrrh to coarse powder, and put them together with the Carbonate of Potash and Extract of Liquorice into a suitable covered vessel with a pint [Imperial measure] of Distilled Water; boil gently for five minutes, then add the Saffron. Let the vessel with its contents cool, then add the Tincture of Cardamoms, and, covering the vessel closely, allow the ingredients to macerate for two hours; finally strain through flannel, pouring as much Distilled Water over the contents of the strainer as will make the strained product measure thirty fluidounces." *Br.*

This is essentially the former process of the British Colleges. The direction is properly given to rub the aloes, myrrh, and carbonate of potassium together before the addition of the other ingredients. The effect of the alkaline carbonate is, by combining with the resin of the myrrh, and the insoluble portion (apotheme of *Berzelius*) of the aloes, to render them more soluble in water, while the liquorice assists in the suspension of the portion not actually dissolved. The tincture of cardamom is useful not only by its cordial property, but also by preventing spontaneous decomposition. This decoction is said not to filter clear when first made, but, if kept for some time, to deposit insoluble matter, and then to become bright and clear on filtering. (*Pharm. Journ.*, xiv. 491.)

Long boiling impairs the purgative property of aloes; and the same effect is thought to be produced, to a certain extent, by the alkalies, which certainly qualify its operation, and render it less apt to irritate the rectum. This decoction, therefore, is milder as a cathartic than aloes itself, and not so liable to produce or aggravate hemorrhoidal disease. At the same time it is more tonic and cordial from the presence of the myrrh, saffron, and cardamom, and derives antacid properties from the carbonate of potassium. It is given as a gentle cathartic, tonic, and emmenagogue; and is especially useful in dyspepsia, habitual constipation, and those complicated cases in which suppressed or retained menstruation is connected with enfeebled digestion and a languid state of the bowels. The dose is from half a fluidounce to two fluidounces. The decoction should not be combined in prescription with acids, acidulous salts, or other saline bodies which are incompatible with the alkaline carbonate. W.

DECOCTUM CETRARIÆ. *U. S., Br. Decoction of Iceland Moss.*

"Take of Iceland Moss *half a troyounce;* Water *a sufficient quantity.* Boil the Iceland Moss in a pint of Water for fifteen minutes, strain with compression, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.*

"Take of Iceland Moss *one ounce* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Wash the Moss in cold water, to remove impurities; boil it with the Distilled Water for ten minutes in a covered vessel, and strain, with gentle pressure, while hot; then pour Distilled Water over the contents of the strainer until the strained product measures a pint [Imp. meas.]." *Br.*

The directions of the U. S. Pharmacopœia of 1850 were to boil *half an ounce* of the Moss with *a pint and a half* of Water down to a pint, and to strain with compression; and this process is preferable when the object is to extract not only the bitter principle, but also the whole of the demulcent and nutritive matter. As the bitter principle is dissolved along with the starch-like matter of the moss, this decoction unites an unpleasant flavour to its demulcent properties; but the plan which has been proposed of first extracting the bitterness by maceration in water, or a very weak solution of an alkaline carbonate, and afterwards preparing the decoction, is inadmissible; as the peculiar virtues which distinguish the medicine from the ordinary demulcents are thus entirely lost. (See *Cetraria.*) A pint of the decoction may be taken during the day. W.

DECOCTUM CHIMAPHILÆ. *U. S. Decoction of Pipsissewa. Decoction of Winter Green.*

"Take of Pipsissewa, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Pipsissewa in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.*

Though, in our estimation, a very valuable medicine, this decoction does not appear to be much used abroad, and has been omitted in the British Pharmacopœia. The U. S. directions of 1850 were to boil an ounce of the bruised leaves with a pint and a half of water to a pint, and strain; and, having been much in the habit of using the decoction thus prepared, and found it to answer our purposes well, we must confess a wish that the same direction in reference to the amount of boiling had been retained.

The medical properties and uses of pipsissewa have been detailed under the head of Chimaphila. One pint of the decoction may be given in the course of twenty-four hours. W.

DECOCTUM CINCHONÆ FLAVÆ. *U. S., Br. Decoction of Yellow Cinchona. Decoction of Yellow Bark.*

"Take of Yellow Cinchona, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Yellow Cinchona in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.*

"Take of Yellow-Cinchona Bark, in coarse powder, *one ounce and a quarter* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel. Strain the decoction, when cold, and pour as much distilled water over the contents of the strainer as will make the strained product measure one pint [Imp. meas.]." *Br.* W.

DECOCTUM CINCHONÆ RUBRÆ. *U. S. Decoction of Red Cinchona. Decoction of Red Bark.*

"Take of Red Cinchona, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Red Cinchona in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.*

The British Council has discarded this decoction, and there is no necessity for making distinct formulas for the several varieties. It would, we think, be better to have but one formula for all the varieties, with the general name of Decoctum Cinchonæ, and to leave to the physician the special designation.

The virtues of Peruvian bark, though extracted more rapidly by decoction than by infusion, are materially impaired by long boiling, in consequence of the changes effected in its constituents, either by their mutual reaction, or by the agency of atmospheric oxygen, or by both causes united. To prevent this result, the process should be performed in a covered vessel, and continued only ten or at the furthest fifteen minutes. But, even with these precautions, a considerable precipitate takes place in the decoction upon cooling, which is thus rendered turbid. According to Pelletier, besides the kinates of cinchonia and quinia, the water dissolves gum, starch, yellow colouring matter, kinate of calcium, tannin, and a portion of cinchonic red, with a minute quantity of fatty matter. But the tannin and starch, at the boiling temperature, unite to form a compound insoluble in cold water; and, when the decoction is allowed to cool, this compound is precipitated, together with a por-

tion of the cinchonic red and fatty matter, which carry with them also a considerable quantity of the alkaline principles of the bark. (*Journ. de Pharm.*, vii. 119.) Hence, the decoction is ordered to be strained while hot, so that the portion of active matter precipitated may be mingled by agitation with the liquor, and not be lost. Pelletier recommends that a larger proportion of water, sufficient to retain the alkaloid in solution, be employed, that the decoction be filtered when cold, and then sufficiently concentrated by evaporation. A better mode is to add to the liquid some acid which may form with the quinia and cinchonia compounds more soluble than the native salts. Lemon juice has been long employed as a useful addition to the decoction of cinchona, and we can now understand the manner in which its acts. Sulphuric acid in excess answers the same purpose. By acidulating the pint of water employed in preparing the decoction with a fluidrachm of the aromatic or diluted sulphuric acid, we shall probably enable the menstruum to extract all the virtues of the bark. The propriety of such an addition is confirmed by the experiments of *MM. Henry, jun.*, and *Plisson*, who ascertained that portions of the alkaloids exist in the bark connected with the colouring matter in the form of insoluble compounds, and that it is impossible, therefore, completely to exhaust the bark by water alone. There may, however, be some diversity of action in the different salts of quinia and cinchonia; and the native kinates may, under certain circumstances, be most efficient.

Numerous substances produce precipitates with this decoction; but comparatively few affect its activity as a medicine. (See *Infusum Cinchonæ.*) Tannic acid and the substances containing it should be excluded from the decoction; as it forms salts with the alkaline principles of the bark, which are either insoluble or but slightly soluble in water. The alkalies, alkaline earths, and salifiable bases generally should also be excluded; because, uniting with the kinic acid, they precipitate the alkaloids.

The dose of the decoction is two fluidounces, to be repeated more or less frequently according to circumstances. Two drachms of orange peel, added to the decoction while still boiling hot, improve its flavour, and render it more acceptable to the stomach. W.

DECOCTUM CORNÛS FLORIDÆ. *U. S.* *Decoction of Dogwood.*

"Take of Dogwood, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Dogwood in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.*

This decoction has been proposed as a substitute for that of Peruvian bark; but, though possessed of analogous properties, it is much inferior in efficacy, and is not likely to be extensively employed so long as the Peruvian tonic is attainable. The dose is two fluidounces. W.

DECOCTUM DULCAMARÆ. *U. S.* *Decoction of Bittersweet.*

"Take of Bittersweet, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Bittersweet in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.*

This has been omitted in the British Pharmacopœia, and an infusion substituted; but why, we are at a loss to say; for there is no reason to suppose that the virtues of bittersweet are materially impaired by boiling; and the twigs, having a somewhat ligneous texture, require a more thorough operation of the menstruum than many other substances. Indeed, this is one of the decoctions in which we are disposed to prefer the formula of 1850, which directed that an ounce of the twigs should be boiled with a pint and a half of water to a pint.

The properties and uses of this decoction have been already detailed under the head of *Dulcamara.* The dose is from one to two fluidounces three or four times a day, or more frequently. W.

DECOCTUM GRANATI RADICIS. *Br.* *Decoction of Pomegranate Root.*

"Take of Pomegranate Root Bark, sliced, *two ounces* [avoirdupois]; Distilled Water *two pints* [Imperial measure]. Boil down to a pint [Imp. meas.], and strain, making the strained product up to a pint [Imp. meas.], if necessary by pouring distilled water over the contents of the strainer." *Br.*

For the uses and dose of this decoction, see *Granati Radicis Cortex.* W.

DECOCTUM HÆMATOXYLI. *U. S., Br. Decoction of Logwood.*

"Take of Logwood, rasped, *a troyounce;* Water *a sufficient quantity.* Boil the Logwood in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.*

"Take of Logwood, in chips, *one ounce* [avoirdupois]; Cinnamon, in coarse powder, *sixty grains;* Distilled Water *one pint* [Imperial measure]. Boil the Logwood in the Water for ten minutes in a covered vessel, adding the Cinnamon towards the end. Strain the decoction, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

We prefer the old U. S. formula, which ordered an ounce of the logwood to be boiled with two pints down to a pint, and doubt much whether the wood is exhausted by a boiling of ten or fifteen minutes. The cinnamon of the Br. formula is in general a very suitable addition; but there might be circumstances under which it would be better avoided; and in this case, as in others, any addition to the simple decoction might be left to the judgment of the prescriber.

This is an excellent astringent in diarrhœa; particularly in that form of it which succeeds the cholera infantum of this climate, or occurs as an original complaint in children during summer. The dose for an adult is two fluidounces, for a child about two years old, two or three fluidrachms, repeated several times a day. A little bruised cinnamon may often be added with advantage at the end of the boiling, as directed in the British process. W.

DECOCTUM HORDEI. *U. S., Br. Decoction of Barley.*

"Take of Barley *two troyounces;* Water *a sufficient quantity.* Having washed away the extraneous matters which adhere to the Barley, boil it with half a pint of Water for a short time, and throw away the resulting liquid. Then, having poured on it four pints of boiling Water, boil down to two pints, and strain." *U. S.*

"Take of Pearl Barley *two ounces* [avoirdupois]; Distilled Water *one pint and a half* [Imperial measure]. Wash the Barley in cold water, and reject the washings; boil the washed barley with the Distilled Water for twenty minutes, in a covered vessel, and strain." *Br.*

Barley water, as this decoction is usually called, is much employed as a nutritive drink in febrile and inflammatory complaints, and, from the total absence of irritating properties, is peculiarly adapted to cases in which the gastric or intestinal mucous membrane is inflamed. As the stomach of those for whom it is directed is often exceedingly delicate, and apt to revolt against anything having the slightest unpleasantness of flavour, it is important that the decoction should be properly made; and, though the office of preparing it generally falls to nurses, yet the introduction of the process into the Pharmacopœia is not without advantage; as a formula is thus ever before the physician, by which he may give his directions, with the certainty, if obeyed, of having a good preparation. The use of the washing with cold water, and of the first short boiling, is completely to remove any mustiness, or other disagreeable flavour, which the barley may have acquired from exposure; and the British Pharmacopœia has probably erred in abandoning the second of these precautions. W.

DECOCTUM PAPAVERIS. *Br. Decoction of Poppies.*

"Take of Poppy Capsules, bruised, *two ounces* [avoirdupois]; Distilled Water *a pint and a half* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

This decoction is used as an anodyne fomentation in painful tumours, and superficial cutaneous inflammation or excoriation. It is recommended not to reject the seeds, as their oil, suspended in the water by the mucilage of the capsules, adds to the emollient virtues of the preparation. W.

DECOCTUM PAREIRÆ. *Br. Decoction of Pareira.*

"Take of Pareira Root, sliced, *one ounce and a half* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for fifteen minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

This is apt to remain turbid after straining, but, if allowed to stand, gradually deposits insoluble matter, and then filters perfectly clear. (*Pharm. Journ.*, xiv. 491.) The dose is from one to two fluidounces three or four times a day. W.

DECOCTUM QUERCÛS ALBÆ. *U. S.* *Decoction of White-oak Bark.* DECOCTUM QUERCUS. *Br.* *Decoction of Oak Bark.*

"Take of White-oak Bark, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the White-oak Bark in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U. S.*

"Take of Oak Bark [bark of Quercus pedunculata], bruised, *one ounce and a quarter* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br*

The U. S. Pharmacopœia of 1850 directed to boil an ounce of the bruised bark with a pint and a half of water down to a pint; and we have little doubt that the result was a more complete exhaustion of the bark than by the present process.

This decoction contains the tannin, bitter principle, and gallic acid of oak bark. It affords precipitates with the decoction of Peruvian bark and other substances containing vegetable alkaloids, with solution of gelatin, and with most metallic salts, particularly those of iron. Alkaline solutions diminish or destroy its astringency. Its uses have been already detailed. The dose is a wineglassful, frequently repeated. W.

DECOCTUM SARSÆ. *Br.* *Decoction of Sarsaparilla.*

"Take of Jamaica Sarsaparilla, cut transversely, *two ounces and a half* [avoirdupois]; Boiling Distilled Water *one pint and a half* [Imperial measure]. Digest the Sarsaparilla in the Water for an hour; boil for ten minutes in a covered vessel, cool, and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint [Imp. meas.]." *Br.*

An idea was long entertained that the virtues of sarsaparilla resided in its fecula, the extraction of which was, therefore, the main object of the decoction. Hence the long boiling formerly ordered by the London and Edinburgh Colleges. But this opinion is now admitted to have been erroneous. The activity of the root is believed to depend upon one or more acrid principles, soluble to a certain extent in water cold or hot, and either volatilized, or rendered inert by chemical change, at the temperature of 212°. This fact appears to be demonstrated by the experiments of Pope,* Hancock,† Soubeiran,‡ Beral, and others. Soubeiran macerated one portion of bruised sarsaparilla in cold water for twenty-four hours; infused another portion in boiling water, and digested with a moderate heat for two hours; boiled a third portion bruised, and a fourth unbruised, in water for two hours; and in each instance used the same relative quantities. Testing these various preparations by the taste, he found the cold and hot infusions scarcely different in this respect; and both possessed of a stronger odour and more acrid taste than the decoctions, of which that prepared with the bruised root was the strongest. Beral has proved that *sarsaparillin*, which is believed to be the active principle of the drug, is volatile. From these facts the inference is obvious, that the best method of imparting the virtues of sarsaparilla to water is either by cold or hot infusion. Digestion for some hours in water maintained at a temperature of 180°, or somewhat less, in a covered vessel, has strong testimony in its favour. Percolation in a displacement apparatus, if properly conducted, is a convenient and no doubt efficient mode of exhausting the root, so far as water will effect that object. Decoction is the worst method; and the longer it is continued, the weaker will be the preparation. Accordingly, in the edition of the U. S. Pharmacopœia for 1850, an infusion of sarsaparilla was substituted for the simple decoction, though abandoned in the present edition as superfluous. It is probable that, as in the case of the Peruvian bark, a boiling of ten or fifteen minutes might be advantageously resorted to

* Trans. of the Medico-chirurg. Society of London, vol. xii. p. 344.

† Trans. of the Medico-botan. Society of London. See also Journ. of the Philad. Col. of Pharm., vol. i. p. 295. The observations of Dr. Hancock are entitled to much credit, as he practised long in South America, in the neighbourhood of the best sarsaparilla regions.

‡ Journ. de Pharmacie, tom. xvi. p. 38.

when circumstances require the preparation to be made in less time than is requisite for infusion. In every instance the root should be thoroughly bruised, or reduced to a coarse powder, thus obviating the necessity for a long maceration, merely to overcome the cohesion of its fibres. These principles, so far as refers to the menstruum, have been recognised by the framers of the present British Pharmacopœia, in which long boiling has been abandoned. The unsplit root, however, is ordered, from the conviction, probably, that the internal amylaceous part is inert; but there can be no doubt that the drug yields its virtues more readily when well bruised or otherwise comminuted than in the natural state.

Precipitates are produced by various substances with this decoction; but it has not been ascertained how far such substances interfere with its activity. Those which merely throw down the fecula do not injure the preparation.

By this preparation it is possible to administer sarsaparilla in the form of decoction, without combination with other medicines, as in the Compound Decoction; and hence it may be considered as a desirable officinal.

The decoction of sarsaparilla may be administered in the dose of four or six fluidounces four times a day. W.

DECOCTUM SARSAPARILLÆ COMPOSITUM. *U.S.* Decoctum Sarsæ Compositum. *Br.*. *Compound Decoction of Sarsaparilla.*

"Take of Sarsaparilla, sliced and bruised, *six troyounces;* Bark of Sassafras Root, sliced, Guaiacum Wood, rasped, Liquorice Root, bruised, each, *a troyounce;* Mezereon, sliced, *one hundred and eighty grains;* Water *a sufficient quantity.* Boil in four pints of Water for fifteen minutes; then digest for two hours in a covered vessel at about 200°, strain, and add sufficient Water, through the strainer, to make the decoction measure four pints." *U.S.*

"Take of Jamaica Sarsaparilla, cut transversely, *two ounces and a half;* Sassafras Root, in chips, Guaiac Wood turnings, Fresh Liquorice Root, bruised, each *a quarter of an ounce;* Mezereon Bark *sixty grains;* Boiling Distilled Water *one pint and a half* [Imperial measure]. Digest the solid ingredients in the Water for an hour; then boil for ten minutes in a covered vessel; cool and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint [Imp. meas.]." *Br.* The ounce employed in this process is the avoirdupois ounce.

This decoction is an imitation of the celebrated *Lisbon diet drink.* The sarsaparilla and mezereon are the active ingredients; the guaiacum wood imparting scarcely any of its virtues, and the sassafras and liquorice serving little other purpose than to communicate a pleasant flavour.

If prepared with good sarsaparilla, and with a due regard to the practical rules which may now be considered as established, the decoction may be used with great advantage as a gentle diaphoretic and alterative in secondary syphilis, either alone, or as an adjuvant to a mercurial course; also in certain scrofulous and other depraved conditions of the system, in chronic rheumatism, and in various obstinate cutaneous affections. The dose is from four to six fluidounces three or four times a day. The patient during its use should wear flannel next the skin, and avoid unnecessary exposure to changes of temperature.* W.

* The *Decoction of Zittmann* (Decoctum Zittmanni) is a preparation of Sarsaparilla much used in Germany, for similar purposes with our compound decoction of sarsaparilla; and, as it has attracted some attention in this country as a remedy in obstinate ulcerative affections, we give the formula of the Prussian Pharmacopœia, which is generally followed in its preparation.—"Take of sarsaparilla *twelve ounces;* spring water *ninety pounds.* Digest for twenty-four hours; then introduce, enclosed in a small bag, *an ounce and a half* of sugar of alum (*saccharum aluminis* seu *saccharum aluminatum*, consisting of equal parts of *powdered alum* and the *whitest sugar*), *half an ounce* of calomel, and *a drachm* of cinnabar. Boil to thirty pounds, and near the end of the boiling add of aniseed, fennel-seed, each, *half an ounce,* senna *three ounces,* liquorice root *an ounce and a half.* Put aside the liquor under the name of THE STRONG DECOCTION. To the residue add *six ounces* of sarsaparilla and *ninety pounds* of water. Boil to thirty pounds, and near the end add lemon-peel, cinnamon, cardamom, liquorice, of each, *three drachms.* Strain and set aside the liquor under the name of THE WEAK DECOCTION." Mercury was detected by Wiggers in this decoction in very small proportion. It should not be prepared in metallic vessels lest the mercurial in solution should be decomposed. The decoction may be drunk freely.

DECOCTUM SCOPARII. *Br.* *Decoction of Broom.*

"Take of Broom-tops, dried, *one ounce* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

This decoction is used as an adjuvant to more powerful diuretics in dropsy. From half a pint to a pint may be taken during the day, in doses of from two to four fluidounces. W.

DECOCTUM SENEGÆ. *U.S.* *Decoction of Seneka.*

"Take of Seneka, bruised, *a troyounce;* Water *a sufficient quantity.* Boil the Seneka in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U.S.*

In the British Pharmacopœia the decoction of seneka has been superseded by the infusion. (See *Infusum Senegæ.*)

This is one of the decoctions in which experience has shown that long boiling impairs the activity of the medicine; and the substitution in our Pharmacopœia of a moderate boiling, for the former direction to boil down from a pint and a half to a pint, was certainly judicious.

It is customary to add to the seneka in decoction an equal weight of liquorice root, which serves to cover its taste, and in some measure to obtund its acrimony. The virtues and practical application of seneka have been already treated of. (See *Senega.*) The dose of the decoction is about *two fluidounces* three or four times a day, or a tablespoonful every two or three hours. W.

DECOCTUM TARAXACI. *Br.* *Decoction of Taraxacum.*

"Take of Dried Dandelion Root, sliced and bruised, *one ounce* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint [Imp. meas.]." *Br.*

This decoction is most efficient when prepared, as in the present British Pharmacopœia, from the root alone. The dose is a wineglassful two or three times a day. (See *Taraxacum.*) W.

DECOCTUM ULMI. *Br.* *Decoction of Elm Bark.*

"Take of Elm Bark, cut in small pieces, *two and a half ounces* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint." *Br.*

For the uses of this preparation, see the article on Elm Bark in *Part* I. The dose is from two to four fluidounces. W.

DECOCTUM UVÆ URSI. *U.S.* *Decoction of Uva Ursi.*

"Take of Uva Ursi *a troyounce;* Water *a sufficient quantity.* Boil the Uva Ursi in a pint of Water for fifteen minutes, strain, and add sufficient Water, through the strainer, to make the decoction measure a pint." *U.S.*

The decoction of uva ursi has been superseded, in the British Pharmacopœia, by the infusion. (See *Infusum Uvæ Ursi.*)

The preparation contains the tannin, extractive, and gallic acid of the leaves. For an account of its uses, see *Uva Ursi.* The dose is from one to two fluidounces three or four times a day. W.

DIGITALINUM.

Digitalin.

DIGITALINUM. *U.S., Br.* *Digitalin.*

"Take of Digitalis, in moderately fine powder, *forty-eight troyounces;* Stronger Alcohol *six pints;* Acetic Acid *half a fluidounce;* Purified Animal Charcoal *one hundred and eighty grains;* Tannic Acid *two hundred grains,* or *a sufficient quantity;* Oxide of Lead, in fine powder, *one hundred and twenty grains;* Stronger Ether *a fluidounce;* Water of Ammonia, Diluted Alcohol, Distilled Water, each, *a sufficient*

quantity. Mix the Stronger Alcohol with two pints of Distilled Water, moisten the Digitalis with a pint of the mixture, and pack it in a conical percolator; pour on two pints of the mixture, and when the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator to prevent evaporation, set it aside in a moderately warm place for four days. Then, having removed the cork, gradually pour on, first the remainder of the mixture, and then Diluted Alcohol until a gallon of tincture has been obtained. Distil off six pints and a half, add to the residue the Acetic Acid, and one hundred and twenty grains of the Animal Charcoal, set aside for twenty-four hours, and filter; to the filtered liquid add Water of Ammonia until the acid is almost neutralized, then add the Tannic Acid, previously dissolved in half a pint of Distilled Water, until it ceases to produce a precipitate; collect this upon a filter, wash it with a little Distilled Water, mix it with the Oxide of Lead, and dry the mixture carefully. Rub the residue to powder, mix it with the remainder of the Animal Charcoal, and digest with three ounces of Stronger Alcohol, for one hour, at a temperature of 160°; transfer the mixture to a small filter, wash the insoluble portion with three ounces of warm Stronger Alcohol, evaporate carefully to dryness, rub the residue into powder, and wash it twice with the Ether, using one-half each time. Lastly, dry it carefully, and preserve it in a well-stopped bottle." *U. S.*

"Take of Digitalis Leaf, in coarse powder, *forty ounces* [avoirdupois]; Rectified Spirit, Distilled Water, Acetic Acid, Purified Animal Charcoal, Solution of Ammonia, Tannic Acid, Oxide of Lead in fine powder, Pure Ether, of each, *a sufficiency.* Digest the Digitalis with a gallon [Imperial measure] of the Spirit for twenty-four hours at a temperature of 120°; then put them into a percolator, and, when the tincture has ceased to drop, pour a gallon [Imp. meas.] of Spirit on the contents of the percolator, and allow it slowly to percolate through. Distil off the greater part of the Spirit from the tincture, and evaporate the remainder over a water-bath until the whole of the alcohol has been dissipated. Mix the residual extract with five [fluid] ounces of Distilled Water to which half an ounce [avoird.] of Acetic Acid has been previously added, and digest the solution thus formed with a quarter of an ounce of Purified Animal Charcoal; then filter, and dilute the filtrate with Distilled Water until it measures a pint [Imp. meas.]. Add Solution of Ammonia nearly to neutralisation, and afterwards add one hundred and sixty grains of Tannic Acid dissolved in three [fluid]ounces of Distilled Water. Wash the precipitate that will be formed with a little Distilled Water; mix it with a small quantity of the Spirit and a quarter of an ounce of the Oxide of Lead, and rub them together in a mortar. Place the mixture in a flask, and add to it four [fluid]ounces of the Spirit; raise the temperature to 160°, and keep it at this heat for about an hour. Then add a quarter of an ounce of Purified Animal Charcoal; put it on a filter, and from the filtrate carefully drive off the Spirit by the heat of a water-bath. Lastly, wash the residue repeatedly with Pure Ether." *Br.*

Under the name of *digitalin*, there have long been in commerce two distinct substances obtained from digitalis, both of them of the nature of extracts rather than of organic principles. The *French* digitalin was that originally prepared by Homolle. It is a whitish powder, of a neutral reaction, soluble in 2000 parts of cold and in 1000 parts of hot water. It is this digitalin which is now recognised by both the United States and British Pharmacopœias, which direct processes similar to that employed by Homolle. The so called *German* digitalin is at once distinguished from the French or officinal by being, in great part or entirely, freely soluble in water. According to the method of Walz (Husemann, *Die Pflanzenstoffe*, p. 900), it is prepared by extracting under pressure one part of digitalis with eight parts of alcohol, evaporating, digesting the residue with successive portions of water so long as they acquire a bitter taste, uniting the liquids and treating them with litharge and acetate of lead until a portion filtered for testing is no longer precipitated by acetate of lead. Sulphuric acid is added to the filtrate to precipitate the lead, and, after filtration, the reaction brought back to neutral with ammonia, and the liquid precipitated by tannic acid. The precipitate, having been well washed and pressed, is rubbed up with freshly precipitated oxide of lead, the mass boiled with alcohol, and, after the lead has been separated by

precipitation with sulphuric acid, and most of the alcohol distilled off, the residue is allowed to slowly evaporate, the crude digitalin being left behind.

Homolle and Quevenne believed digitalin to be composed of three substances, which they named *Digitalin*, *Digitaline*, and *Digitalose*. The German digitalin Walz found to be composed of *Digitalin*, *Digitaletin*, *Digitaloin*, *Digitalacrin*, and *Digitalis fat*. As there is no proof that these various principles are really distinct organic principles, the reader is referred to Husemann's *Pflanzenstoffe* for an account of their methods of preparation and of their qualities.

In 1871, M. Nativelle, in conformity with the report of a commission of the French Academy, received the prize of Orfila for the discovery of the active principle of digitalis, which he had obtained in fine crystals. The method of preparation, as finally improved and modified by himself, and published in the *Journal de Pharmacie*, xx. 1874, p. 81, is given in a note below.* A process, which has the advantage of being far shorter and more readily carried out, has been devised by M. Tauret (*Ibid.*, Oct. 1875), and is also appended.

* Digitalis Leaves 1000 parts [by weight]; Neutral Acetate of Lead 250 parts; Distilled Water 1000 parts. The lead salt is dissolved in the cold water, mixed thoroughly with the powder, then passed through a sieve, and contact allowed for twenty-four hours, with occasional thorough stirring. The mixture is exhausted in a displacement apparatus with 50 per cent. alcohol, until it ceases to impart any bitterness. To this liquid is added 40 parts of the bicarbonate of sodium, dissolved to saturated solution in cold water. When effervescence has ceased, the spirit is distilled off, the residue evaporated in a water-bath to about 2000 parts, allowed to cool, and diluted with six times its weight of water. Two or three days after, the clear liquid is decanted with a syphon, the precipitate drained and pressed; it should weigh 100 parts. This is suspended in 1000 parts of 80 per cent. alcohol, and the whole passed through a fine metallic or silken sieve. The resulting turbid liquor is then heated to ebullition, and ten parts of neutral acetate of lead added to it; the heat is continued for a few minutes, and the liquor filtered through paper. Upon the deposit in the filter alcohol is poured, to remove any liquor it may retain, and it is then pressed. To the liquor is added 50 parts of quite neutral vegetable charcoal, in fine powder, and it is then distilled. The charcoal remaining is heated for some time in a water-bath, to drive off any alcohol it may retain; then allowed to cool, and put to drain upon the sieve used for the separation of the precipitate, and thus separated from the coloured liquor. This charcoal is dried in a stove, and exhausted by displacement with chloroform, until the latter passes through colourless. This liquor is distilled to dryness, and the residue is crude digitalin, mixed with a pitchy substance and oil. It is dissolved with heat in 100 parts of 90 per cent. alcohol; one part of neutral acetate of lead, dissolved in a little water, is added, and ten parts of purified animal charcoal, in fine grains, without powder; after boiling for ten minutes, it is allowed to cool. After the liquor has settled, it is filtered through a glass cylinder, furnished with a tight cotton plug; it passes quickly and clear, and to the residue the deposit is added, and the whole exhausted of all bitterness by alcohol, which is afterwards distilled. The digitalin appears in a crystalline grumous mass, contaminated by the coloured oil. It is separated from the small quantity of aqueous liquor in which it is found, then dissolved with heat in ten parts of 90 per cent. alcohol, five parts of rectified sulphuric ether and fifteen parts of distilled water added, and the whole shaken together in a stoppered vessel. Two layers are formed; the upper is coloured, and consists of ether, which has taken up the fat; the lower is colourless, and contains the digitalin, which, being set free, quickly crystallizes. Two days afterwards the whole is poured into a small cylinder, furnished with a tight cotton plug; the mother-liquor passes through, followed by the coloured layer, what remains of the latter adhering to the crystals being washed off by a little ether.

The first crystals of digitalin are slightly coloured. To obtain them perfectly white, two purifications are necessary; but previously a treatment with chloroform is indispensable to separate about one-tenth their weight of digitin, which they still retain. The digitalin, well dried, is therefore reduced to a fine powder and dissolved in twenty parts of chloroform, and the solution filtered through a tight plug of cotton. The clear liquor which passes is distilled to dryness, and a little alcohol then added for the purpose of removing, by evaporation, the last traces of chloroform. This digitalin is dissolved in thirty parts of 90 per cent. alcohol, five parts of purified animal charcoal, in granules, added, the liquid boiled during ten minutes, the charcoal exhausted as before, and, finally, the product distilled; the digitalin crystallizes on the side of the vessel. To obtain it white, dissolve it in eight parts of 90 per cent. alcohol, four parts of ether and eight parts of water being added, and the whole shaken together in a close vessel. During the night, nearly the whole digitalin crystallizes out white; that which remains in the mother-liquid may readily be recovered by evaporation.

The process of M. Tauret is as follows. The powdered digitalis is displaced with its weight of 25 per cent. alcohol. This is then agitated with one-fifth of its weight of chloroform; which, after standing, is removed with a pipette or syphon, and the liquid shaken with one-twentieth of chloroform, and served as before. The two chloroformic solutions, mixed with albuminous extractive matter which they have precipitated, are then united, their weight of water added, and agitated with an equal volume of concentrated solution of tannin. The tannate of digitaline is then mixed with chloroform, to dissolve impurities, and afterwards dissolved in alcohol at 90 per cent. This is then mixed with oxide of zinc, and allowed to stand some time, with occasional agitation. A metallic tannate is thus formed, and the digitalin remains dissolved in the alcohol, which is filtered, decolorized with animal charcoal, and allowed to evaporate spontaneously, when crystals form. (*Note to the fourteenth edition.*)

Crystallized digitalin occurs in granular radiating masses of acicular crystals, or in brilliant acicular crystals. The characteristic reactions of it are stated by Tauret to be, the yellowish-green colour which it strikes with hydrochloric acid; the brown or rose colour, according to the amount of digitalin, developed by concentrated sulphuric acid; and the violet colour, which is produced in its solution in dilute sulphuric acid when a drop of bromine-water or, better still, some of the vapours of bromine are added. According to Nativelle, it is insoluble in water, very soluble in chloroform, soluble in 12 parts of cold and in 6 parts of boiling alcohol of 90 per cent. When heated to 212° F., it softens and becomes elastic; heated on platina foil, it fuses without colouring, and evaporates in white vapour. M. Lebaigne gives, as the mean of two analyses, $C_{39}H_{39}O_{30}$. Solution of chloral dissolves it readily. According to Ch. Blaquart (*L'Union Pharmaceutique*, Nov. 1872), ten per cent. of it can readily be obtained from the crude drug. Besides digitalin, M. Nativelle obtained a crystallizable but inert substance, to which he gave the name of digitin.

The relation of Nativelle's crystallized digitalin to digitalis and the amorphous digitalin has given rise to considerable controversy. The French commission affirmed that it acted similarly to digitalin, but was much stronger. M. Gubler, M. Vulpian and M. Blaquart have separately arrived at a different result from this; they found the crystallized digitalin no stronger or even weaker than the amorphous French preparation. However this may be, it is plain that Nativelle's digitalin cannot be the sole or even chief principle of digitalis, since he found it in the residue left as exhausted and inert in the preparation of the officinal or French digitalin. There is abundant proof that the latter substance is a powerful drug, and, if it contain no crystallized digitalin, it is plain that crystallized digitalin is not the sole or even chief active principle of digitalis. Dr. Roucher (*Les Mondes*, Juillet, 1872) affirms that Nativelle's digitalin is a complex body, and O. Schmiedeberg* (*Archiv für Exper. Pathologie und*

* *Digitonin* may be prepared from the German or soluble digitalin. The finely-powdered digitalin is moistened with absolute alcohol, and then treated with a mixture of equal volumes of chloroform and absolute alcohol. This having been separated from the insoluble residue, is mixed with pure ether, until no further precipitate can be obtained. The precipitate which usually adheres to the glass is chiefly digitonin; it is separated from the fluid, and treated as before. The final precipitate is then dissolved upon a water-bath in alcohol at a temperature of 90°, and decolorized with animal charcoal. On cooling, a portion of the digitonin is precipitated, and the remainder may be precipitated by ether. The digitonin is still yellowish, and is to be further purified by washing with absolute alcohol, and dissolving in warm alcohol, &c., as before. As finally obtained, it is in white or whitish, compact, not hygroscopic masses; insoluble in ether, chloroform, and benzole; very soluble in water, moderately so in dilute alcohol and in hot absolute alcohol, but insoluble in cold absolute alcohol. It is a glucoside, containing no nitrogen, with the formula $C_{31}H_{53}O_{17}$ or $C_{31}H_{52}O_{17}$. It is closely allied to saponin. Indeed, some commercial saponin answered to the only test which Schmiedeberg found to distinguish digitonin from saponin. This test is as follows. Concentrated sulphuric acid dissolves it without colour, but the solution gradually grows yellow, and, on heating, assumes, with the separation of flocculi, a pomegranate or violet-red colour, which gives way to a yellowish hue when bromine is added. Boiling in dilute sulphuric acid develops the pomegranate-red very beautifully.

Digitalin forms the bulk of the officinal digitalin. The powder is first treated with ether free from alcohol, in order to extract everything soluble in that menstruum. The residue is then treated with absolute alcohol until exhausted. What is left is chiefly digitonin, which is to be purified in a manner previously indicated. To the alcoholic solution is added one-third to one-half its volume of ether, whereby any digitonin present and a part of the digitalein is precipitated. The resulting liquid is much concentrated by evaporation, and ether again added, to still further purify the digitalin from its congeners. The ether is then evaporated off, water added, and the alcohol distilled at a moderate temperature, when digitalin, still contaminated with digitalein, is precipitated. Purification consists in repeated solutions in warm dilute alcohol, distilling off of the alcohol, and washing of the precipitate with water. When at last a light yellowish or brownish mass is obtained, it should be dissolved in a mixture of absolute alcohol and chloroform. If the mass has been very dark coloured, this may be precipitated with an excess of ether, and a resolution in alcohol and chloroform effected. Finally, the solution is diluted, the precipitated digitalin dissolved in warm dilute alcohol, decolorized with animal charcoal, recovered by slow evaporation until complete precipitation has occurred. The result is a nearly pure digitalin. It may be still further purified by dissolving in hot alcohol, containing a little water, concentrating the filtered solution over a water-bath, covering well, so as to prevent drying of the margins, and setting aside to deposit.

This digitalin is a glucoside, splitting upon short boiling in alcohol into glucose and a resinous substance, *digitaliresin*. A crystallizable derivative was obtained by O. Schmiedeberg from it. The formula is $C_5H_8O_2$. It forms with cold concentrated muriatic acid a colourless solution, which, on heating, becomes intense yellow or yellowish-green. With cold sulphuric acid it forms a colourless solution, becoming yellowish or brownish on exposure to the air; the addition of a little

Pharmak., Bd. iii. p. 19) confirms this. The latter author has examined the constitution of digitalis very carefully, and found that there are four principles in it: *Digitonin*, a substance allied to saponin, which constitutes the bulk of the German or soluble digitalin; *Digitalin*, which constitutes the greater part of the French or soluble digitalin; *Digitalein;* and *Digitoxin*, the most active of all the substances, which forms the bulk of Nativelle's crystalline digitalin. These principles readily break up into a number of derivatives; hence the various principles which have been obtained from digitalis by investigators.

The above résumé of our present knowledge clearly shows that the chemistry of digitalis cannot be considered as settled; but it also clearly shows that the officinal digitalin does not represent digitalis. When it is further borne in mind that the digitalin of the drug stores is always bought from large manufacturers, and that sometimes it is the French, sometimes the German preparation, and sometimes probably something else, it is plain that the practitioner cannot rely upon it. The dose of powdered digitalis is so small that it is readily contained in a small pill, and there is therefore no good reason for the use of the preparation under consideration.

The dose of digitalinum should not, to begin with, exceed the fiftieth of a grain.

H. C. W.

EMPLASTRA.

Plasters.

Plasters are solid compounds intended for external application, adhesive at the temperature of the human body, and of such a consistence as to render the aid of heat necessary in spreading them. Most of them have as their basis a compound of olive oil and litharge, constituting the Emplastrum Plumbi of the U.S. Pharmacopœia. Those plasters which contain none of the compound of oil and litharge owe their consistence and adhesiveness to resinous substances, or to a mixture of these with wax and oleaginous matter.

In the preparation of the plasters, care is requisite that the heat employed be not sufficiently elevated to produce decomposition, nor so long continued as to drive off any volatile ingredient upon which the virtues of the preparation may in any degree depend. After having been prepared, they are usually shaped into cylindrical rolls, and wrapped in paper to exclude the air. Plasters should be firm at ordinary tempera-

bromide of potassium produces a splendid reddish colour. It is nearly insoluble in cold, slightly so in boiling water, readily soluble in alcohol and in a mixture of absolute alcohol and chloroform, very slightly so in ether and chloroform.

Digitalein. This is prepared by dissolving officinal digitalin in water, filtering, evaporating in a vacuum over sulphuric acid to absolute dryness, dissolving in absolute alcohol, and precipitating by excess of ether; the precipitate having been separated, and the liquid concentrated, it is again precipitated with ether. The precipitate is purified by resolution and precipitation until it ceases to give a violet-red colour when heated in concentrated sulphuric acid. Digitalein resembles digitalin in its reactions with sulphuric acid, and in its breaking up into glucose and digitaliresin, or a substance closely allied to it, when heated with dilute sulphuric acid; it is allied to digitonin by its forming with water a soapy solution, precipitated by acetate of lead, ammonia, and tannic acid.

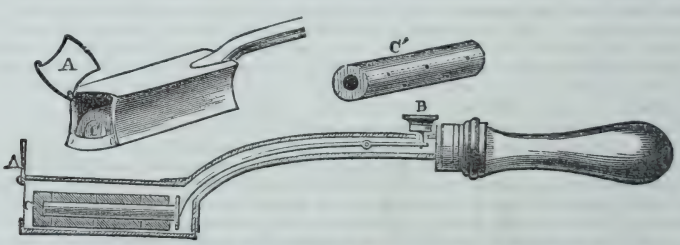
Digitoxin is prepared by macerating powdered digitalis leaves, previously exhausted with water, in 50 per cent. alcohol for ten or twelve hours, pressing out the fluid, and repeating the operation. The united tinctures are then treated with acetate of lead and ammonia, and the coloured yellow liquid, which must have a neutral reaction, freed from alcohol by distillation. The precipitate of digitoxin which forms, having been washed on the filter first with a dilute solution of carbonate of sodium and afterwards with water, is dried over a water-bath and exhausted with chloroform, which is distilled, and the residue purified by repeated boiling with rectified benzine, which removes a reddish indifferent colouring matter. The residue is then dissolved in boiling 80 per cent. alcohol, decolorized with animal charcoal, and set aside to crystallize. If the crystals be coloured, they may be purified by washing with the carbonate of sodium solution, and repeating the remainder of the process. Digitoxin appears to be simply Nativelle's crystallized digitalin purified. Digitoxin is not a glucoside, but is readily converted into *Toxiresin* and other substances. The crystallized digitalin which O. Schmiedeberg had was a commercial specimen very probably more impure than those prepared by Nativelle himself; it consisted chiefly of digitoxin and its derivatives. Digitoxin is insoluble in water and benzine, very soluble in chloroform, very slightly so in other, more so in cold and still more so in hot absolute alcohol. With concentrated nitric acid, on heating, it produces an emerald green, disappearing on standing, with the deposition of a yellowish resinoid. Concentrated sulphuric acid dissolves a small portion of it, with a brownish, greenish-brown, or blackish-brown colour, which is not altered by the addition of bromine. Its formula is $C_{31}H_{33}O_7$. (*Note to the fourteenth edition.*)

tures, should spread easily when heated, and, after being spread, should remain soft, pliable, and adhesive, without melting, at the heat of the human body. When long kept, they are apt to change colour and to become hard and brittle; and, as this alteration is most observable upon their surface, it must depend chiefly upon the action of the air, which should therefore be as much as possible excluded. The defect may usually be remedied by melting the plaster with a moderate heat, and adding a sufficient quantity of oil to give it the due consistence.

Plasters are prepared for use by spreading them upon leather, linen, or muslin, according to the particular purposes they are intended to answer. Leather is most convenient when the application is made to the sound skin, linen or muslin when the plaster is used as a dressing to ulcerated or abraded surfaces, or with the view of bringing and retaining together the sides of wounds. The leather usually preferred is white sheep skin. A margin about a quarter or half an inch broad should usually be left uncovered, in order to facilitate the removal of the plaster, and to prevent the clothing in contact with its edges from being soiled. An accurate outline may be obtained by pasting upon the leather a piece of paper, so cut as to leave in the centre a vacant space of the required dimensions, and removing the paper when no longer needed. The same object may often be accomplished by employing two narrow rulers of sheet tin graduated in inches, and so shaped that each of them may form two sides of a rectangle. (See the figure, p. 976.) These may be applied in such a manner as to enclose within them any given rectangular space, and may be fixed by weights upon the leather while the plaster is spread.* For any other shape, as in the instance of plasters for the breast, pieces of tin may be employed having a vacuity within, corresponding to the required outline. The spreading of the plaster is most conveniently accomplished by means of a peculiar iron instrument employed for the purpose; though a common spatula will answer.† This may be heated by means of a spirit lamp. Care must be taken that the instrument be not so hot as to discolour or decompose the plaster; and special care is requisite in the case of those plasters which contain a volatile ingredient. A sufficient portion of the plaster should first be melted by the heated instrument, and, having been received on a piece of coarse stiff paper,

* We are informed by a good practical pharmaceutist that this proposed plan of regulating the size and shape of plasters is not successful in practice; as, unless the tin is kept in close contact with the leather or cloth by some steady and equable pressure, the plaster is apt to pass beneath the edge, and thus make an irregular outline; nor do the weights on the corners obviate the difficulty. (*Note to the thirteenth edition.*)

† The common plaster spatula is too well known to need description. In the *Am. Journ. of Pharm.* (xxv. 29) are figures of a plaster spatula, with an instrument employed for heating it, the invention of Mr. Stockton, of Brompton, England, which present certain advantages that render them worthy of notice. We introduce the figures here, with the following description, taken from the *Lond. Pharm. Journ.* for Nov. 1853. "The blade is a hollow case into which the heater is inserted, having



a door (A) at one end, and connected at the other, by a hollow tube, with the handle. The heater (C) is supported on a lever, which passes through the hollow tube, and terminates in a thumb-button (B). By depressing the button the heater is raised so as not to be in contact with the lower part of the spatula. On removing the thumb when more heat is required, the heater is depressed, and produces the desired effect. The heater, which consists of a hollow tube of thick copper, slides on a pin which forms the termination of the lever, and which regulates its position in the box. Some heaters are perforated, to admit of their being easily heated by means of gas. The chief advantage of the spatula consists in the facility with which the heat may be regulated by means of the lever and button, which latter is quite under the control of the thumb. The box containing the heater is of brass, and, not being inserted in the fire, may be more readily kept clean than the common spatula. When several plasters are required, the heater may be removed and another inserted with facility." To the *Am. Journ. of Pharm.* (xxvi. 15) the reader is referred for the figure of another spatula which may be found convenient. (*Note to the twelfth edition.*)

or in a shallow tin tray open on one side, should, when nearly cool, be transferred to the leather, and applied quickly and evenly over its surface. By this plan the melted plaster is prevented from penetrating the leather, as it is apt to do when applied too hot. Before removing the paper from the edge of the plaster, if this has become so hard as to crack, the iron should be drawn over the line of junction. When linen or muslin is used, and the dimensions of the portion to be spread are large, as is often the case with adhesive plaster, the best plan is to pass the cloth "on which the plaster has been laid through a machine, formed of a spatula fixed by screws at a proper distance from a plate of polished steel." A machine for spreading plasters is described by M. Hérent in the *Journ. de Pharm.* (3e sér., ii. 403).* W.

EMPLASTRUM ACONITI. *U. S.* *Aconite Plaster.*

"Take of Aconite Root, in fine powder, *sixteen troyounces;* Alcohol, Resin Plaster, each, *a sufficient quantity.* Moisten the Aconite Root with six fluidounces of Alcohol, and pack it in a conical percolator. Cover the surface with a disk of paper, and pour upon it ten fluidounces of Alcohol. When the liquid begins to drop, cork the percolator, and, having closely covered it to prevent evaporation, set it aside in a moderately warm place for four days. Then remove the cork, and gradually pour on Alcohol until two pints of tincture have been obtained, or the Aconite Root is exhausted. Distil off a pint and a half of alcohol, and evaporate the residue to a soft uniform extract, by means of a water-bath. Add to this sufficient Resin Plaster, previously melted, to make the mixture weigh sixteen troyounces, and then mix them thoroughly." *U. S.*

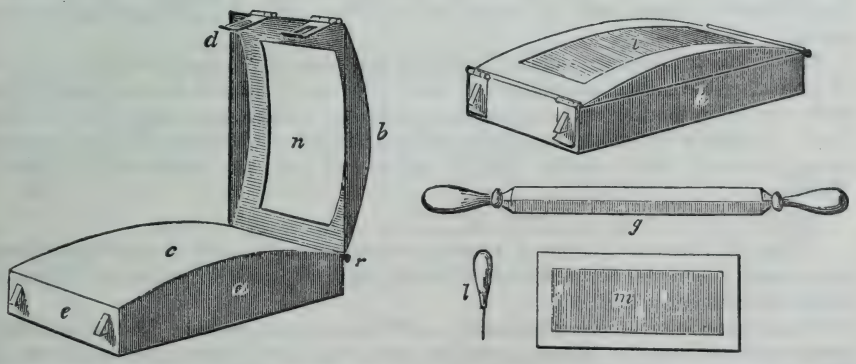
This plaster was introduced into the Pharmacopœia at the last revision. The formula is a modification of that proposed by Prof. Procter. (*Am. Journ. of Pharm.*, xxv. 202.) Aconite Plaster may be used whenever it is desired to produce a very powerful local anodyne effect. H. C. W.

EMPLASTRUM AMMONIACI. *U. S.* *Plaster of Ammoniac.*

"Take of Ammoniac *five troyounces;* Diluted Acetic Acid *half a pint.* Dissolve the Ammoniac in the Diluted Acetic Acid, and strain; then evaporate the solution by means of a water-bath, stirring constantly until it acquires a proper consistence." *U. S.*

This plaster has been omitted in the British Pharmacopœia.

* Within a few years it has been customary with apothecaries to employ an apparatus, such as that figured below, for spreading quantities of plasters. An oblong rectangular block of hard wood (*a e*) has its upper surface (*c*) gently convex. To this is attached by a movable joint (at *r*) a sheet iron frame (*b*), with an opening (*n*) of the dimensions of the plaster to be spread, and clasps (*d*) at the other end, by which this may be fixed to the block. Another portion of the apparatus is a wooden measure (*m*), by which the leather is cut out, and the margin marked. The leather thus prepared is laid on the convex surface of the block (*c*); the sheet iron frame is brought down on it evenly (as at *h i*); the plaster, previously melted, is poured on the leather in the centre, and, by means of an iron instrument (*g*) previously heated by a spirit lamp, is spread uniformly over the surface, the thickness being regulated by the frame against which the iron is pressed. Any excess of plaster is thus pressed over upon the frame. The point of a sharp instrument (*l*)



is then drawn along the interior edge of the frame so as to separate the plaster from it, after which the clasps are unfastened and the plaster removed.

As ammoniac is not usually kept purified in our shops, the straining of the solution in the diluted acid is directed, as the most convenient method of separating impurities. Dr. Duncan remarked that the plaster, prepared in iron vessels, "acquires an unpleasant dark colour, from being impregnated with iron, whereas, when prepared in a glass or earthenware vessel, it has a yellowish-white colour, and more pleasant appearance." Care should also be used to avoid iron spatulas in its preparation, as the acetic acid acts on that metal, and discolours the plaster. The use of a moderate heat will facilitate the action of the diluted acid; and at best it is a thick creamy mass that is obtained, which requires the aid of the hand to strain it properly.

Medical Properties. The ammoniac plaster is stimulant, and is applied over scrofulous tumours and chronic swellings of the joints, to promote their resolution. It often produces a papular eruption, and sometimes occasions considerable inflammation of the skin. W.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO. *U. S., Br. Plaster of Ammoniac with Mercury.*

"Take of Ammoniac *twelve troyounces;* Mercury *three troyounces;* Olive Oil *sixty grains;* Sublimed Sulphur *eight grains.* Heat the Oil, and gradually add the Sulphur, stirring constantly until they unite; then add the Mercury, and triturate until globules cease to be visible. Boil the Ammoniac with sufficient water to cover it until they are thoroughly mixed; then strain through a hair sieve, and evaporate, by means of a water-bath, until a small portion taken from the vessel hardens on cooling. Lastly, add the Ammoniac, while yet hot, gradually to the mixture of Oil, Sulphur, and Mercury, and thoroughly incorporate all the ingredients." *U. S.*

"Take of Ammoniacum *twelve ounces* [avoirdupois]; Mercury *three ounces* [avoird.]; Olive Oil *one fluidrachm;* Sublimed Sulphur *eight grains.* Heat the Oil, and add the Sulphur to it gradually, stirring till they unite. With this mixture triturate the Mercury until globules are no longer visible; and, lastly, add the Ammoniacum, previously liquefied, mixing the whole carefully." *Br.*

The only use of the sulphur is to aid in the extinguishment of the mercury; as the compound formed by it with the metal is probably inert. When ammoniac not previously prepared is used, as it is not fusible by heat, it must be brought to the proper consistence by softening it in a small quantity of hot water, straining, and evaporating.

Medical Properties and Uses. This plaster unites with the stimulant power of the ammoniac the specific properties of the mercury, which is sometimes absorbed in sufficient quantity to affect the gums. It is used as a discutient in enlargement of the glands, tumefaction of the joints, nodes, and other indolent swellings, especially when dependent on a venereal taint. It is also sometimes applied over the liver in chronic hepatitis. W.

EMPLASTRUM ANTIMONII. *U. S. Antimonial Plaster.*

"Take of Tartrate of Antimony and Potassium, in fine powder, *a troyounce;* Burgundy Pitch *four troyounces.* Melt the Pitch by means of a water-bath, and strain; then add the powder, and stir them well together until the mixture thickens on cooling." *U. S.*

This is a useful formula, as it will probably supersede the former irregular methods of preparing the antimonial plaster, of which the most primitive was to sprinkle the tartar emetic in powder upon the surface of adhesive plaster, somewhat softened with heat. It affords one of the most convenient methods of obtaining the local pustulating effects of tartar emetic. For its effects and uses, see *Antimonii et Potassii Tartras.* W.

EMPLASTRUM ARNICÆ. *U. S. Plaster of Arnica.*

"Take of Alcoholic Extract of Arnica *a troyounce and a half;* Resin Plaster *three troyounces.* Add the Extract to the Plaster, previously melted by means of a water-bath, and mix them." *U. S.*

These ingredients incorporate readily, and form a good plaster. The preparation was introduced into the Pharmacopœia, to enable the apothecary to meet the demand for a convenient preparation of arnica for external use. It is supposed to be useful in sprains and bruises, and sometimes probably acts beneficially by its stimulant

properties in chronic rheumatism and other chronic external inflammations. (See *Arnica.*) W.

EMPLASTRUM ASSAFŒTIDÆ. *U. S.* *Plaster of Assafetida.*

"Take of Assafetida, Plaster of Lead, each, *twelve troyounces;* Galbanum, Yellow Wax, each, *six troyounces;* Alcohol *three pints.* Dissolve the Assafetida and Galbanum in the Alcohol by means of a water-bath, strain the liquid while hot, and evaporate to the consistence of honey; then add the Plaster and Wax previously melted together, stir the mixture well, and evaporate to the proper consistence." *U. S.*

This plaster has been omitted in the British Pharmacopœia.

The directions of the U. S. Pharmacopœia indicate the mode in which the gum-resins may be brought to the liquid state, before being incorporated with the other ingredients. Galbanum melts sufficiently by the aid of heat to admit of being strained; but this is not the case with assafetida, which must be prepared by dissolving it in a small quantity of hot water or alcohol, straining, and evaporating to the consistence of honey; and even galbanum may be most conveniently treated in the same way. Formerly these gum-resins were ordered merely to be melted and strained.

This plaster may be advantageously applied over the stomach or abdomen, in cases of hysteria attended with flatulence, and to the chest or between the shoulders in hooping-cough. W.

EMPLASTRUM BELLADONNÆ. *U. S., Br.* *Plaster of Belladonna.*

"Take of Belladonna Root, in fine powder, *sixteen troyounces;* Alcohol, Resin Plaster, each, *a sufficient quantity.* Moisten the Belladonna Root with six fluidounces of Alcohol, pack it in a conical percolator, and, having covered the surface with a disk of paper, pour on ten fluidounces of Alcohol. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator, set it aside for four days. Then remove the cork, and gradually pour on Alcohol until two pints of tincture have slowly passed. Distil off by means of a water-bath a pint and a half of Alcohol; introduce the residue into a two-pint capsule, and evaporate on a water-bath to a soft, uniform extract; ascertain its weight, and, having added sufficient Resin Plaster, previously melted, to make the whole weigh sixteen troyounces, mix them thoroughly." *U. S.*

"Take of Extract of Belladonna, Resin Plaster, each, *three ounces* [avoirdupois]; Rectified Spirit *six fluidounces* [Imperial measure]. Rub the Extract and Spirit together in a mortar, and when the insoluble matter has subsided, decant the clear solution, remove the spirit by distillation or evaporation, and mix the alcoholic extract thus obtained with the Resin Plaster melted by the heat of a water-bath, continuing the heat until with constant stirring the plaster has acquired a suitable consistence." *Br.*

This preparation was formerly prepared with the extract made from the inspissated juice of the leaves, and is so still in the British process; but, in the present edition of the U. S. Pharmacopœia, an alcoholic extract of the root has been substituted with the effect of rendering the plaster easier to be spread and more adhesive. The preparation is a useful anodyne application in neuralgic and rheumatic pains, and in dysmenorrhœa. We have seen the constitutional effects of belladonna result from its external use.* W.

EMPLASTRUM CALEFACIENS. *Br.* *Warm Plaster.*

See EMPLASTRUM PICIS CUM CANTHARIDE. *U. S.*

EMPLASTRUM CANTHARIDIS. *Br.* *Cantharides Plaster. Blistering Plaster.*

See CERATUM CANTHARIDIS. *U. S.*

EMPLASTRUM CERATI SAPONIS. *Br.* *Soap Cerate Plaster.*

"Take of Hard Soap, in powder, *ten ounces* [avoirdupois]; Yellow Wax *twelve and a half ounces* [avoird.]; Olive Oil *one pint* [Imperial measure]; Oxide of Lead *fifteen ounces* [avoird.]; Vinegar *one gallon* [Imp. meas.]. Boil the Vinegar and

* Mr. T. W. Worthington proposes a formula for making belladonna plaster with caoutchouc in the *Amer. Journ. of Pharm.*, xliii. p. 153. (*Note to the fourteenth edition.*)

Oxide of Lead together, by the heat of a steam-bath, constantly stirring them until the Oxide has combined with the Acid; then add the Soap and boil again until most of the moisture is evaporated; finally, add the Wax and Oil melted together, and stir the whole continuously, maintaining the heat until by the evaporation of the remaining moisture the product has acquired the proper consistence for a plaster." *Br.*

This is the old *Ceratum Saponis Compositum* of the London College, the name of which has been changed in the British Pharmacopœia, because, the former class of Cerates having been abandoned, it was necessary to put the preparation into another class with a different title. It is not strictly a plaster, as this term is understood in American pharmacy; for heat is not required to spread it, it being applied to the leather or cloth by means of a spatula, like our Cerates, to which it properly belongs. Indeed, it is essentially the same preparation as the U. S. *Ceratum Saponis*, consisting like that of soap plaster with wax and olive oil, though made differently, and containing some acetate of sodium, as an incidental result of the process. In the British formula, subacetate of lead is first formed by the boiling of litharge or oxide of lead with vinegar; and the subacetate is then converted, by double decomposition with hard soap, into a compound of the oxide of lead and the fatty acids of the soap, and acetate of sodium, which, with some glycerin formed in the process, remains as an ingredient of the lead plaster. The process is completed by incorporating this with the melted wax and oil, thus in fact converting the preparation into a cerate. The U. S. Ceratum Saponis was formerly prepared in the same way; but the process was superseded in the last revision of the Pharmacopœia by the neater one now officinal. For the uses of this preparation, see *Ceratum Saponis*, page 1123. W.

EMPLASTRUM FERRI. *U. S., Br.* Emplastrum Roborans. *Plaster of Iron. Chalybeate Plaster. Strengthening Plaster.*

"Take of Subcarbonate of Iron *three troyounces;* Plaster of Lead *twenty-four troyounces;* Burgundy Pitch *six troyounces.* To the Plaster and Burgundy Pitch, previously melted together, add the Subcarbonate of Iron, and stir them constantly until the mixture thickens on cooling." *U. S.*

"Take of Hydrated Peroxide of Iron, in fine powder, *one ounce;* Burgundy Pitch *two ounces;* Lead Plaster *eight ounces.* Add the Peroxide of Iron to the Burgundy Pitch and Lead Plaster, previously melted together, and stir the mixture constantly till it stiffens on cooling." *Br.*

This preparation has enjoyed some popular celebrity, under the impression that it strengthens the parts to which it is applied; whence it has derived the name of strengthening plaster. It is used in those conditions of the loins, larger muscles, and joints, which, though usually ascribed to debility, are in fact most frequently dependent on rheumatic or other chronic inflammatory affection, and, if relieved by the plaster, are so in consequence of the gentle excitation produced by it in the vessels of the skin, or of the exclusion of the air. It may also, in some instances, give relief by affording mechanical support; but neither in this, nor in any other respect, can it be deemed very efficient. W.

EMPLASTRUM GALBANI. *Br. Galbanum Plaster.*

"Take of Galbanum, Ammoniacum, Yellow Wax, of each, *one ounce;* Lead Plaster *eight ounces.* Melt the Galbanum and Ammoniacum together, and strain. Then add them to the Lead Plaster and Wax, also previously melted together, and mix the whole thoroughly." *Br.*

The galbanum and ammoniac are best prepared by dissolving them in a small quantity of hot water or diluted alcohol, straining the solution, and evaporating it to the proper consistence for mixing with the other ingredients. W.

EMPLASTRUM GALBANI COMPOSITUM. *U. S. Compound Plaster of Galbanum.*

"Take of Galbanum *eight troyounces;* Turpentine *a troyounce;* Burgundy Pitch *three troyounces;* Lead Plaster *thirty-six troyounces.* To the Galbanum and Turpentine, previously melted together and strained, add first the Burgundy Pitch, and afterwards the Lead Plaster melted over a gentle fire, and mix the whole together.' *U. S.*

Before being employed in this process, the galbanum should be purified, as it often contains foreign matters which must injure the plaster. It may be freed from these by melting it with a little water or diluted alcohol, straining, and evaporating to the due consistence.

This and the preceding plaster act as an excellent local stimulant in chronic scrofulous enlargements of the glands and joints. We have employed the compound plaster in obstinate cases of this kind, which, after having resisted general and local depletion, blistering and other measures, have yielded under its use. As a discutient it is also employed in the induration which sometimes remains after the discharge of abscesses. It is said to have been useful in rickets, applied over the whole lumbar region, and has been recommended in chronic gouty and rheumatic articular affections. It should not be used in the discussion of tumours in which any considerable inflammation exists. W.

EMPLASTRUM HYDRARGYRI. *U. S., Br. Mercurial Plaster.*

"Take of Mercury *six troyounces;* Olive Oil, Resin, each, *two troyounces;* Plaster of Lead *twelve troyounces.* Melt the Oil and Resin together, and, when they have become cool, rub the Mercury with them until globules of the metal cease to be visible. Then gradually add the Lead Plaster, previously melted, and mix the whole together." *U. S.*

"Take of Mercury *three ounces;* Olive Oil *one fluidrachm;* Sublimed Sulphur *eight grains;* Lead Plaster *six ounces.* Heat the Oil and add the Sulphur to it gradually, stirring until they unite; with this mixture triturate the Mercury until globules are no longer visible, then add the Lead Plaster, previously liquefied, and mix the whole thoroughly." *Br.* The ounce employed in this process is the avoirdupois ounce.

The U. S. and former British processes may be considered as identical in their results. The sulphuretted oil which was employed in the process of the London College to facilitate the extinguishment of the mercury was abandoned in the first British Pharmacopœia, as, just in proportion to the increased facility of the process, it lessened the efficacy of the resulting plaster; sulphuret of mercury being wholly inert. Nevertheless, the Pharmacopœia has in its late revision gone back to the old London formula. Mr. Thomas Blunt has found it almost impossible to divide the mercury sufficiently by trituration with oil and resin, and the resulting plaster was so crumbly that it could not be formed into rolls; but by substituting a weight of Venice turpentine equal to that of the oil and resin combined, he found it to answer completely. An objection, however, to the turpentine is, that it might render the plaster too irritant for susceptible skins. (*Pharm. Journ. and Trans.*, July, 1864, p. 56.)

This plaster is employed to produce the local effects of mercury upon venereal buboes, nodes, and other chronic tumefactions of the bones or soft parts, dependent on a syphilitic taint. In these cases it sometimes acts as a powerful discutient. It is frequently also applied to the side in chronic hepatitis or splenitis. In peculiarly susceptible persons it occasionally affects the gums.

From observations made in France by M. Serres and others, it appears that the mercurial plaster of the Codex (*Emplastrum de Vigo cum Mercurio*) has the power, when applied over the eruption of smallpox, before the end of the third day from its first appearance, to check its progress, and prevent suppuration and pitting. This operation of the plaster, so far from being attended with an increase of the general symptoms, seems to relieve them in proportion to the diminution of the local affection. It is also thought that the course of the disease is favourably modified when the mercurial impression is produced upon the system. That the local effect is not ascribable to the mere exclusion of the air is proved by the fact that the use of lead plaster was not followed by the same results. It is probable that other mercurial preparations would answer the same purpose; and the common mercurial ointment has, in our own hands, proved effectual in rendering the eruption upon the face to a considerable extent abortive, in one bad case of smallpox. But as the most successful results were obtained with the plaster above mentioned, we give the formula of the French

Codex for its preparation. The weights mentioned are those of the French metrical pound. (See *table in the Appendix.*)

Emplastrum de Vigo cum Mercurio. "Take of simple plaster [lead plaster] *two pounds eight ounces;* yellow wax *two ounces;* resin *two ounces;* ammoniac, bdellium, olibanum, and myrrh, each, *five drachms;* saffron *three drachms;* mercury *twelve ounces;* turpentine [common European] *two ounces;* liquid storax *six ounces;* oil of lavender *two drachms.* Powder the gum-resins and saffron, and rub the mercury with the storax and turpentine in an iron mortar until completely extinguished. Melt the plaster with the wax and resin, and add to the mixture the powders and volatile oil. When the plaster shall have been cooled, but while it is yet liquid, add the mercurial mixture, and incorporate the whole thoroughly." This should be spread upon leather or linen cloths, and applied so as effectually to cover the part to be protected. W.

EMPLASTRUM OPII. *U. S., Br. Plaster of Opium.*

"Take of Extract of Opium *a troyounce;* Burgundy Pitch, *three troyounces;* Plaster of Lead *twelve troyounces;* Water *a sufficient quantity.* Mix the Extract with three fluidounces of Water, and evaporate, by means of a water-bath, to a fluidounce and a half. Add this to the Burgundy Pitch and Plaster, melted together by means of a water-bath, and continue the heat for a short time, stirring constantly, that the moisture may be evaporated." *U. S.*

"Take of Opium, in fine powder, *one ounce;* Resin Plaster *nine ounces.* Melt the Resin Plaster by means of a water-bath; then add the Opium by degrees, and mix thoroughly." *Br.*

We decidedly prefer the extract of opium, as employed in the present U. S. process, to the opium itself of the British formula. It not only forms a better plaster, but, being soluble, is more likely to produce the anodyne effect desired, by being brought by the perspiration to the liquid state necessary for its absorption. The use of water in the former process is also an advantage, as it enables the opium to be more thoroughly incorporated with the other ingredients; but care should be taken that the moisture be well evaporated.

The opium plaster is thought to relieve rheumatic and other pains in the parts to which it is applied. W.

EMPLASTRUM PICIS. *Br. Pitch Plaster.*

"Take of Burgundy Pitch *twenty-six ounces;* Common Frankincense [Terebinthina, U. S.] *thirteen ounces;* Resin, Yellow Wax, of each, *four ounces and a half;* Expressed Oil of Nutmeg *one ounce;* Olive Oil, Water, of each, *two fluidounces.* Add the Oils and the Water to the Frankincense, Burgundy Pitch, Resin, and Wax, previously melted together; then, constantly stirring, evaporate to a proper consistence." *Br.* The ounce used in this process is the avoirdupois ounce, and the fluidounce that of the Imperial measure.

This is a rubefacient plaster, applicable to catarrhal and other pectoral affections, chronic inflammation of the liver, and rheumatic pains in the joints and muscles. It often keeps up a serous discharge, which requires that it should be frequently renewed. The irritation which it sometimes excites is so great as to render its removal necessary. W.

EMPLASTRUM PICIS BURGUNDICÆ. *U. S. Plaster of Burgundy Pitch.*

"Take of Burgundy Pitch *seventy-two troyounces;* Yellow Wax *six troyounces.* Melt them together, strain, and stir constantly until they thicken on cooling." *U. S.*

In this formula the object of the wax is simply to give a proper consistence to the Burgundy pitch, and to prevent it from breaking in cold weather. M. Lavigne proposes to obviate the tendency of Burgundy pitch plaster to crack by incorporating with it caoutchouc, in the following method. Dissolve 35 parts, by weight, of caoutchouc, in small pieces, in 13 parts of oil of petroleum in a close vessel. Melt together 300 parts of Burgundy pitch and 25 parts of white wax. Warm the solution of caoutchouc in a suitable vessel, and add gradually, with constant stirring,

the melted pitch and wax, and finally incorporate thoroughly with the mass 3 parts of glycerin. (*Journ. de Pharm.*, 4e sér., ix. 131.) W.

EMPLASTRUM PICIS CANADENSIS. *U. S. Plaster of Canada Pitch. Hemlock Pitch Plaster.*

"Take of Canada Pitch *seventy-two troyounces;* Yellow Wax *six troyounces.* Melt them together, strain, and stir constantly until they thicken on cooling." *U. S.*

The yellow wax, in this preparation, answers the same purpose as in the Burgundy Pitch Plaster, and is even more necessary, in order to give additional consistence to the Canada Pitch, which, when pure, is somewhat too soft, at the temperature of the body, for convenient application. W.

EMPLASTRUM PICIS CUM CANTHARIDE. *U. S.* EMPLASTRUM CALEFACIENS. *Br. Plaster of Pitch with Cantharides. Warming Plaster.*

"Take of Burgundy Pitch *forty-eight troyounces;* Cerate of Cantharides *four troyounces.* Heat the Cerate as nearly as possible to 212° in a water-bath, and, having continued the heat for fifteen minutes, strain the Cerate, add the Pitch, and, melting them together by means of a water-bath, stir constantly until the mixture thickens on cooling." *U. S.*

"Take of Cantharides, in coarse powder, Expressed Oil of Nutmeg, Yellow Wax, Resin, of each, *four ounces* [avoirdupois]; Soap Plaster *three pounds and a quarter* [avoird.]; Resin Plaster *two pounds* [avoird.]; Boiling Water *one pint* [Imperial measure]. Infuse the Cantharides in the Boiling Water for six hours; squeeze strongly through calico, and evaporate the expressed liquid by a water-bath, till reduced to one-third. Then add the other ingredients, and melt in a water-bath, stirring well until the whole is thoroughly mixed." *Br.*

This Plaster is an excellent rubefacient, more active than Burgundy pitch, yet in general not sufficiently so to produce vesication. As prepared by the former U. S. process, it occasionally blistered; and the proportion of cantharides has, therefore, been considerably diminished in the present formula; but while such a reduction may render the plaster insufficiently active in most cases, it does not entirely obviate the objection; as the smallest proportion of flies would vesicate in certain persons, and even the Burgundy pitch alone sometimes produces the same effect. In whatever mode, therefore, this plaster may be prepared, it cannot always answer the expectations which may be entertained; and the only plan, when the skin of any individual has been found to be very susceptible, is to accommodate the proportions to the particular circumstances of the case. Much, however, may be accomplished by care in the preparation of the plaster, towards obviating its tendency to blister. If the flies of the *Ceratum Cantharidis* have been coarsely pulverized, the larger particles, coming in contact with the skin, will exert upon the particular part to which they may be applied their full vesicatory effect, while, if reduced to a very fine powder, they would be more thoroughly enveloped in the other ingredients, and thus have their strength much diluted. Hence the cerate, when used as an ingredient of the warming plaster, should contain the cantharides as minutely divided as possible; and, if that usually kept is not in the proper state, a portion should be prepared for this particular purpose. A good plan, we presume, would be to keep the cerate used in this preparation, for a considerable time, at the temperature of 212°, and then strain it so as to separate the flies. (See *Ceratum Cantharidis.*) The mode frequently pursued of preparing the warming plaster by simply sprinkling a very small proportion of powdered flies upon the surface of Burgundy pitch is altogether objectionable. The U. S. process is that of the old Dublin Pharmacopœia. We strongly approve of that portion of the British process which uses an inspissated infusion of the flies, as an equable distribution of these is thus ensured.

It has been objected to the U. S. plaster that it is apt to be too soft in hot weather. Mr. G. C. Close, ascribing this inconvenience to the proportion of lard in the cerate employed, proposes to obviate it by substituting Burgundy pitch plaster for Burgundy pitch, and powdered cantharides for the cerate, and offers a formula in compliance with this suggestion. (See *Am. Journ. of Pharm.*, Jan. 1867, p. 20; from *Proceed. of Am. Pharm. Association*, 1866.)

The warming plaster is employed in chronic rheumatism, and various chronic internal diseases attended with inflammation or an inflammatory tendency; such as catarrh, asthma, pertussis, phthisis, hepatitis, and the sequelæ of pleurisy and pneumonia. W.

EMPLASTRUM PLUMBI. *U.S.*, *Br.* Emplastrum Lithargyri. *Br.* 1864. *Plaster of Lead. Lead Plaster.*

"Take of Oxide of Lead [Litharge] in fine powder, *thirty troyounces;* Olive Oil *fifty-six troyounces;* Water *a sufficient quantity.* Rub the Oxide of Lead with half its weight of the Oil; add the mixture to the remainder of the Oil, contained in a suitable vessel of a capacity equal to twice the bulk of the ingredients. Then add half a pint of boiling Water, and boil the whole together until a plaster is formed; adding from time to time, during the process, a little boiling Water, as that first added is consumed." *U.S.*

"Take of Oxide of Lead, in fine powder, *four pounds;* Olive Oil *one gallon;* Water *three pints and a half.* Boil all the ingredients together gently by the heat of a steam-bath, and keep them simmering for four or five hours, stirring constantly, until the product acquires a proper consistence for a plaster, and adding more water during the process if necessary." *Br.* The weights used in this process are the avoirdupois, and the measures the Imperial.

The importance of this plaster, as the basis of most of the others, requires a somewhat detailed account of the principles and manner of its preparation.

It was formerly thought that the oil and oxide of lead entered into direct union, and that the presence of water was necessary only to regulate the temperature, and prevent the materials from being decomposed by heat. The discovery, however, was afterwards made, that this liquid was essential to the process; and that the oil and oxide alone, though maintained at a temperature of 220°, would not combine; while the addition of water, under these circumstances, would produce their immediate union. It was now supposed that the oil was capable of combining only with the hydrated oxide of lead, and that the use of the water was to bring the oxide into that state; and, in support of this opinion, the fact was advanced that the hydrated oxide of lead and oil would form a plaster, when heated together without any free water. But, since the general reception of Chevreul's views in relation to oils, and their combinations with alkalies and other metallic oxides, the former opinions have been abandoned; and it is now admitted that the preparation of the lead plaster affords a genuine example of saponification, as explained by that chemist. A reaction takes place between the oil and water, resulting in the development of a sweetish substance called *glycerin*, and of two acid bodies, the *oleic* and *margaric acids*, to which, when animal fat is employed instead of olive oil, a third is added, namely the *stearic*. The plaster is formed by a union of these acids with the oxide, and, prepared according to the directions of the Pharmacopœias, is in fact an oleo-margarate of lead. The glycerin remains dissolved in the water, or mechanically mixed with the plaster. That such is the correct view of the nature of this compound is evinced by the fact, that, if the oxide of lead be separated from the plaster by digestion at a moderate heat in very dilute nitric acid, the fatty matter which remains will unite with litharge with the greatest facility, without the intervention of water. According to a more recent chemical view, the fixed oils are compounds of the oily acids mentioned and *oxide of glyceryl*. When boiled with the oxide of lead and water, the oily acids combine with the metallic oxide to form the plaster, and the oxide of glyceryl takes an equivalent of water and becomes glycerin. *Glyceryl* is a hypothetical compound of carbon and hydrogen (C_6H_7), which unites with five equivalents of oxygen to form oxide of glyceryl ($C_6H_7O_5$), also a hypothetical substance, and additionally with an equivalent of water to form glycerin ($C_6H_7O_5 + HO$).

Other oleaginous substances and other metallic oxides are susceptible of the same combination, and some of them form compounds having the consistence of a plaster; but, according to *M. Henry*, of Paris, no oily matter except animal fat can properly be substituted for olive oil, and no metallic oxide, not even one of the other oxides of lead, for litharge. He ascertained, moreover, that the English litharge is preferable for the formation of lead plaster to the German. From more recent experiments

of Soubeiran, it appears that massicot or even minium may be substituted for litharge, and a plaster of good consistence be obtained; but that a much longer time is required for completing the process than when the officinal formula is followed. When minium is used, the necessity for its partial deoxidation renders a longer continuance of the process necessary than with massicot. According to M. Davallon, Professor in the School of Medicine and Pharmacy at Lyons, it is important that the olive oil employed should be pure; for when adulterated, as it frequently is in commerce, it yields an imperfect product. Mr. N. S. Thomas prepared a good plaster by substituting lard for olive oil, in the proportion of eight pounds of lard to five of litharge (*Am. Journ. of Pharm.*, xix. 175); and we are told that it is a common practice, in this country, to make lead plaster with a mixture of lard oil and olive oil. A good deal of dissatisfaction exists among the English plaster-makers with the British formula, indeed it would appear that they rarely follow its direction, preferring the recipe of the old London Pharmacopœia, which contains more litharge and yields a much firmer and less adhesive product. (*Pharm. Journ. and Trans.*, 3d ser., v. 701, 716.)

Lead plaster has also been prepared by double decomposition between soap and acetate or subacetate of lead; but the results have not been so advantageous as to lead to the general adoption of this process. For particular information on the subject, the reader is referred to the *American Journal of Pharmacy* (ix. 127), and to the *Journal de Pharmacie* (xxiii. 163 and 322).*

Preparation. The vessel in which the lead plaster is prepared should be of such a size that the materials will not occupy more than two-thirds of its capacity. The oil should be first introduced, and the litharge then sprinkled in by means of a sieve, the mixture being constantly stirred with a spatula. The particles of the oxide are thus prevented from coalescing in small masses, which the oil would not easily penetrate, and which would therefore delay the process. While the water exerts an important chemical agency in the changes which occur, it is also useful by preventing too high a temperature, which would decompose the oil, and cause the reduction of the oxide. The waste must, therefore, be supplied by fresh additions as directed in the process; and the water added for this purpose should be previously heated, as otherwise it would not only delay the operation, but by producing explosion might endanger the operator. During the continuance of the boiling, the material should be constantly stirred, and the spatula should be repeatedly passed along the bottom of the vessel, from side to side, so as to prevent any of the oxide, which is disposed by its greater density to sink to the bottom, from remaining in that situation. The materials swell up considerably, in consequence partly of the vaporization of the water, partly of the escape of carbonic acid gas, which is liberated by the oily acids from some carbonate of lead usually contained in the litharge. The process should not be continued longer than is sufficient to produce complete union of the ingredients, and this may be known by the colour and consistence of the mass. The colour of the litharge gradually becomes paler, and at length almost white when the plaster is fully formed. The consistence increases with the progress of the boiling, and is sufficiently thick, when a portion of the plaster, taken out and allowed to cool upon the end of a spatula, or thrown into cold water, becomes solid, without adhering in this state to the fingers. The portion thus solidified should not present, when broken, any red points, which would indicate the presence of a portion of uncombined litharge. When the plaster is formed, it should be removed from the fire, and after a short time cold water should be poured upon it. Portions should then be detached from the mass, and, having been well kneaded under water, in order to separate the viscid solution of glycerin contained in the interior, should be formed into cylindrical rolls, and

* M. de Mussy, physician of the hospital *de la Pitié*, having witnessed inconveniences from lead plaster in consequence of the absorption of the lead, substituted for it a plaster with a basis of oxide of zinc, which he has found to answer very well in practice. It cannot be made by direct combination of the oxide; and it is necessary to have recourse to the method of double decomposition. Solutions of white olive oil soap and of sulphate of zinc being mixed, a copious precipitate takes place of oleo-margarate of zinc, which, after being washed and dried, may be combined with resins, oil, and wax, to give it the necessary consistence. This preparation, however, is not likely to supersede the officinal. (*Journ. de Pharm.*, xxvii. 100.)—*Note to the eleventh edition.*

wrapped in paper. Such at least has been the course of proceeding usually recommended. But M. Davallon maintains that the presence of glycerin in the plaster is useful by keeping it in a plastic state, and that washing and kneading are injurious, the former by removing the glycerin, the latter by introducing particles of air and moisture into the mass, which is thus rendered more disposed to rancidity. (*Am. Journ. of Pharm.*, xv. 274; from *Journ. de Chim. Méd.*) By employing steam heat in the preparation of this plaster, the risk of burning it is avoided. For a good arrangement for this purpose, see *Mohr and Redwood's Pharmacy*, edited by Prof. Procter, p. 420.

Mr. C. Lewis Diehl has found it almost impossible, in following the U. S. directions of 1860, to obtain a plaster wholly free from uncombined litharge. He obviated the difficulty by first rubbing the sifted litharge with about half its weight of oil, then stirring the mixture with the remainder of the oil, in a tinned copper kettle, adding the water, and heating to 212° until a uniform plaster was formed. (*Am. Journ. of Pharm.*, Sept. 1867, p. 385.) At the last revision of the Pharmacopœia the process of Mr. Diehl was substantially adopted.

Medical Properties and Uses. This plaster, which has long been known under the name of *diachylon*, is used as an application to excoriated surfaces, and to slight wounds, which it serves to protect from the action of the air. It may also be beneficial by the sedative influence of the lead which enters into its composition. A case is on record in which lead colic resulted from its long-continued application to a large ulcer of the leg. (*Am. Journ. of Med. Sci.*, xxiii. 246.) Dr. J. M. Bigelow reports a case of excessive sweating of the feet, which he cured by putting the patient in bed for thirteen days and keeping the feet enveloped in strips of lead plaster. (*New Remedies*, Oct. 1875.) Its chief use is in the preparation of other plasters.*

Off. Prep. Emplastrum Assafœtida, *U. S.;* Emp. Ferri; Emp. Galbani, *Br.;* Emp. Galbani Compositum, *U. S.;* Emp. Hydrargyri; Emp. Opii, *U. S.;* Emp. Resinæ; Emp. Saponis. W.

EMPLASTRUM PLUMBI IODIDI. *Br.* *Iodide of Lead Plaster.*

"Take of Iodide of Lead *one ounce;* Soap Plaster, Resin Plaster, each, *four ounces.* Add the Iodide of Lead, in fine powder, to the Plasters previously melted, and mix them intimately." *Br.*

This is a local discutient plaster, which may also be used with other means to affect the system. (See *Plumbi Iodidum*, Part II.) W.

EMPLASTRUM RESINÆ. *U. S.*, *Br.* *Resin Plaster.* *Adhesive Plaster.*

"Take of Resin, in fine powder, *six troyounces;* Plaster of Lead *thirty-six troyounces.* To the Plaster, melted over a gentle fire, add the Resin, and mix them." *U. S.*

"Take of Resin *four ounces;* Lead Plaster *two pounds;* Hard Soap *two ounces.* To the Lead Plaster, previously melted with a gentle heat, add the Resin and Soap,

* *Logan's Plaster.* Take of Litharge, Carbonate of Lead, each, *a pound;* Castile Soap *twelve ounces;* Butter (fresh) *four ounces;* Olive Oil *two and a half pints;* Mastic, in powder, *two drachms.* It is to be understood that the pound and ounce are of the avoirdupois weight. Having mixed the Soap, Oil, and Butter, add the Litharge, and boil the mixture gently, constantly stirring, for an hour and a half, or until it shall assume a pale-brown colour; then increase the heat somewhat, and continue to boil, until a portion of the liquid, dropped on a smooth board, is found not to adhere to it on cooling; then remove it from the fire, and mix the mastic with it. Logan's plaster has long been in popular use in Philadelphia, and is considerably employed by regular practitioners as a protective and discutient application.

Plaster of Carbonate of Lead. This was originally introduced into our Pharmacopœia as a substitute for *Mahy's plaster*, at one time much employed in some parts of the United States; but was omitted in the edition of 1840. It is a good application to surfaces inflamed or excoriated by friction; and may be resorted to with advantage in those troublesome cases of cutaneous irritation, and even ulceration, which are apt to occur upon the back and hips during long-continued confinement to one position. We give the process as contained in the Pharmacopœia of 1830. "Take of Carbonate of Lead *a pound;* Olive Oil *two pints;* Yellow Wax *four ounces;* Lead Plaster *a pound and a half;* Florentine Orris, in powder, *nine ounces.* Boil together the Oil and Carbonate of Lead, adding a little water, and constantly stirring, till they are thoroughly incorporated; then add the Wax and Plaster, and, when these are melted, sprinkle in the Orris, and mix the whole together." By this process, a good plaster may be prepared, rather too soft at first, but soon acquiring the proper consistence.

first liquefied, and stir them until they are thoroughly mixed." *Br.* The weights here referred to are the avoirdupois.

This preparation differs from the lead plaster in being more adhesive and somewhat more stimulating. It is the common adhesive plaster of the shops, and is much employed for retaining the sides of wounds in contact, and for dressing ulcers according to the method of Baynton, by which the edges are drawn towards each other, and a firm support is given to the granulations. As prepared by the Dublin College it contained soap, which gave it greater pliability, and rendered it less liable to crack in cold weather, without impairing its adhesiveness; and the process of that College has been adopted in the British Pharmacopœia. It is usually spread upon muslin; and the spreading is best accomplished, on a large scale, by means of a machine, as described in the general observations upon plasters. It is kept in the shops ready spread; but, as the plaster becomes less adhesive by long exposure to the air, the supply should be frequently renewed. When the skin is very delicate, it occasionally excites some irritation, and, under these circumstances, a plaster may be substituted containing a smaller proportion of resin. That originally employed by Baynton contained only six drachms of resin to the pound of lead plaster. To obviate the same evil, M. Herpin recommends the addition of tannate of lead, the proportion of which, when adhesiveness is required in the plaster, should not exceed one-twentieth, but, under other circumstances, may be increased to one-twelfth. (*Bullet. de Thérap.*, xlviii. 155.)

In order to render the plaster more adhesive, and less brittle in cold weather, it is customary with many apothecaries to employ a considerable proportion of Burgundy pitch or turpentine in its preparation; but these additions are objectionable, as they greatly increase the liability of the plaster to irritate the skin, and thus materially interfere with the purposes for which the preparation was chiefly intended.*

Off. Prep. Emplastrum Aconiti, *U. S.;* Emplastrum Arnicæ, *U. S.;* Emplastrum Belladonnæ; Emplast. Calefaciens, *Br.;* Emplast. Opii, *Br.;* Emplast. Plumbi Iodidi, *Br.* W.

EMPLASTRUM SAPONIS. *U. S.*, *Br.* *Soap Plaster.*

"Take of Soap, sliced, *four troyounces;* Lead Plaster *thirty-six troyounces;* Water *a sufficient quantity.* Rub the Soap with Water until brought to a semi-liquid state; then mix it with the Plaster previously melted, and boil to the proper consistence." *U. S.*

"Take of Hard Soap *six ounces;* Lead Plaster *two pounds and a quarter;* Resin *one ounce.* To the Lead Plaster, melted by a gentle heat, add the Soap and the Resin, first liquefied; then, constantly stirring, evaporate to a proper consistence." *Br.* The avoirdupois weights are used in this process.

The present U. S. formula is an improvement upon that of a former edition of the Pharmacopœia. The proportion of soap in the old process was so large as to render the plaster friable. It has been diminished from six to four ounces. Besides, by the present mode of proceeding, it is more thoroughly incorporated with the plaster. The same end of greater plasticity is accomplished, in some degree, in the British process by the resin. In preparing the U. S. plaster, Mr. C. Lewis Diehl has found some difficulty in rubbing the soap up perfectly and rapidly with the water, and has, therefore, adopted the plan of first rubbing the soap with its weight of water, then straining the mixture through coarse muslin, and lastly reducing the residue with a proportionate quantity of water, before stirring the whole into the melted plaster. (*Am. Journ. of Pharm.*, Sept. 1867, p. 386.)

Soap plaster is considered discutient, and is sometimes used as an application to tumours.

Off. Prep. Ceratum Saponis, *U. S.;* Emplastrum Calefaciens, *Br.;* Emplastrum Plumbi Iodidi, *Br.* W.

* An adhesive plaster, exempt from oxide of lead, is prepared by Pettenkofer. It consists of calcareous soap incorporated with turpentine and suet, and may be prepared in the following manner. A solution of soap is decomposed by a solution of chloride of calcium. The precipitate, having been expressed and dried, is powdered with half its weight of turpentine dried by heat; and the mixture is melted, along with an eighth part of suet, in boiling water. The mixture is boiled until the mass melts into a homogeneous fluid, when it is worked by the hand, in the ordinary manner, in cold water. Should portions of the calcareous soap not melt, they should be separated by straining through flannel. (*Journ. de Pharm.*, 3e sér., x. 358; from *Repertorium für die Pharm.*, xiii. 40.)

ENEMATA.

Clysters.

These can scarcely be considered proper objects for officinal direction; but, having been introduced into the former British Pharmacopœias, and retained in the present, the plan of this work requires that they should be noticed. They are substances in the liquid form, intended to be thrown up the rectum, with the view either of evacuating the bowels, of producing the peculiar impression of a remedy upon the lower portion of the alimentary canal and neighbouring organs, or of acting on the system generally through the medium of the surface to which they are applied. They are usually employed to assist the action of remedies taken by the mouth, or to supply their place when the stomach rejects them, or is insensible to their impression. Sometimes they are preferably used when the seat of the disorder is in the rectum or its vicinity. As a general rule, three times as much of any remedy is required to produce a given impression by enema, as when taken into the stomach; but this rule should be acted on with caution, as the relative susceptibilities of the stomach and rectum are not the same in all individuals; and, with regard to all very active remedies, the best plan is to administer less than the stated proportion. Attention should also be paid to the fact, that, by the frequent use of a medicine, the susceptibility of the stomach may be in some measure exhausted, without a proportionate diminution of that of the rectum.

When the object is to evacuate the bowels, the quantity of liquid administered should be considerable; for an adult, from ten fluidounces to a pint; for a child of eight or ten years, half that quantity; for an infant within the year, from one to three fluidounces. Much larger quantities of mild liquids may sometimes be given with safety and advantage; as the bowels will occasionally feel the stimulus of distension, when insensible to irritating impressions.

When the design is to produce the peculiar impression of the remedy upon the neighbouring parts, or on the system, it is usually desirable that the enema should be retained, and the vehicle should therefore be bland, and as small in quantity as is compatible with convenient administration. A solution of starch, flaxseed tea, or other mucilaginous fluid should be selected, and the quantity should seldom exceed two or three fluidounces. In every case, the patient should be instructed to resist any immediate disposition to discharge the injected fluid; and his efforts to retain it should be assisted, if necessary, by pressure with a warm folded towel upon the fundament. The best instrument for administering enemata is an accurate metallic syringe. W.

ENEMA ALOES. *Br.* *Enema of Aloes.*

"Take of Aloes *forty grains;* Carbonate of Potash *fifteen grains;* Mucilage of Starch *ten fluidounces.* Mix and rub together." *Br.*

This is intended as a formula for the use of aloes in cases of ascarides in the rectum, and of amenorrhœa attended with constipation. W.

ENEMA ASSAFŒTIDÆ. *Br.* *Enema of Assafetida.* ENEMA FŒTIDUM. *Ed., Dub.* *Fetid Enema.*

"Take of Assafetida *thirty grains;* Distilled Water *four fluidounces.* Rub the Assafetida in a mortar with the Water added gradually, so as to form an emulsion." *Br.*

This is carminative and antispasmodic as well as laxative. In the former Br. Pharmacopœia it was directed to be made by mixing the tincture and Distilled Water; and, in commenting on it, we stated that we should prefer a preparation consisting of the gum-resin rubbed up with water; as the alcohol of the tincture might in some instances prove injurious. In the present formula this plan has been adopted. The whole quantity directed may be administered at once. W.

ENEMA MAGNESIÆ SULPHATIS. *Br.* *Enema of Sulphate of Magnesia.* ENEMA CATHARTICUM. *Ed., Dub.* *Cathartic Clyster.*

"Take of Sulphate of Magnesia *one ounce* [avoirdupois]; Olive Oil *one fluid-*

ounce; Mucilage of Starch *fifteeen fluidounces.* Dissolve the Sulphate of Magnesia in the Mucilage, add the Oil, and mix." *Br.*

The laxative enema, most commonly employed in this country, consists of a tablespoonful of common salt, two tablespoonfuls of lard or olive oil, the same quantity of molasses, and a pint of warm water. It has the advantage of consisting of materials which are always at hand in families, and is in all respects equal to the officinal preparation. W.

ENEMA OPII. *Br. Enema of Opium.* ENEMA OPII vel ANODYNUM. *Ed. Anodyne Enema.*

"Take of Tincture of Opium *half a fluidrachm;* Mucilage of Starch *two fluidounces.* Mix." *Br.*

This formula is unobjectionable. It must have happened to every one in the habit of prescribing opium in this way, to have seen a much greater effect produced by a certain amount of laudanum injected into the rectum than by one-third of the quantity swallowed. The fluidrachm contains at least one hundred drops of laudanum of the ordinary size, and not less than one hundred and twenty as they are often formed. From twenty to twenty-five drops are usually considered as a medium dose by the mouth; so that sixty drops, equivalent to about thirty minims, are abundantly sufficient by enema. As the object is that the enema should remain in the rectum, the smaller the quantity of the vehicle the better; and a mucilaginous fluid is preferable to water, as it involves the tincture, and prevents the irritation of the alcohol before the opium begins to take effect. The ordinary anodyne enema, employed in this country, consists of about sixty drops of laudanum and one or two fluidounces of flaxseed tea or solution of starch, conforming precisely with the present British formula.

This is an admirable remedy in obstinate vomiting, strangury from blisters, painful affections of the kidneys, bladder, and uterus, and in the tenesmus of dysentery. It may also frequently be employed to produce the effects of opium upon the system, when circumstances prevent the administration of that medicine by the mouth. W.

ENEMA TABACI. *Br. Enema of Tobacco.*

"Take of Leaf Tobacco *twenty grains;* Boiling Water *eight fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

The whole quantity is to be given at once. The dose is somewhat less than that usually employed in this country. (See *Infusum Tabaci.*) W.

ENEMA TEREBINTHINÆ. *Br. Enema of Turpentine.*

"Take of Oil of Turpentine *one fluidounce;* Mucilage of Starch *fifteen fluidounces.* Mix." *Br.*

For the dose of this preparation, see *Oleum Terebinthinæ.* W.

EXTRACTA.

Extracts.

Extracts, as the term is employed in the Pharmacopœias, are solid substances, resulting from the evaporation of the solutions of vegetable principles, obtained either by exposing the vegetable to the action of a solvent, or by expressing its juice in the recent state. A distinction was formerly made between those prepared from the infusions, decoctions, or tinctures, and those from the expressed juices of plants, the former being called *Extracta*, the latter *Succi Spissati;* but the distinction has been generally abandoned. There is no such essential difference between these two sets of preparations as to require that they should be separately classed; and something is gained in the simplicity of nomenclature, as well as of arrangement, which results from their union. We shall consider them under the same head, taking care, however, to detail distinctly whatever is peculiar in the mode of preparing each.

The composition of extracts varies with the nature of the vegetable, the character of the solvent, and the mode of preparation. The object is generally to obtain as much of the active principle of the plant, with as little of the inert matter as possi-

ble; though sometimes it may be desirable to separate two active ingredients from each other, when their effects upon the system are materially different; and this may be accomplished by employing a menstruum which, while it dissolves one, leaves the other untouched. The proximate principles most commonly present in extracts are gum, sugar, starch, tannin, extractive, colouring matter, salts, and the peculiar principles of plants; to which, when a spirituous solvent is employed, may usually be added resinous substances, fatty matter, and frequently more or less essential oil; gum and starch being excluded when the menstruum is pure alcohol. Of these substances, as well as of others which, being soluble, are sometimes necessarily present in extracts, we have taken occasion to treat under various heads in the Materia Medica. There is one, however, which, from its supposed almost uniform presence in this class of preparations, and from the influence it is thought to exert upon their character, deserves particular consideration in this place. We allude to *extractive*, or, as it is sometimes called, *extractive matter*.

It has long been observed that in most vegetables there is a substance, soluble both in water and alcohol, which, in the preparation of extracts, undergoes chemical change during the process of evaporation, imparting to the liquid, even if originally limpid, first a greenish, then a yellowish-brown, and ultimately a deep-brown colour, and becoming itself insoluble. This substance, originally called *saponaceous matter* by Scheele, afterwards received the more expressive name of *extractive*, derived from its frequent presence in extracts. Its existence as a distinct principle is denied, or at least doubted, by some chemists, who consider the phenomena supposed to result from its presence, as depending upon the mutual reaction of other principles; and, in relation to Peruvian bark, it appears to have been proved that the insoluble matter which forms during its decoction in water is a compound of starch and tannin. A similar compound must also be formed in other cases when these two principles coexist; but they are not always present in the same vegetable, nor can all the changes which have been attributed to extractive be accounted for by their union, even when they are present; so that, till further light is shed on the subject, it is best to admit the existence of a distinct substance, which, though not the same in all plants, possesses sufficient identity of character to be entitled, like sugar, resin, &c., to a distinctive name. The most interesting property of extractive is its disposition to pass, by the influence of atmospheric air at a high temperature, into an insoluble substance. If a vegetable infusion or decoction be evaporated in the open air to the consistence of an extract, then diluted, filtered, and again evaporated, and the process repeated so long as any insoluble matter is formed, the whole of the extractive will be separated from the liquid, while the other ingredients may remain. If chlorine be passed through an infusion or decoction, a similar precipitate is formed with much greater rapidity. The change is usually ascribed to the absorption of oxygen by the extractive, which has, therefore, been called, in its altered condition, oxidized extractive; but De Saussure ascertained that, though oxygen is absorbed during the process, an equal measure of carbonic acid gas is given out, and the oxygen and hydrogen of the extractive unite to form water in such a manner as to leave the principle richer in carbon than it was originally. The name of oxidized extractive is, therefore, obviously incorrect; and Berzelius proposed to substitute for it that of *apotheme*, synonymous with deposit. According to Berzelius, apotheme is not completely insoluble in water, but imparts a slight colour to that liquid when cold, and is rather more soluble in boiling water, which becomes turbid upon cooling. It is still more soluble in alcohol, and is freely dissolved by solutions of the alkalies and alkaline carbonates, from which it is precipitated by acids. It has a great tendency, when precipitated from solutions, to unite with other principles, and to carry them along with it; thus acquiring properties somewhat different according to the source from which it is obtained. In this way, also, even when the extractive of a plant is itself medicinally inert, its conversion into apotheme may be injurious by causing a precipitation of a portion of the active principle; and, in practical pharmaceutic operations, this change should always, if possible, be avoided. With these preliminary views, we shall proceed to the consideration of the practical rules necessary to be observed in the preparation of extracts. We shall treat of the subject under the several heads of, 1. the extraction

of the soluble principles from the plant; 2. the method of conducting the evaporation; 3. the proper condition of extracts, the changes they are liable to undergo, and the best method of preserving them; and 4. the general directions of the Pharmacopœias in relation to them.

1. *Extraction of the Soluble Principles.*

There are two distinct modes of obtaining, in a liquid state, the principles which we wish to extract; 1. by expression alone; 2. by the agency of a solvent, with or without expression.

1. *By Expression.* This method is applicable to recent vegetables. All plants cannot be usefully treated in this way, as many have too little juice to afford an appreciable quantity upon pressure, and of the succulent a considerable portion do not yield all their active principles with their juice. Succulent fruits, and various acrid and narcotic plants, are proper subjects for this treatment. The plants should be operated upon, if possible, immediately after collection. Mr. Battley, of London, recommended that, if not entirely fresh, they should be revived by the immersion of the stalks in water for twelve or eighteen hours, and those only used which recover their freshness by this management. They should then be cut into pieces, and bruised in a stone mortar till brought to a pulpy consistence. When the plant is not very succulent, it is necessary to add a little water during this part of the process, in order to dilute the juice. After sufficient contusion, the pulp is introduced into a linen or canvas bag, and the liquid parts expressed. Mr. Brande states that light pressure only should be employed; as the extract is thus procured greener, of a less glutinous or viscid consistence, and, in his opinion, more active than when considerable force is used in the expression. (*Manual of Pharmacy.*) The juice thus obtained is opaque and usually green, in consequence of the presence of green wax or chlorophyll, and of a portion of the undissolved vegetable fibre in minute division. By heating the juice to about 160°, the albumen contained in it coagulates, and, involving the chlorophyll and vegetable fibre, forms a greenish precipitate. If the liquid is now filtered, it becomes limpid and nearly colourless, and is prepared for evaporation. The clarification, however, is not absolutely necessary, and is generally neglected. Sometimes the precipitate carries with it a considerable portion of the active principle; in which case it should be subsequently incorporated with the juice, when reduced by evaporation to the consistence of syrup. Ether added to the expressed juices of plants enables them to be kept long without injurious change. M. Lepage, of Gisors, France, has kept the juice of belladonna in this way more than 10 years, and found it, at the end of that time, to yield an extract, identical in physical, chemical, and physiological properties with that obtained from the fresh juice. If this fact is found to be of general applicability, it will be of considerable importance, as enabling the pharmaceutist to supply himself, at pleasure, with extracts to be relied on, without reference to the season. (*Journ. de Pharm.*, Mai, 1863, p. 361.)

2. *By Solution.* The active principles of dried vegetables can be extracted only by means of a liquid solvent. The menstruum usually employed is either water or alcohol, or a mixture of the two. Water, on account of its cheapness, is always preferred, when circumstances do not strongly call for the use of alcohol. It has the advantage, moreover, that it may be assisted in its action, if necessary, by a higher degree of heat than the latter. Pump water is often unfit for the purpose, in consequence of the quantity of its saline matter, which, in some instances, may exert an unfavourable influence on the active principle, and must always be left in the extract. Rain, river, or distilled water should be preferred. Alcohol is employed when the principles to be extracted are insoluble, or but slightly soluble in water, as in the case of the resins; when it is desirable to avoid in the extract inert substances, such as gum and starch, which are dissolved by water and not by alcohol; when the heat required to evaporate the aqueous solution would dissipate or decompose the active ingredients of the plant, as the volatile oils and the active principle of sarsaparilla; when the reaction of the water itself upon the vegetable principles is injurious; and, finally, when the nature of the substance to be exhausted requires so long a maceration in water as to endanger spontaneous decomposition. The watery solution re-

quires to be soon evaporated, as this fluid rather promotes than counteracts chemical changes; while an alcoholic tincture may be preserved unaltered for an indefinite period. An addition of alcohol to water is sufficient to answer some of the purposes for which the former is preferable; and the employment of both fluids is essential, when the virtues of the plant reside in two or more principles, all of which are not soluble in either of these menstrua. In this case it is usually better to submit the vegetable to the action of the two fluids successively, than of both united. Extracts obtained by the agency of water are called *watery* or *aqueous extracts;* those by means of alcohol, undiluted or diluted, *alcoholic* or *spiritous extracts.* Sometimes the term *hydro-alcoholic* is applied to extracts obtained by the joint agency of alcohol and water.

The method of preparing the solution is not a matter of indifference. The vegetable should be thoroughly bruised, or reduced to a coarse powder, so as to allow the access of the solvent to all its parts, and yet not so finely pulverized as to prevent a ready precipitation of the undissolved and inactive portion. When the water is employed, it has been customary to boil the medicine for a considerable time, and, if the first portion of liquid does not completely exhaust it, to repeat the operation with successive portions, till the whole of the active matter is extracted. This may be known by the sensible properties of the liquid, and by its influence upon reagents. But the boiling temperature produces the decomposition of many vegetable principles, or at least so modifies them as to render them inert; and the extracts prepared by decoction are usually less efficient than those made with a less degree of heat. From numerous experiments upon extracts, Orfila concluded that their virtues were less in proportion to the heat employed. It has, therefore, been recommended to substitute for decoction the process of maceration, digestion, or hot fusion; in the first of which the liquid acts without heat, in the second is assisted by a moderately increased temperature sustained for a considerable time, and in the third is poured boiling hot upon the vegetable matter, and allowed to stand for a short period in a covered vessel. When the active principles are readily soluble in cold water, *maceration* is often preferable to the other modes, as starch, which is inert, is thus left behind; but in many instances the preparation would spoil before the extraction would be completed. By *digestion*, though the solvent power of water is moderately increased, the advantage is often more than counterbalanced by the increased disposition to spontaneous decomposition. *Hot infusion*, therefore, is to be preferred where the vegetable does not readily yield its virtues to cold water. It has the advantage, moreover, in the case of albuminous substances, that the albumen is coagulated, and thus prevented from increasing the bulk of the extract, without adding to its virtues. A convenient mode of performing this process, is to introduce the solid material into a vessel with an opening near the bottom temporarily closed, or into a funnel with its mouth loosely stopped, then to pour on the boiling water, and, having allowed it to remain a sufficient length of time, to draw it off through the opening. This operation may be repeated till the water comes away without any obvious impregnation. It is always desirable to obtain the solution in the first place as concentrated as possible, so as to prevent the necessity of long-continued evaporation, which injures the extract. It is better, therefore, to incur the risk, both when decoction and infusion are employed, of leaving a portion of the active matter behind, than to obtain a very weak solution. When successive portions of water are employed, those which are least impregnated should be brought by evaporation to the strength of that first obtained before being mixed with it, as the latter thus escapes unnecessary exposure to heat.

Sometimes the filtering of a turbid infusion or decoction, before evaporation, causes the resulting extract to keep better, by removing substances which, besides undergoing decomposition themselves, may act as a ferment, and thus occasion the decomposition of the active matter of the extract.

When alcohol is employed as a menstruum, the vegetable should be macerated in it for one or two weeks, and care should be taken that the tincture be as nearly saturated as possible. The extraction may be hastened by substituting digestion for maceration; as the moderate heat employed, while it facilitates the action of the

alcohol, has in this case no effect in promoting decomposition, and the influence of the atmospheric air may be excluded by performing the process in close vessels. When alcohol and water are both used, it is best, as a general rule, to exhaust the vegetable with each separately, as the two menstrua require different modes of treatment. In whichever of these modes the extraction is effected, it requires the assistance of occasional agitation; and, when the vegetable matter is very porous, and absorbs a large quantity of the solvent, expression must be resorted to.

Acetic acid has been introduced into use as a menstruum in the preparation of extracts. It is supposed to be a better solvent of the active principles of certain substances than either water or alcohol alone. According to Girolamo Ferrari, the acrid narcotics, such as aconite, hemlock, hyoscyamus, and stramonium, yield much stronger extracts with distilled vinegar than with water, and still stronger with alcohol to which strong acetic acid has been added. (*Journ. de Pharm.*, 3e sér., i. 239.) This acid is used in the preparation of the acetic extract of colchicum.

Ether also is now used to a considerable extent in the preparation of certain extracts. Having the property of dissolving volatile oil and resin, and of evaporating at a temperature insufficient to volatilize the oil, it is admirably adapted for the preparation of extracts from those substances, the virtues of which reside in the two principles referred to. An ethereal tincture is first prepared by the process of percolation or displacement, and the ether is then either allowed to escape by spontaneous evaporation, or is distilled off at a very moderate heat. The oleoresinous extracts thus obtained are usually of a thick fluid or semi-fluid consistence. For more precise information as to the mode of preparing them, the reader is referred to a paper by Prof. Procter, in the *Am. Journ. of Pharm.* (xxi. 114). Several of them are now ranked among the officinal preparations, in the U. S. Pharmacopœia, under the title of *Oleoresins.*

The process of percolation or displacement has within a few years been very advantageously applied to the preparation of extracts, both with water and spirituous menstrua. It has the following great advantages: 1. that it enables the soluble principles to be sufficiently extracted by cold water, thereby avoiding the injury resulting from heat in decoction and hot infusion; 2. that it effects the extraction much more quickly than can be done by maceration, thereby not only saving time, but also obviating the risk of spontaneous decomposition; and 3. that it affords the opportunity of obtaining highly concentrated solutions, thus diminishing the injurious effects of the subsequent evaporation. While thus advantageous, it is less liable in this particular case than in others to the objection of yielding imperfect results if not well performed; for, though an inexpert or careless operator may incur loss by an incomplete exhaustion of the substance acted on, and the extract may be deficient in quantity, it may still be of the intended strength and quality, which is not the case with infusions or tinctures unskilfully prepared upon this plan. In the U. S. Pharmacopœia, all the extracts to which the process is applicable are prepared by percolation, and, with a very few exceptions, without previous maceration or digestion, which, as a general rule, is useless if not injurious. In the British Pharmacopœia, the process is applied, as it were, hesitatingly to a portion of the extracts, and withheld in others to which it seems equally appropriate; and, as if there was an unwillingness to trust this exotic method entirely, previous maceration for a greater or less length of time, never less than twelve, and more generally for twenty-four hours, is with a single exception universally adopted, whenever percolation is employed. In this respect British pharmacy is, we think, behind that of the United States. For an account of the mode of operating in the process of displacement, and of the instruments used, the reader is referred to *pages* 971 and 981.

Repercolation. In consequence of the existing high price of alcohol, and of the liquids prepared from it, as ether and chloroform, it is important to adopt some plan by which, while the ends aimed at are attained, the consumption of the menstruum used in percolation may be diminished. This object has been accomplished, to a considerable extent, by Dr. Ed. R. Squibb, of Brooklyn, N. Y., by a modification of the process of percolation to which he has given the name at the head of the present paragraph. As defined by Dr. Squibb, repercolation consists in the successive appli-

cation of the same percolating menstruum to fresh portions of the substance to be percolated. The result is that the same menstruum, acting repeatedly on unexhausted portions of the medicine, becomes concentrated to the greatest possible extent; so that much of the menstruum is saved, while the amount of the subsequent evaporation is diminished, which is itself an object of great importance in the preparation of extracts. It is obvious that repercolation is not applicable to the preparation of infusions, decoctions, tinctures, &c., in which the object in general is less a high degree of concentration than precision in the strength of the preparation, and consequently in the dose. It is to the extracts that the process is peculiarly adapted. One of its disadvantages is that the substance treated is less completely exhausted than when the proceeding is inverted, and fresh portions of menstruum are made to act on the same material until the latter is deprived of all its soluble matter. But the loss in this way is trifling, compared with the gain where a high-priced menstruum, as alcohol at the present time, is employed. In deciding when to adopt it, the operator will of course be influenced by the relative value of the drug and the menstruum, and decide in its favour only when the former is not so great as to overbalance the saving from the reduced quantity of the latter. In carrying repercolation into effect, in order to secure the most favourable results, certain methods of proceeding are advisable in various steps of the process, differing with the character of the substance to be acted on; and this can be determined only by a careful study, confirmed by repeated experiment. Dr. Squibb has applied it especially to the preparation of an extract of cinchona; and, by presenting in a note below an abstract of his plan of proceeding in this case, and the accompanying explanations, we can more forcibly impress on the mind of the pharmaceutical student the lessons applicable to the case than by abstract rules.*

* *Dr. Squibb's Process for Extract of Cinchona by Repercolation.* Take of Cinchona, in very fine powder, *forty-eight troyounces*, Alcohol *ten pints*, Water *a sufficiency*. Divide the Cinchona into three equal parts. Mix one part thoroughly with two pints of the Alcohol; allow the mixture to stand in a covered vessel for half an hour, and then transfer it to a ten-inch glass funnel for percolation; return the first two or three fluidounces that pass to the funnel; and pour in first five pints of the Alcohol, in portions of a pint each, waiting after each addition till the liquid has disappeared; and afterwards 20 fluidounces of Water. Continue the percolation till 6·5 pints have passed; dividing the percolate as it appears into portions, the first of two pints, and the remainder of a pint each, except the last, which is to be half a pint.

Mix the second part of the Cinchona with the first two pints of the percolate obtained, and proceed as with the first part, using the successive portions of percolate in the place of alcohol, until the last portion disappears. Then pour into the funnel a pint of the Alcohol, and when this has disappeared 20 fluidounces of Water. Continue the percolation till 7·5 pints have passed; separating the percolate into portions as before.

Mix the third part of the Cinchona with the first two portions of the percolate of the last operation, and proceed as with the second part, except that the remaining two pints of the Alcohol are to be poured into the funnel after the percolate and before the Water, and that the percolation is to continue till 9·5 pints of percolate are obtained, or till water appears in the percolate.

Recover the alcohol from the percolate by distillation for future use, and prepare the extract in the form directed.

The following explanatory observations by Dr. Squibb in relation to the foregoing process are important. The cinchona for percolation should be in the finest powder possible, and perfectly dry. The exhaustion is less economically effected with smaller quantities than 16 troyounces, used in each operation of the process; and a 10 or 10·5 inch funnel is of a convenient size. The mixture of the powder and alcohol, which should be made in a vessel of a capacity not less than half a gallon, may be effected by means of a wooden spatula, and should be free from lumps. After the magma has been put into the funnel, from 4 to 6 ounces of percolate may drain from it without the addition of menstruum; but this is not desirable, as the magma becomes impacted, and is less easily penetrated by the menstruum. The first two or three fluidounces that pass, being weak and sometimes turbid, are returned into the funnel, and the menstruum is to be immediately added, to prevent shrinking and impaction. The surface of the mass in the funnel, in the first part, should always be kept covered, when the alcohol is added; and, when the percolate is used in successive portions, one portion should be allowed to sink into the magma before another is applied; because these portions are successively weaker, and consequently better adapted to the more exhausted magma; but the surface should not remain long uncovered between the additions, as shrinking might take place and the percolation cease. Should it, however, have remained so, as when unwatched in the night, the whole surface should be gently pressed down in order to close the cracks; and this may be done without removing the paper from the surface. The percolate should throughout be perfectly transparent, and should pass at the average rate of a pint in 12 hours; though more rapid with the first portion, and slower with the third. The first part of each percolation is slower; and the rapidity increases with the exhaustion. To prevent loss of alcohol by evaporation, in consequence of the slowness of the percolation, the point of the funnel should pass well into the flask, and the funnel should be kept closely covered by India-rubber cloth, or oiled cloth or silk, and a plate.

Some prefer the mode of expression to that of displacement. This also is applicable both to watery and alcoholic menstrua. The substance to be acted upon is mixed with the menstruum, cold or hot according to circumstances; and the mixture is allowed to stand from twelve to twenty-four hours. The liquid part is then filtered off, and the remainder submitted to strong pressure, in a linen bag, by means of a common screw press, or other convenient instrument. Another portion of the menstruum may then be added, and pressure again applied, and, if the substance is not sufficiently exhausted, the same operation may be performed a third time. Frequently only a single expression is required, and very seldom a third. The quantity of menstruum added must vary with the solubility of the principles to be extracted. According to Mohr, the method of expression has the advantages over that of displacement, that it yields solutions of more uniform concentration, that it does not require the materials to be so carefully powdered, or otherwise so skilfully managed in order to ensure favourable results, and finally that it occupies less time.

2. *Mode of conducting the Evaporation.*

In evaporating the solutions obtained in the modes above described, attention should always be paid to the fact, that the extractive matter is constantly becoming insoluble at high temperatures with the access of air, and that other chemical changes are going on, sometimes not less injurious than this, while the volatile principles are expelled with the vapour. The operator should, therefore, observe two rules: 1. to conduct the evaporation at as low a temperature as is consistent with other objects; 2. to exclude atmospheric air as much as possible, and, when this cannot be accomplished, to expose the liquid the shortest possible time to its action. According to Berzelius, the injurious influence of atmospheric air is much greater at the boiling point of water than at a less heat, even allowing for the longer exposure in the latter case; and, therefore, a slow evaporation at a moderate heat is preferable to the more rapid effects of ebullition. Bearing these principles in mind, we shall proceed to examine the different modes in practice. First, however, it is proper to observe that decoctions generally let fall upon cooling a portion of insoluble matter; and it is a question whether this should be rejected, or retained so as to form a part of the extract. Though it is undoubtedly in many instances inert, as in that of the insoluble tannate of starch formed during the decoction of certain vegetable substances, yet, as

Two accidents may occur here, either of which may spoil a process or even group of processes. If in emptying the funnel, and preparing for a new percolation, the blanket or cork be left wet or even very damp, the new percolate will pass turbid from the beginning, and will often stop entirely. If, moreover, the tube of the funnel fit closely, as it should do, in the neck of the receiver, and its orifice do not project into the wider portion of the flask below, the interstice between the end of the funnel and neck of the flask is liable to be closed by the dropping liquid, so as to prevent the escape of air, and thus cause the percolate to pass upward through the interstice, and escape over the top of the receiver; and when this course is established, not a drop appears to fall into the flask.

After the last pint of the alcohol has been added, and disappeared beneath the surface, the water is poured into the funnel to displace the last portion of the spirituous menstruum, and is known to have sufficiently accomplished its object when it begins itself to appear in the percolate, as indicated by the turbidness produced by it in the tincture; and the process should be closely watched, so as to be suspended at this moment.

The percolate is very bitter, and deeply coloured; the tint varying with the variety of the bark; being of a deep, port-wine colour with the red, and nearly as dark as brown sherry with the yellow. If loss by evaporation be avoided, full 6·5 pints of alcoholic percolate may be obtained from the 7 pints of alcohol first employed; and a similar proportion from the other two parts, making altogether 9·5 pints. In obtaining this product from 10 pints of alcohol, about half a pint from the last percolation will contain some water, but not sufficient materially to interfere with the result.

The first part of the percolate is very dense, the last almost syrupy; and, were the process to be carried to the fourth percolation, it would become quite syrupy, so as to interfere with the passage of the liquid in any further repetition of the process; and a natural limitation of repercolation is thus afforded. The first pint of percolate is usually obtained in about 10 hours; the first from the second percolation in about 16 hours; that from the third in 24 hours; and the last pint of each, with little variation, in 8 or 10 hours.

The alcohol recovered by distillation is ready for use with other portions of cinchona; and the loss in the process varies from 20 to 30 per cent., according to the efficiency of the distillatory apparatus, and the care and skill employed. The alcohol used in percolation with the red bark retains a brown tint, that with the yellow is nearly or quite colourless. (*Proceedings of the Am. Pharm. Association*, A. D. 1867, p. 393; see also Pharmacy of the Cinchonas, *Am. Journ. of Pharm.*, 1867, pp. 289, 398, and 513.)—*Note to the thirteenth edition.*

it frequently also contains a portion of the active principle which a boiling saturated solution necessarily deposits on cooling, and as it is difficult to decide with certainty when it is active and when otherwise, the safest plan, as a general rule, is to allow it to remain.

The method of evaporation usually resorted to in the case of aqueous solutions is rapid boiling over a fire. The more quickly the process is conducted the better, provided the liquid is to be brought to the boiling point; for the temperature cannot exceed this, and the length of exposure is diminished. But, even where this method is employed, it should not be continued till the completion of the evaporation; for, when most of the water has escaped, the temperature can no longer be kept down to the boiling point, and the extract is burnt. The caution, therefore, should always be observed of removing the preparation from the fire before it has attained the consistence of thick syrup, and completing the evaporation, either by means of a water-bath, or in shallow vessels at a moderate heat. When large quantities of liquid are to be evaporated, it is best to divide them into portions and evaporate each separately; for, as each portion requires less time for evaporation than the whole, it will thus be a shorter time exposed to heat. (*Mohr.*) But the mode of evaporation by boiling is always more or less objectionable, and should be employed only in cases where the principles of the plant are so fixed and unchangeable as to authorize their extraction by decoction.

Evaporation by means of the water-bath, from the commencement of the process, is safer than the plan just mentioned, as it obviates all danger of burning the extract; but, as the heat is not supplied directly from the fire, the volatilization of the water cannot go on so rapidly, and the temperature being nearly the same, when the water-bath is kept boiling, there is greater risk of injurious action from the air. The liquid should be stirred during the process. The use of the vapour-bath, as suggested by M. Henry, is perhaps preferable; as it requires a smaller consumption of fuel, and the heat imparted to the liquid, while sufficient to evaporate it, is less than 212°. We take the following description of the apparatus, employed at the Central Pharmacy of Paris, from M. Chevallier's highly useful Manual. It consists of a covered boiler, containing water, the vapour of which is conducted through a pipe into the evaporating vessels, communicating with each other by means of metallic tubes. These vessels have the form of an ordinary copper basin, over the top of which is soldered a shallow tin capsule, intended to contain the liquid to be evaporated. The vapour from the boiler circulates through these vessels, and the water into which it condenses is allowed to escape through a stop-cock attached to the bottom of each vessel. From the last one of the series a tube passes into a vessel of water, so as to afford a slight pressure against the escape of any excess of vapour. The liquid to be evaporated is first distributed in two or three capsules, but when considerably concentrated, is transferred to a single one, where it is stirred towards the close of the process to hasten the evaporation. The heat applied to the liquid, if there are four vessels, is in that nearest the boiler about 198° F., in the fourth or most remote, about 135°. An incidental advantage of this apparatus is, that it affords a large supply of distilled water.

As the heat capable of being applied by a boiling water-bath to the evaporating liquid does not exceed 200° F., while that by steam can, by a moderate pressure, be increased to the boiling point or beyond it, the evaporation by the latter agency may be much more rapid than by the former, according to Mr. Redwood, twice as rapid, when the pressure is from ten to twenty pounds to the square inch; so that there is a temptation to raise the heat to a degree seriously injurious to the product. Evaporation, therefore, by steam heat always requires caution, while the water-bath is much less liable to be abused. In this respect, the latter method has the advantage.

A good plan of evaporation, though slow, is to place the liquid in a broad, shallow vessel, exposed in a stove or drying room to a temperature of about 100°, or a little higher, taking care that the air have free access in order to facilitate the evaporation. This mode is particularly applicable to those cases in which maceration or infusion is preferred to decoction for extracting the active principles. Berzelius says that we may thus usually obtain the extract in the form of a yellowish transparent mass,

while those prepared in the ordinary way are almost black, and are opaque even in very thin layers. Even when the liquid is boiled at first, the process may often be advantageously completed in this manner. It has been proposed to effect the evaporation at the common temperature, by directing a strong current of air, by means of a pair of smith's bellows, over the surface of the liquid; and, in reference to substances which are injured by heat and not by atmospheric air, the plan will be found useful.

Plans have been proposed and carried into execution for performing evaporation without the admission of atmospheric air. The apparatus for evaporation in vacuo, invented by Mr. Barry, and described in the *Lond. Journ. of Science and Arts* (vol. viii. p. 360), is well calculated to meet this object, at the same time that, by removing the atmospheric pressure, it enables the water to rise in vapour more rapidly, and at a comparatively low temperature. The method of Barry consists in distilling the liquid into a large receiver, from which the air has been expelled by steam, and in which the vapour is condensed by cold water applied to the surface of the receiver, so as to maintain a partial vacuum. Mr. Redwood has modified this process by keeping an air-pump in action during the evaporation, thus removing not only the air, but the vapour as fast as it forms, and maintaining a more complete vacuum than can be done by the condensation of the vapour alone. (*Journ. de Pharm.*, 3e sér., i. 231.) Another method is to place the liquid under an exhausted receiver, together with some concentrated sulphuric acid or chloride of calcium, which, by its affinity for water, promotes the evaporation of the liquid. But, from the expense and trouble of these modes of evaporation, they are not calculated for general use. Dr. Christison recommends as probably the most perfect and convenient method, especially with watery infusions and decoctions, to evaporate the fluid in a vacuum to the consistence of syrup, and then to complete the process in shallow vessels, exposed to a current of air without heat.*

A convenient plan of excluding the air, though it does not at the same time meet the object of reducing the requisite degree of heat, is to distil off the water in close vessels. Berzelius says that this is the best mode of concentration next to that *in vacuo*. Care, however, must be taken that the fire be not too long applied, lest the extract should be burnt. The process should, therefore, be completed by means of the water-bath.

In the concentration of alcoholic solutions, distillation should always be performed; as not only is the atmospheric air thus excluded, but the alcohol is recovered, if not absolutely pure, certainly fit for the purpose to which it was originally applied. Here also the water-bath should be employed, to obviate any possible risk of injury

* M. Grandval has described an apparatus for evaporation in vacuo, for the preparation of extracts, in the *Journ. de Pharm.* (xv. 82). In the same journal (xxiii. 1), MM. Soubeiran and Gobley have described and figured an apparatus, founded upon that of M. Grandval, but modified so as to be adapted to operations on a small scale, and to be within the reach of apothecaries who may desire to prepare their own extracts. Messrs. Tilden & Co., of New York, employ a vacuum apparatus analogous to that used in refining sugar. The vacuum is obtained and continued by the constant action of a powerful steam-driven pump. Their apparatus includes two evaporating pans; one large, having a capacity of several hundred gallons, used to concentrate the solutions for extracts to a syrupy consistence; the other, holding about fifty gallons, in which the evaporation is finished. The latter is furnished with an opening of such size as to permit the operator to remove the residual extract. The temperature during the evaporation is from 120° to 140° F., and is derived from steam pipes, placed within the boiler in the large evaporating pan, and a steam jacket beneath the smaller one. Very fine extracts are prepared in this way. A very ingenious apparatus for evaporating in vacuo on a small scale has been invented by Prof. A. B. Prescott (*Am. Journ. of Pharm.*, xlii. 349). Two vessels are required; a small one, for evaporation; a large one, which is best made of copper, and should be so arranged as to be readily heated or refrigerated at will. The two are to be connected by glass tubing, through rubber corks, and into the cork of the evaporating dish is to be set a short straight glass tube with a piece of rubber tubing fitted to it so that it can be tightly closed with a glass rod at will. An ounce or two of water having been put in the receiver, and the material in the evaporating vessel, a mild heat is, by means of water, applied to the evaporating vessel, but a strong heat to the receiver. The water in this latter boils furiously, and the vapour escapes through the opened tube in the evaporating vessel. When the water is exhausted the tube is closed and the receiver refrigerated. Of course a vacuum results, and is maintained by the continuous condensation of vapour in the receiver. (*Note to the ninth, tenth, and fourteenth editions.*)

We are told that the vacuum pan is now much more used by pharmaceutical chemists than formerly. (*Note to the thirteenth edition.*)

from the fire. When the decoction or infusion, and tincture of the same vegetable have been made separately, they should be separately evaporated to the consistence of syrup, and then mixed together, while they are of such a consistence as to incorporate without difficulty. The object of this separate evaporation is, that the spirituous extract may not be exposed to the degree of heat, or lengthened action of the air, which is necessary in the ordinary mode of concentrating the infusion or decoction.

In every instance, care should be taken to prevent any portion of the extract from becoming dry and hard on the sides of the evaporating vessel, as in this state it will not readily incorporate with the remaining mass. The heat, therefore, should be applied to the bottom, and not to the sides of the vessel.

3. *Condition and Preservation of Extracts.*

Extracts are prepared of two different degrees of consistence; soft so that they may be readily made into pills, and hard that they may be pulverized. The soft extracts always contain a notable percentage of water; in the case of belladonna and hyoscyamus, this has been found by Mr. Chas. Ekin to be about 20 per cent., and of conium 25 per cent. (*Pharm. Journ. and Trans.*, 3d ser., iv. 391.) In astringent extracts, the evaporation should be carried to dryness. Those obtained from the expressed juices of plants are apt to attract moisture from the air, in consequence of the deliquescent nature of the salts existing in the juice. They are thus rendered softer, and more liable to become mouldy upon the surface. Others, especially such as contain much chlorophyll, harden by time, in consequence of the escape of their moisture; and it not unfrequently happens that small crystals of saline matter are formed in their substance. Most extracts, especially those containing azotized principles, are capable, when left to themselves, of producing nitrates. Mr. John Attfield, of London, has made a chemical examamination of the crystals found in numerous extracts, and ascertained that, in a large number, they consisted of chloride of potassium, and, in a comparatively few, of the nitrate of potassium.* The air, moreover, exercises an unfavourable chemical influence over the softer extracts, which are enfeebled, and ultimately become nearly inert, by the same changes which they undergo more rapidly in the liquid state at an elevated temperature. If an extract be dissolved in water, and the liquid be saturated with common salt or any other very soluble salt of difficult decomposition, the greater part of it will be precipitated, in consequence of the insolubility of this class of substances in saline solutions. The precipitate may be again dissolved in pure water.

Extracts, in order that they may keep well, should be placed in glazed earthenware, glass, or porcelain jars, and completely protected from the access of the air. This may be effected by covering their surface with a layer of melted wax, or with a piece of paper moistened with strong spirit, then closing the mouth of the vessel with a cork, spreading wax or rosin over this, and covering the whole with leather, or a piece of bladder. (*Duncan.*) The dry extracts, being less liable to be affected by atmospheric oxygen, do not require so much care. The application of alcohol to the surface has a tendency to prevent mouldiness. A method of protecting extracts from the action of the air, frequently resorted to, is to cover them closely with oiled bladder; but this, though better than to leave them uncovered, is not entirely effectual. Should the extract become too moist, it may be dried by means of a water-bath: should it, on the contrary, be too dry, the proper consistence may be restored by softening it in the same manner, and incorporating with it a little distilled water. (*Chevallier.*)

Some extracts when powdered have a tendency to cohere again. According to Geiseler, this may be obviated by the addition of sugar of milk or powdered liquorice-root; two or three parts of the former, and one part of the latter to one of the extract being sufficient for the purpose. (*Pharm. Cent. Blatt.*, A. D. 1850, p. 238.) Mohr recommends the following plan of drying and preserving extracts. Take equal parts

* Thus chloride of potassium was detected in the extracts of belladonna, hemlock, sarsaparilla (compound), colchicum seeds, stramonium seeds, and aconite; nitrate of potassium in extracts of belladonna, hyoscyamus, and lettuce; and sulphate of sodium in extract of stramonium seeds. (*Pharm. Journ.*, March, 1862, p. 448.)

of powdered liquorice-root and of the extract, rub them well together in a mortar, put the resulting paste into an earthen vessel with a flat bottom, place this in another of iron, a little deeper, containing chloride of calcium thoroughly dried by heat insufficient to melt it; then enclose the whole with a cover fitted to the iron vessel, and allow them to stand for a day or more. When the mixture is quite dry, powder it, and add so much of the powdered root as to make the weight double that of the original extract. (*Ibid.*, p. 119.) W. Stromeyer has found sugar to answer very well as an addition to too moist narcotic extracts. It is necessary, however, that the extract in drying be not exposed to a heat of over 112°, else it remains soft. (*Am. Journ. of Pharm.*, 1872, pp. 300, 353.)

The incorporation of a little glycerin with extracts by adding it to the materials in the course of their preparation has been of late highly recommended, and by some carried into effect. By its unchangeable liquid character it keeps the extract soft, so as to be readily made into pills, and exercises also a favourable influence through its chemical properties; protecting in some degree against the oxidation of certain principles which render them insoluble, and dissolving apotheme already formed, as well as other principles that may not be soluble in the menstruum employed, as resin when water is used as the solvent. Mr. T. S. Wiegand considers glycerin as the best excipient for extracts given in the form of liquid mixture, or applied externally; equal parts being used in the former case, and a double proportion of glycerin in the latter. (*Am. Journ. of Pharm.*, March, 1863, p. 117.)

Extracts from recent plants should be prepared at the season when the plant is medicinally most active; and a good rule is to prepare them once a year.*

4. *General Officinal Directions.*

"In preparing the Extracts, unless otherwise directed, evaporate as quickly as possible, in a broad, shallow vessel, by means of a water-bath, until they have acquired the consistence proper for forming pills; and, towards the end of the process, stir them constantly with a spatula. Sprinkle upon the softer Extracts a small quantity of Alcohol." *U. S.*

EXTRACTUM ACONITI. *U. S., Br.* Extractum Aconiti Alcoholicum. *U. S. Pharmacopœia*, 1860. *Extract of Aconite.*

"Take of Aconite Leaves, recently dried and in fine powder, *twelve troyounces;* Alcohol *a pint;* Diluted Alcohol *a sufficient quantity.* Introduce the powder, previously mixed with one-third of the Alcohol, into a conical percolator, and pour upon it the remainder of the Alcohol. When the liquid has all been absorbed by the powder, pour on Diluted Alcohol until a pint of tincture has been obtained. Set this aside in a warm place, and allow it to evaporate spontaneously until reduced to three fluidounces. Continue the percolation with Diluted Alcohol until two pints more of tincture have passed, or until the powder is exhausted; then evaporate by means of a water-bath, at a temperature not exceeding 160°, to the consistence of syrup, and add the three fluidounces of tincture first obtained. Lastly, continue the evaporation, at a temperature not exceeding 120°, until the whole is reduced to the proper consistence." *U. S.*

"Take of the fresh Leaves and Flowering Tops of Aconite *one hundred and twelve pounds* [avoirdupois]. Bruise in a stone mortar, and press out the juice; heat it gradually to 130°, and separate the green colouring matter by a calico filter. Heat

* M. Lepage, of Gisors, gives the following method of testing the quality of the narcotic extracts, and determining whether they contain any of the alkaloids to which they owe their efficiency. Take a gramme (15·3 grs.) of the extract, dissolve it in twice its weight of distilled water, introduce the solution into a test-tube, and add from 25 to 30 centigrammes (4 or 5 grs.) of powdered bicarbonate of potassium. When effervescence has ceased, add to the mixture 5 or 6 times its bulk of pure ether, cork the tube, and shake briskly three times in 2 or 3 minutes. Then let the mixture rest; and, when the ether has become transparent, decant, and allow it to evaporate spontaneously. Dissolve the residue in 6 or 8 grammes (f℥iss to f℥ij) of water, acidulated with a drop or two of muriatic acid. If the extract be good, the solution will be rendered very turbid by a few drops of a solution of the double iodide of mercury and potassium, and will give a flocculent precipitate with solution of tannic acid. (*Journ. de Pharm.*, Mai, 1863, p. 362.) The test is applicable to the extracts of aconite, belladonna, hyoscyamus, and conium. (*Note to the twelfth edition.*)

the strained liquor to 200° to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and, stirring the whole together assiduously, continue the evaporation at a temperature not exceeding 140°, until the extract is of a suitable consistence for forming pills." *Br.*

The extract from the fresh leaves of aconite has been abandoned in the U. S. Pharmacopœia in favour of one made by means of alcohol from the dried plant, probably because the plant is not generally cultivated in this country. The exhaustion of the aconite in the U. S. process is indicated by the absence of its peculiar taste in the liquid which passes. To save the alcohol at the low temperature at which the evaporation is directed, would require the aid of a vacuum apparatus; but, at the present high price of alcohol, it would be advisable for every apothecary, who prepares these alcoholic extracts, to be provided with such an instrument. The attempt to save the alcohol by ordinary distillation would imply an elevation of the heat above that officinally ordered, and thus endanger the decomposition of the active principle of the aconite; and views of economy should never be allowed to interfere with the efficiency of medicines. It will be perceived that, in the British process, not the leaves only but the flowering tops also are used, as experience has shown that these are at least equally efficient. The process consists essentially in the evaporation of the expressed juice; and the product, therefore, ranks with inspissated juices.

In relation to the preparation of this extract, as well as of all others derived from the expressed juices of narcotic plants, the following summary of the plan pursued by Mr. Battley, an experienced apothecary of London, may be of service. Having passed the expressed juice through a fine hair sieve, he places it immediately upon the fire. Before it boils, a quantity of green matter rises to the surface, which in some plants is very abundant. This is removed by a perforated tin dish, and preserved. It ceases to appear soon after the liquid begins to boil. The boiling is continued till rather more than half the fluid has been evaporated, when the decoction is poured into a conical pan and allowed to cool. An abundant dark-green precipitate forms, from which the supernatant liquid is poured off; and this, having been reduced one-half by a second boiling, is again allowed to stand. The precipitate which now falls is less green than the first. The remaining fluid is once more placed over the fire, and allowed to boil till it assumes the consistence of syrup, when it is removed. The matter at first collected by skimming, together with that precipitated, is now incorporated with it, and the whole placed in a metallic pan, and by means of a water-bath evaporated to the consistence of an extract. In the latter part of the process, care is necessary to prevent the extract from hardening on the sides of the vessel, as it thus loses its fine green colour, and becomes proportionably feeble.

The superiority of this plan over a continuous boiling is, that the portions of active matter which are deposited at different stages of the process are subjected for a shorter time to heat than if allowed to remain in the liquor, and are consequently less deteriorated. The matter which coagulates before the fluid boils is chiefly albumen, embracing portions of chlorophyll and of the undissolved vegetable fibre. It might probably be thrown away without diminishing the virtues of the extract; but as chlorophyll, though itself inactive, has often associated with it a portion of the active principle, it is the most economical plan to incorporate it with the other matters, and, besides, its presence in the mass is said to render it easier to be worked into pills. Mr. Brande states that one cwt. of fresh aconite yields about five pounds of extract. According to Geiger, one pound yields an ounce and a half.

In the new process of the British Pharmacopœia, it will be perceived that a discrimination is made between the chlorophyll and albumen; the former, which coagulates at 130°, being at first separated in order to prevent the continuous action of heat upon it, and afterwards added to the extract; the latter, coagulating at 200°, is separated and rejected. The rejection of the albumen is altogether advisable, as it is not only inert, but renders the extract more liable to decomposition. The chlorophyll is retained for the reasons stated in the preceding paragraph; and also to give a greenish colour to the extract, which has come to be associated in general opinion with its goodness of quality.

If made from recently dried leaves, which have not yet been impaired by time, the U. S. extract is a good preparation of aconite; and it is believed to be more powerful, and to keep better, than the inspissated juice. According to Prof. Schroff, of Vienna, it has four times the strength of that preparation. The dose is half a grain or a grain, to be gradually increased if necessary. An alcoholic extract prepared from the root is stronger, and may be given in the dose of one-sixth or one-quarter of a grain three times a day, to be gradually increased until its effects are experienced.

When properly prepared, the British extract has a greenish-brown colour, with a disagreeable narcotic odour, and the acrid taste of the plant. It may be given in the dose of one or two grains, night and morning, to be gradually increased till the system is affected. Twenty grains or more have been given in the course of a day. W.

EXTRACTUM ALOES BARBADENSIS. *Br. Extract of Barbadoes Aloes.*

"Take of Barbadoes Aloes, in small fragments, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure]. Add the Aloes to the Water, and stir well until they are thoroughly mixed. Set aside for twelve hours; then pour off the clear liquor, strain the remainder, and evaporate the mixed liquors by a water-bath or a current of warm air to dryness." *Br.*

EXTRACTUM ALOES SOCOTRINÆ. *Br. Extract of Socotrine Aloes.*

This is prepared precisely as the Barbadoes Aloes.

The object of these processes is to separate from Aloes the resinoid matter, the *apotheme* of Berzelius, which is supposed to irritate the bowels, without possessing purgative properties; but the truth appears to be, that, when deprived of a small portion of adhering extractive, this matter is quite inert. It cannot, therefore, injuriously affect the virtues of the medicine; and, as it exists in comparatively small proportion, and during the process a part of the extractive becomes insoluble, the preparation may be considered as at best unnecessary. The dose of the purified aloes is from two to ten grains.*

Off. Prep. Decoctum Aloës Compositum, *Br.;* Extractum Colocynthidis Compositum, *Br.* W.

EXTRACTUM ANTHEMIDIS. *Br. Extract of Chamomile.*

"Take of Chamomile Flowers *one pound* [avoirdupois]; Oil of Chamomile *fifteen minims;* Distilled Water *one gallon* [Imperial measure]. Boil the Chamomile with the Water until the volume is reduced to one-half, then strain, press, and filter. Evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills, adding the Oil of Chamomile at the end of the process." *Br.*

According to Mr. Brande, one cwt. of dried chamomile flowers affords upon an average 48 pounds of extract.

This extract has a deep-brown colour, with the bitter taste and aroma of chamomile. It much better represents the chamomile than the old Edinburgh extract, which, being obtained by decoction and inspissation, contained none of the volatile

* *Glycerate of Aloes. Glycerole of Aloes.* Under the latter name, M. Chausit brought to the notice of the profession a preparation consisting of an alcoholic extract of aloes dissolved in glycerin. Mr. Haselden prepared this in the following method. Macerating half an ounce of aloes in four fluidounces of alcohol until dissolved, he filtered the tincture through bibulous paper, evaporated it to the consistence of molasses, and, while it was still warm, added enough glycerin to make four fluidounces. Finding that the aloes was wholly dissolved, with the exception of a little impurity he concluded that the spirit might very well be dispensed with, and the aloes used directly in the process. Accordingly, he proposes to substitute the following method. Mix well in a mortar half an ounce of Socotrine aloes, in fine powder, and four fluidounces of glycerin; transfer the mixture to a bottle, and agitate occasionally for several days; if the aloes be not now dissolved, heat for fifteen minutes by a water-bath, and strain through linen to separate impurities. The resulting liquid is of a bright mahogany colour, and of the consistence of glycerin. The preparation has been recommended as an external remedy in lichen agrius and the excoriations of eczema, applied by means of a camel's-hair brush. (*Pharm. Journ.*, Dec. 1859, p. 322.) It is unfortunate, we think, that the French name of glycerole has been employed to express solutions in glycerin, as this termination has been adopted for certain proximate principles. It appears to us that the term *glycerate* would be unexceptionable; as it is sufficiently expressive, and no confusion could result. For the mode of preparing *a fluid extract of aloes* with the aid of glycerin, by Prof. Procter, see *Proceed. of Am. Pharm. Assoc.*, 1863, p. 240. (*Note to the twelfth edition.*)

oil of the plant. In the present British process, not only is care taken to avoid boiling, but also to supply any possible loss of oil during the cautious evaporation, by the addition of a small portion near the close of the process. The extract may be given for the same purposes as the flowers, but is most used as a vehicle for other tonics in the pilular form. The dose is from ten to twenty grains. An extract may be prepared, having the peculiar flavour as well as bitterness of chamomile, by macerating the flowers in water, and evaporating the infusion in vacuo. W.

EXTRACTUM ARNICÆ. Extractum Arnicæ Alcoholicum. *U.S. Pharm.* 1860. *Extract of Arnica.*

"Take of Arnica, in moderately coarse powder, *twenty-four troyounces;* Alcohol *four pints;* Water *two pints;* Diluted Alcohol *a sufficient quantity.* Mix the Alcohol and Water, and moisten the powder with a pint of the mixture; then pack it firmly in a cylindrical percolator, and gradually pour on the remainder of the mixture. Continue the percolation with Diluted Alcohol until six pints of tincture have passed. Lastly, evaporate this, by means of a water-bath, to the proper consistence." *U.S.*

This extract very well represents the virtues of arnica, and is a convenient form for its administration. According to Prof. Procter, it amounts, in the soft state, to 33 per cent. of the flowers. The dose is from five to ten grains. But the chief employment of the extract is in the preparation of the plaster. (See *Emplastrum Arnicæ.*)

Off Prep. Emplastrum Arnicæ, *U.S.* W.

EXTRACTUM BELLADONNÆ. *U.S., Br. Extract of Belladonna.*

"Take of Belladonna Leaves, fresh, *twelve troyounces.* Bruise the Leaves in a stone mortar, sprinkling on them a little water, and express the juice; then, having heated this to the boiling point, strain, and evaporate to the proper consistence." *U.S.*

The British Pharmacopœia takes the "fresh leaves and young branches of Belladonna," and prepares the Extract from them in the same manner precisely as Extract of Aconite. (See *Extractum Aconiti.*)

The U.S. Pharmacopœia directs the extract to be prepared from the leaves of the plant, the British from the leaves and young branches. The latter direction was probably based on experiments by Mr. Squire, of London, who found that an extract prepared from the soft herbaceous parts of the plant generally, including leaves, flowers, and young stalks, not only has a better consistence, and is less apt to become mouldy by keeping, than that made from the leaves exclusively, but is more effectual in the same quantity. (*Pharm. Journ.*, Dec. 1861, p. 300.) There is little doubt of the accuracy of these results, and it is to be hoped that, in a future edition of our officinal standard, should they be confirmed by further observation, the same measure may be adopted. It is probable that these remarks are as applicable to other extracts prepared from fresh leaves as to that of belladonna, at least in relation to perennial plants.

From the experiments of MM. Solon and Soubeiran, it appears that, in relation to this extract, the insoluble matter separated from the expressed juice by filtering, and that coagulated by heat, are nearly if not quite inert; so that advantage results from clarifying the juice by these means before evaporating it. So far as the albumen is concerned, there can be no doubt of the accuracy of this statement; but it is questionable whether the same remark is applicable to the chlorophyll which first separates, and which is reserved in the British process. (See *Extractum Aconiti*, page 1169.) Mr. Brande states that one cwt. of fresh belladonna yields from 4 to 6 pounds of extract. According to M. Recluz, nearly ten parts may be obtained from one hundred. The best extract is brought chiefly from England; but Mr. Alfred Jones has found that it may be prepared of equally good quality from the plant grown in the United States. (*Am. Journ. of Pharm.*, xxiv. 108.) It has usually a dark-brown colour, a slightly narcotic not unpleasant odour, a bitterish taste, and a soft consistence which it long retains. Asparagin has been found in this extract. (*Journ. de Pharm.*, xxi. 178.)

Its medical properties and uses have been detailed under the head of Belladonna.

A few words in relation to its mode of application may be proper here. For the dilatation of the pupil, it is either mixed with water to the consistence of cream and rubbed on the brow and eyelids, or dissolved in water and dropped into the eye. In rigidity of the os uteri, it is applied at intervals to the neck of the uterus, mixed with simple ointment in the proportion of two drachms to an ounce; but care must be taken not too powerfully to affect the system; and the preparation, therefore, should be used in a small quantity at first. In irritability of the bladder, chordee, spasm of the urethra, and painful constriction of the rectum, it may either be rubbed in the form of ointment upon the perineum, along the urethra, &c., or may be used in the form of enema; but care is requisite not to introduce it too freely into the bowel. It is sometimes smeared upon the bougie, mixed with oil, in the treatment of stricture of the urethra. In the form of ointment it has been beneficially employed in phymosis and paraphymosis, and in that of plaster or ointment, in local neuralgic or rheumatic pains. (See *Emplastrum Belladonnæ.*) The dose of the extract is uncertain on account of its variable strength. The best plan is to begin with one-quarter or one-half of a grain, repeated two or three times a day, and gradually to increase the dose till the effects of the medicine are experienced. To a child two years old not more than one-twelfth of a grain should be administered at first.

Off. Prep. Emplastrum Belladonnæ, *Br.;* Unguentum Belladonnæ. W.

EXTRACTUM BELLADONNÆ ALCOHOLICUM. *U. S. Alcoholic Extract of Belladonna.*

"Take of Belladonna Leaves, in fine powder, *twenty-four troyounces;* Alcohol *four pints;* Water *two pints;* Diluted Alcohol *a sufficient quantity.* Mix the Alcohol and Water, and moisten the powder with a pint of the mixture, then pack it firmly in a conical percolator, and gradually pour upon it the remainder of the mixture. Continue the percolation with Diluted Alcohol until six pints of tincture have passed. Lastly, evaporate this, by means of a water-bath, to the proper consistence." *U. S.*

This is a good preparation, though less necessary than some other spirituous extracts of the narcotic plants; as the inspissated juice, or common extract of belladonna, can generally be procured of good quality. It is one of the officinals of the French Codex. The dose to begin with is half a grain.

Off. Prep. Suppositoria Belladonnæ, *U. S.* W.

EXTRACTUM CALUMBÆ. *Br. Extract of Calumba.*

"Take of Calumba Root, cut small, *one pound* [avoirdupois]; Distilled Water *four pints* [Imperial measure]. Macerate the Calumba with two pints of the Water for twelve hours, strain and press. Macerate again with the same quantity of Water, strain and press as before. Mix and filter the liquors, and evaporate them by the heat of a water-bath until the extract is of a suitable consistence for forming pills." *Br.*

We prefer the Br. process of 1864, in which proof spirit was employed as a menstruum. As proof spirit takes up all the active matter of columbo, leaving the starch and albumen behind, the extract prepared according to that formula had, in a comparatively small bulk, all the powers of the root, except those of the small proportion of volatile oil which may be dissipated in the process. In the present process, though the starch is left behind, the albumen is taken up, and adds to the bulk of the extract. Besides, the alcoholic preparation has the advantage of requiring less heat in the evaporation, and consequently of retaining more of the volatile oil in the product. Its only disadvantage is its greater costliness. The extract may be given in the dose of from five to fifteen grains three times a day. W.

EXTRACTUM CANNABIS AMERICANÆ. *Extract of American Hemp.*

"Take of American Hemp, in moderately fine powder, *twelve troyounces;* Alcohol *a sufficient quantity.* Moisten the Hemp with six fluidounces of Alcohol, pack it in a conical percolator, cover the surface with a disk of paper, and pour on six fluidounces of Alcohol. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator, to prevent evaporation, set it aside in a moderately warm place for four days. Then, having removed the cork, gradually pour Alcohol upon the surface until two pints of tincture have

been obtained, or until the Hemp is exhausted. Lastly, by means of a water-bath, evaporate to the proper consistence." *U. S.*

This is a new officinal of the U. S. Pharmacopœia, which has not been sufficiently tested to settle its exact value. It might be used in the dose of half a grain and upwards.

EXTRACTUM CANNABIS INDICÆ. *U. S., Br. Extract of Indian Hemp.*

"Take of Indian Hemp, in moderately fine powder, *twelve troyounces;* Alcohol *a sufficient quantity.* Moisten the Hemp with six fluidounces of Alcohol, pack it in a conical percolator, cover the surface with a disk of paper, and pour on six fluidounces of Alcohol. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator, to prevent evaporation, set it aside in a moderately warm place for four days. Then, having removed the cork, gradually pour Alcohol upon the surface until two pints of tincture have been obtained, or until the Hemp is exhausted. Lastly, by means of a water-bath, evaporate to the proper consistence." *U. S.*

"Take of Indian Hemp, in coarse powder, *one pound* [avoirdupois]; Rectified Spirit *four pints* [Imperial measure]. Macerate the Hemp in the Spirit for seven days, and press out the tincture. Distil off the greater part of the Spirit, and evaporate what remains by a water-bath to the consistence of a soft extract." *Br.*

Although there is some difference in the details of the two processes, the preparations of the U. S. and Br. Pharmacopœias are practically identical. The preparation varies exceedingly in strength, so that it is wisest to commence with a small dose, one quarter of a grain, and rapidly increase the amount given until some effect is produced.

Prof. Procter has investigated the subject of the tests for the purified extract or resin, and come to the following conclusions. Its peculiar odour when moderately heated, its indifference to alkalies, and its solubility in alcohol, ether, chloroform, benzole, and oil of turpentine are characteristic though not entirely distinctive properties. The best test, he thinks, is nitric acid (sp. gr. 1·38), which acts slowly when cold, but with heat rapidly, evolving red fumes, and converting the resin into an orange-red resinoid substance, which, when washed and dried, closely resembles gamboge in colour. (*Proceed. of the Am. Pharm. Assoc.*, A. D. 1864.)

Off. Prep. Tinctura Cannabis, *U. S.;* Tinctura Cannabis Indicæ, *Br.* W.

EXTRACTUM CINCHONÆ. *U. S. Extract of Cinchona.*

"Take of Yellow Cinchona, in fine powder, *twelve troyounces;* Alcohol *three pints;* Water *a sufficient quantity.* Mix the powder with twenty fluidounces of the alcohol, and allow the mixture to stand for four days, then introduce it into a conical glass percolator, and gradually pour upon it the remainder of the Alcohol. When the liquid ceases to pass, pour upon the residue sufficient Water to keep its surface covered, until three pints of tincture have passed. Set this aside, and continue the percolation until six pints of infusion are obtained. Distil off the alcohol from the tincture, and evaporate the infusion until the liquids respectively are brought to the consistence of thin honey; then mix them, and evaporate to the proper consistence." *U. S.*

The yellow or Calisaya bark is selected for this preparation, as it can always be relied on as efficient. By this process all the virtues of the bark are extracted; the parts soluble in alcohol being first taken up, and afterwards those in water, and the tincture and infusion thus obtained separately. This proceeding has the great advantage that no more heat is necessary to evaporate the tincture than the alcoholic menstruum requires; while, if the two liquids were mixed, it would be necessarily subjected to a longer continuance if not a higher degree of the heat; and the advantage is the greater as most of the active matter is extracted in the first percolation with alcohol. If proper care be taken in executing the process, both in relation to the percolation, and the avoidance of too high a temperature, the extract will fully represent the virtues of the bark.

In relation to this process, Dr. Squibb, though stating that it yields a very good

extract, considers it capable of improvement. Three fluidounces of alcohol, directed to be mixed with the powder previously to its introduction into the percolator, is insufficient to moisten the cinchona for packing. In a formula of his own for the extract he first mixes sixteen ounces of cinchona with thirty fluidounces of alcohol, and, having allowed the mixture to stand for half an hour in a covered vessel, then pours it into the glass funnel, and proceeds to percolate with alcohol, as in the officinal process. The subsequent percolation with water to obtain an infusion he considers entirely useless, as very little that is of any value is extracted; the cinchona having in effect been exhausted by the alcohol; or at least it would be so if the percolation were carried somewhat further. Hence in his formula he omits the water except merely for displacing the alcohol, and uses a somewhat larger proportion of alcohol. Dr. Squibb thinks that the extract is improved by a little glycerin, and consequently adds a proportion equivalent to six troy drachms to the extract while yet hot after the evaporation, and rubs them well together. (*Pharmacy of the Cinchonas*, p. 25.)

The former extracts of cinchona of the British Colleges are all omitted in the new British Pharmacopœia, which directs in their place a fluid extract, under the name of *Extractum Cinchonæ Liquidum*, which will be treated of among the Fluid Extracts.

A very good extract of bark was formerly prepared, in the shops of Philadelphia, by macerating cinchona for a considerable length of time in a large proportion of water, and slowly evaporating the infusion, by a very moderate heat, in large shallow dishes placed upon the top of a stove. Before the use of sulphate of quinia had superseded that of most other preparations of bark, we employed this extract with success in the treatment of intermittents, and found ten grains of it equivalent to nearly a drachm of the powdered cinchona.

The extract should always be brought to the hard dry state in which it may be pulverized; as it is thus less apt to be injured by exposure, and in the state of powder may be more uniformly incorporated with other substances. Though directed officinally to be prepared from the yellow or Calisaya bark, it would no doubt be equally efficient if made from the red.*

Medical Uses. The extract of Peruvian bark is at present much less employed than before the discovery of quinia. It is still, however, occasionally prescribed as a tonic in combination with other medicines; and, as it possesses, when properly prepared with a spirituous menstruum, almost all the active principles as they exist in the bark itself, it may be used in preference to the sulphate of quinia, whenever it is supposed that the latter is incapable of exerting all the curative influence of cinchona. We are told, however, that, on account of the high price of Calisaya bark, much of the extract as at present in the shops is prepared from inferior varieties. The dose is from ten to thirty grains, equivalent to about a drachm of the powdered bark. W.

EXTRACTUM COLCHICI. *Br. Extract of Colchicum.*

"Take of Fresh Colchicum Corms, deprived of their coats, *seven pounds* [avoirdupois]. Crush the Corms; press out the juice; allow the feculence to subside, and heat the clear liquor to 212°; then strain through flannel, and evaporate by a water-bath, at a temperature not exceeding 160°, until the extract is of a suitable consistence for forming pills." *Br.*

There scarcely seems to be occasion for both this and the following extract. The dose is one or two grains.

In Great Britain a preparation called *preserved juice of colchicum* is given in the dose of five minims or more. It is made by expressing the fresh bulb, allowing the juice to stand for forty-eight hours that the feculent matter may subside, then adding one-quarter of its bulk of alcohol, allowing it again to stand for a short period, and ultimately filtering. W.

* *Quinium.* Under this name a preparation has had some reputation in Europe, made by mixing quinia and cinchonia barks in such proportion that there should be about two parts of the former alkaloid to one of the latter, with half their weight of slaked lime, exhausting the mixture with alcohol, and then distilling and evaporating to dryness. The resulting *quinium* should yield one-third of its weight of the two alkaloids. The dose is three grains. The disadvantage of this as of all the amorphous preparations of the cinchona alkaloids, is the want of that protection against adulteration which is afforded by the crystalline form of the pure principles. (See *Am. Journ. of Pharm.*, Sept. 1858, p. 400.)—*Note to the twelfth edition.*

EXTRACTUM COLCHICI ACETICUM. *U. S., Br. Acetic Extract of Colchicum.*

"Take of Colchicum Root, in moderately fine powder, *twelve troyounces;* Acetic Acid *four fluidounces;* Water *a sufficient quantity.* To the Acetic Acid add a pint of Water, and mix the resulting liquid with the Colchicum Root. Transfer the mixture to a conical glass percolator, and pour Water gradually upon it until the liquid passes with little or no taste. Lastly, evaporate the liquid, in a porcelain vessel, to the proper consistence." *U. S.*

In the British Pharmacopœia this extract is directed to be prepared as the preceding, except that *six fluidounces* of Acetic Acid (*Br.*) are to be added to the crushed corms before expression, and that the strained liquor is to be evaporated to the consistence of a soft extract.

As the fresh colchicum bulb is rarely to be had in this country, the U. S. Pharmacopœia employs the dried bulb; and its process, if properly conducted, will afford a very efficient extract. Some inconveniences are experienced in preparing the extract, according to the London process, from the recent bulb by expression, which would seem to render the U. S. process under all circumstances preferable. (*Pharm. Journ.*, xiii. 62.)

The use of the acetic acid, in this preparation, is to render more soluble the alkaline principle upon which the virtues of meadow-saffron are thought to depend. The acetic extract of colchicum is highly commended by Sir C. Scudamore, who prefers it made by evaporating, to the consistence of honey, a saturated acetic infusion of the dried bulb. (*Lond. Med. Gazette*, Dec. 10, 1841.) The dose of the extract is one or two grains, to be repeated two or three times a day, and increased if necessary. W.

EXTRACTUM COLOCYNTHIDIS. *U. S.* EXTRACTUM COLOCYNTHIDIS ALCOHOLICUM. *U. S. Pharm.* 1860. *Extract of Colocynth. Alcoholic Extract of Colocynth.*

"Take of Colocynth *forty-eight troyounces;* Diluted Alcohol *a sufficient quantity.* Dry the Colocynth, and, having removed the seeds, and reduced it to coarse powder by grinding or bruising, macerate it in eight pints of Diluted Alcohol for four days, with occasional stirring; then express strongly, and strain through flannel. Pack the residue, previously broken up with the hands, firmly in a cylindrical percolator, cover it with the strainer, and pour Diluted Alcohol upon it, until the tincture and expressed liquid, taken together, measure sixteen pints. Mix the tincture with the expressed liquid, and, having recovered from the mixture ten pints of alcohol by distillation, evaporate the residue to dryness by means of a water-bath. Lastly, reduce the dry mass to powder, and keep it in a well-stopped bottle. The Extract obtained by this process weighs about seven troyounces." *U. S.*

Colocynth should be deprived of its seeds, as directed by the U. S. Pharmacopœia, before being submitted to the action of the menstruum. Dr. Duncan found half a pound of colocynth to contain 2770 grains of seeds, which, boiled by themselves, yielded almost nothing to water. Dr. Squibb found selected fruits to yield from 25·8 to 34 per cent. of medullary part; and this, when well exhausted by diluted alcohol, to yield 60·7 to 60·8 per cent. of dry extract; while from the whole fruit, including pulp and seeds, from 15·69 to 20·6 per cent. was obtained according to the degree of dryness. (*Am. Journ. of Pharm.*, Jan. 1857, p. 98.) Boiling water extracts so much pectic acid and mucilage from colocynth, that the decoction or hot infusion gelatinizes on cooling; and the extract made by means of it is loaded with inert matter, and, besides, is apt to become mouldy, or so tough and hard as to resist trituration and formation into pills. Hence the London College, following in this respect the French Codex, directed, in the last edition of its Pharmacopœia, maceration with cold water; but diluted alcohol has been found to be a much better menstruum, and has been adopted in the U. S. process; while, in the British Pharmacopœia, the simple extract has been discarded altogether. The chief, if not exclusive use of the alcoholic extract is in the preparation of the compound extract.

Off. Prep. Extractum Colocynthidis Compositum, *U. S.* W.

EXTRACTUM COLOCYNTHIDIS COMPOSITUM. *U. S., Br. Compound Extract of Colocynth.*

"Take of Extract of Colocynth, in fine powder, *three troyounces and a half;* Puri-

fied Aloes, in fine powder, *twelve troyounces;* Resin of Scammony, in fine powder, *three troyounces;* Cardamom, in fine powder, *a troyounce and a half;* Soap, in fine powder, *three troyounces.* Mix the powders thoroughly, and keep the mixture in a well-stopped bottle." *U. S.*

"Take of Colocynth Pulp *six ounces;* Extract of Socotrine Aloes *twelve ounces;* Resin of Scammony *four ounces;* Hard Soap, in powder, *three ounces;* Cardamom Seeds, in fine powder, *one ounce;* Proof Spirit *one gallon* [Imperial measure]. Macerate the Colocynth in the Spirit for four days; press out the tincture, and distil off the Spirit; then add the Aloes, Scammony, and Soap, and evaporate by a water-bath until the extract is of a suitable consistence for forming pills, adding the Cardamoms towards the end of the process." *Br.* The ounce employed in this process is the avoirdupois.

The present U. S. formula differs from that of 1850, in taking the extract of colocynth already prepared, instead of directing its preparation from the colocynth, and in substituting resin of scammony for the scammony itself. The former provision ensures uniformity of result so far as the colocynth is concerned; whereas, by the old formula, this was impossible, owing to the variable quality of the colocynth employed, unless an unusual amount of care was taken in its selection. The second change contributes to the same result of uniformity; because the resin of scammony is very nearly of equable strength, while scammony is notoriously otherwise; and it has the additional advantage of yielding a stronger extract, as the resin is much more energetic in an equal dose than the crude drug as ordinarily found in the market. The object of the soap in this formula is to improve the consistence of the mass, which, when hardened by time, it renders more soluble in the liquors of the stomach. It may possibly also serve the purpose of qualifying the action of the aloes. In the U. S. process the extract is in the form of powder, which is very convenient for admixture with other substances; while, if given uncombined, it may be readily made into pills by suitable additions. The alternative of using the scammony or its resin, in the first British formula, which appeared to us very objectionable, has been abandoned in the present edition, and the resin only directed. It was objected to the U. S. compound extract of 1860, that it is apt to gripe in consequence of deficiency in the proportion of the aromatic ingredient, and the addition of some aromatic oil, as oil of cloves, was recommended; but this was remedied in the last revision by increasing the proportion of cardamom. The plan of having the powders simply mixed is liable to the objection, that the mixture is apt not to be thoroughly effected, so as to obtain a uniform result; and hence it is suggested, in accordance with Dr. Squibb's plan, to melt together all the ingredients unpowdered, except the cardamom, and when the mixture is thoroughly made, to stir in the powdered aromatic. (Procter, *Am. Journ. of Pharm.*, Jan. 1867, p. 20.)

This extract is an energetic and safe cathartic, possessing the activity of its three purgative ingredients, with comparatively little of the drastic character of the colocynth and scammony. It may be still further and advantageously modified by combination with rhubarb, jalap, calomel, &c., with one or more of which it is often united in prescription. In such combination it is much employed whenever an active cathartic is desirable, particularly in the commencement of fevers and febrile complaints, in congestion of the liver or portal system, and in obstinate constipation. In small doses it is an excellent laxative in that state of habitual costiveness, depending on a want of the due irritability of the bowels, which often occurs in old people. The dose is from five to thirty grains, according to the effect to be produced, and the susceptibility of the bowels. A very eligible combination is the compound cathartic pill of the U. S. Pharmacopœia. We are informed that much of the extract sold in this country is made with inferior scammony and aloes, and an insufficient proportion of colocynth, so that it is comparatively inert. Compound extract of colocynth should be looked on with suspicion when cheap, and the apothecary should prepare it for himself.*

Off. Prep. Pilulæ Catharticæ Compositæ, *U. S.* W.

* See in the *American Journal of Pharmacy* for March, 1857 (xxix. 97), and in the *Proceedings of the Am. Pharm. Assoc.*, 1858 (p. 411), some useful practical observations by Dr. E. R. Squibb, upon the best method of preparing this extract, so as to secure uniformity and efficiency.

EXTRACTUM CONII. *U. S., Br. Extract of Hemlock.*

"Take of Conium Leaves, fresh, *twelve troyounces.* Bruise the leaves in a stone mortar, sprinkling on it a little water, and express the juice, then, having heated this to the boiling point, filter it, and evaporate to the proper consistence, either in a vacuum with the aid of heat, or in shallow vessels, at the ordinary temperature, by means of a current of air, directed over the surface of the liquid." *U. S.*

The directions of the *British Pharmacopœia* for this extract are precisely the same as those for the extract of aconite, the fresh leaves and young branches of conium being used.

The most important point in the preparation of this extract is to evaporate the juice without an undue degree of heat. At a temperature of 212° or upwards, its active principle undergoes rapid decomposition, being converted into resinous matter and ammonia. This is detected by the operator by the ammoniacal odour mixed with that which is peculiar to the plant. The juice always to a certain extent undergoes this decomposition when evaporated over a fire, and is not exempt from it even when the heat is regulated by a water-bath. Hence the propriety of the directions in the U. S. and British Pharmacopœias. An excellent plan in the evaporation is to conduct it first in a vacuum, and afterwards in shallow vessels with a current of air at common temperatures. By the direction to heat the juice to the boiling point, or 200° (*Br.*), and then to filter, whereby the inert albumen is coagulated, and, with the equally inert chlorophyll and vegetable fibre, is separated from the liquid before evaporation, the extract is procured in a more concentrated state, and, besides, deprived of substances which might favour its decomposition. Long-continued exposure to the air is productive of the same result as too much heat, so that old extracts are frequently destitute of activity. (*Journ. de Pharm.*, xxii. 416.) No one of the extracts is more variable in its qualities than this. The season at which the herb is collected, the place and circumstances of its growth, the method of preparing the extract, are all points of importance, and are all too frequently neglected. (See *Conii Folia.*) In this country the process has often been carelessly conducted; and large quantities of an extract, prepared by boiling the plant in water and evaporating the decoction, have been sold as the genuine drug. The apothecary should always prepare the extract himself, or procure it from persons in whom he can have confidence. That imported from London has usually been considered the best; but we have seen and tried the extract prepared by the Messrs. Tilden & Co., of New York, by evaporation in vacuo at a low heat, and have found it superior to any that we had previously employed. It is not improbable that, as suggested to us by Professor Procter, the addition of a portion of acetic acid to the juice, before evaporation, might tend to fix the conia, and enable it better to resist the influence of heat than its native combination. The activity of any specimen of the extract may be in some measure judged of by rubbing it with potassa, which, disengaging the *conia* and rendering it volatile, gives rise to the peculiar mouse-like odour of that principle. If no odour be evolved under these circumstances, the extract may be deemed inert.

The extract of hemlock prepared without separating the chlorophyll has a fresh olive or green colour, but, according to the U. S. process, is brownish. It should have a strong narcotic, somewhat fetid odour, and a bitterish saline taste. According to Brande, from three to five pounds are obtained from one cwt. of the leaves. M. Recluz got rather more than an ounce from sixteen ounces. Of the medical properties and application of this extract, we have spoken under the head of Conii Folia. The dose is two grains, two, three, or four times a day, to be gradually increased till evidences of its action upon the system are afforded. It may be administered in pill or solution.

Off. Prep. Pilula Conii Composita, *Br.;* Vapor Coniæ, *Br.* W.

EXTRACTUM CONII ALCOHOLICUM. *U. S. Alcoholic Extract of Hemlock.*

"Take of Conium Leaves, recently dried and in fine powder, *twelve troyounces;* Alcohol *a pint;* Diluted Alcohol *a sufficient quantity.* Introduce the powder, previously mixed with one-third of the Alcohol, into a conical percolator, and pour upon

it the remainder of the Alcohol. When the liquid has all been absorbed by the powder, pour Diluted Alcohol upon it until a pint of tincture has been obtained. Set this aside in a warm place, and allow it to evaporate spontaneously until reduced to three fluidounces. Continue the percolation with Diluted Alcohol until two pints more of tincture have passed, or until the powder is exhausted; then evaporate this liquid, by means of a water-bath, at a temperature not exceeding 160°, to the consistence of syrup. To this add the three fluidounces of tincture first obtained, and continue the evaporation, at a temperature not exceeding 120°, until the whole is reduced to the proper consistence." *U. S.*

This is one of the French officinal extracts, and, when well made from recently and carefully dried leaves, is a good preparation. The same caution is requisite in evaporating in this case as in that of the inspissated juice or common extract. It will be noticed that care is taken in the formula to prevent injury from too great a heat, by first passing alcohol, which forms a highly concentrated tincture, and allowing this to evaporate spontaneously to three fluidounces, which is not added to the remainder until but little of the menstruum remains; and the process is completed at the low heat of 120°. This caution is necessary from the great facility with which conia is decomposed by heat. The proportion of extract yielded by dried hemlock, by percolation with alcohol, is, according to Messrs. Vielguth and Nentwich, 21·3 per cent. (See *Am. Journ. of Pharm.*, May, 1859, p. 237.) The dose, to begin with, is one or two grains, to be increased if necessary. W.

EXTRACTUM DIGITALIS. *U. S.* EXTRACTUM DIGITALIS ALCOHOLICUM. *U. S. Pharm.* 1860. *Extract of Digitalis.*

"Take of Digitalis, recently dried and in fine powder, *twelve troyounces;* Alcohol *a pint;* Diluted Alcohol *a sufficient quantity.* Introduce the powder, previously mixed with one-third of the Alcohol, into a percolator, and pour upon it the remainder of the Alcohol. When the liquid has all been absorbed by the powder, pour Diluted Alcohol upon it until a pint of tincture has been obtained. Set this aside in a warm place, and allow it to evaporate spontaneously until reduced to three fluidounces. Continue the percolation with Diluted Alcohol until two pints more of tincture have passed, or until the powder is exhausted; then evaporate this liquid, by means of a water-bath, at a temperature not exceeding 160°, to the consistence of syrup. To this add the three fluidounces of tincture first obtained, and continue the evaporation, at a temperature not exceeding 120°, until the whole is reduced to the proper consistence." *U. S.*

This was a new officinal of the U. S. Pharmacopœia of 1860, though less needed than many others, because the dose of digitalis itself is small; and nothing is gained on the point of equability of strength; as the really active part of digitalis constitutes but a small proportion even of the extract, and might be altogether wanting without observably affecting its bulk. The same caution is used, in preparing this extract, against the injurious effects of heat as in the instance of the extract of conium. The skill, exhibited by the revisers of the Pharmacopœia in the application of the process of percolation to pharmaceutical purposes, is evinced nowhere more strongly than in the directions for preparing extracts, fluid extracts, and oleoresins. The alcoholic extract of digitalis contains all the virtues and may be used for all the purposes of the powdered leaves. According to Messrs. Vielguth and Nentwich, the amount of alcoholic extract obtained from dried digitalis by cold displacement is 27·1 per cent. (See *Am. Journ. of Pharm.*, May, 1859, p. 237.) The dose, therefore, of this extract to begin with should not exceed one-fourth of a grain. W.

EXTRACTUM DULCAMARÆ. *U. S.* *Extract of Bittersweet.*

"Take of Bittersweet, in moderately fine powder, *twelve troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the Bittersweet with four fluidounces of Diluted Alcohol, pack it in a conical percolator, and pour Diluted Alcohol gradually upon it until the tincture passes but slightly impregnated with the properties of the Bittersweet. Distil off the alcohol from the tincture until reduced to one-half; then strain, and, by means of a water-bath, evaporate to the proper consistence." *U. S.*

This preparation is well known on the continent of Europe, but comparatively little used in the United States or Great Britain. The substitution, in the 1860

revision of the Pharmacopœia, of diluted alcohol for water as the menstruum was a decided improvement. The dose is from five to ten grains; but much more may be given with safety. W.

EXTRACTUM GENTIANÆ. *U. S.*, *Br.* *Extract of Gentian.*

"Take of Gentian, in moderately coarse powder, *twelve troyounces;* Water *a sufficient quantity.* Moisten the Gentian with four fluidounces of Water, pack it in a conical percolator, and gradually pour Water upon it until the infusion passes but slightly imbued with the properties of the Gentian. Boil the liquid to three-fourths of its bulk; then strain, and, by means of a water-bath, evaporate to the proper consistence." *U. S.*

"Take of Gentian Root, sliced, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure]. Infuse the Gentian in the Water for two hours, boil for fifteen minutes; pour off, press, and strain. Then evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills." *Br.*

The U. S. plan of percolation with cold water is admirably adapted to the extraction of the active matter of gentian, and even the British method of maceration with hot water is much better than the old method of decoction. By the use of cold water starch and pectic acid are left behind, while any albumen that may be taken up is got rid of by the boiling and straining.

The extract, however, may be advantageously made by macerating the root in two parts of water for thirty-six hours, then expressing in a powerful press, again macerating with additional water, and in like manner expressing, and evaporating the united expressed liquors. MM. Guibourt and Cadet de Vaux obtained by maceration in cold water an extract not only greater in amount, but more transparent, more bitter, and possessing more of the colour and smell of the root than that prepared by decoction. Guibourt attributes this result to the circumstance that, as gentian contains little if any starch, it yields nothing to boiling which it will not also yield to cold water; while decoction favours the combination of a portion of the colouring matter with the lignin. But this opinion requires modification, now that it is understood that gentian contains pectic acid, which water will extract when boiling hot, but not when cold. For observations in relation to the best modes of evaporation in the formation of extracts, the reader is referred to *page* 1165. Gentian, according to Brande, yields half its weight of extract by decoction.

As ordinarily procured, the extract of gentian is nearly inodorous, very bitter, of a dark-brown colour approaching to black, shining, and tenacious. It is frequently used as a tonic, in the form of pill, either alone or in connection with metallic preparations. The dose is from ten to thirty grains. W.

EXTRACTUM HÆMATOXYLI. *U. S.*, *Br.* *Extract of Logwood.*

"Take of Logwood, rasped, *twelve troyounces;* Water *eight pints.* Boil down to four pints, and strain the decoction while hot; then evaporate to dryness." *U. S.*

"Take of Logwood, in fine chips, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure]. Infuse the Logwood in the water for twenty-four hours, then boil down to one-half, strain, and evaporate to dryness by a water-bath, stirring with a wooden spatula. Iron vessels should not be used." *Br.*

This is one of the few instances in which decoction in the preparation of extracts is not considered objectionable. Iron vessels should not be employed in the process, in consequence of the presence of tannic acid. The evaporation should be carried so far that the extract may be dry and brittle when cold. About 20 lbs. of it are obtained from one cwt. of logwood. (*Brande.*) It is of a deep-ruby colour, and an astringent, sweetish taste, and has all the medical virtues of the wood. If given in pills, these should be recently made, as, when long kept, they are said to become so hard as sometimes to pass unchanged through the bowels. The extract, however, is best administered in solution. The dose is from ten to thirty grains. This extract is said to be prepared largely in Yucatan and other parts of Mexico. W.

EXTRACTUM HELLEBORI. *U. S.* EXTRACTUM HELLEBORI ALCOHOLICUM. *U. S.* 1860. *Extract of Black Hellebore.*

"Take of Black Hellebore, recently dried and in fine powder, *twelve troyounces;*

Alcohol *a pint;* Diluted Alcohol *a sufficient quantity.* Introduce the powder, previously mixed with one-third of the Alcohol, into a conical percolator, and pour upon it the remainder of the Alcohol. When the liquid has all been absorbed by the powder, pour on diluted Alcohol until a pint of tincture has been obtained. Set this aside in a warm place, and allow it to evaporate spontaneously until reduced to three fluidounces. Continue the percolation with Diluted Alcohol until two pints more of tincture have passed, or until the powder is exhausted; then evaporate, by means of a water-bath, at a temperature not exceeding 160°, to the consistence of syrup. To this add the three fluidounces of tincture first obtained, and continue the evaporation, at a temperature not exceeding 120°, until the whole is reduced to the proper consistence." *U. S.*

In consequence, probably, of the injurious influence of heat upon black hellebore, the watery extract prepared by decoction is little if at all stronger than the root. The process of percolation with cold spirit was, therefore, adopted in the U. S. Pharmacopœia of 1850, and has been retained with subsequent improvements; and, if proper care be taken to conduct the evaporation at as low a temperature, and with as little exposure to the air as possible, an efficient extract will be obtained. Any resin which may be deposited during the evaporation should be separated from the sides of the vessel, and mixed with the rest. If the hellebore itself be of good quality, the extract will operate as a drastic purge in the dose of from five to ten grains.

The former French Codex contained a process for preparing the extract of hellebore, according to the method of Bacher. Two pounds of the root and half a pound of carbonate of potassium are digested, with a moderate heat, for twelve hours, in eight pounds of alcohol of 22° B.; the tincture is strained with expression; the residuum is again digested with eight pounds of white wine for twenty-four hours; the wine is expressed, and, having stood four hours to settle, is decanted; the liquors are then mixed, and with a gentle heat evaporated to the consistence of an extract. One ounce of this extract, mixed with the same quantity of myrrh, and with ten scruples of the powdered leaves of Centaurea benedicta, and made into pills of one grain each, constitutes the preparation known as the *tonic pills of Bacher*, formerly much used in amenorrhœa and dropsy, and probably not without advantage, especially in the former of these diseases. The dose is from ten to twenty pills during the day. An additional quantity of diluted alcohol might, without disadvantage, be substituted for the wine in the preparation of this extract. W.

EXTRACTUM HYOSCYAMI. *U.S., Br.* *Extract of Hyoscyamus.*

"Take of Hyoscyamus Leaves, fresh, *twelve troyounces.* Bruise the Leaves in a stone mortar, sprinkling on them a little water, and express the juice; then having heated this to the boiling point, strain, and evaporate to the proper consistence." *U. S.*

In the British Pharmacopœia this extract is prepared from "the fresh Leaves and Young Branches of Hyoscyamus" in the same manner precisely as Extract of Aconite. (See *Extractum Aconiti.*)

MM. Solon and Soubeiran have shown that the insoluble matter separated from the expressed juice of henbane by filtering, and that coagulated by heat, are nearly if not quite inert; so that the juice may be usefully clarified before evaporation. (*Amer. Journ. of Pharm.*, viii. 228.) The retention of the chlorophyll, however, as provided for in the British formula, is thought to be advantageous. Extract of Henbane has been chiefly derived from England, but it is at present prepared by Messrs. Tilden & Co., of New York, by the vacuum process. Mr. Brande says that one cwt. of the fresh herb affords between four and five pounds. M. Recluz obtained about one part from sixteen.

The extract is of a dark olive-colour, of a narcotic rather unpleasant odour, and a bitterish, nauseous, slightly saline taste. It retains its softness for a long time; but at the end of three or four years becomes dry, and exhibits, when broken, small crystals of nitrate of potassium and chloride of sodium. (*Recluz.*) Like all the inspissated juices, it is of variable strength, according to its age, the care used in its preparation, and the character of the leaves from which it was procured. (See *Hyoscyamus.*)*

* Much depends on the choice of the leaves; and too little attention is paid to this point. In reference to the biennial plant, there seems to be no doubt that the leaves of the second year are

its use, therefore, it is advisable to begin with a moderate dose, two or three grains for instance, and gradually to increase the quantity till some effect is experienced, and the degree of efficiency of the particular parcel employed is ascertained. It is usually given in pill. It is sometimes used externally for the same purpose as extract of belladonna.

Off. Prep. Pilula Colocynthidis et Hyoscyami, *Br.* W.

EXTRACTUM HYOSCYAMI ALCOHOLICUM. *U.S. Alcoholic Extract of Hyoscyamus.*

"Take of Hyoscyamus Leaves, recently dried and in moderately fine powder, *twenty-four troyounces;* Alcohol *four pints;* Water *two pints;* Diluted Alcohol *a sufficient quantity.* Mix the Alcohol and Water, and moisten the powder with a pint of the mixture; then pack it firmly in a conical percolator, and gradually pour upon it the remainder of the mixture. Continue the percolation with Diluted Alcohol until the tincture measures six pints. Lastly, evaporate this, by means of a water-bath, to the proper consistence." *U.S.*

The alcoholic extract of henbane, if prepared from recently dried leaves, is thought to be more uniform and powerful than the inspissated juice or common extract. It is one of the preparations of the French Codex. The dose is one or two grains, to be gradually increased until its effects are obtained. W.

EXTRACTUM IGNATIÆ. *U.S.* EXTRACTUM IGNATIÆ ALCOHOLICUM. *U.S.* 1860. *Extract of Ignatia. Alcoholic Extract of Ignatia.*

"Take of Ignatia, in fine powder, *twelve troyounces;* Alcohol *a sufficient quantity.* Mix the Ignatia with four fluidounces of Alcohol, and allow the mixture to stand for an hour. Then introduce it into a cylindrical percolator, press it firmly, and gradually pour Alcohol upon it until three pints of tincture have slowly passed. Distil off the Alcohol, by means of a water-bath, until the tincture is reduced to half a pint, and evaporate this to the proper consistence." *U.S.*

This was introduced into the U. S. Pharmacopœia in 1860, not so much because the preparation is needed; for it is essentially the same in remedial properties and applications as the extract of nux vomica; as in order to give due officinal sanction to a preparation already in popular use, and, by regulating it duly, to prevent serious consequences from so powerful a medicine.* For the uses of the extract the reader is referred to the article on Ignatia in *Part* I. The dose is from half a grain to three times that quantity, to be repeated three times a day until its effects begin to be experienced. W.

EXTRACTUM JALAPÆ. *U.S., Br. Extract of Jalap.*

"Take of Jalap, in moderately fine powder, *twelve troyounces;* Alcohol *four pints;* Water *a sufficient quantity.* Introduce the powder, previously mixed with three fluidounces of Alcohol, into a conical percolator, and gradually pour upon it the remainder of the Alcohol. When the liquid ceases to pass, pour upon the residue suffi-

much more efficacious than those of the first, and should, therefore, always be selected. It is stated under Hyoscyamus, in the first part of this work, that the leaves should be gathered soon after the plant has flowered. Mr. Charles Cracknell gives more particular directions. He thinks that the plant is in a fit state for collection only during a very short period; when the flowers at the top are blown, but have not yet begun to fade, and the seed-vessels and seeds which have been formed are still soft and juicy. For other observations on the preparation of this extract, see a paper by Mr. Cracknell, in the *Am. Journ. of Pharm.* (xxiii. 245), from the *Pharm. Journ.*, March, 1851.

An important contribution to our knowledge, as to the proper choice of the parts of this plant to be expressed, has been made by Mr. T. B. Groves, of England. Whatever may be the case with those plants, such as aconite, the roots of which are active, and in which the juice, containing the active matter, on its way from the leaves to the root, might be supposed to exist in the young stems, this does not appear to be the case with the Hyoscyamus; and, accordingly, an extract obtained by inspissating the juice of the stems was found altogether inferior to another obtained in like manner from the leaves, being not only less in amount, but less bitter and odorous, and more saline, showing that it contained more of the ordinary salts of the plant, and less of its active matter. (*Pharm. Journ.*, Jan. 1862, p. 376.)—*Note to the tenth and twelfth editions.*

* According to Prof. Procter, a portion of fixed oil is extracted by the alcohol, which separates when the concentrated tincture is allowed to stand, and, being in itself inert, might be rejected with advantage, care being taken to wash it first with weak alcohol, and add the washings to the liquid. The same result does not happen when diluted alcohol is used as the menstruum; as this does not take up the oil.

cient water to keep its surface covered, until four pints of tincture have passed. Set this portion aside, and continue the percolation until six pints of infusion have been obtained. Distil off the alcohol from the tincture, and evaporate the infusion until the liquids respectively have been brought to the consistence of thin honey; then mix them, and evaporate to the proper consistence." *U. S.*

"Take of Jalap, in coarse powder, *one pound* [avoirdupois]; Rectified Spirit *four pints* [Imperial measure]; Distilled Water *one gallon* [Imp. meas.]. Macerate the Jalap in the Spirit for seven days; press out the tincture, then filter, and distil off the Spirit, leaving a soft extract. Again macerate the residual Jalap in the Water for four hours, express, strain through flannel, and evaporate by a water-bath to a soft extract. Mix the two extracts, and evaporate, at a temperature not exceeding 140°, until it has acquired a suitable consistence for forming pills." *Br.*

Jalap contains a considerable quantity of starch, which is extracted by decoction, but left behind by cold water; and, as this principle serves only to impede the filtration or straining, and augment the bulk of the extract, without adding to its virtues, cold water is very properly used in both the *U. S.* and *Br.* processes. The use both of alcohol and water has been deemed necessary, in order to extract all the medicinal qualities of the drug; and they are employed successively, under the impression that the previous removal of the resin by the former facilitates the action of the latter.* The use of percolation, as directed by the U. S. Pharmacopœia, enables the cold water to extract the soluble parts without the long maceration which would otherwise be necessary. According to Cadet de Gassicourt, water at ordinary temperatures, and in the old mode, acts so slowly, that fermentation takes place before the active matter is all dissolved. Hence, if the extract be prepared without percolation, the residuum, after the tincture has been decanted, should be digested with water at a heat of about 90° or 100° F., which, while it is insufficient for the solution of the starch, enables the solvent to take up the active matter with sufficient rapidity.

One cwt. of jalap affords, according to Mr. Brande, about fifty pounds of aqueous extract and fifteen of resin. The product of the former is somewhat less by infusion than decoction; and the extract is proportionably stronger.

There is reason to believe, as we have been informed on good authority, that what is sold for extract of jalap is sometimes prepared from tubers which had been previously exhausted of their resin by alcohol; and a spurious substance has been offered in considerable quantities in our markets for extract of jalap, which, on examination by Messrs. Ch. Bullock and Ed. Parrish, proved to owe its purgative property to 42 per cent. of gamboge. (*Am. Journ. of Pharm.*, March, 1862, p. 113.)

Extract of jalap is of a dark-brown colour, slightly translucent at the edges, and tenacious when not perfectly dry. It contains the resin and gummy extractive, and, consequently, has all the medical properties of the root; but it is not often exhibited alone, being chiefly used as an ingredient of purgative pills, for which it is adapted by its comparatively small bulk. It is most conveniently kept for use in the form of powder, which, however, is apt to attract moisture and to aggregate into a solid mass, unless carefully excluded from the air. The dose is from ten to twenty grains, or rather more than half that of jalap.†

Off. Prep. Pilulæ Catharticæ Compositæ, *U. S.* W.

* Mr. A. B. Taylor has satisfactorily determined that the substance which water will extract from jalap, previously exhausted by alcohol, has no observable influence on the system; having taken 240 grains of the matter thus extracted without effect. (*Proceedings of the Am. Pharm. Association*, A. D. 1864, p. 215.) But it does not follow that this material is useless in the extract; for it is highly probable that the irritant properties of the resin, which is the real purgative principle of jalap, are so mechanically modified by association with the gum in the root as to render jalap a less irritant cathartic than its extracted resin; and that consequently the present hydro-alcoholic extract, representing the root as it does in this respect, while not less energetic, in proportional doses, as a purgative than the resin, is less apt to provoke irritation of the alimentary mucous membrane. (*Note to the thirteenth edition.*)

† *Fluid Extract of Jalap.* The following process has been proposed by Prof. Procter. Take of jalap, in coarse powder, ℥xvi; sugar ℥viij; carbonate of potassium ℥ss; alcohol, water, each, *q. s.* Add to the jalap one pint of a mixture consisting of two parts of alcohol and one of water, and set aside for twenty-four hours. Then put the mixture into a percolator, and pour on it diluted alcohol until half a gallon has passed. Evaporate the filtered liquid one-half, add the sugar and carbonate of potassium, and evaporate to 12 fluidounces. Put the liquid, while warm, into a pint

EXTRACTUM JUGLANDIS. *U. S. Extract of Butternut.*

"Take of Butternut, in moderately coarse powder, *twelve troyounces;* Water *a sufficient quantity.* Moisten the Butternut with four fluidounces of Water, pack it in a conical percolator, and gradually pour Water upon it until the infusion passes but slightly imbued with the properties of the Butternut. Boil the liquid to three-fourths of its bulk; then strain, and, by means of a water-bath, evaporate to the proper consistence." *U. S.*

This extract was formerly for the most part prepared by the country people, who are said to have used the bark of the branches and even the branches themselves, instead of the inner bark of the root; and to have injured the preparation by too much heat. That it should have proved uncertain in the hands of many physicians is, therefore, not a matter of surprise. It should be prepared by the apothecary, and from the inner bark of the root gathered in May or June. Experiments are yet wanting to prove that water is the best solvent of the active principles of this bark. Prof. Procter informed us that he found an extract of the fresh bark prepared with diluted alcohol to have much more of the pungency of the bark than the officinal.

The extract of butternut is of a black colour, sweetish odour, and bitter astringent taste. In the dose of twenty or thirty grains, it acts as a mild cathartic. (See *Juglans.*)

W.

EXTRACTUM KRAMERIÆ. *U. S., Br. Extract of Rhatany.*

"Take of Rhatany, in moderately fine powder, *twelve troyounces;* Water *a sufficient quantity.* Moisten the powder with four fluidounces of Water, pack it in a conical percolator, and gradually pour Water upon it until the infusion passes but slightly imbued with the astringency of the Rhatany. Heat the liquid to the boiling point, strain, and, by means of a water-bath, at a temperature not exceeding 160°, evaporate to the proper consistence." *U. S.*

"Take of Rhatany Root, in coarse powder, *one pound* [avoirdupois]; Distilled Water *a sufficiency.* Macerate the Rhatany in a pint and a half [Imperial measure] of the Water for twenty-four hours; then pack in a percolator, and add more Distilled Water, until twelve pints [Imp. meas.] have been collected, or the Rhatany is exhausted. Evaporate the liquor by a water-bath to dryness." *Br.*

In selecting a plan for the preparation of this extract, it was undoubtedly wise to adopt the mode of displacement, with cold water as the menstruum. It is absolutely necessary to the success of the process, that the root should be well and uniformly comminuted; and the "moderately fine powder" of the U. S. Pharmacopœia is, therefore, preferable to the "coarse powder" of the British. The wood of the root yielded to Prof. Procter only 6·8 per cent. of extract, while the bark separated from the wood yielded 33 per cent. As the wood is of difficult pulverization, the inference is obvious, that, in powdering the roots, the ligneous portion may be rejected with advantage. (*Am. Journ. of Pharm.*, xiv. 270.) As a prolonged exposure of the infusion to the air is attended with the absorption of oxygen, and the production of insoluble apotheme, it is desirable that the evaporation should be conducted rapidly or in a vacuum. There scarcely appears to be occasion, in the case of rhatany, for heating and filtering the infusion before evaporation, the only use of which is to get rid of albumen, which is not among the recognised ingredients of the root.

Very inferior extracts of rhatany are often sold. Such is the South American extract, which has been occasionally imported. As the product obtained by decoction is greater than that afforded by the officinal plan, the temptation to substitute the former is not always resisted, although it has been shown to contain nearly 50 per cent. of insoluble matter. Some druggists prepare the extract with an alcoholic menstruum, with a view to the greater product; but the extract thus prepared has from 20 to 30 per cent. less of the active principle than the officinal. A substance has been shown to us, said to have been imported as extract of rhatany from Europe, which was nearly tasteless, and was plausibly conjectured to be the dried coagulated

bottle, add four fluidounces of alcohol, and mix. The carbonate of potassium renders the resin soluble in water, and probably favourably qualifies the irritating properties of the jalap. A fluidrachm of this extract would represent a drachm of jalap, so that the dose should be from 15 to 30 minims. (*Am. Journ. of Pharm.*, xxix. 108.)—*Note to the eleventh edition.*

matter of old tincture of kino. Indeed, we are informed that very little of the genuine extract, prepared according to the officinal directions, is to be found in the shops. From a notice by Prof. Procter in the *Am. Journ. of Pharm.* (May, 1862, p. 209), it would appear that the rhatany now imported is much inferior to that formerly in use, having a larger proportion of wood, and yielding much less extract; and a specimen carefully manipulated by himself, gave but 9·14 per cent.

Extract of rhatany should have a reddish-brown colour, a smooth shining fracture, and a very astringent taste; and should be almost entirely soluble in water. Its virtues may be considered as in proportion to its solubility. It is much used for all the purposes for which the astringent extracts are employed. The dose is from ten to twenty grains. W.

EXTRACTUM LACTUCÆ. *Br. Extract of Lettuce.*

In the British Pharmacopœia, this extract is prepared from "the Flowering Herb of Lettuce," in the same manner precisely as Extract of Aconite. (See *Extractum Aconiti.*) For the medical properties and uses of extract of lettuce the reader is referred to the article on Lettuce in *Part* I. The dose is from five to fifteen grains. W.

EXTRACTUM LUPULI. *Br. Extract of Hop.*

"Take of Hop *one pound* [avoirdupois]; Rectified Spirit *one pint and a half* [Imperial measure]; Distilled Water *one gallon* [Imp. meas.]. Macerate the Hop in the Spirit for seven days; press out the tincture, filter, and distil off the spirit, leaving a soft extract. Boil the residual Hop with the Water for one hour, press out the liquor, strain, and evaporate by a water-bath to the consistence of a soft extract. Mix the two extracts, and evaporate at a temperature not exceeding 140° until it has acquired a suitable consistence for forming pills." *Br.*

This is a great improvement on the old Lond. and Ed. process by maceration with water and evaporation. Alcohol is necessary for the exhaustion of the hop, and very cautious evaporation, to preserve the aroma in the extract. But since the discovery of the fact that the active properties of hops reside chiefly in the lupulin, the extract has been to a great extent superseded by that substance in this country, and has been little used. Lupulin may be advantageously substituted for it in all cases in which it was formerly employed. Mr. Brande says that the average yield of one cwt. of hops is 40 lbs. of the extract. The dose is from ten to thirty grains.

Under the inappropriate name of *humuline*, an extract has been prepared by first treating hops with alcohol and subsequently with water, evaporating the tincture and infusion separately, and mixing the products. (*Pharm. Journ.*, xiii. 231.) W.

EXTRACTUM MEZEREI ÆTHEREUM. *Br. Ethereal Extract of Mezereon.*

"Take of Mezereon Bark, cut small, *one pound* [avoirdupois]; *Rectified Spirit eight pints* [Imperial measure]; Ether *one pint* [Imp. meas.]. Macerate the Mezereon in six pints of the Spirit for three days, with frequent agitation; strain and press. To the residue of the Mezereon add the remainder of the Spirit, and again macerate for three days, with frequent agitation; strain and press. Mix and filter the strained liquors; recover the greater part of the Spirit by distillation, evaporate what remains to the consistence of a soft extract; put this into a stopped bottle with the Ether, and macerate for twenty-four hours, shaking them frequently. Decant the ethereal solution; recover part of the Ether by distillation, and evaporate what remains to the consistence of a soft extract." *Br.*

This is the process of the present French Codex, with slight modifications, which do not affect the result. In the Codex the mezereon is exhausted by means of percolation, instead of by a double maceration; and in this respect the process is, we think, preferable, in the hands of a skilful operator. With those not experienced in percolation, it may be better to follow the British Pharmacopœia.

By the method of proceeding in the preparation of this extract the irritating properties of mezereon are concentrated in a small bulk; all the ingredients of the bark not soluble both in alcohol and in ether being excluded. For external use this is probably desirable; and the extract is therefore chiefly useful as an external irritant; for which purpose it is brought into the state of an ointment, as in the French "*pom-*

made epispastique au garou," or used in liniments, as in the British "*compound liniment of mustard.*" The French "pommade," which might properly be designated as *Unguentum Mezerei*, or *Ointment of Mezereon*, is prepared in the following manner.

"Take of Ethereal Extract of Mezereon *forty parts;* Lard *nine hundred parts;* White Wax *one hundred parts;* Alcohol *ninety parts.* Dissolve the Extract in the Alcohol, add the Lard and Wax, and heat moderately, with continual agitation, until the alcohol is evaporated. Pass through linen; pour into a pot, and shake until the ointment is partly cooled." (*Fr. Codex.*)

The object of this preparation is to act as an irritant agent, and especially as a dressing for issues and blistered surfaces to keep them open. For this purpose it is preferable to the ointment of cantharides, in all cases in which the latter is disposed to cause strangury. Such a preparation is much needed; and in the U. S. Pharmacopœia is found in the fluid extract.

Off. Prep. Linimentum Sinapis Compositum, *Br.* W.

EXTRACTUM NUCIS VOMICÆ. *U. S.*, *Br.* Extractum Nucis Vomicæ Alcoholicum. *U. S.* 1860. *Extract of Nux Vomica.*

"Take of Nux Vomica, in fine powder, *twelve troyounces;* Alcohol *a sufficient quantity.* Mix the Nux Vomica with four fluidounces of Alcohol, and allow the mixture to stand for an hour. Then introduce it into a cylindrical percolator, and gradually pour Alcohol upon it until the tincture passes without bitterness. Distil off the Alcohol by means of a water-bath, until the tincture is reduced to half a pint, and evaporate this to the proper consistence." *U. S.*

"Take of Nux Vomica *one pound* [avoirdupois]; Rectified Spirit *a sufficiency.* Apply steam to the Nux Vomica until it is thoroughly softened, then dry rapidly, and reduce the fine powder. Exhaust the powder by boiling it with successive portions of the Spirit until the latter comes off nearly free from bitterness. Strain, distil off the spirit and evaporate by a water-bath to the consistence of a soft extract." *Br.*

In both the U. S. and Br. Pharmacopœias the nux vomica is directed in fine powder; but in the latter only are we told how to reduce it to that state. Another method, formerly employed by the Ed. College, was to grind it in a coffee-mill. The method of percolation in the U. S. process is preferable to that of decoction in the British, for exhausting the drug. This is one of the few instances in which the U. S. Pharmacopœia deems a preliminary maceration advisable. It is said that, when the extract is kept in powder, it is apt to agglutinate into a tough mass. According to Zippel, this may be prevented by adding a little water before the close of the evaporation, and then continuing the evaporation to dryness. (*Arch. der Pharm.*, July 24, 1859.)

This extract is an active preparation, though not always of uniform strength, owing to the variable proportion of strychnia in the nux vomica. M. Recluz obtained from sixteen ounces of nux vomica the average product of one ounce and a quarter. The dose of the extract is from half a grain to two grains, to be repeated three times a day.* W.

EXTRACTUM OPII. *U. S.*, *Br.* *Extract of Opium.*

"Take of Opium *twelve troyounces;* Water *five pints.* Cut the Opium into small pieces, macerate it for twenty-four hours in a pint of the Water, and reduce it to a soft mass by trituration. Express the liquid, and treat the residue with each of the four remaining pints of water successively in the same manner. Having mixed the liquids, filter the mixture, and evaporate, by means of a water-bath, to the proper consistence." *U. S.*

"Take of Opium, in thin slices, *one pound* [avoirdupois]; Distilled Water *six pints* [Imperial measure]. Macerate the Opium in two pints of the water for twenty-

* Professor Procter informs us, as the result of his own observation, that in the alcoholic extract of nux vomica there is a considerable proportion of fixed oil (℥iij in ℥xvi of the seeds), which will not remain mixed with the other ingredients, becoming fluid in summer, and concreting in cold weather. This he thinks should be separated from the extract, and shaken with a little diluted alcohol, which takes from it any adhering active matter. The washings should be evaporated, and the residuum mixed with the extract, the fatty matter being thrown away. (*Note to the tenth edition.*)

four hours, and express the liquor. Reduce the residue of the Opium to a uniform pulp, macerate it again in two pints of the Water for twenty-four hours, and express. Repeat the operation a third time. Mix the liquors, strain through flannel, and evaporate by a water-bath until the extract has acquired a suitable consistence for forming pills." *Br.*

These processes are essentially the same. An advantage of the preparation is that, by the solubility of the extract in water, it affords a convenient method of obtaining quickly an aqueous solution of the active ingredients of opium. It is exceedingly doubtful whether anything is left behind after the opium has been exhausted by water, which materially modifies the action of its anodyne principle; and the extract probably has no advantage on this account over opium. Nor has it the advantage of greater uniformity; as the gum, extractive, &c., taken up by the water, bear no fixed proportion to the active ingredients. But, as purely aqueous preparations of opium have been found to agree better with certain individuals than opium alone or its alcoholic preparations, there is reason to believe that there are in the crude drug one or more principles, capable of causing nausea, headache, nervous disturbance, &c., which are insoluble in water, though extracted by alcohol or ether. M. Guibourt states that this extract, when kept, is apt to swell up, owing, as he at first supposed, to the fermentation of glucose; but he now ascribes the phenomenon to the change of meconic acid into the parameconic, with the escape of carbonic acid. (*Journ. de Pharm.*, Août, 1860, p. 138.)

Denarcotized Extract of Opium. Under the impression that the stimulating and unpleasant effects of opium are owing to the narcotina, it has been proposed to separate that principle by treating the extract with ether, which dissolves the narcotina, and leaves the morphia with the other ingredients. Robiquet employed cold ether; but M. Dublanc, convinced that the whole of the narcotina was not thus extracted, proposed the following plan. "Take of watery extract of opium 16 ounces; dissolve it in 8 ounces of distilled water; introduce the solution into the water-bath of a still; pour upon it 104 ounces of pure ether; distil off 24 ounces of the ether; take apart the apparatus, and decant the ether which floats on the top of the extract; wash the latter while hot with the distilled ether; concentrate the residual matter, dissolve it in distilled water, filter the solution, and evaporate to a proper consistence." It is doubtful whether any useful end is gained by this operation commensurate with its costliness; as there is reason to think that narcotina does not in fact produce the unpleasant effects which have been ascribed to it; and the noxious principles in opium, of which ether is capable of depriving it, are probably left behind, for the most part at least, in the formation of the aqueous extract.

Recluz obtained from sixteen ounces of opium an average product of nine ounces by hot water and six by cold; and Prof. Procter informs us that the U. S. formula usually yields about seven and a half ounces from the same quantity. The dose of the extract of opium is about one-half that of opium itself.

Off. Prep. Emplastrum Opii, *U. S.;* Extractum Opii Liquidum, *Br.;* Suppositoria Opii, *U. S.;* Suppositoria Plumbi et Opii, *U. S.;* Trochisci Opii, *Br.;* Vinum Opii, *Br.* W.

EXTRACTUM PAPAVERIS. *Br.* *Extract of Poppies.*

"Take of Poppy Capsules, dried, freed from the seeds, and coarsely powdered, *one pound* [avoirdupois]; Rectified Spirit *two ounces* [avoird.]; Boiling Distilled Water *a sufficiency.* Mix the Poppy Capsules with two pints [Imperial measure] of the Water, and infuse for twenty-four hours, stirring them frequently; then pack them in a percolator, and, adding more of the Water, allow the liquid slowly to pass until about a gallon [Imp. meas.] has been collected, or the Poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to a pint [Imp. meas.], and, when cold, add the Spirit. Let the mixture stand for twenty-four hours; then separate the clear liquor by filtration, and evaporate this by a water-bath, until the extract has acquired a suitable consistence for forming pills." *Br.*

The Extract of Poppy Capsules was an officinal of the Lond. and Edin. Colleges, but was abandoned in the formation of the first British Pharmacopœia. It has, however, been introduced into the present edition of that work, though with a process

somewhat modified. The London Pharmacopœia merely directed the maceration of the capsules in hot water, boiling down and straining, and then evaporating to a proper consistence. Mr. Brande observed, in relation to the extract thus made, that, if boiled over an open fire, it is often nearly inert. He stated, moreover, that it was apt to have a troublesome consistence, being too hard to be formed into pills, and too tough to be pulverized. It was, we presume, in reference to these objections that the present modifications of the old method were adopted. Decoction has been superseded by maceration and percolation, and evaporation by the water-bath is directed in order to avoid an excessive heat. The addition of the spirit is probably intended to produce coagulation of the albumen, which was effected by heat in the former process. The present formula is no doubt a great improvement upon that of the colleges.

According to Brande, one cwt. of the capsules without the seeds yields the average product of 35 pounds of extract. Mr. Jos. Ince, in reference to the London process, recommends that the strained hot decoction, after having been brought by evaporation to a syrupy consistence, should be diluted with eight times its bulk of water, then filtered, and ultimately evaporated. In this way substances which had become insoluble in the evaporation were separated. Thus made, the extract will keep well. (*Pharm. Journ.*, xiv. 489.) M. Meurein gives particular directions for making an alcoholic extract of poppy capsules, which may be consulted with advantage by those who may be called on to supply any demand for this preparation. (See *Journ. de Pharm.*, 3e sér., xxiii. 341.) We are told that an extract is prepared in this country from the whole herb, cut after the fruit has formed, but while it is still green. The capsules exclusively should be used; and the best time for collecting them is immediately after they have begun to become yellowish. The extract possesses the virtues of opium, but is greatly inferior, and less uniform in strength. The dose is from five to ten grains. W.

EXTRACTUM PAREIRÆ. *Br.* *Extract of Pareira.*

"Take of Pareira Root, in coarse powder, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure], or *a sufficiency*. Digest the Pareira with a pint [Imp. meas.] of the Water for twenty-four hours, then pack in a percolator, and, adding more of the Water, allow the liquor slowly to pass until a gallon [Imp. meas.] has been collected, or the Pareira is exhausted. Evaporate the liquor by a water-bath until the extract has acquired a suitable consistence for forming pills." *Br.*

Like the preceding extract, this was formerly directed by the London and Edinburgh Colleges, was omitted in the first British Pharmacopœia, and has been adopted again in the present edition. By the formula of the London College, it was prepared by boiling the root in water, straining while hot, and then evaporating to dryness. The British Pharmacopœia more wisely exhausts the root by percolation, and evaporates by a water-bath, thus avoiding the bad effects of long-continued heat. The dose is from ten to thirty grains. W.

EXTRACTUM PHYSOSTIGMATIS. *U. S.*, *Br.* *Extract of Calabar Bean.*

"Take of Calabar Bean, in moderately fine powder, *twelve troyounces;* Alcohol *a sufficient quantity*. Moisten the powder with four fluidounces of Alcohol, pack it in a conical percolator, and pour on half a pint of Alcohol. Cork and closely cover the percolator, and set it aside in a moderately warm place, for four days. Then, having removed the cork, proceed with the percolation, and gradually pour on Alcohol, until two pints of tincture have been obtained, or the Bean has been exhausted. Distil off a pint and a half of alcohol from the tincture, and evaporate the remainder, by means of a water-bath, to the consistence of a soft extract." *U. S.*

"Take of Calabar Bean, in coarse powder, *one pound* [avoirdupois]; Rectified Spirit *four pints* [Imperial measure]. Macerate the Bean for forty-eight hours with one pint [Imp. meas.] of the Spirit in a close vessel, agitating occasionally, then transfer to a percolator, and, when the fluid ceases to pass, add the remainder of the Spirit so that it may slowly percolate through the powder. Subject the residue of the Bean to pressure, adding the pressed liquor to the product of the percolation;

filter, distil off most of the Spirit, and evaporate what is left in the retort by a water-bath to the consistence of a soft extract." *Br.*

As alcohol is a much better solvent than water of the active principles of the bean, it is preferred in making the extract. For the uses of the extract, see *Physostigmatis Faba* in *Part* I. (page 702). The dose for internal use is from one-sixteenth to one-sixth of a grain. W.

EXTRACTUM PODOPHYLLI. *U. S. Extract of May-apple.*

"Take of May-apple, in moderately fine powder, *twelve troyounces;* Alcohol *two pints;* Diluted Alcohol *a sufficient quantity.* Introduce the powder, previously mixed with three fluidounces of Alcohol, into a conical percolator, and pour upon it the remainder of the Alcohol. When the tincture ceases to pass, pour gradually upon the powder sufficient Diluted Alcohol to keep its surface covered, until two pints of tincture have passed. Set this portion aside, and continue the percolation until two more pints of infusion have been obtained. Distil off the alcohol from the tinctures, and evaporate them, until the liquids respectively have been brought to the consistence of thin honey; then mix them, and evaporate to the proper consistence." *U. S.*

This is possessed of the purgative properties of the root, and may be given in the dose of from five to fifteen grains. It might be substituted in all cases for the extract of jalap.

From experiments made by Mr. John R. Lewis, it is probable that the alcoholic extract would be much more powerful as a purgative than the officinal preparation; but it does not follow that it would be more serviceable. (See *Am. Journ. of Pharm.*, xix. 170.) W.

EXTRACTUM QUASSLÆ. *U. S., Br. Extract of Quassia.*

"Take of Quassia, in moderately fine powder, *twelve troyounces;* Water *a sufficient quantity.* Moisten the Quassia with four fluidounces of Water, pack it in a conical percolator, and gradually pour Water upon it until the infusion passes but slightly impregnated with the properties of the Quassia. Boil down the liquid to three-fourths of its bulk; then strain, and, by means of a water-bath, evaporate to the proper consistence." *U. S.*

"Take of Quassia Wood, rasped, *one pound* [avoirdupois]; Distilled Water *a sufficiency.* Macerate the Quassia with eight fluidounces of the Water for twelve hours; then pack in a percolator, and adding more of the Water allow the liquor slowly to pass until the Quassia is exhausted. Evaporate the liquor; filter before it becomes too thick; and again evaporate by a water-bath until the extract is of a suitable consistence for forming pills." *Br.*

According to M. Recluz, sixteen ounces of Quassia yield by infusion in water seven drachms of extract; by maceration in alcohol of 19° Baumé, two ounces five drachms and a half. The difference between these quantities is so great that we suspect some mistake in the table of the Dictionnaire des Drogurs from which we quote.

The extract of quassia is dark-brown or black, and excessively bitter. It is apt to become dry and disposed to crumble by time. It concentrates a greater amount of tonic power within a given weight than any other extract of the simple bitters; and may, therefore, be given with great advantage in cases in which it is desirable to administer this class of substances in as small a bulk, and with as little inconvenience to the patient as possible. The dose is about three grains, to be given in the form of pill. W.

EXTRACTUM RHEI. *Br.* EXTRACTUM RHEI ALCOHOLICUM. *U. S.* 1860. *Alcoholic Extract of Rhubarb. Extract of Rhubarb.*

"Take of Rhubarb, in moderately fine powder, *twelve troyounces;* Alcohol *a pint;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with four fluidounces of the Alcohol, pack it in a conical percolator, and gradually pour upon it, first the remainder of the Alcohol, and afterwards Diluted Alcohol, until twelve fluidounces of tincture have been obtained. Set this aside in a warm place, and allow it to evaporate spontaneously until reduced to six fluidounces. Continue the percolation with Diluted Alcohol until the tincture passes nearly tasteless. Evaporate this in a

porcelain vessel, by means of a water-bath, at a temperature not exceeding 160°, to the consistence of syrup. With this mix the tincture first obtained, and continue the evaporation until the mixture is reduced to the proper consistence." *U. S.*

"Take of Rhubarb Root, sliced or bruised, *one pound* [avoirdupois]; Rectified Spirit *ten fluidounces* [Imperial measure]; Distilled Water *five pints* [Imp. meas.]. Mix the Spirit and the Water, and macerate the Rhubarb in the mixture for four days; then decant, press, and set by that the undissolved matter may subside; pour off the clear liquor, filter the remainder, mix the liquors, and evaporate by a water-bath, at a temperature not exceeding 160°, until the extract has acquired a suitable consistence for forming pills." *Br.*

Rhubarb yields all its active matter to water and alcohol; but, unless the evaporation is performed with great care and with a moderate heat, it is certain that the purgative principle is, to a greater or less extent, injured or dissipated in the process; and the extract may thus become even less efficient than the root. Among other consequences which result from the boiling temperature, is the formation of a compound of the tannin and starch, which is insoluble in cold water, and upon its precipitation probably carries with it a portion of the purgative principle. There is, moreover, reason to believe that this principle is volatilizable by heat, and that a portion of it escapes with the vapour. When properly prepared, the extract has decidedly the peculiar odour of rhubarb. The dose of the extract is from ten to thirty grains. W.

EXTRACTUM SENEGÆ. *U. S.* EXTRACTUM SENEGÆ ALCOHOLICUM. *U. S.* 1860. *Alcoholic Extract of Seneka.*

"Take of Seneka, in moderately fine powder, *twelve troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with four fluidounces of Diluted Alcohol, pack it in a conical percolator, and gradually pour upon it Diluted Alcohol until three pints of tincture have passed. Evaporate this, by means of a water-bath, to the proper consistence." *U. S.*

This is a good preparation of Seneka, possessing all its virtues in a concentrated form. For its uses, see *Senega* in *Part* I. The dose is from one to three grains. W.

EXTRACTUM STRAMONII FOLIORUM. *U. S.* EXTRACTUM STRAMONII ALCOHOLICUM. *U. S.* 1860. *Extract of Stramonium Leaves.**

"Take of Stramonium Leaves, recently dried and in fine powder, *twelve troyounces;* Alcohol *a pint;* Diluted Alcohol *a sufficient quantity.* Introduce the powder, previously mixed with one-third of the Alcohol, into a conical percolator, and gradually pour upon it the remainder of the Alcohol. When the liquid has all been absorbed by the powder, pour on Diluted Alcohol until a pint of tincture has been obtained. Set this aside in a warm place, and allow it to evaporate spontaneously until reduced to three fluidounces. Continue the percolation with Diluted Alcohol until two pints more of tincture have passed, or until the powder is exhausted; then evaporate, by means of a water-bath, at a temperature not exceeding 160°, to the consistence of syrup. With this mix the three fluidounces of tincture first obtained, and continue the evaporation, at a temperature not exceeding 120°, until the mixture is reduced to the proper consistence." *U. S.*

The dose of this extract is a grain. W.

* The fresh juice extract of stramonium was very properly abandoned at the last revision of the Pharmacopœia as uncertain in its strength. The following is the article about it in the previous edition of the U. S. Dispensatory.

"Take of Stramonium Leaf *twelve troyounces.* Bruise it in a stone mortar, sprinkling on it a little water, and express the juice; then, having heated this to the boiling point, strain, and evaporate, at a temperature not exceeding 160°, to the proper consistence." *U. S.*

Like all the other inspissated narcotic juices, this is an uncertain preparation, varying in strength according to the care used in conducting the process, and the season at which the leaves are collected. The reader will find at *page* 1170, and in the preliminary observations on the Extracts, some general rules which will prove useful in conducting this process. The insoluble matter separated from the expressed juice by filtering, and that coagulated by heat, may be advantageously rejected; as, according to the observations of MM. Solon and Soubeiran, they are nearly or quite inert. This is done in the present process, which, as well in this respect as in directing the temperature not to exceed 160°, is an improvement of the old one. M. Recluz obtained half an ounce of extract from sixteen ounces of the leaves. The dose is a grain night and morning, to be gradually increased till it affects the system. (*Note to the fourteenth edition.*) W.

EXTRACTUM STRAMONII SEMINIS. *U. S.* EXTRACTUM STRAMONII. *Br.* *Extract of Stramonium Seed.*

"Take of Stromonium Seed, in moderately fine powder, *sixteen troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the Stramonium Seed with four fluidounces of Diluted Alcohol, pack it in a conical percolator, and pour on twelve fluidounces of Diluted Alcohol. When the liquid begins to pass from the percolator, close the lower orifice with a cork, and, having closely covered the percolator, set it aside in a moderately warm place for four days. Then remove the cork, and gradually pour on Diluted Alcohol until two pints of tincture have been obtained, or until the tincture passes but slightly imbued with the properties of the Stramonium. Distil off the alcohol from the tincture, and, by means of a water-bath, evaporate to the proper consistence." *U. S.*

"Take of Stramonium Seeds, in coarse powder, *one pound* [avoirdupois]; Ether *one pint* [Imperial measure], or *a sufficiency;* Distilled Water, Proof Spirit, of each, *a sufficiency.* Shake the Ether in a bottle with half a pint of the Water, and after separation decant the Ether. Pack the Stramonium in a percolator, and free it from its oil by passing the washed Ether slowly through it. Having removed and rejected the ethereal solution, pour the Spirit over the residue of the Stramonium in the percolator and allow it to pass through slowly until the powder is exhausted. Distil off most of the Spirit from the tincture, and evaporate the residue by a water-bath until the extract has acquired a suitable consistence for forming pills." *Br.*

This preparation was omitted from the U. S. Pharmacopœia of 1860, but, in accordance with suggestions made in the U. S. Dispensatory, was reinstated at the last revision. It is an excellent preparation, not only stronger, but more uniform, and therefore more to be relied on than any other officinal extract of stramonium. As the seeds yield their virtues more freely to spirit than to water alone, the Pharmacopœias have very properly adopted proof spirit as the menstruum. The use of the ether is to separate inert fatty matter, and consequently to make the extract stronger than when prepared according to the Br. process of 1864, in which ether was not used; and the ether is washed, in order to separate any alcohol contained in it, which might dissolve the active matter. According to the table of Recluz, sixteen ounces of the seed afford two ounces and two drachms of extract by maceration in diluted alcohol, and one ounce and a half by decoction. The dose to begin with is the quarter or half of a grain, twice a day, to be gradually increased.

Off. Prep. Unguentum Stramonii, *U. S.* W.

EXTRACTUM TARAXACI. *U. S., Br.* *Extract of Dandelion.*

"Take of Dandelion, gathered in September, *sixty troyounces.* Slice the Dandelion, and bruise it in a stone mortar, sprinkling on it a little water, until reduced to a pulp. Then express and strain the juice, and evaporate it in a vacuum, or in a shallow dish over a water-bath, to the proper consistence." *U. S.*

"Take of Fresh Dandelion Root *four pounds* [avoirdupois]. Crush the Root; press out the juice, and allow it to deposit; heat the clear liquor to 212°, and maintain the temperature for ten minutes; then strain, and evaporate by a water-bath, at a temperature not exceeding 160°, until the extract has acquired a suitable consistence for forming pills." *Br.*

This extract is undoubtedly stronger, prepared from the root alone than from the whole plant. It is important that the root should be collected at the right season. The juice expressed from it in the spring is thin, watery, and of a feeble flavour; in the latter part of the summer, and in autumn, thick, opaque, cream-coloured, very bitter, and abundant, amounting to one-third or one-half its weight. It may be collected in August, and afterwards until severe frost. According to Mr. Squire, frost has the effect of diminishing the bitterness and increasing the sweetness of the root. An extract prepared by inspissating the juice, as in the present U. S. and Br. processes, is much more efficient than that prepared in the old way by decoction. The inspissation should be effected by exposing the juice in shallow vessels to a current of warm dry air, or by evaporation in a vacuum, and should not be unnecessarily protracted. Long exposure, during evaporation, changes the bitterness of the juice into

sweetness, which is a sign of inferiority. In the British process, it is wisely directed that, before the evaporation of the juice, it shall be exposed for a short time to a heat sufficient to coagulate the albumen, which is then separated and rejected as useless, and indeed injurious by favouring decomposition. As often found in the shops, the extract is dark-coloured, sweet, and in all probability nearly inert. Mr. Houlton took more than an ounce of it in a day, without any sensible effect. (*Pharm. Journ.*, i. 421.) When prepared from the root and leaves together, it has a greenish colour. Mr. Brande states that one cwt. of the fresh root affords from twenty to twenty-five pounds of extract by decoction in water. The expressed juice yields from 11 to 25 per cent. of extract, the greatest product being obtained in November, and the least in April and May.

This extract deteriorates by keeping, and should, therefore, be renewed annually. It is most conveniently given dissolved in cinnamon or mint water. The dose is from a scruple to a drachm three times a day. W.

EXTRACTUM VALERIANÆ. *U. S.* EXTRACTUM VALERIANÆ ALCOHOLICUM. *U. S. Pharm.* 1860. *Alcoholic Extract of Valerian.*

"Take of Valerian, in fine powder, *twelve troyounces;* Alcohol *a pint;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with four fluidounces of Alcohol, pack it in a percolator, and gradually pour upon it the remainder of the Alcohol. When the liquid has all been absorbed by the powder, pour on Diluted Alcohol until a pint of tincture has been obtained. Set this aside in a warm place, and allow it to evaporate spontaneously until reduced to three fluidounces. Continue the percolation with Diluted Alcohol until two pints more of tincture have passed, and evaporate this, by means of a water-bath, to the consistence of syrup. Lastly, mix the two liquids, and continue the evaporation, at a temperature not exceeding 120°, until the mixture is reduced to the proper consistence." *U. S.*

This extract contains most of the active matter of the root, though a portion of the volatile oil may be lost in the process. It may be used for obtaining the effects of valerian on the system. According to Vielguth and Nentwich, the root yields 23 per cent. of its weight to cold diluted alcohol by percolation. The dose of the extract is from ten to thirty grains. W.

EXTRACTA FLUIDA.

Fluid Extracts.

These were first introduced into the U. S. Pharmacopœia of 1850, as a distinct class of preparations; the fluid extract of sarsaparilla being the only one previously directed, either in our own officinal code, or by the British Colleges. Their distinctive character is the concentration of the active ingredients of medicinal substances into a small bulk, in the liquid form, a minim of any one of them representing a grain of the crude drug. Independently of the greater convenience of administration, the advantage of this class of preparations is that, the evaporation not being carried so far as in the ordinary extracts, the active principles are less liable to be injured by heat. The main difficulty, in relation to them, is the liability of substances in the liquid state to undergo spontaneous decomposition. Formerly this was counteracted by means of sugar and of alcohol, but in 1865 (*Amer. Journ. of Pharm.*, 1865, p. 50), Mr. Alfred Taylor proposed the use of glycerin, and in the last revision of the Pharmacopœia his suggestion was adopted. Glycerin, while it exerts a powerful preservative influence, possesses the very valuable property of dissolving matters which were deposited by some of the fluid extracts when made with sugar, as in the old officinal recipes. Consequently the new fluid extracts* are much clearer and more elegant preparations than were the old ones. Further, the use of glycerin lessens the consumption and waste of alcohol, which, from an economical point of view, is a great gain. In the United States Pharmacopœia, besides the individual formulas for the preparation of the fluid extracts, a general direction is given and constantly re-

* For valuable remarks on the fluid extracts as originally prepared, see paper by Prof. Procter in the *Proceedings of American Pharmaceutical Association*, 1859, p. 265, and 1863, p. 222.

ferred to. It is as follows. "The powder is to be moistened with a specified quantity of menstruum, and properly packed in a suitable percolator. The surface of the powder is then to be covered with a disk of paper, and the remaining portion of sixteen fluidounces of menstruum is to be poured upon it. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator, to prevent evaporation, set it aside in a moderately warm place for four days. The cork is then to be removed, more menstruum is to be gradually poured on, and the percolation continued until twenty-four fluidounces have been obtained. Of these the first fourteen fluidounces are to be reserved, and the remainder, having been carefully evaporated to two fluidounces, is to be mixed with the reserved portion, and filtered through paper if necessary." The modification of the process of percolation which is officinally directed is one proposed by Mr. Samuel Campbell (*Amer. Journ. of Pharm.*, 1869, p. 385).

Two modes have been suggested of preparing the fluid extracts more economically; one, by applying the plan of repercolation, as proposed by Dr. E. R. Squibb, to this class of preparations as well as to the dry extracts; the other by means of expression, as recommended by Mr. N. Spencer Thomas. With the peculiarities of the former method the reader is already familiar. Much may be said in its favour; but it is liable to two objections; one, that, by leaving the medicine incompletely exhausted, it endangers results more or less different from those officinally contemplated; the other, that, in order to obviate this inconvenience, a degree of knowledge and skill is requisite not always met with in those whose business it is to make these preparations. As regards the plan of Mr. Thomas, it consists in exposing the substance to be acted on to successive expressions, by means of a press, with the menstruum divided into different portions; so that fresh portions of liquid are brought to act on the same solid body in different stages of exhaustion; and then mixing the expressed liquids. The due proportion between the weight of the medicine and the bulk of the ultimate fluid extract is secured by regulating the measure of the last-added portion of menstruum, which, in the process as described by Mr. Thomas, is the third. Whatever may be the advantages of this method, and it is not without its recommendations, it is liable to the objection of having been patented. (*Am. Journ. of Pharm.*, May, 1866, p. 219.)

A third method of limiting the quantity of alcohol used, has been proposed by Mr. S. P. Duffield, of Detroit. It consists in macerating, for from six to ten days, the medicine to be acted on, previously deprived, by means of a vacuum apparatus, of all the air, and of all readily volatilizable matter contained in its pores, with a certain volume of the menstruum, which is forced through a tube into the vacuum pan by atmospheric pressure, and thus brought into the most intimate contact with all parts of the powder. The process is completed by submitting the mass thus impregnated to hydraulic pressure, and, after allowing the liquid to settle in glass carboys, drawing off the clear liquid into bottles. It is only by experience that the value of this process can be determined. (*Ibid.*, Jan. 1869, p. 2.) It is obviously inapplicable to substances, whose virtues depend in any considerable degree upon readily volatilizable constituents. Mr. Campbell (*Amer. Journ. of Pharm.*, xlii. 17) has proposed a method for doing away with the use of heat, but which, although in some cases it may do well, cannot be relied upon for the complete exhaustion of all drugs. In carrying it out, mix with sixteen troyounces of the powder four to six fluidounces of the menstruum (usually alcohol), and pack it in a glass funnel moderately but uniformly tight, a piece of a sponge having previously been put in the beak of the funnel; then cover the surface of the powder with a disk of paper, and pour on twelve fluidounces of menstruum. So soon as the sponge becomes saturated cork tightly the beak of the funnel, and set the whole aside for four days, at the end of which time the percolation may be allowed to proceed. Mr. James W. Mill has called attention to the advantage of separating the powder into fine and coarse parts by means of sieves and packing the finer powder at the bottom of the percolator. W.

EXTRACTUM BELLADONNÆ RADICIS FLUIDUM. *U.S.*

Fluid Extract of Belladonna Root.

"Take of Belladonna Root, in moderately fine powder, *sixteen troyounces;* Glycerin

four fluidounces; Alcohol, Water, each, *a sufficient quantity.* Mix twelve fluidounces of Alcohol, three fluidounces of Glycerin, and one fluidounce of Water, and, having moistened the Belladonna Root with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

The necessity for such a concentrated fluid preparation of belladonna as this does not seem very evident; nevertheless it represents fully the drug, and may be given in doses of one or two minims. H. C. W.

EXTRACTUM BELÆ LIQUIDUM. *Br. Liquid Extract of Bael.*

"Take of Bael Fruit *one pound* [avoirdupois]; Distilled Water *twelve pints* [Imperial measure]; Rectified Spirit *two fluidounces.* Macerate the Bael for twelve hours in one-third of the Water; pour off the clear liquor; repeat the maceration a second and third time for one hour in the remaining two-thirds of the Water; press the marc; and filter the mixed liquors through flannel. Evaporate to fourteen fluidounces; and, when cold, add the Rectified Spirit." *Br.*

This is a new officinal of the British Pharmacopœia, of which very little is known in the United States. It is one of the forms in which the new India remedy bael is employed, and the reader is referred to the article on that subject in *Part* I. Each fluidounce of the extract represents an avoirdupois ounce of the medicine, and the dose is from one to four fluidrachms. W.

EXTRACTUM BUCHU FLUIDUM. *U. S. Fluid Extract of Buchu.*

"Take of Buchu, in moderately fine powder, *sixteen troyounces;* Alcohol *a sufficient quantity.* Moisten the Buchu with six fluidounces of Alcohol, introduce it into a cylindrical percolator, and proceed according to directions given in the general formula at *page* 1193." *U. S.*

In consequence of the tenacity of the leaves, it is somewhat difficult to powder them in a mortar, and it will be convenient to resort to a mill for the purpose. As the most active ingredient of buchu is volatile, the direction in the formula to set aside the first portion of tincture obtained, which is a highly concentrated solution, is peculiarly important; for, if it were subjected to evaporation, much of the volatile oil would necessarily escape. The tincture subsequently obtained probably contains a large proportion of the fixed ingredients of the leaves, and will, therefore, allow of concentration without material loss.

This fluid extract is clear, greenish-black, and possessed in a high degree of the sensible properties of the leaves. It is said to acquire the odour of mint when long kept, showing that some change takes place in its volatile oil. Each fluidounce of the fluid extract represents a troyounce of the leaves; and the dose is twenty to thirty minims, to be given diluted with water. W.

EXTRACTUM CALUMBÆ FLUIDUM. *U. S. Fluid Extract of Columbo.*

"Take of Columbo, in fine powder, *sixteen troyounces;* Glycerin *two fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix the Glycerin with fourteen fluidounces of Alcohol, and, having moistened the Columbo with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with a menstruum consisting of two parts of Alcohol and one part of Water." *U. S.*

This is a dark-brown opaque liquid of an intensely bitter taste. The dose is from fifteen minims to half a fluidrachm. H. C. W.

EXTRACTUM CHIMAPHILÆ FLUIDUM. *U. S. Fluid Extract of Pipsissewa.*

"Take of Pipsissewa, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Pipsissewa with half a pint of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted

Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This is a very thick, molasses-like fluid of a decidedly astringent taste. It may be given in doses of from twenty to forty minims. H. C. W.

EXTRACTUM CIMICIFUGÆ FLUIDUM. *U. S. Fluid Extract of Cimicifuga.*

"Take of Cimicifuga, in very fine powder, *sixteen troyounces;* Stronger Alcohol *a sufficient quantity.* Moisten the Cimicifuga with four fluidounces of the Stronger Alcohol, and proceed according to directions given in the general formula on *page* 1193." *U. S.*

This is a dark reddish-brown liquid, having a very strong odour and taste similar to that of the crude drug. It is probably superior to the preparation of the U. S. Pharmacopœia of 1860, because there is less opportunity offered during the making of it for the escape of volatile principles, the first percolation exhausting all of the volatile substances of the root; moreover, the resinous substances are more completely held in solution than they were when diluted alcohol was the chief menstruum. The dose is from thirty minims to a fluidrachm. H. C. W.

EXTRACTUM CINCHONÆ FLUIDUM. *U. S.* EXTRACTUM CINCHONÆ FLAVÆ LIQUIDUM. *Br. Fluid Extract of Cinchona. Liquid Extract of Yellow Cinchona.*

"Take of Yellow Cinchona, in very fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Cinchona with five fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Continue the percolation with Diluted Alcohol, until two pints of tincture have been obtained, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

"Take of Yellow-Cinchona Bark, in coarse powder, *one pound* [avoirdupois]; Distilled Water *a sufficiency;* Rectified Spirit *one fluidounce.* Macerate the Cinchona Bark in two pints [Imp. meas.] of the Water for twenty-four hours, stirring frequently; then pack in a percolator, and add more Water, until twelve pints [Imp. meas.] have been collected, or until the Water ceases to dissolve anything more. Evaporate the liquor at a temperature not exceeding 160° to a pint [Imp. meas.]; then filter through paper, and continue the evaporation to three fluidounces, or until the sp. gr. of the liquid is 1·200. When cold, add the Spirit gradually, constantly stirring. The sp. gr. should be about 1·100." *Br.*

Of these two formulas, the first is decidedly preferable. It is based upon that of Mr. Alfred B. Taylor, of Philadelphia (*Amer. Journ. of Pharm.*, Jan. 1865). The British Pharmacopœia uses water only as the menstruum, while it adds alcohol to the liquid to preserve it. In the U. S. process a mixture of diluted alcohol and glycerin is used as the menstruum. Now it is well known that Peruvian bark cannot be exhausted by water alone; and, though by its use as a menstruum the resin and cinchonic red are mainly left behind, so also is a considerable proportion of the alkaloids. By using diluted alcohol the U. S. Pharmacopœia extracts all the virtues of the bark, though it may also take up some of the resin and cinchonic red. Of the British preparation, four fluidounces are intended to represent an avoirdupois pound or sixteen ounces of the bark; but certainly fail to do so, and to an indefinite degree. Of the U. S. preparation, one fluidounce actually represents an ounce of the bark, and may be relied on, if well prepared, to produce all its effects. The U. S. fluid extract of cinchona is a moderately thin, dark reddish-brown translucent fluid, of a bitter, astringent taste. The dose equivalent to a drachm of the bark is two fluidrachms; and to produce an antiperiodic effect, at least two fluidounces should be taken between the paroxysms. W.

EXTRACTUM COLCHICI RADICIS FLUIDUM. *U. S. Fluid Extract of Colchicum Root.*

"Take of Colchicum Root, in moderately fine powder, *sixteen troyounces;* Glycerin

four fluidounces; Alcohol, Water, each, *a sufficient quantity.* Mix twelve fluidounces of Alcohol, three fluidounces of Glycerin, and one fluidounce of Water, and, having moistened the Colchicum Root with five fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

EXTRACTUM COLCHICI SEMINIS FLUIDUM. *U. S. Fluid Extract of Colchicum Seed.*

"Take of Colchicum Seed, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix twelve fluidounces of Alcohol, three fluidounces of Glycerin, and one fluidounce of Water, and, having moistened the Colchicum Seed with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

These two preparations, the one of the cormus, the other of the seeds of Colchicum, are made precisely in the same manner, and are nothing more nor less than strong tinctures. Considering that we had one tincture, two wines, and two extracts of Colchicum, all efficient preparations, these additions to our pharmacy might have been spared, unless some peculiar advantage could have been gained from them. They are, however, well made, and no doubt concentrate the virtues of colchicum within a small space.

Supposing the root and seeds to be exhausted by the menstruum employed, and none of the active matter to be lost in the evaporation, a troyounce of each is represented by a fluidounce of the fluid extract, the dose of which, therefore, would be from two to eight minims. W.

EXTRACTUM CONII FRUCTÛS FLUIDUM. *U. S. Fluid Extract of Conium Seed.*

"Take of Conium Seed, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Muriatic Acid *one hundred and eighty grains;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Conium Seed with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add the Muriatic Acid and one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

The fluid extract of conium of the U. S. Pharmacopœia of 1860 was prepared from the leaves, and was, therefore, of necessity a very uncertain, if not for the most part inert preparation. The alkaloid conia is contained in very unequal proportions in the fresh leaves, and is so very volatile and destructible that in the dried leaves it may be altogether wanting. Dr. Wm. Manlius Smith (*Amer. Journ. of Pharm.*, xl. 459), as the result of an elaborate investigation, found that the immature fruits of conium are not only richer in the alkaloids than are the leaves, but are less variable in the proportion they contain, and have the conia in them in such form that drying does not dissipate it. The superiority of the fluid extract of conium seed over the same preparation of the leaves was shown by Dr. Smith, and has been since abundantly confirmed by experience. The revisers of the Pharmacopœia acted very wisely in abandoning the old for the new preparation. The reservation of the first tincture is important, because it probably contains all or nearly all of the active principle, so that little or none of this is lost during the evaporation. The specimens of the present fluid extract we have seen, have been very dark thick liquids having a molasses-like odour, but emitting a strong conium smell on the addition of potassa; any sample which fails to do this should be rejected as wanting in the alkaloid. Dr. Smith found sixteen minims of a fluid extract of the seed prepared by Dr. Squibb to produce violent symptoms. Dr. L. Wheeler, however, took thirty minims without experiencing any result. (*Boston Med. and Surg. Journ.*, June, 1870.)

The officinal preparation is of the same strength as that prepared by Dr. Squibb,

one fluidounce representing one ounce of the seed, and it would seem hardly safe to commence with a dose of more than five minims, to be increased until some effect is produced. H. C. W.

EXTRACTUM CORNÛS FLORIDÆ FLUIDUM. *Fluid Extract of Dogwood.*

"Take of Dogwood, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Dogwood with five fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This preparation, without doubt, represents whatever virtues the crude drug may contain, but it was scarcely worth introduction into the Pharmacopœia. The dose is half a drachm. H. C. W.

EXTRACTUM CUBEBÆ FLUIDUM. *U. S. Fluid Extract of Cubeb.*

"Take of Cubeb, in moderately fine powder, *sixteen troyounces;* Stronger Alcohol *a sufficient quantity.* Moisten the Cubeb with six fluidounces of Stronger Alcohol, and proceed according to directions given in the general formula at *page* 1193." *U. S.*

This is a dark-olive, translucent fluid, with the sensible properties of the drug. It may be given in doses of from ten to forty minims. H. C. W.

EXTRACTUM DIGITALIS FLUIDUM. *U. S. Fluid Extract of Digitalis.*

"Take of Digitalis, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix twelve fluidounces of Alcohol, three fluidounces of Glycerin, and one fluidounce of Water, and, having moistened the Digitalis with half a pint of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This is a dark, greenish-black, thickish fluid, having the sensible properties of the drug in a very marked degree. It may be employed whenever digitalis is indicated, in doses of from one to three drops. H. C. W.

EXTRACTUM DULCAMARÆ FLUIDUM. *U. S. Fluid Extract of Bittersweet.*

"Take of Bittersweet, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Bittersweet with six fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

It is a thickish, almost syrupy liquid, of a dark-olive hue, with the sensible properties of the bittersweet in a concentrated state. One fluidounce represents a troyounce of the twigs. The dose is from thirty minims to a fluidrachm, three or four times a day, and gradually increased if necessary. W.

EXTRACTUM ERGOTÆ FLUIDUM. *U. S.* EXTRACTUM ERGOTÆ LIQUIDUM. *Br. Fluid Extract of Ergot. Liquid Extract of Ergot.*

"Take of Ergot, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Acetic Acid *half a fluidounce;* Alcohol *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Ergot with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add the Acetic Acid and one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

"Take of Ergot, in coarse powder, *one pound* [avoirdupois]; Ether *one pint* [Imperial measure], or *a sufficiency;* Distilled Water *three pints and a half* [Imp. meas.]; Rectified Spirit *eight fluidounces.* Shake the Ether in a bottle with half a pint [Imp. meas.] of the Water, and after separation decant the ether. Place the Ergot in a percolator, and free it from its oil by passing the washed ether slowly through it. Remove the marc, and digest it in three pints [Imp. meas.] of the Water at 160° for twelve hours. Press out, strain, and evaporate the liquor, by the heat of a water-bath, to nine fluidounces; when cold, add the Spirit. Allow it to stand for an hour to coagulate, then filter. The product should measure sixteen fluidounces." *Br.*

These are not identical preparations. The U. S. fluid extract is probably the best officinal preparation of ergot, having all the virtues of the medicine in a concentrated state. It was first suggested by Mr. Jos. Laidley, of Richmond, Va.; but the process has since been very much modified. Diluted alcohol dissolves all the active matter of ergot, leaving its oil behind, and the tincture first obtained, holding most of the active principles, is reserved without concentration; while the acetic acid has the effect of counteracting the injurious influence of the heat used in concentrating the tincture subsequently passed, probably by forming fixed salts with the alkaloids. In the British process, the first step is to dissolve out the oil with ether previously deprived of alcohol by washing with water; because ordinary ether, in consequence of the alcohol it contains, dissolves a portion of the active matter along with the oil. The remainder of the process consists simply in forming an infusion with the residue of the ergot by digesting it with water, and then adding the spirit to preserve it. Why the ether should be used to dissolve out the oil, it is difficult to understand, when it is considered that, if this menstruum were not employed, the oil would remain undisturbed in the ergot. It is also stated that when macerated in water of the temperature directed the ergot swells up into a sort of colloid mass, making straining very difficult, and the substitution of a large amount of cold water has been proposed.

The U. S. fluid extract of ergot is a clear, very dark reddish-brown liquid, having the taste of ergot, but without its fishy odour, owing to the fixation of the alkaloid propylamia, upon which that odour depends. On the addition, however, of solution of potassa, the odour is strongly developed, and the alkaloid escapes so largely that, if muriatic acid be held near it, a cloud of muriate of propylamia will be perceived. This may be considered as a good test of the efficiency of the preparation; for, though all the virtues of ergot do not depend on its volatile alkaloid, yet, if this be retained in the fluid extract, there can be little doubt that the other more fixed principles will be retained also. One fluidounce of the preparation, made by the U. S. process, represents a troyounce of the ergot; according to the British, an avoirdupois ounce. The dose is from ten to twenty minims.

Off. Prep. Vinum Ergotæ. W.

EXTRACTUM ERIGERONTIS CANADENSIS FLUIDUM. *U. S. Fluid Extract of Canada Erigeron.*

"Take of Canada Erigeron, in moderately coarse powder, *sixteen troyounces;* Alcohol *a sufficient quantity.* Moisten the Erigeron with half a pint of Alcohol, and proceed according to directions given in the general formula at *page* 1193." *U. S.*

The dose of this preparation is from half a drachm to a drachm. H. C. W.

EXTRACTUM FILICIS LIQUIDUM. *Br. Liquid Extract of Fern.*

This, being properly an oleoresin, will be considered under the head of the *Oleoresinæ*, to which the reader is referred. W.

EXTRACTUM GELSEMII FLUIDUM. *U. S. Fluid Extract of Yellow Jessamine.*

"Take of Yellow Jessamine, in very fine powder, *sixteen troyounces;* Alcohol *a sufficient quantity.* Moisten the Yellow Jessamine with four fluidounces of Alcohol, and proceed according to the directions given in the general formula." *U. S.*

This is a dark-red, concentrated tincture, possessed of the physical and medical properties of the root. The dose of it is from two to three minims to begin with.

H. C. W.

EXTRACTUM GENTIANÆ FLUIDUM. *U. S. Fluid Extract of Gentian.*

"Take of Gentian, in moderately coarse powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Gentian with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This is a translucent, reddish-brown fluid, with the smell and taste of the root, of which a troyounce is represented by a fluidounce of the preparation. It may be questionable whether it was needed, though it has the advantage that we may obtain from it the tonic effects of the drug with less alcohol than in an equivalent quantity of the tincture; and pharmaceutically it affords a convenient method of giving to mixtures the tonic properties of gentian when required. The dose is from ten to thirty or forty minims. W.

EXTRACTUM GERANII FLUIDUM. *U. S. Fluid Extract of Geranium.*

"Take of Geranium, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Geranium with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This preparation, without doubt, represents the geranium root. The dose of it is half a fluidrachm to a drachm. H. C. W.

EXTRACTUM GLYCYRRHIZÆ FLUIDUM. *U. S. Fluid Extract of Liquorice.*

"Take of Liquorice Root, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Liquorice Root with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

A black opaque liquid of a sweet, pleasant taste, a fluidrachm of which equals a drachm of the root. H. C. W.

EXTRACTUM GOSSYPII RADICIS FLUIDUM. *U. S. Fluid Extract of Cotton Root.*

"Take of Cotton Root, in very fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Cotton Root with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This is a deep-red liquid, with the sensible properties of the root. The dose is half a drachm to a drachm. H. C. W.

EXTRACTUM HYDRASTIS FLUIDUM. *U. S. Fluid Extract of Hydrastis.*

"Take of Hydrastis, in very fine powder, *sixteen troyounces;* Glycerin *two fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix the Glycerin with fourteen fluidounces of Alcohol, and, having moistened the Hydrastis with four fluidounces of the mixture, proceed according to directions given in the general formula at *page*

1193. Finish the percolation with a menstruum consisting of two parts of Alcohol and one part of water." *U. S.*

The dose of this preparation is from one to two fluidrachms. H. C. W.

EXTRACTUM HYOSCYAMI FLUIDUM. *U. S.* *Fluid Extract of Hyoscyamus.*

"Take of Hyoscyamus Leaves, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix twelve fluidounces of Alcohol, three fluidounces of Glycerin, and one fluidounce of Water, and, having moistened the Hyoscyamus with half a pint of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This is a thin, blackish fluid, of a heavy narcotic odour, and a taste resembling that of the crude drug. It was first prepared by Mr. Ch. A. Smith, of Cincinnati (*Am. Journ. of Pharm.*, xxv. p. 418). The commencing dose is five minims. H. C. W.

EXTRACTUM IPECACUANHÆ FLUIDUM. *U. S.* *Fluid Extract of Ipecacuanha.*

"Take of Ipecacuanha, in fine powder, *sixteen troyounces;* Glycerin *half a pint;* Stronger Alcohol *a pint and a half;* Water *twelve fluidounces;* Diluted Alcohol *a sufficient quantity.* Mix the Stronger Alcohol and Water, and, having moistened the Ipecacuanha with six fluidounces of the mixture, pack it firmly in a conical percolator, and pour upon it twelve fluidounces of the mixture. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator, set it aside for four days. Then remove the cork, and gradually pour on the remainder of the mixture, and finally Diluted Alcohol, until two pints of tincture have slowly passed. Mix this portion with the Glycerin, and evaporate the mixture, at a temperature not exceeding 140°, to one pint." *U. S.*

This fluid extract is a thin, dark reddish-brown transparent liquid, of a bitterish slightly acrid taste, but without the nauseous flavour of the root. A fluidounce of it represents an ounce of the root, and the emetic dose would therefore be from fifteen to thirty minims. It is a convenient preparation for adding to expectorant and diaphoretic mixtures, and is used officinally in preparing the syrup of ipecacuanha.

The formula of the present Pharmacopœia is thought by some to be superior to that of 1860, as yielding a preparation less apt to become turbid. A further change is, however, desirable, as the officinal fluid extract deposits very heavily when diluted in making syrup.*

Off. Prep. Syrupus Ipecacuanhæ, *U. S.* W.

EXTRACTUM KRAMERIÆ FLUIDUM. *U. S.* *Fluid Extract of Rhatany.*

"Take of Rhatany, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Rhatany with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This is a new officinal preparation, of a deep red, or, in mass, blackish-red colour, and exceedingly astringent taste. The dose is from ten minims to a fluidounce. H. C. W.

EXTRACTUM LUPULINÆ FLUIDUM. *U. S.* *Fluid Extract of Lupulin.*

"Take of Lupulin *sixteen troyounces;* Stronger Alcohol *a sufficient quantity*

* The following formula, devised by Mr. Richard V. Mattison, is stated by its author to yield a clear syrup. Percolate with the officinal menstruum until exhausted, eighty troyounces of powdered ipecacuanha, after four days' maceration in the percolator. To the percolate add ten fluidounces of glycerin, and evaporate at a temperature not exceeding 140° F. until reduced to fifty-five fluidounces. Transfer this to a moistened filter, and allow to drain; wash the deposit with water, by means of a sprit, until the filtrate measures sixty fluidounces; refilter and add twenty fluidounces of glycerin. It is doubtful whether this preparation fully represents the drug. (*Note to the fourteenth edition.*)

Moisten the Lupulin with six fluidounces of Stronger Alcohol, and proceed according to directions given in the general formula at *page* 1193." *U. S.*

This is a concentrated tincture of lupulin, containing the virtues of an ounce of lupulin in a fluidounce. The dose is ten or fifteen minims, which may be conveniently given mixed with syrup of gum arabic, afterwards diluted with water. W.

EXTRACTUM MATICO FLUIDUM. *Fluid Extract of Matico.*

"Take of Matico, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix twelve fluidounces of Alcohol, three fluidounces of Glycerin, and one fluidounce of Water, and, having moistened the Matico with half a pint of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This is a greenish-black liquid, which probably contains all the medical principles of matico, and affords an excellent form of it for internal administration. The dose of it is half a fluidrachm to a drachm. H. C. W.

EXTRACTUM MEZEREI FLUIDUM. *U. S. Fluid Extract of Mezereon.*

"Take of Mezereon, in moderately coarse powder, *sixteen troyounces;* Stronger Alcohol *a sufficient quantity.* Moisten the Mezereon with six fluidounces of Stronger Alcohol, and proceed according to directions given in the general formula at *page* 1193." *U. S.*

This preparation represents the crude drug; minim for grain.

Off. Prep. Unguentum Mezerei, *U. S.* H. C. W.

EXTRACTUM OPII LIQUIDUM. *Br. Liquid Extract of Opium.*

"Take of Extract of Opium *one ounce* [avoirdupois]; Distilled Water *sixteen fluidounces* [Imperial measure]; Rectified Spirit *four fluidounces* [Imp. meas.]. Macerate the Extract of Opium in the Water for an hour, stirring frequently; then add the Spirit, and filter. The product should measure one pint [Imp. meas.]." *Br.*

This is a good preparation, one which has long been needed, and in the absence of which from the Pharmacopœias empirical preparations have obtained a certain vogue. It is well known that in opium there are principles, soluble in alcohol but not in water, which often produce various disagreeable effects, not experienced from the watery extract. What was wanted was a liquid preparation meeting this demand. All that was required was to make an aqueous solution of the watery extract, and to add something to preserve it. The British Pharmacopœia uses alcohol for the purpose, and in the original formula employed it in such proportion that an Imperial pint of the liquid should contain three fluidounces of the spirit, or between one-sixth and one-seventh by measure. But this amount of alcohol, according to Mr. Squire, is insufficient for its preservation, and should be doubled. In the present Pharmacopœia the spirit has been increased to four fluidounces, and the water diminished from seventeen to sixteen fluidounces; but even with this increase the spirit constitutes only one-fifth, which is considerably short of the proportion recommended by Mr. Squire. A preparation similar to the British was made some years since by Mr. Eugene Dupuy, of New York, an account of which is given in a note to Opium in *Part* I. of this work (*page* 681). In the *Deodorized Tincture of Opium* of the U.S. Pharmacopœia, the advantages of the preparation have, we think, been still better secured. (See *Tinctura Opii Deodorata.*) The dose of the liquid extract, equivalent to a grain of opium, would be about 10 minims. W.

EXTRACTUM PAREIRÆ FLUIDUM. *U. S.* EXTRACTUM PAREIRÆ LIQUIDUM. *Br. Fluid Extract of Pareira Brava. Liquid Extract of Pareira.*

"Take of Pareira Brava, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Pareira Brava with four fluidounces of the mixture, proceed according to directions

given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

"Take of Pareira Root, in coarse powder, *one pound* [avoirdupois]; Boiling Distilled Water *one gallon* [Imperial measure], or *a sufficiency;* Rectified Spirit *three fluidounces.* Digest the Pareira with a pint [Imp. meas.] of the Water for twenty-four hours, then pack in a percolator, and, adding more of the Water, allow the liquor slowly to pass until a gallon [Imp. meas.] has been collected, or the Pareira is exhausted. Evaporate the liquor by a water-bath to thirteen fluidounces, and, when it is cold, add the Spirit, and filter through paper." *Br.*

The British preparation is a concentrated infusion, preserved by adding somewhat less than one-fourth of its measure of alcohol, and is said by those who have used it to have all the virtues of the root. The American fluid extract is made with diluted alcohol, and is probably the better preparation of the two. The dose is one or two fluidrachms. H. C. W.

EXTRACTUM PRUNI VIRGINIANÆ FLUIDUM. *U. S. Fluid Extract of Wild-cherry.*

"Take of Wild-cherry, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Water *half a pint;* Stronger Alcohol *a sufficient quantity.* Mix the Glycerin and Water, and, having moistened the Wild-cherry with half a pint of the mixture, allow it to macerate in a covered vessel for four days; then pack it in a conical glass percolator, and pour on the remainder of the mixture; when this has disappeared from the surface, gradually pour on Stronger Alcohol until twelve fluidounces have been obtained, and set this portion aside. Continue the percolation with Stronger Alcohol until twenty fluidounces more have been obtained; evaporate to four fluidounces and filter through paper, rinsing the filter with a small portion of Stronger Alcohol, so as to preserve the measure of four fluidounces. Lastly, mix this with the reserved portion, and keep in a well-stopped bottle." *U. S.*

At the last revision of the Pharmacopœia, the formula* originally suggested by Prof. Procter, and adopted as officinal in 1860, was abandoned in favor of that just given. There can be no doubt both as to the scientific character of the older formula and as to the value of the preparation it yielded. The theory of it may be expressed in a few words. Wild-cherry bark contains amygdalin, emulsin, tannic acid, and bitter principles. When water is added to it, hydrocyanic acid is generated by reaction between the amygdalin and emulsin. Hydrocyanic acid, being very volatile and destructible, is liable to be lost in any process of concentration. For this reason alcohol, which does not develop the hydrocyanic acid reaction, was selected as the menstruum. It extracts the amygdalin and the other active principles of the bark; and when, in the formula, after the alcohol had been driven off, water with emulsin from almonds was added, the bark was fully represented. The practical difficulty was in the complexity and expensiveness of the process. In the present formula, during the first maceration for four days the reaction between the amygdalin and emulsin takes place, and the full-formed hydrocyanic acid is taken up by the alcoholic menstruum which is subsequently added. Probably all of it is contained in the reserved fluid, so that little or none is lost during the evaporation of the remainder. The process is far

* "Take of Wild-cherry Bark, in fine powder, *sixteen troyounces;* Sweet Almond *two troyounces;* Sugar, in coarse powder, *twenty-four troyounces;* Alcohol, Water, each, *a sufficient quantity.* Introduce the Bark, previously mixed with four fluidounces of Alcohol, into a cylindrical percolator, press it firmly, and gradually pour Alcohol upon it until three pints of tincture have slowly passed. From this distil off two pints and a half of alcohol, and, having mixed the residue with a pint of Water, evaporate, by means of a water-bath, to half a pint.

"Beat the Almond into a paste, and rub this with successive portions of Water until, after straining through a coarse sieve or cloth, nearly all the substance of the Almond has been converted into an emulsion, and twelve fluidounces of liquid have been obtained. Mix this with the liquid first obtained, in a suitable bottle, and, having closely stopped it, agitate occasionally during twenty-four hours. Then express quickly and strongly through a cloth; and, if the expressed liquid measure less than eighteen fluidounces, add Water to the residue, and again express until that quantity is obtained. Filter the expressed liquid through cotton flannel, in a covered funnel, into a bottle containing the Sugar. Shake the bottle occasionally during the process until the Sugar is dissolved, and continue the filtration until the syrupy liquid measures two pints. Lastly, mix the whole thoroughly together." *U. S.* (*Note to the fourteenth edition.*)

simpler and cheaper than the old one. The old preparation was of a clear, light wine colour, and did not become turbid when diluted. The present one is of a very dark wine colour, scarcely translucent, and deposits a copious precipitate when diluted with water. It has a very rough, astringent taste, and a decided odour and taste of hydrocyanic acid. One fluidrachm of the old fluid extract represented only half a drachm of the bark; but, as now made, the preparation represents the crude drug drachm for drachm. The dose is half a drachm to a drachm. H. C. W.

EXTRACTUM RHEI FLUIDUM. *U. S. Fluid Extract of Rhubarb.*

"Take of Rhubarb, in moderately fine powder, *sixteen troyounces;* Glycerin *two fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix the Glycerin with fourteen fluidounces of Alcohol, and, having moistened the Rhubarb with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with a menstruum consisting of two parts of Alcohol and one part of Water." *U. S.*

The fluid extract of 1850 contained the aromatic oils of fennel and anise, but in the revision of 1860 these were omitted, probably for the good reason that they might not always be wanted, and that, should these or any similar oils be desired by any one, they might be readily added. The fluid extract of 1860, though when freshly prepared sufficiently liquid, soon began to deposit saccharine matter, and in the end became so loaded with granular sugar as to be unfit for use. Owing to the substitution of glycerin for sugar, the present preparation is not only thinner than the old at first, but also retains its fluidity. The colour of the officinal fluid is black. On the addition of water it precipitates heavily, so that syrups or mixtures made with it are very unsightly. As the chief use of the fluid extract is in making such preparations, this is very unfortunate, and constitutes sufficient grounds for the abandonment of the officinal formula in favour of one which will exhaust the root of its purgative properties, and yet afford an extract that remains clear when water is added to it. Mr. Geo. Bille claims that all that is necessary is to exhaust the sixteen troyounces of rhubarb with cold water, evaporate, by means of a water-bath, to twelve fluidounces, and add four fluidounces of glycerin. A fluidrachm of the officinal extract should contain the virtues of a drachm of the root; and the dose, therefore, for an adult may be twenty or thirty minims as a purgative, and from five to ten minims as a laxative.

Off. Prep. Syrupus Rhei, *U. S.* W.

EXTRACTUM RUBI FLUIDUM. *U. S. Fluid Extract of Blackberry.*

"Take of Blackberry, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the powdered bark with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

A very dark, reddish, translucent fluid, having the sensible properties of the root. The dose is half a drachm to a drachm.

Off. Prep. Syrupus Rubi, *U. S.* H. C. W.

EXTRACTUM SABINÆ FLUIDUM. *U. S. Fluid Extract of Savine.*

"Take of Savine, in moderately fine powder, *sixteen troyounces;* Stronger Alcohol *a sufficient quantity.* Moisten the Savine with half a pint of Stronger Alcohol, and proceed according to directions given in the general formula at *page* 1193."

This is nothing but a concentrated tincture. The dose is from five to ten drops. H. C. W.

EXTRACTUM SARSAPARILLÆ FLUIDUM. *U. S.* EXTRACTUM SARSÆ LIQUIDUM. *Br. Fluid Extract of Sarsaparilla.*

"Take of Sarsaparilla, in moderately fine powder, *sixteen troyounces;* Glycerin

half a pint; Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol with four fluidounces each of Glycerin and Water, and, having moistened the Sarsaparilla with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 151. Continue the percolation with Diluted Alcohol until twenty-six fluidounces have been obtained. Reserve the first ten fluidounces, and, having added four fluidounces of Glycerin to the remainder of the percolate, carefully evaporate to six fluidounces, and mix with the reserved portion." *U. S.*

"Take of Jamaica Sarsaparilla, cut transversely, *one pound* [avoirdupois]; Distilled Water, at 160°, *fourteen pints* [Imperial measure]; Rectified Spirit *one fluidounce.* Digest the Sarsaparilla in one-half of the Water for six hours, and decant the liquor. Digest the residue in the remainder of the Water for the same time, express, and filter the mixed liquors, and evaporate them by a water-bath to seven fluidounces, or until the sp. gr. of the liquid is 1·13. When cold, add the Spirit. The sp. gr. should be about 1·095." *Br.*

Of these two processes, that of the U. S. Pharmacopœia, except in respect to the high price of alcohol, is greatly preferable; and this objection will be in great measure obviated by recovering the alcohol, which can be done by using a distillatory apparatus in the evaporation. There can be no doubt that Sarsaparilla is more thoroughly exhausted when submitted, in the state of powder, to percolation with a mixture of diluted alcohol and glycerin, than it can be by maceration and subsequent digestion of the whole root in water, even though continued for twelve hours. The non-use of heat in the U. S. process is also a great advantage; and the glycerin is preferable as a preservative to alcohol, even admitting, what is scarcely probable, that the quantity of spirit directed in the Br. formula is sufficient to prevent decomposition, especially in our hot summer weather. There is some difficulty in properly mixing the powder with the menstruum, as it is apt to agglutinate in lumps; but this can be obviated by suitable manipulation, and a uniformly moistened mass obtained. The introduction of a simple fluid extract of sarsaparilla into our Pharmacopœia was judicious; as it enables the physician to associate this medicine with others at his pleasure, and in such proportions as he may deem expedient. He may rely upon the efficiency of the preparation, if made with sufficient care and skill, and from good parcels of the root. The U. S. fluid extract is a somewhat thickish, scarcely translucent liquid, of a very dark reddish-brown colour, and of a sweetish and a slightly, though persistently, acrid taste. The dose is from thirty to sixty minims, equivalent to the same number of grains of sarsaparilla in substance. The dose of the British preparation is stated in the Pharmacopœia to be from two to four fluidrachms. W.

EXTRACTUM SARSAPARILLÆ COMPOSITUM FLUIDUM.

U. S. Extractum Sarsaparillæ Fluidum. *U. S.* 1850. *Compound Fluid Extract of Sarsaparilla.*

"Take of Sarsaparilla, in moderately fine powder, *sixteen troyounces;* Liquorice Root, in moderately fine powder, Sassafras, in moderately fine powder, each, *two troyounces;* Mezereon, in moderately fine powder, *three hundred and sixty grains;* Glycerin *half a pint;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol with four fluidounces each of Glycerin and Water, and, having moistened, with six fluidounces of the mixture, the powders previously well mixed, proceed according to directions given in the general formula at *page* 1193. Continue the percolation with Diluted Alcohol until two pints have been obtained. Reserve the first twelve fluidounces, and, having added four fluidounces of Glycerin to the remainder of the percolate, carefully evaporate to six fluidounces, and mix with the reserved portion." *U. S.*

This is the Extractum Sarsaparillæ Fluidum of the U. S. Pharmacopœia of 1850, now necessarily entitled "Compositum," to distinguish it from the simple fluid extract. Everything depends in the process upon having the several ingredients equably powdered, mixing them well and duly moistening them, and then packing them properly in the percolator. The moistening of the mixed powders is more easily effected, as they are less disposed to form lumps than the sarsaparilla powder alone. The preparation is intended to represent, in a concentrated state, the compound decoction of

sarsaparilla, having all its ingredients with the exception of the guaiacum wood, which probably adds little to the efficacy of the decoction. It was originally proposed by Wm. Hodgson, jun. (*Journ. of the Philad. Col. of Pharm.*, ii. 285); and the officinal process differs from his mainly in the omission of the guaiacum wood, the resin of which, separating during the evaporation, somewhat embarrassed the process, without adding to the virtues of the extract. The dose is from thirty minims to a fluidrachm, equivalent to half a drachm or a drachm of the root, three or four times a day. W.

EXTRACTUM SCILLÆ FLUIDUM. *Fluid Extract of Squill.*

"Take of Squill, in moderately coarse powder, *sixteen troyounces;* Glycerin *two fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix the Glycerin with fourteen fluidounces of Alcohol, and, having moistened the Squill with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with a menstruum consisting of two parts of Alcohol and one part of Water." *U. S.*

This is a beautifully clear dark-red liquid, which is especially useful for combining with stimulant expectorants, such as carbonate of ammonium, which are incompatible with the officinal syrup of squill. The dose as an expectorant is two to three minims. H. C. W.

EXTRACTUM SENEGÆ FLUIDUM. *Fluid Extract of Seneka.*

"Take of Seneka, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Seneka with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

This is a blackish-brown moderately thin liquid, which may be used for the same purposes as the crude drug, in doses of from one to five minims. H. C. W.

EXTRACTUM SENNÆ FLUIDUM. *U. S. Fluid Extract of Senna.*

"Take of Senna, in fine powder, *sixteen troyounces;* Glycerin *half a pint;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol with four fluidounces each of Glycerin and Water, and, having moistened the Senna with half a pint of the mixture, proceed according to directions given in the general formula at *page* 1193. Continue the percolation with Diluted Alcohol until twenty-six fluidounces have been obtained. Reserve the first ten fluidounces, and, having added four fluidounces of Glycerin to the remainder of the percolate, carefully evaporate to six fluidounces, and mix with the reserve portion." *U. S.*

The present officinal fluid extract of senna differs materially from that of the Pharmacopœias of 1850 and 1860, containing neither sugar, oil of fennel, or Hoffmann's anodyne. It was deemed better to leave to the prescriber the choice of the volatile oil; and to depend for the preservation of the fluid extract upon the glycerin and what might remain of the alcohol after the evaporation. The fluid extract is a dark, blackish, thickish and somewhat turbid liquid, with a strong flavour of senna. The dose is from one to four fluidrachms for an adult. In consequence of its griping tendency it should be mixed with one of the volatile oils, as of fennel, anise, or caraway, in the proportion of about two minims to the fluidounce; and is well adapted for exhibition with saline cathartics, such as Epsom salt or cream of tartar, which also obviate its griping. In this case not more than one-half of the full dose of the fluid extract should be given at once.

Off. Prep. Extractum Spigeliæ et Sennæ Fluidum, *U. S.* W.

EXTRACTUM SERPENTARIÆ FLUIDUM. *U. S. Fluid Extract of Serpentaria.*

"Take of Serpentaria, in fine powder, *sixteen troyounces;* Alcohol *a sufficient quantity.* Moisten the Serpentaria with four fluidounces of Alcohol and proceed according to directions given in the general formula at *page* 1193." *U. S.*

This, though simply a concentrated tincture, is a good preparation, containing the virtues of the root within a small bulk. The fluid extract of serpentaria originated

with Mr. J. C. Savery, whose formula was published in the eleventh edition of the U. S. Dispensatory (*page* 713). It was afterwards modified by Mr. A. B. Taylor (*Am. Journ. of Pharm.*, xxv. 206). The fluid extract is thin, reddish-brown, and transparent, with the peculiar bitterness of the root in perfection, but its odour less obviously. A fluidounce of it is equivalent to a troyounce of the powder, and the dose is twenty or thirty minims, to be frequently repeated. W.

EXTRACTUM SPIGELIÆ ET SENNÆ FLUIDUM. *U.S. Fluid Extract of Spigelia and Senna.*

"Take of Fluid Extract of Spigelia *ten fluidounces;* Fluid Extract of Senna *six fluidounces;* Oil of Anise, Oil of Caraway, each, *twenty minims.* Mix the Fluid Extracts, and dissolve the Oils in the mixture." *U. S.*

This fluid extract was formerly made from powdered pinkroot and senna by percolation and concentration; but it is now more conveniently prepared by simply mixing the two fluid extracts. It combines the cathartic property of senna with the anthelmintic virtues of pinkroot, and is a very good vermifuge, being generally acceptable to the stomach, and, what is of no little importance in such medicines, not excessively offensive to the taste. It has been in use in Philadelphia for several years, and with satisfactory results. The dose is from two fluidrachms to half a fluidounce for an adult, from thirty minims to a fluidrachm for a child two years old. W.

EXTRACTUM SPIGELIÆ FLUIDUM. *U.S. Fluid Extract of Spigelia.*

"Take of Spigelia, in fine powder, *sixteen troyounces;* Glycerin *half a pint;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol with four fluidounces each of Glycerin and Water, and, having moistened the Spigelia with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Continue the percolation with Diluted Alcohol until twenty-six fluidounces have been obtained. Reserve the first ten fluidounces, and, having added four fluidounces of Glycerin to the remainder of the percolate, carefully evaporate to six fluidounces, and mix with the reserved portion." *U. S.*

The fluid extract of spigelia is a dark-brown, translucent, syrupy liquid, with the flavour of the root. A fluidounce of it represents the virtues of a troyounce of spigelia, and the dose of it is one or two fluidrachms for an adult, from ten to twenty minims for a child two or three years old, to be repeated morning and evening for three or four days, and then followed by a brisk cathartic. It is, however, most used in connection with the fluid extract of senna.

Off. Prep. Extractum Spigeliæ et Sennæ Fluidum, *U. S.* W.

EXTRACTUM STILLINGIÆ FLUIDUM. *U.S. Fluid Extract of Stillingia.*

"Take of Stillingia, in fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix twelve fluidounces of Alcohol, three fluidounces of Glycerin, and one fluidounce of Water, and, having moistened the Stillingia with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U. S.*

The dose of this extract is from fifteen to forty-five minims. H. C. W.

EXTRACTUM TARAXACI FLUIDUM. *Fluid Extract of Dandelion.*

"Take of Dandelion, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Dandelion with four fluidounces of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation."

This is a blackish, moderately thick liquid, which may be given in doses of from one to three fluidrachms. It is said to be an excellent vehicle for quinia. H. C. W.

EXTRACTUM UVÆ URSI FLUIDUM. *U.S.* *Fluid Extract of Uva Ursi.*

"Take of Uva Ursi, in moderately fine powder, *sixteen troyounces;* Glycerin *four fluidounces;* Alcohol, Water, each, *a sufficient quantity.* Mix half a pint of Alcohol, three fluidounces of Glycerin, and five fluidounces of Water, and, having moistened the Uva Ursi with half a pint of the mixture, proceed according to directions given in the general formula at *page* 1193. Finish the percolation with Diluted Alcohol, and, having reserved fourteen fluidounces, add one fluidounce of Glycerin to the remainder of the percolate, before evaporation." *U.S.*

This is a thickish, blackish liquid, of a sweet, bitterish, astringent, but not very disagreeable taste. The dose of this preparation is from thirty minims to a fluidrachm three times a day. W.

EXTRACTUM VALERIANÆ FLUIDUM. *U.S.* *Fluid Extract of Valerian.*

"Take of Valerian, in fine powder, *sixteen troyounces;* Stronger Alcohol *a sufficient quantity.* Moisten the Valerian with five fluidounces of Stronger Alcohol, and proceed according to directions given in the general formula at *page* 1193." *U.S.*

This is another concentrated tincture, strong both in alcohol and the virtues of valerian. It is probable that all or nearly all the volatile ingredients of the root are extracted by the fourteen fluidounces of alcohol which first pass, and which, not being exposed to evaporation, lose none of the volatile oil and acid which they have dissolved; while the soluble matter subsequently extracted, consisting chiefly of the fixed principles, will not be dissipated by the concentration ordered. The fluid extract may, therefore, be considered as fully representing the virtues of the root. The formula is, with some modification, that of Prof. Grahame, late of Baltimore, now of Philadelphia, published in the *Am. Journ. of Pharm.* (xxi. 379). The preparation is a dark soot-coloured liquid, transparent in thin layers, with the smell and taste of valerian. The dose is about a fluidrachm. W.

EXTRACTUM VERATRI VIRIDIS FLUIDUM. *U.S.* *Fluid Extract of American Hellebore.*

"Take of American Hellebore, in fine powder, *sixteen troyounces;* Stronger Alcohol *a sufficient quantity.* Moisten the Hellebore with five fluidounces of Stronger Alcohol, and proceed according to the directions given in the general formula at *page* 1193." *U.S.*

It may be doubted whether this fluid extract is among those demanded by the wants of the profession. We have already a tincture, which, supposing none of the virtues of the medicine to be lost in preparing the fluid extract, will be at least half as strong, and at all events is quite strong enough. It is true that the proportion of alcohol is somewhat less in the fluid extract; but, in so powerful a preparation, this is of little consequence. The tincture itself purports to be saturated; and, though it is probable that, by the concentration of the alcoholic solution, more of the active matter is held by it in the same measure of alcohol than by the tincture; yet a portion of this active matter may be deposited during the evaporation; and, as the deposit is separated by the filtration, no accurate ground of calculation is left as to the real strength of the fluid extract. It may be but little stronger than the tincture, or may possibly be of double the strength; a point which can be determined only by analysis, or physiological experiment, to ascertain how much, if any, of the active matter may be contained in the separated deposit. In the mean time, it would be injudicious to prescribe more of it, as a commencing dose, than from one to three minims. W.

EXTRACTUM ZINGIBERIS FLUIDUM. *U.S.* *Fluid Extract of Ginger.*

"Take of Ginger, in moderately fine powder, *sixteen troyounces;* Alcohol *a sufficient quantity.* Moisten the Ginger with four fluidounces of Alcohol, and proceed according to directions given in the general formula at *page* 1193." *U.S.*

The fluid extract of ginger is a highly concentrated alcoholic solution of the active principles of ginger. It is transparent, and of a reddish colour; and each minim

represents a grain of the root. The dose, therefore, is from ten to twenty minims, or double the number of drops.

Off. Prep. Syrupus Zingiberis, *U. S.* W.

FEL BOVINUM.

Preparation of Ox-gall.

In the British Pharmacopœia of 1864, crude Ox Bile was placed in the *Appendix*, as one of the substances used in preparing medicines; and, in the second part of the work, the following process was given for its purification. In the present edition the crude bile is referred to solely as the source of the purified, which is defined to be "the purified gall of the Ox, Bos Taurus," and is prepared in the same manner as before.

FEL BOVINUM PURIFICATUM. *Br.* *Purified Ox Bile.*

"Take of Fresh Ox Bile *one pint* [Imperial measure]; Rectified Spirit *two pints* [Imp. meas.]. Mix the Bile and the Spirit by agitation in a bottle, and set aside for twelve hours until the sediment subsides. Decant the clear solution, and evaporate it in a porcelain dish by the heat of a water-bath, until it acquires a suitable consistence for forming pills." *Br.*

The properties and uses of Ox Bile are fully treated of in *Part* III. of this work (see *Ox-gall*). The purified bile is sometimes used in cases of debility of the alimentary canal in which the due proportion of bile is wanting. The dose is from two to five grains, and is best given in pill, as there is some chance that it may then pass unchanged into the bowels, where its effects are wanted. W.

FERRUM.

Preparations of Iron.

In accordance with the U. S. Pharmacopœia, we arrange all the preparations of iron under the several heads to which, by the character of the preparation, they appear to belong; the pills, for example, with the Pilulæ or Pills, and the solutions with the Liquores or Solutions. Formerly some of them were distributed according to this plan of arrangement, others were treated of among the preparations of iron. The rule is now made uniform. The preparations of iron considered elsewhere than in the present place are *Plaster of Iron*, with the EMPLASTRA or *Plasters; Aromatic and Compound Mixtures of Iron*, with the MISTURÆ or *Mixtures; Solutions of Citrate, Iodide, Nitrate, Perchloride, Persulphate, Subsulphate*, and *Tersulphate of Iron*, with the LIQUORES or *Solutions; Pills of Aloes and Iron*, and *of Carbonate of Iron, Compound Pills of Iron*, and *Pills of Iodide of Iron*, with the PILULÆ or *Pills; Syrups of Iodide* and *Phosphate of Iron*, with the SYRUPI or *Syrups; Tinctures of Acetate* and *of Chloride of Iron*, with the TINCTURÆ or *Tinctures; Troches of Reduced Iron*, and *of Carbonate of Iron*, with the TROCHISCI or *Troches;* and the *Wine of Iron* and *Wine of Citrate of Iron*, with the VINA or *Wines.* The preparations contained in the old Pharmacopœias, and omitted in the present, are the *Sulphuret of Iron*, Ed., Dub., the *Valerianate of Iron*, Dub., the *Ammoniated Iron*, U. S., Lond.; and the *Tincture of Ammonio-chloride of Iron*, Lond.*

* *Tasteless Salts of Iron.* A very important set of preparations of iron have been recently proposed by Mr. J. L. A. Creuse, of Brooklyn, N. Y. (*Amer. Journ. of Pharm.*, xlv. 214.) It has long been known that the citrate of ammonium has the property of rendering soluble many ordinarily insoluble preparations of iron. Mr. Creuse has discovered that all the salts of the sesquioxide of iron form chemical combinations with *all* the alkaline (ammonium, sodium, potassium, lithium) citrates, which combinations are all greenish, soluble in water, nearly insoluble in alcohol, free from ferruginous taste, perfectly stable, and so resisting decomposition as to form no precipitate with Peruvian bark; indeed chemical reagents do not reveal the iron in them unless strong acids or sulphuretted hydrogen be used. None of these salts coagulate blood; they cannot be used as styptics.

Tasteless Iodide of Iron is prepared in the following manner: 126·3 grains of iodine are combined with iron in the usual way to obtain the solution of the protiodide; this is filtered and sixty-three grains of iodine dissolved in it; a solution of 201 grains of citric acid is exactly saturated with potassa and then added gradually to the first solution. When the apple-green colour has been developed the solution is evaporated, with gentle stirring, to dryness, when cauliflower-like masses of acicular crystals will be obtained. These are stable except in direct sunlight.

FERRI ARSENIAS. *Br.* *Arseniate of Iron.*

"Take of Sulphate of Iron *nine ounces* [avoirdupois]; Arseniate of Soda, dried at 300°, *four ounces* [avoird.]; Acetate of Soda *three ounces* [avoird.]; Boiling Distilled Water *a sufficiency.* Dissolve the Arseniate and Acetate of Soda in *two pints* [Imperial measure], and the Sulphate of Iron in *three pints* [Imp. meas.] of the Water, mix the two solutions, collect the white precipitate, which forms, on a calico filter, and wash until the washings cease to be affected by a dilute solution of chloride of barium. Squeeze the washed precipitate between folds of strong linen in a screw press, and dry it on porous bricks, in a warm chamber whose temperature shall not exceed 100°." *Br.*

This is an officinal of the first British Pharmacopœia, which as yet is the only one that has adopted it. Of the salts used in the process, omitting their water of crystallization, the sulphate of iron consists of one eq. of protoxide of iron and one of sulphuric acid, the arseniate of sodium of two eqs. of soda and one eq. of arsenic acid, and the acetate of sodium of one eq. of base and one of acid; while the salt to be obtained consists of three eqs. of protoxide of iron and one of arsenic acid. The reactions which result in the production of the last-mentioned salt take place between three eqs. of sulphate of iron and one eq. of each of the other salts. The three eqs. of protoxide of iron of the sulphate unite with the one eq. of arsenic acid of the arseniate to form one eq. of arseniate of iron, which is deposited; while the three eqs. of sulphuric acid, thus liberated, combine with the two liberated eqs. of soda of the arseniate of sodium, and one eq. of soda of the acetate, to make three eqs. of sulphate of sodium, which, with the separated acetic acid, remain in solution. The quantities of the several salts are very nearly in due equivalent proportion; the arseniate and acetate of sodium, however, being very slightly in excess.

Arseniate of iron is white when first formed, but quickly becomes green on exposure to the air. It is an amorphous powder, without smell or taste, insoluble in water, but readily dissolved by muriatic acid. It consists of three eqs. of protoxide of iron and one of arsenic acid ($3FeO,AsO_5$), but, like other salts of protoxide of iron, absorbs oxygen, and probably, therefore, contains an indefinite proportion of sesquioxide of iron. The British Pharmacopœia gives the following characters of the salt. Its solution in muriatic acid causes a copious light-blue precipitate with the yellow prussiate of potash (ferrocyanide of potassium), and a still more abundant one, of a deeper colour, with the red prussiate of potash (ferridcyanide of potassium). A small quantity, boiled with an excess of soda, and filtered, gives, when exactly neutralized by nitric acid, a brick-red precipitate on the addition of solution of nitrate of silver. The former test proves the presence both of protoxide and sesquioxide of iron, the latter of arsenic acid. The solution in muriatic acid, when diluted, gives no precipitate with chloride of barium, showing the absence of any sulphate. "Twenty grains dissolved in an excess of hydrochloric acid diluted with water continue to give a blue precipitate with the red prussiate of potash (ferridcyanide of potassium), until at least 170 grain-measures of the *volumetric solution of bichromate of potash* have been added." *Br.* This test proves that there is a due proportion of the protoxide of iron present; for the bichromate of potassium oxidizes the protoxide, and, until this is wholly converted into sesquioxide, a blue precipitate continues to be produced, ceasing, however, when the conversion is complete.

Medical Properties. The arseniate of iron is said to unite the virtues of the two metals which enter into its composition; but the quantity of iron in any permissible dose is so small as to be nearly or quite insignificant; and the activity of the medicine is in fact due to the arsenic alone. The complaints in which it has been found efficient are those in which arsenic in other forms has proved to be a most valuable remedy; and, judging from our own observation, there is no one of them in which the common solution of arsenite of potassium will not produce all the effects that can

Tasteless Chloride of Iron is made by adding an alkaline citrate in solution to a solution of sesquichloride of iron, in such proportion that there shall be two equivalents of the former to three equivalents of chlorine. Usually from 120 to 140 grains of citric acid saturated with soda, potassa, or ammonia are required for the preparation of an ounce of a tincture of corresponding strength to the officinal tincture. The addition should be made to the liquor, and the final solution must not contain more than forty per cent. of alcohol. (*Note to the fourteenth edition.*) H. C. W.

be obtained from the arsenical preparations, with which this ought undoubtedly to be ranked rather than with the chalybeates. Should the coexistence of an anemic state of the system with any disease requiring the use of arsenic, indicate the joint use of iron, it would be unsafe to depend on the arseniate of iron alone. This remedy is peculiarly useful in chronic affections of the skin, especially those of a scaly character, as lepra, psoriasis, and the advanced stage of eczema and impetigo. It is useful also in lupus; and, mixed with twelve times its weight of simple cerate, may be employed externally in cancerous ulcers, though much caution is requisite. The dose is from the eighth to the tenth of a grain, of which about one-half only is protoxide of iron. It may be given in pill, three times a day. W.

FERRI CARBONAS SACCHARATA. *Br.* *Saccharated Carbonate of Iron.*

"Take of Sulphate of Iron *two ounces* [avoirdupois]; Carbonate of Ammonia *one ounce and a quarter* [avoird.]; Boiling Distilled Water *two gallons* [Imperial measure]; Refined Sugar *one ounce* [avoird.]. Dissolve the Sulphate of Iron and the Carbonate of Ammonia each in half a gallon [Imp. meas.] of the Water, and mix the two solutions with brisk stirring in a deep cylindrical vessel, which is then to be covered as accurately as possible. Set the mixture by for twenty-four hours, and from the precipitate which has subsided separate the supernatant solution by a siphon. Pour on the remainder of the Water, stir well, and, after subsidence, again remove the clear solution. Collect the resulting carbonate on a calico filter, and, having first subjected it to expression, rub it with the Sugar in a porcelain mortar. Finally dry the mixture at a temperature not exceeding 212°." *Br.*

When solutions of sulphate of iron and carbonate of sodium are mixed together, there are formed, by double decomposition, sulphate of sodium which remains in solution, and carbonate of protoxide of iron which falls as a pale-blue precipitate. This precipitate begins immediately to alter in nature by the absorption of oxygen, and, if washed and dried in the ordinary way, becomes sesquioxide of iron, associated with a small quantity of the carbonate of the protoxide, which has escaped change; in other words, it is converted into the subcarbonate of iron of the U. S. Pharmacopœia. (See *Ferri Subcarbonas.*) As the preparations of iron containing the protoxide are the most esteemed, the change which this precipitate undergoes was always matter of regret, and various attempts were made to prevent it. Now saccharine matter has been ascertained to possess the required property; and, in the preparation under consideration, it is used to prevent the protoxide of iron of the carbonate as first precipitated from passing into sesquioxide, with loss of carbonic acid.

Dr. Becker, a German physician, was the first to suggest the use of saccharine matter as a means of protection against the absorption of oxygen; and the idea was carried out by Klauer, a German chemist, who first made the saccharine carbonate of iron. The use of boiling distilled water in the process is to avoid the action of the air contained in unboiled water. The washed precipitate is pressed so as to free it from water as far as possible, and then incorporated with the sugar in fine powder. The mode of treating the precipitate unnecessarily exposes it to the action of the air; and the late London method of incorporating it with the sugar immediately after washing was on this account preferable. The final drying heat should not exceed 130°. The protection from oxidation, however, is more complete, when both the materials and product of the process are maintained constantly in contact with saccharine matter, by using weak syrup both for dissolving the salts and washing the precipitate, after the improved method of Vallet, of Paris. This improved method of proceeding is adopted for forming the U. S. pills of carbonate of iron, or Vallet's ferruginous pills. (See *Pilulæ Ferri Carbonatis, U. S.*)*

* *Saccharated Oxide of Iron. Saccharum Ferrugineum.* This is a combination of sugar and sesquioxide of iron. It is soluble and of a pure sweet taste. According to the method of Siebert, to prepare it dissolve two parts of iron in twenty-four parts of nitric acid, sp. gr. 1·2; evaporate the filtrate to fifteen parts; when *quite cool* dissolve twelve parts of sugar in the filtrate, and add an excess of a solution of twelve parts of sugar in twelve parts of 20 per cent. water of ammonia. After setting aside for twenty-four hours, precipitate this with four or five times its volume of strong alcohol; collect the precipitate, partially dry with bibulous paper, intimately mix the moist mass with its own weight of powdered sugar, dry by a moderate heat. There is good reason for believing that

Properties. Saccharine carbonate of iron is in small coherent lumps, of a grayish-brown colour, permanent in the air, having a sweet, styptic taste, and wholly and readily soluble in muriatic acid with brisk effervescence. According to the British Pharmacopœia, it is a "carbonate of iron (FeO,CO_2), mixed with peroxide of iron and sugar, and forming at least 57 per cent. of the mixture." The presence of sesquioxide of iron is a defect, which is avoided in Vallet's ferruginous pills.

Its solution in dilute muriatic acid is but slightly affected by ferrocyanide of potassium, showing the presence of the sesquioxide of iron in only small proportion, but yields a copious blue precipitate with the ferridcyanide, proving the abundance of the protoxide. The same solution should give but a very slight precipitate with chloride of barium, evincing that very little sulphate either of iron or soda has escaped the washing process. "Twenty grains dissolved in excess of hydrochloric acid, and diluted with water, continue to give a blue precipitate with red prussiate of potash until at least 330 grain-measures of the *volumetric solution of bichromate of potash* have been added." *Br.* This test determines the quantity of protoxide of iron present, requiring the stated amount of the bichromate to convert it into sesquioxide.

Medical Properties. This preparation is an excellent chalybeate, possessing the advantages of having nearly all the iron in it in the state of protoxide, and of being readily soluble in acids. Originally introduced into the officinal list by the Edinburgh College, it appeared for the first time in the Dublin and London Pharmacopœias of 1850 and 1851. It is probably more active than the subcarbonate of iron, and must be used in a smaller dose. It is, however, inferior to Vallet's ferruginous mass, in the preparation of which the anti-oxidizing influence of saccharine matter is more fully applied. The dose of the saccharine carbonate of iron is from five to thirty grains, given in the form of pill.

Off. Prep. Pilula Ferri Carbonatis, *Br.* B.

FERRI CHLORIDUM. *U. S. Chloride of Iron. Sesquichloride of Iron. Perchloride of Iron.*

"Take of Iron, in the form of wire and cut in pieces, *two troyounces;* Muriatic Acid *twelve troyounces;* Nitric Acid *a troyounce* or *a sufficient quantity.* Add the Iron to eight troyounces of Muriatic Acid, contained in a two-pint flask, and apply a gentle heat, until the Acid is saturated and effervescence has ceased. Filter the solution, add to it the remainder of the Muriatic Acid, heat the mixture nearly to the boiling point in a four-pint porcelain capsule, and add Nitric Acid in successive portions until red fumes are no longer evolved, and a drop of the liquid ceases to yield a blue precipitate with ferridcyanide of potassium. Transfer the liquid to a smaller capsule, evaporate it by a gentle heat, on a sand-bath, until reduced to eight troyounces and three hundred and sixty grains, and set aside the residue, covered with glass, until it forms a solid, crystalline mass. Lastly, break this into pieces, and keep the fragments in a well-stopped bottle protected from the light." *U. S.*

This is a recent formula of the U. S. Pharmacopœia, adopted with little alteration from that of Wittstein. (*Pract. Pharm. Chem., Darby's Transl.*, p. 265.) When iron is heated with muriatic acid, water is decomposed, the hydrogen escapes with effervescence, and the oxygen uniting with the iron forms the protoxide of that metal, which reacts with the muriatic acid to form water and protochloride of iron. This is believed by the author to be the true rationale; though a simpler explanation is usually given, according to which the chlorine of the acid unites directly with the iron, and the hydrogen is set free. The next step of the process is to convert the protochloride into the sesquichloride of iron. This is effected by treating it with muriatic and nitric acids, and heating till red fumes no longer escape. The nitric acid is decomposed into nitric oxide, which, escaping, forms red hyponitric acid fumes by combining with the oxygen of the air, and into oxygen which sesquioxidizes a portion of the iron of the protochloride, thus converting the remainder into sesquichloride, while the sesquioxide produced reacts with the additional muriatic acid to form an additional portion of sesquichloride; or the oxygen of the nitric acid may combine

this saccharated oxide of iron is the best known antidote for arsenic. (*Amer. Journ. of Pharm.*, xl. 324, 326.) For further information, see *Neues Repertor. für Pharm.*, xviii. 36. (*Note to the fourteenth edition.*)

with the hydrogen of the muriatic acid, and thus liberate sufficient chlorine to form a sesquichloride with the iron. The solution is then evaporated, and, on cooling, concretes into a crystalline mass. The relative proportions of iron and the two acids are adjusted very nearly to the production of these results.

Properties. Sesquichloride of iron (Ferri Chloridum, *U. S.*) is in fragments of a crystalline structure, an orange-yellow colour, inodorous, and of a strong chalybeate and styptic taste. It is deliquescent, very soluble in water, and soluble also in alcohol and ether. It consists of two eqs. of iron and three of chlorine (Fe_2Cl_3), with a variable proportion of water according to the crystalline forms it is made to assume, having about 40 per cent. or 12 eqs. when in fine acicular crystals, and only 22 per cent. or five eqs. when in the form of larger tables. (*Brande and Taylor.*) Its solution in water gives with ammonia a brown precipitate of sesquioxide of iron, and does not yield a blue one with the ferridcyanide of potassium, proving the absence of protochloride or protoxide of iron.*

The sesquichloride of iron is used almost exclusively in the form of tincture or liquor; and in reference to its effect and application we refer to the *Tinctura Ferri Chloridi* and *Liquor Ferri Chloridi.* It is kept in the solid state, because, when dissolved, it is apt to deposit sesquioxide of iron (oxychloride of iron, *Brurin du Buisson*) in an insoluble condition, whereby an excess of acid is produced, which renders the preparation too irritant for many of the purposes for which it is used. (Squibb, *N. Y. Journ. of Med.*, March, 1860, p. 170.) As a solid, it keeps indefinitely without change. When used, it may be dissolved in water in such proportions as may be required. Six, three, two, and one and a half drachms to a fluidounce of water have been recommended; the stronger solutions being used in the treatment of varices, the weaker for injection into aneurisms, and for application to bleeding surfaces, &c. Mr. J. Z. Lawrence, of England, has used it as a styptic in a semi-deliquesced state, and found it extremely efficient. He keeps it in a bottle, in which it gradually deliquesces; and, while it is in this condition, he applies the thick liquid portion, by means of a brush of spun-glass, to the bleeding surface. He has employed it in arresting hemorrhage after excision of the tonsils, and from the deeper-seated gums. (*Med. Times and Gaz.*, Aug. 1859, p. 219.) Chloride of iron has been employed internally, by Messrs. Jodin and Aubrun, of Paris, and with great asserted success, in the treatment of pseudo-membranous croup, in quantities varying, according to the severity of the disease and the age of the patient, from ninety grains to half an ounce, in divided doses, in the twenty-four hours, and continued for three or four days. (*Ann. de Thérap.*, 1861, p. 201.) W.

FERRI CITRAS. *U. S.* *Citrate of Iron.*

"Take of Solution of Citrate of Iron *a convenient quantity.* Evaporate the solution, at a temperature not exceeding 140°, to the consistence of Syrup, and spread it on plates of glass, so that the salt, when it is dry, may be obtained in scales." *U. S.*

Citrate of iron, as thus prepared, is in thin transparent pieces, of a beautiful garnet-red colour. It is an uncrystallizable salt, slowly soluble in cold, but readily soluble in boiling water, and possessing a mild chalybeate taste. It probably consists of one eq. of citric acid 165, and one of sesquioxide of iron 80 = 245.

Citrate of iron was introduced to the notice of the profession, in 1831, by M. Béral, of Paris. It is a pleasant chalybeate, and is best given in solution. Prof. Procter finds that a solution of this salt in distilled water, containing 240 grains in a fluidounce, keeps perfectly, and is very convenient for dispensing. It may be given in the dose of ten minims, containing five grains of the salt, several times a day. (See *Liquor Ferri Citratis.*) B.

FERRI ET AMMONII CITRAS. *U. S.*, *Br.* *Citrate of Iron and Ammonia.*

"Take of Solution of Citrate of Iron *a pint;* Water of Ammonia *six fluidounces.* Mix the Solution of Citrate of Iron with the Water of Ammonia, evaporate the mix-

* *Incompatibles with the Perchloride of Iron.* The following list is given (*L'Union Pharmaceutique*, 1872) by M. Bouilhon. Salts of silver; protosalts of mercury; alkalies, their carbonates and bicarbonates; the arsenites and arseniates; borate of sodium; tannin and vegetable astringents; gums; vegetable extracts and vegetable infusions; albumen; casein. (*Note to the fourteenth edition.*)

ture, at a temperature not exceeding 140°, to the consistence of syrup, and spread it on plates of glass, so that the salt, when it is dry, may be obtained in scales." *U. S.*

"Take of Solution of Persulphate of Iron *eight fluidounces;* Solution of Ammonia *nineteen and a half fluidounces;* Citric Acid *four ounces* [avoirdupois]; Distilled Water *a sufficiency.* Mix fourteen fluidounces of the Solution of Ammonia with two pints [Imperial measure] of Distilled Water, and to this add gradually the Solution of Persulphate of Iron, previously diluted with two pints [Imp. meas.] of Distilled Water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with Distilled Water until that which passes through the filter ceases to give a precipitate with chloride of barium. Dissolve the Citric Acid in eight [fluid]ounces of Distilled Water, and having applied the heat of a water-bath, add the oxide of iron, previously well drained, and stir them together until the whole or nearly the whole of the oxide has dissolved. Let the solution cool, then add five and a half fluidounces of Solution of Ammonia. Filter through flannel, evaporate to the consistence of syrup and dry it in thin layers on flat porcelain or glass plates at a temperature not exceeding 100°. Remove the dry salt in flakes, and keep it in a stoppered bottle." *Br.**

In the U. S. Pharmacopœia, the process consists simply in evaporating a mixture of solution of citrate of iron and water of ammonia. In the British, hydrated sesquioxide of iron is first precipitated from a solution of the tersulphate, then digested at a boiling heat with a solution of citric acid, and lastly neutralized by ammonia. It has, however, been found by Dr. Squibb that a heat above 180° acts injuriously in the preparation of the citrate of iron; and the boiling heat directed in the British Pharmacopœia of 1864 was, therefore, improper. (*Am. Journ. of Pharm.*, xxvii. 297.) This error has been corrected in the present Pharmacopœia, which directs that the salt should be dried at a heat not above 100°. In the U. S. formula the citrate of iron is used already prepared, in the British is prepared in the process. The direction as to the evaporation, at the close of the original British process, was not sufficiently explicit. The solution should be concentrated to a syrupy consistence, as ordered in the U. S. and existing British formulas, before being poured out on porcelain or glass to dry; and it is important that the heat employed in the concentration should not exceed 140°.

Properties, &c. Ammonia-citrate of iron is in garnet-red translucent scales, having a slightly chalybeate taste, and readily and wholly soluble in water, forming a solution of a clear ruby colour. It is much more readily soluble in water than the citrate of iron, described in the last article. It is almost insoluble in alcohol. It is neutral to test paper ("feebly reddens litmus paper," *Br.*); and its solution in water, acidulated with muriatic acid, though not rendered blue by ferridcyanide of potassium, gives a copious blue precipitate with the ferrocyanide, at once proving the absence of protoxide of iron and the presence of the sesquioxide. In heated solution it is decomposed by potassa, soda, and lime-water, which throw down sesquioxide of iron and evolve ammonia; and the alkaline solution from which the iron has been thrown down, if acidulated with muriatic acid in slight excess, does not yield a crystalline deposit, showing that the acid is not the tartaric. When incinerated in the air, it leaves 26·5 per cent. (not less than 27 per cent., *Br.*) of peroxide of iron. Its precise chemical constitution is not determined; but it probably consists of one eq. of each of its three constituents, besides water (Fe_2O_3,NH_4O,HO,$C_{12}H_5O_{11} + 2HO$). (*Br.* 1864.) This salt is a pleasant chalybeate. Its ready solubility gives it an advantage over the citrate. The dose is five grains, repeated several times a day, and given in solution. According to Dr. Paris, it may be mixed with the carbonated alkalies without decomposition, and given in a state of effervescence with citric acid.

Off. Prep. Ferri et Strychniæ Citras, *U. S.;* Vinum Ferri Citratis, *Br.* B.

FERRI ET AMMONII SULPHAS. *U.S.* *Sulphate of Iron and Ammonium.* *Ammonio-ferric Alum.*

"Take of Solution of Tersulphate of Iron *two pints;* Sulphate of Ammonium *four*

* A formula for the preparation of the *citrate of iron and bismuth* may be found in the *Pharm. Journal and Trans.*, 3d ser., v. 832.

troyounces and a half. Heat the Solution of Tersulphate of Iron to the boiling point, add the Sulphate of Ammonium, stirring until it is dissolved, and set the liquid aside to crystallize. Wash the crystals quickly with very cold water, wrap them in bibulous paper, and dry them in the open air." *U. S.*

This is an ammonia iron-alum, in which the place of the sesquioxide of aluminium (alumina) is occupied by sesquioxide of iron. It is prepared by heating the solution of tersulphate of iron with sulphate of ammonium until the latter salt is dissolved, and then allowing the solution to cool. The two salts unite to form the sulphate of iron and ammonium, which, being insoluble in the amount of liquid employed, crystallizes when it cools. The process is based on one published by Wm. Hodgson, jun., in the *Am. Journ. of Pharm.* for July, 1856 (p. 305). The salt consists of one eq. of each of the two salts composing it, with probably 24 eqs. of water of crystallization ($Fe_2O_3,3SO_3+NH_4O,SO_3+24HO$).

Ammonio-ferric alum is in octohedral crystals, of a pale violet colour, and sour astringent taste, slowly efflorescent on exposure, and soluble in 1·5 parts of water at 60°, and in less than their weight of boiling water. The sulphuric acid is recognised by giving a precipitate with chloride of barium insoluble in nitric acid; the sesquioxide of iron by being thrown down of a reddish-brown colour, by potassa; and the ammonia, by the emission, when the moistened salt is rubbed with the same alkali, of its peculiar odour. According to H. Rose, the pure salt is white, and gives a coloured solution with water, in consequence of the formation of a basic ferruginous salt. This decomposition is prevented by dissolving it in dilute sulphuric acid, when the solution is colourless.

Instead of sulphate of ammonium, sulphate of potassium may be employed along with the tersulphate of iron, in which case a potassa iron-alum is produced, called *potassio-ferric alum*, which has all the properties, physical and remedial, of the ammonio-ferric salt; and the two appear to have been indiscriminately used. The formula of this salt would be $Fe_2O_3,3SO_3+KO,SO_3+24HO$.

The iron alums were brought to the notice of the Pharmaceutical Society of London, in Dec. 1853, by Mr. Lindsley Blyth, as a new remedy, prescribed in St. Mary's Hospital. Dr. Tyler Smith found them to be more astringent than common alum, and devoid of the stimulating effects of the other salts of iron. They have been used internally in leucorrhœa, with great asserted benefit, in diarrhœa and chronic dysentery, and in other affections requiring combined tonic and astringent treatment. (*Pharm. Journ.*, Jan. 1854, p, 306.) A saturated solution of ferric alum has been strongly recommended as a styptic. The dose is from three to twelve or fifteen grains, to be repeated twice or three times a day. B.

FERRI ET AMMONII TARTRAS. *U.S.* *Tartrate of Iron and Ammonium.*

"Take of Tartaric Acid *twelve troyounces;* Solution of Tersulphate of Iron *two pints and a half;* Carbonate of Ammonium, Distilled Water, each, *a sufficient quantity.* Dissolve six troyounces of the Tartaric Acid in two pints of Distilled Water, and neutralize it carefully by means of Carbonate of Ammonium; then add the remainder of the Acid, dissolved in half a pint of Distilled Water, and mix the solutions. From the Solution of Tersulphate of Iron, prepare the Hydrated Oxide of Iron according to the formula for that substance, and add it gradually to the solution of bitartrate of ammonium, kept at the temperature of 140°, until it is no longer dissolved. Then filter the solution, and evaporate, at a temperature not exceeding 140°, to the consistence of syrup. Lastly, spread it on plates of glass, so that the salt when it is dry may be obtained in scales." *U. S.*

This is a recent officinal of the U. S. Pharmacopœia, adopted from Prof. Procter, whose process was published in the *American Journal of Pharmacy*, so long since as in 1841 (xii. 276). Tartrate of ammonium is first prepared, which is converted into bitartrate by the addition of tartaric acid; and the excess of acid is then combined with hydrated sesquioxide of iron freshly prepared from the officinal solution of the tersulphate. A double salt of tartrate of ammonium and tartrate of iron is thus made in solution, which is obtained by filtering and concentrating the solution. The

bibasic view of tartaric acid requires a different explanation. According to this, the salt must be considered as consisting of one eq. of tartaric acid, with a doubled equivalent number, and two eqs. of base, one consisting of ammonia and the other of sesquioxide of iron. In the first view, it would be represented by the formula $Fe_2O_3,C_4H_2O_5+NH_4O,C_4H_2O_5$; in the second, by $Fe_2O_3,NH_4O+C_8H_4O_{10}$, independently of the water, which has been estimated between four and five equivalents.

This salt is in transparent garnet-red scales, which when powdered assume a rust-brown colour. It has a sweetish not disagreeable taste, and is very soluble in water though slowly, being taken up by somewhat more than its own weight. It is insoluble in alcohol and ether. Test paper is not affected by it. The fixed alkalies do not precipitate it from its solution, nor is it rendered blue by ferrocyanide of potassium, showing that it contains no protoxide of iron. Incinerated in the air, it leaves 29 per cent. of sesquioxide of iron. It is a mild chalybeate, and may be given in a dose of from ten to thirty grains. W.

FERRI ET POTASSII TARTRAS. *U. S.* FERRUM TARTARATUM. *Br. Tartrate of Iron and Potassium. Tartarated Iron. Potassio-tartrate of Iron.*

"Take of Solution of Tersulphate of Iron *a pint;* Bitartrate of Potassium *seven troyounces;* Distilled Water *four pints.* From the Solution of Tersulphate of Iron, prepare the Hydrated Oxide of Iron according to the formula for that substance. Mix the Bitartrate of Potassium with the Distilled Water. heat the mixture to 140°, and, keeping it at that temperature, gradually add the Hydrated Oxide, frequently stirring, until it ceases to be dissolved. Then filter the solution, evaporate it by means of a water-bath at a temperature not exceeding 140°, to the consistence of syrup, and spread it upon plates of glass or porcelain, so that the salt, when it is dry, may be obtained in scales." *U. S.*

"Take of Solution of Persulphate of Iron *five and a half fluidounces* [Imperial measure]; Solution of Ammonia *ten fluidounces* [Imp. meas.]; Acid Tartrate of Potash, in powder, *two ounces* [avoirdupois]; Distilled Water *a sufficiency.* Mix the Solution of Ammonia with *three pints* [Imp. meas.] of Distilled Water, and to this add gradually the Solution of Persulphate of Iron previously diluted with two pints [Imp. meas.] of Distilled Water, stirring constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with Distilled Water until that which passes through the filter ceases to give a precipitate with chloride of barium. Mix the washed and drained precipitate intimately with the Acid Tartrate of Potash in a porcelain dish and let the mixture stand for twenty-four hours; then, having applied a gentle heat, not exceeding 140°, add gradually a pint [Imp. meas.] of Distilled Water, and stir constantly until nothing more will dissolve. Filter; evaporate at a temperature not exceeding 140° to the consistence of syrup, and dry it in thin layers on flat porcelain or glass plates in a drying closet at 120°. Remove the dry salt in flakes and keep it in stoppered bottles." *Br.*

The object of these processes is to combine the excess of acid in the bitartrate of potassium with sesquioxide of iron. In both, the plan of Soubeiran is adopted; namely, that of dissolving the moist hydrated sesquioxide to saturation in a mixture of the bitartrate and water, aided by a moderate heat. The sesquioxide is now obtained from the tersulphate of sesquioxide of iron, which is precipitated by ammonia. Potassa, which was used in the former British process, is not a good precipitant; because the alkali adheres obstinately to the precipitated sesquioxide, and cannot be completely separated even by repeated washings. The sesquioxide should be gradually added to the bitartrate and water, heated to 140°, as recommended by Soubeiran, at which temperature the oxide dissolves more readily and in larger quantity than when a higher temperature is employed. Besides, in the latter case, a portion of the sesquioxide is converted into protoxide. (*Gmelin's Handbook*, x. 315.) In both formulas, the liquid is poured out on a plane surface, so as to dry in scales. When duly carried into effect, they yield a product at all times identical, and having all the required qualities of the salt.*

* *A new method of preparing this salt.* M. Roger, having found the tartrate of iron and potassium,

The late Dr. Ure proposed the *tartrate of protoxide of iron* for medical use. He made it by acting on clean iron filings, or bits of iron wire, with a solution of tartaric acid. It is a pulverulent salt, insoluble in water, and possessing a mild chalybeate taste.

Properties. Tartrate of iron and potassium, as obtained by the above formulas, is in transparent scales of a ruby-red colour, wholly soluble in about four parts of water, and "sparingly soluble in spirit." *Br.* It has a sweetish slightly chalybeate taste. Its solution does not change the colour of litmus, and at common temperatures is not precipitated by potassa, soda, or ammonia. Ferrocyanide of potassium does not render it blue, unless an acid be added. The non-action of this test shows that the iron is in a peculiar state of combination. Acidulated with muriatic acid, the solution gives a copious blue precipitate with the ferrocyanide of potassium, but none with the ferridcyanide, showing the absence of protoxide of iron. In boiling solution, soda precipitates sesquioxide of iron, without evolution of ammonia; and the filtered solution, acidulated with muriatic acid, deposits a crystalline substance when it cools; the latter test showing the presence of tartrate of potassium, the former that of the sesquioxide of iron without ammonia, and both together the character of the salt. According to the view of its nature taken in the U. S. Pharmacopœia, it is a double salt, consisting of one eq. of tartrate of sesquioxide of iron and one of tartrate of potassium ($Fe_2O_3,C_4H_2O_5+KO,C_4H_2O_5+HO$); according to the bibasic view of tartaric acid, it is a tartrate with a double base ($Fe_2O_3,KO,C_8H_4O_{10}+HO$), the eq. of tartaric acid being doubled. "By incinerating 50 grains at a red heat, washing what is left with distilled water, and again incinerating, a residue of peroxide is obtained, weighing 15 grains." (*Br.*) The salt is incompatible with astringent vegetable infusions, which give rise to a dark-coloured precipitate.

Medical Properties. Tartrate of iron and potassium is an agreeable chalybeate, and may be depended upon for activity and uniformity of composition. It has a somewhat laxative effect, which makes it suitable to the treatment of certain cases. It is the chalybeate preferred by M. Mialhe, who conceives that it is more readily absorbed than any other ferruginous preparation. It is also well borne by the stomach, whether taken fasting, or with the food. From its slight taste and ready solubility, it is one of the best ferruginous preparations for children. The dose for an adult is from ten grains to half a drachm, given preferably in solution. B.

FERRI ET QUINLÆ CITRAS. *U. S., Br. Citrate of Iron and Quinia.*

"Take of Solution of Citrate of Iron *ten fluidounces;* Sulphate of Quinia *a troyounce;* Diluted Sulphuric Acid, Water of Ammonia, Distilled Water, each, *a suffi-*

as existing in the shops of Paris, a very variable salt, seldom presenting perfect identity of composition in any two specimens, and ascribing this result to the imperfection of the prevalent mode of preparing it, which requires a large amount of water, and consequently a prolonged evaporation, resulting in the reduction of the sesquioxide, and the production of a yellowish insoluble ferrous salt, and which is attended besides with various other inconveniences, proposes the following method, which he conceives to be free from these objections, and to present in all instances an identical product. The newly proposed method consists in causing, as a first step, strongly hydrated sesquioxide of iron to be dissolved in tartaric acid to complete saturation, for which purpose the water of hydration of the sesquioxide is sufficient at a temperature of 100° to 120° F. The solution takes place completely and quickly; and the point of saturation is known when the liquid, at first clear, becomes turbid, thickens, and at last concretes in the form of a jelly. No more of the sesquioxide, which is in slight excess, is now to be added. Upon this jelly is to be poured, little by little, a very concentrated solution of *pure* carbonate of potassium, of which the quantity to be used should be the equivalent of that of the tartaric acid employed. But this precision as to the quantity of the carbonate is not absolutely necessary; as the cessation of effervescence is a sufficient criterion of saturation. Should, however, the solution, upon testing it, be found slightly acid, the solution of carbonate of potassium should be cautiously added till the reaction becomes slightly alkaline. The vessel is then to be removed from the water-bath, and the liquid allowed to cool. Twelve hours afterwards, the liquid is decanted, filtered, and evaporated by means of a water-bath, with constant agitation, to a syrupy consistence. It is then to be spread by means of a brush, in thin layers, on plates of glass, which are to be placed in the drying room. The salt is thus obtained in beautiful spangles, of a deep garnet red. Or it may be dried in moulds of tinned iron with a large surface; but in this case, instead of scales, it forms little black masses not unlike jet. Thus prepared, it always presents the same composition, dissolves in water without residue, and, besides, is little disposed to deliquescence, so that it may be readily employed in pills. The solution, however, is slow in forming, as the salt at first agglomerates at the bottom of the vessel; but in half an hour it is complete, and may be kept long unchanged. (*Journ. de Pharm.*, Juin, 1861, p. 401.)—***Note to the twelfth edition.***

cient quantity. Triturate the Sulphate of Quinia with six fluidounces of Distilled Water, and, having added sufficient Diluted Sulphuric Acid to dissolve it, cautiously pour into the solution Water of Ammonia, with constant stirring, until in slight excess. Wash the precipitated Quinia on a filter, and, having added it to the Solution of Citrate of Iron, maintained at the temperature of 120° by means of a water-bath, stir constantly until it is dissolved. Lastly, evaporate the solution, at a temperature not exceeding 140°, to the consistence of syrup, and spread it on plates of glass, so that the salt, when it is dry, may be obtained in scales." *U. S.*

"Take of Solution of Persulphate of Iron *four and a half fluidounces;* Sulphate of Quinia *one ounce* [avoirdupois]; Diluted Sulphuric Acid *twelve fluidrachms* [Imperial measure]; Citric Acid *three ounces* [avoird.]; Solution of Ammonia, Distilled Water, of each, *a sufficiency.* Mix eight fluidounces [Imp. meas.] of the Solution of Ammonia with two pints [Imp. meas.] of Distilled Water, and to this add the solution of Persulphate of Iron previously diluted with two pints of Distilled Water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with Distilled Water until that which passes through the filter ceases to give a precipitate with chloride of barium.

"Mix the Sulphate of Quinia with eight [fluid]ounces of Distilled Water, add the Diluted Sulphuric Acid, and when the salt is dissolved precipitate the quinia with a slight excess of Solution of Ammonia. Collect the precipitate on a filter, and wash it with a pint and a half of Distilled Water.

"Dissolve the Citric Acid in five [fluid]ounces of Distilled Water, and, having applied the heat of a water-bath, add the oxide of iron previously well drained; stir them together, and when the oxide has dissolved, add the precipitated quinia, continuing the agitation until this also has dissolved. Let the solution cool, then add in small quantities at a time twelve fluidrachms of Solution of Ammonia diluted with two fluidounces of Distilled Water, stirring the solution briskly, and allowing the quinia which separates with each addition of ammonia to dissolve before the next addition is made. Filter the solution, evaporate it to the consistence of a thin syrup, then dry it in thin layers on flat porcelain or glass plates at a temperature of 100°. Remove the dry salt in flakes, and keep it in a stoppered bottle." *Br.*

The U. S. process is based on a published formula of Prof. Procter, described in the eleventh edition of this Dispensatory (*page* 1393). It consists simply in dissolving, at a temperature of 120°, in a definite measure of solution of citrate of iron (U. S.), the quinia obtained by precipitating a given weight of sulphate of quinia by water of ammonia. The British process of 1864 was more complicated. First, a mixture of sesquioxide and protoxide of iron was obtained by precipitating a mixture of the sesquisulphate and sulphate in solution by means of soda. Secondly, the mixed oxides thus obtained were digested with a solution of citric acid, so as to produce in solution a citrate of the two oxides. Thirdly, sulphate of quinia, dissolved by means of dilute muriatic acid, was precipitated by chloride of barium so as to separate the sulphuric acid, and from the solution of the muriate of quinia remaining, the quinia was thrown down by ammonia. Lastly, the quinia thus procured was digested with the solution of citrate of iron, and the resulting citrate of iron and quinia was obtained by evaporation. This process has been much altered, and, we think, amended in the present Pharmacopœia. Indeed, M. Fleurot, after trying the process, came to the conclusion that it was fallacious. (*Pharm. Journ.*, July, 1864, p. 21.) M. Fleurot has proposed a formula of his own, which appears to have served as the basis of the amended British process, especially in reference to the addition of ammonia to the solution of the oxide of iron and the quinia in the citric acid. (*Journ. de Pharm.*, 4e sér., i. 443.) The use of the two sulphates of iron has been abandoned, and only the solution of the persulphate retained. From this the freshly precipitated hydrated sesquioxide of iron is obtained by precipitation with ammonia. The next step is to separate quinia from the sulphate, by simply dissolving the salt in water with the aid of sulphuric acid, and then precipitating by ammonia. Thirdly, the sesquioxide and quinia are dissolved successively, with the heat of a water-bath, in solution of citric acid, whereby a citrate of iron and of quinia is obtained. The

ammonia appears to be added in order to render the citrate of iron and quinia more soluble by the agency of a portion of citrate of ammonium. It is important that the ammonia should not be added in excess; on the contrary, the solution should retain a slight acid reaction. (*Fleurot.*) After evaporation, the salt is dried, as in the other process, on glass or porcelain, so as to be obtained in thin scales.

The U. S. and Br. preparations now essentially agree; both consisting of citric acid, sesquioxide of iron, and quinia; the British, however, containing in addition a little citrate of ammonium. The Br. preparation of 1864 consisted of citric acid, mixed sesquioxide and protoxide of iron, and quinia. No such analysis of either salt has been made as to determine precisely its equivalent composition; but the U. S. salt is probably a mixture of the proper citrate of iron and quinia with citrate of the sesquioxide.

The characters of the U. S. salt, as given in the Pharmacopœia, are the following. "In thin transparent scales, varying in colour from reddish-brown to yellowish-brown with a tint of green, according to the thickness of the scales. Its taste is ferruginous and moderately bitter. It is slowly soluble in cold water, more readily so in hot water, but insoluble in ether and officinal alcohol. Ammonia, added to the aqueous solution, deepens its colour to reddish-brown, and causes a whitish curdy precipitate of quinia; but no sesquioxide of iron is thrown down."

The British citrate is described as in thin scales of a greenish golden-yellow colour, of a bitter and chalybeate taste, somewhat deliquescent, which does not seem to be the case with the former salt, and entirely soluble in cold water. "The solution is very slightly acid, and is precipitated reddish-brown by solution of soda, white by solution of ammonia, blue by the red and yellow prussiates* of potash, and grayish-black by tannic acid." *Br.* The following additional tests are given in the Br. Pharmacopœia. "When burned with exposure to air, it leaves a residue which when moistened with water is not alkaline to test paper [oxide of iron]. Fifty grains, dissolved in a fluidounce of water, and treated with a slight excess of ammonia, give a white precipitate [quinia] which, when collected on a filter and dried, weighs 8 grains. The precipitate is almost entirely soluble in pure ether [showing the absence of cinchonia and quinidia] and when burned leaves but a minute residue." *Br.* Mr. Umney states (*Pharm. Journal and Trans.*, 3d ser., iv.) that the salt prepared according to the British formula will not stand this test, and that fifty grains of it will not yield more than 7·1 grains of quinia. When dissolved by the aid of an acid, it forms a solution which, decolorized by a little purified animal charcoal, turns the plane of polarization strongly to the left; a character of quinia; cinchonia turning it to the right. (*Squire.*) The salt is said to be sometimes adulterated by cinchonia, which would be at once detected by the test of solubility in ether and the effect on polarized light, above given. As it occurs in the British market, it is of exceedingly variable composition, containing, according to Mr. J. C. Braithwaite, who examined 35 different specimens, a proportion of quinia varying from 1·5 to 17 per cent. (*Pharm. Journ. and Trans.*, Sept. 1868, p. 157.) The proportion of alkaloid appears to be usually below the standard. (A. W. Gerrard, *Ibid.*, March, 1873, p. 763.) According to Mr. C. H. Wood (*Ibid.*, 2d ser., x. 644), this salt undergoes a rapid change of composition when exposed to the direct rays of the sun.

Citrate of iron and quinia combines the virtues of its two bases, and may be given in all cases in which iron and quinia are jointly indicated. It is, therefore, admirably adapted to the cases of anæmia, with enlarged spleen, which are so apt to accompany and follow our autumnal fevers. It may be given in pill or solution, in the dose, as a tonic, of five or six grains, containing about a grain of quinia, three or four times a day. This dose may be greatly increased, if deemed advisable. W.

FERRI ET STRYCHNIÆ CITRAS. *U. S.* *Citrate of Iron and Strychnia.*

"Take of Citrate of Iron and Ammonium *five hundred grains;* Strychnia, Citric Acid, each, *five grains;* Distilled Water *nine fluidrachms.* Dissolve the Citrate of

* Has not this test been retained by inadvertence, from the former British Pharmacopœia? It indicates the presence of both protoxide and sesquioxide of iron, which was true of the preparation of 1864, but is not so of the present, which contains only the sesquioxide.

Iron and Ammonium in a fluidounce, and the Strychnia together with the Citric Acid in a fluidrachm of the Distilled Water. Mix the two solutions, evaporate the mixture by means of a water-bath, at a temperature not exceeding 140°, to the consistence of syrup, and spread it upon plates of glass, so that the salt, when it is dry, may be obtained in scales." *U. S.*

Citrate of iron and strychnia, although long used in medicine to some extent, was first recognised at the last revision of the U. S. Pharmacopœia. It is no doubt an efficient tonic, but has no advantages over the two active substances it contains when given conjointly in an uncombined state; and has the great disadvantage that the dose of one principle cannot be varied independently of that of the other. It occurs in beautiful red scales, of an intensely bitter, scarcely ferruginous taste, and is very soluble in water. It contains one per cent. of strychnia, there being in five grains one-twentieth of a grain of the alkaloid. The dose is three to five grains in pill or solution. H. C. W.

FERRI FERROCYANIDUM. *U. S.* Ferri Ferrocyanuretum. *U. S.* 1850. *Ferrocyanide of Iron. Ferrocyanuret of Iron. Pure Prussian Blue.*

"Take of Ferrocyanide of Potassium *nine troyounces;* Solution of Tersulphate of Iron *a pint;* Water *three pints.* Dissolve the Ferrocyanide of Potassium in two pints of the Water, and add the solution gradually to the Solution of Tersulphate of Iron, previously diluted with the remainder of the Water, stirring the mixture during the addition. Then filter the liquid, and wash the precipitate on the filter with boiling water until the washings pass nearly tasteless. Lastly, dry it, and rub it into powder." *U. S.*

In the U. S. Pharmacopœia of 1850, tersulphate of sesquioxide of iron was prepared as the first step of the process; in the present formula, it is taken already prepared, in the form of the officinal solution. This salt is decomposed by the gradual addition of the solution of ferrocyanide of potassium. Three eqs. of ferrocyanide and two of tersulphate of sesquixode of iron are mutually decomposed, with the result of forming one eq. of Prussian blue, or the 3–4 ferrocyanide of iron, which precipitates, and six eqs. of sulphate of potassium, which remain in solution. Ferrocyanogen is a tercyanide of iron ($FeCy_3$); and representing it by its symbol Cfy, we may compactly express the above reaction by the following equation: $3K_2Cfy$ and $2(Fe_2O_3, 3SO_3) = Fe_4Cfy_3$ and $6(KO,SO_3)$. Prussian blue contains the elements of six eqs. of water, which cannot be separated without the destruction of the compound. Adding these elements, we may suppose it to become a hydroferrocyanate of the sesquioxide of iron, represented by the formula $2Fe_2O_3,3H_2Cfy$. From the formula given for the anhydrous compound (Fe_4Cfy_3), it is evident that it contains seven eqs. of iron and nine of cyanogen.

Preparation for Use in the Arts. Prussian blue is manufactured on the large scale as follows. A mixture made of equal parts of carbonate of potassium (pearl-ash of commerce) and of animal matter, such as dried blood, hair, the shavings of horn, &c., is calcined at a red heat, in an iron vessel, until it becomes pasty. The mass, when cold, is thrown, by portions at a time, into twelve or fifteen times its weight of water, with which it is stirred for half an hour. The whole is then put upon a linen filter; and the clear solution obtained is precipitated by a mixed solution of two parts of alum and one of sulphate of protoxide of iron. An effervescence occurs, due principally to carbonic acid; and a very abundant precipitate is thrown down of a blackish-brown colour. This precipitate is washed, by decantation, by means of a large quantity of water, which is removed every twelve hours. By these washings, which last from twenty to twenty-five days, the precipitate becomes successively greenish-brown, bluish, and finally deep-blue. When of the latter colour, it is collected and allowed to drain upon a cloth, after which it is divided into cubical masses and dried. In relation to the manufacture of Prussian blue, see the *Pharmaceutical Journal* (March, 1856, p. 423, and May, 1856, p. 511).*

* *Soluble Prussian Blue.* A preparation under this name has been introduced into use for injecting anatomical preparations by Shrœder Van Der Kolk, and is said to be much esteemed for this purpose. To obtain it there must be a great excess of the yellow prussiate of potassa in concentrated

Properties. Pure Prussian blue is a tasteless powder, insoluble in water and alcohol, and having a rich deep-blue colour. It is insoluble in dilute acids, decomposed by fuming nitric acid, and dissolved without decomposition by strong sulphuric acid, forming a white mass of the consistence of paste, from which the Prussian blue may be precipitated unchanged by water. Concentrated muriatic acid decomposes it, dissolving sesquioxide of iron, and liberating hydroferrocyanic acid (H_2Cfy). Boiled with red oxide of mercury, it generates bicyanide of mercury. (See *Hydrargyri Cyanidum.*) By the contact of a red-hot body, it takes fire and burns slowly, leaving a residue of sesquioxide of iron. When it is heated in close vessels, water, hydrocyanic acid, and carbonate of ammonium are evolved, and carburet of iron is left. Its composition has been given above. The Prussian blue of commerce was discovered by accident, in 1710, by Diesbach, a preparer of colours at Berlin. It has the same general properties as the pure substance. It occurs in small rectangular masses, which are heavier than water, and have a fracture presenting a bronzed appearance. Besides the constituents of pure Prussian blue, it always contains uncombined sesquioxide of iron, and a portion of alumina, derived from the alum employed in its manufacture, which serves to give it body as a pigment. These substances may be detected by boiling the pigment with dilute muriatic acid, and precipitating the filtered solution with ammonia. Pure Prussian blue, treated in this manner, yields no precipitate.

Medical Properties, &c. Prussian blue is deemed a tonic, febrifuge, and alterative. Dr. Zollickoffer, of Maryland, recommended it in intermittent and remittent fevers, and deemed it to be particularly adapted to the cases of children, on account of the smallness of the dose and its want of taste. He considered it more certain, prompt, and efficacious than the bark; while it has the advantage of being admissible in the state of pyrexia, and of not disagreeing with the most irritable stomach. It has also been used by Dr. Kirchoff, of Ghent, in epilepsy with advantage. Dr. Bridges, of this city, exhibited it in a case of severe and protracted facial neuralgia, with considerable relief, after the usual remedies for this complaint had been tried with little or no benefit. It is sometimes employed as an application to ill-conditioned ulcers, mixed with simple ointment in the proportion of a drachm to the ounce. The dose of pure Prussian blue is from three to five grains, repeated several times a day, and gradually increased until some obvious effect is produced. B.

FERRI IODIDUM. *Br. Iodide of Iron.*

"Take of Fine Iron Wire *one ounce and a half* [avoirdupois]; Iodine *three ounces* [avoird.]; Distilled Water *fifteen fluidounces.* Put the Iodine, Iron, and twelve [fluid]ounces of the Water into a flask, and having heated the mixture gently for about ten minutes, raise the heat and boil until the froth becomes white. Pass the solution as quickly as possible through a wetted calico filter into a dish of polished iron, washing the filter with the remainder of the Water, and boil down until a drop of the solution taken out on the end of an iron wire solidifies on cooling. The liquid should now be poured out on a porcelain dish, and, as soon as it has solidified, should be broken into fragments, and enclosed in a well-stoppered bottle." *Br.*

The solid iodide of iron is omitted in the present edition of the U. S. Pharmacopœia, which directs it in the form of pills and syrup prepared immediately from the materials; the iodide itself being so liable to spontaneous change, as to render its preservation for any length of time unaltered almost impossible.

In the Br. process, which is a modification of that of the late Dublin Pharmacopœia, iron is made to unite with iodine by the intervention of water, and the combination takes place readily and quickly. The liquid at first is red or orange-coloured, from the circumstance that all the iodine has not united with the iron; but, after the

solution. The iron should be in the state of sesquichloride, in the proportion of not more than $\frac{1}{8}$ or $\frac{1}{10}$ of the prussiate employed. After their mixture, the precipitate is washed with water till it begins to become blue, when it is expressed and dried in the air. On the small scale it may be economically obtained in the following manner. Take solutions of the prussiate containing 217 grammes to the litre of water, and of the sesquichloride containing one part of the solid salt in 10 parts of water. Then, taking equal volumes of the two solutions, add to each one twice its volume of a cold concentrated solution of sulphate of sodium, and mix the solutions. Put on a filter, and treat as directed above. The product dried in the air is perfectly soluble, and admirably adapted for injection. (*Journ. de Pharm.*, 4e sér., iv. 238.) For other formula for Soluble Prussian Blue see *Ibid.*, 4e sér., xix. 227. (*Note to the thirteenth and fourteenth editions.*)

application of heat, it becomes fully saturated and limpid, and assumes a greenish colour. It is now a solution of iodide of iron, and yields the solid salt by evaporation. The proportion of the iron taken is half the weight of the iodine. Fine iron wire, recently cleaned, is directed on account of its purity; but iron filings dissolve more readily, and, if carefully selected, will be sufficiently pure. It is exceedingly difficult to obtain this salt in the solid state perfectly pure, so great is the proneness of its solution to absorb oxygen, whereby the iodide becomes, in part, converted into sesquioxide. This change is prevented to a certain extent by evaporating to dryness in an *iron* vessel.

The Messrs. T. & H. Smith, of Edinburgh, recommend the following improved process, which more effectually excludes atmospheric air. Boil, in a Florence flask, six drachms of pure iron filings with two ounces and a quarter of iodine, in four and a half ounces of distilled water, until the liquid loses its dark colour. Then filter the liquid rapidly into another flask, and evaporate it, at a boiling heat, until its green shade passes into black. After this period, the heat is kept up as long as the evaporation of moisture continues, which may be ascertained by its condensation on a cold piece of glass, placed, from time to time, over the mouth of the flask. When this ceases, the flask contains pure, anhydrous, spongy iodide of iron, which, when cold, is to be removed by breaking the flask, bruised coarsely in a warm dry mortar, and enclosed immediately in small well-corked bottles. If it is wished to obtain the iodide as a crystallized hydrate, the heat is to be withdrawn as soon as the liquid is sufficiently concentrated to congeal, in a dry and hard crust, on the end of an iron wire dipped into it. A modification of this process by Dr. Squibb will be found in the *American Journal of Pharmacy* for Jan. 1859 (p. 52). *Iodates of Iron* have been used to some extent as therapeutic agents in Dublin. Formulas for their preparation may be found in the *Pharm. Journ. and Trans.*, 3d ser., i. 624.

Properties. Iodide of iron is a crystalline substance, exceedingly deliquescent, of a greenish-black colour, and styptic, chalybeate taste. Its solution, by evaporation with as little contact of air as possible, affords transparent, green, tabular crystals. When heated moderately it fuses, and, on cooling, becomes an opaque crystalline mass, having an iron-gray colour and metallic lustre. At a higher temperature it emits violet-coloured vapours, and the iron is left in the state of sesquioxide. It is very soluble both in water and alcohol. When recently prepared it is wholly soluble in water, forming a pale-green solution; but, if made for some time, it almost unavoidably contains some sesquioxide of iron, from a partial decomposition, and will not entirely dissolve. M. Lecoq, of Saint-Quentin, has proposed to preserve it in a wide-mouthed, ground-stoppered bottle, covered with a layer of reduced iron, which cannot decompose it, and protects it from the action of the air. When the iodide is wanted, the iron is removed with a bone spatula, or a little brush. The aqueous solution is very liable to spontaneous decomposition, becoming at last orange-red from the generation of free iodine, and depositing sesquioxide of iron. According to Mr. Richard Phillips, jun., the first step in this change is the formation of protoxide of iron and hydriodic acid, from the decomposition of water. As the protoxide immediately begins to be converted into sesquioxide by absorbing oxygen from the air, and in this state is precipitated, the hydriodic acid is set free; and hence is explained the acidity of the solution from the first moment the sesquioxide is deposited. Afterwards, the hydriodic acid is decomposed by the air, and iodine liberated. When the solution is prevented from generating free iodine, by placing in it a coil of iron wire, according to the plan of Mr. Squire, the iron acts by combining with the iodine of nascent hydriodic acid, and not with nascent iodine. (*Pharm. Journ.*, iv. 19.) The plan of Mr. Squire does not prevent the deposition of sesquioxide, and has, therefore, been superseded by the use of saccharine matter, which affords a better protection to the solution. (See *Syrupus Ferri Iodidi.*) Iodide of iron is incompatible with alkalies and their carbonates, with lime-water, and with all other substances by which sulphate of iron is decomposed. When crystallized it consists of one eq. of iodine 126·3, one of iron 28, and five of water 45 = 199·3. "Mixed with mucilage of starch, it acquires a blue colour on the addition of a minute quantity of solution of chlorine" (*Br.*); showing the presence of iodine, which is separated by the chlorine.*

* *Preservation of the Protiodide and Protosulphate of Iron.* A new method of accomplishing

Medical Properties and Uses. Iodide of iron was first employed in medicine by Dr. Pierquin in 1824. It was first used in the United States in 1832 by Professor Samuel Jackson, of this city, at whose request it was prepared in solution by Mr. E. Durand. Its powers are those of a tonic, alterative, diuretic, and emmenagogue. It acts more like the preparations of iron than like those of iodine. It sometimes sharpens the appetite and promotes digestion, and occasionally proves laxative. When it does not operate on the bowels, it generally augments the urine. Its use blackens the stools and lessens their fetor. It is chiefly employed in scrofulous complaints, swellings of the cervical glands, visceral obstructions attended with deficient action, chlorosis, atonic amenorrhœa, and leucorrhœa. In the two diseases last mentioned, Dr. Pierquin employed it with success. Dr. Burguet, of Bordeaux, cured a case of diabetes of long standing, by the use of the remedy for several months. In obstinate syphilitic ulcers, M. Baumes, of Lyons, used it with satisfactory results. He gave it in the form of pill, conjoined with extract of opium, and sometimes increased the dose to 20 grains in the course of twenty-four hours. In secondary syphilis, occurring in debilitated and scrofulous subjects, Ricord has found it a valuable remedy. The dose is a grain, gradually increased to eight grains or more.

This salt, on account of its deliquescent property, and proneness to decomposition, should not be given in pill, unless protected from change by saccharine matter, or other means. (See *Pilulæ Ferri Iodidi.*) The most convenient form of exhibition is that of syrup or glycerate.*

For forming enemata, injections for the vagina, and lotions for ulcers, one or two drachms of the iodide may be dissolved in a pint of water. B.

FERRI LACTAS. *U. S.* *Lactate of Iron.*

"Take of Lactic Acid *a fluidounce;* Iron, in the form of filings, *half a troyounce;* Distilled Water *a sufficient quantity.* Mix the Acid with a pint of Distilled Water in an iron vessel, add the Iron, and digest the mixture on a water-bath, supplying Distilled Water, from time to time, to preserve the measure. When the action has ceased, filter the solution, while hot, into a porcelain capsule, and set it aside to crystallize. At the end of forty-eight hours, decant the liquid, wash the crystals with a little alcohol, and dry them on bibulous paper. By evaporating the mother-water in an iron vessel to one-half, filtering while hot, and setting the liquid aside, more crystals may be obtained." *U. S.*

In this process the iron is protoxidized by the water, and the lactic acid unites with the protoxide, forming lactate of iron, a part of which crystallizes when the solution cools, and the remainder is obtained by evaporation and crystallization. It may be more cheaply prepared, on the large scale, by digesting the impure acid first obtained in M. Louradour's process, with iron filings, or by reaction between sulphate of iron and the lactate of calcium or lactate of zinc prepared as a step in obtaining lactic acid. The following is M. Gobley's process for making lactate of calcium, preparatory to its conversion into lactate of iron. Add to 2 pints of skim-milk, diluted with twice its bulk of water, and contained in an earthen pan, 64 drachms of powdered lactin, and 51 drachms of powdered chalk. Allow the whole to ferment for eleven or twelve days, at a temperature of from 80° to 90°, supplying water as it evaporates. Transfer the liquor to a capsule, heat it gradually to boiling, and stir it constantly. Boil for a quarter of an hour to coagulate casein, allow the insoluble matters to subside, and strain the liquid through flannel. The clear liquid is a solution of lactate of calcium. In this process the casein of the milk, acting as a ferment, converts not only the lactin of the milk, but the lactin added, into lactic

this object has been proposed by M. Carlo Pavesi of Mortara. His method consists in incorporating the salt with gum arabic in concentrated solution, evaporating with a gentle heat, and drying on porcelain plates, so as to obtain the salt in scales. These are to be kept in bottles well stopped. (*Journ. de Pharm.*, 4e sér., iii. 49.)—*Note to the thirteenth edition.*

* *Glycerate of Iodide of Iron.* Glycerin has the property at once of dissolving and preserving iodide of iron, and therefore makes an excellent excipient. M. Veza proposes the following formula. "Take of Iodine 70 parts, Iron, in powder, 35 parts, and Glycerin 400 parts. Mix them." The colour of the solution is an emerald green; its taste is bitter and astringent; and tests do not detect in it the presence of free iodine. It may be used for preparing the syrup or pills. Five grains of it contain one of the iodide of iron. (*Journ. de Pharm.*, Oct. 1862, p. 338.)—*Note to the twelfth edition.*

acid; a result which would not take place were it not for the presence of the chalk, which saturates the lactic acid as it is formed, and prevents it from uniting with the casein, whereby the power of the latter as a ferment would be destroyed. (*Journ. de Pharm.*, 3e sér., vi. 54.) Lactate of calcium may be expeditiously converted into lactate of iron by the following process of M. Lepage. Dissolve 100 parts of lactate of calcium, obtained by M. Gobley's process, in 500 parts of boiling water; and 68 parts of pure crystallized sulphate of protoxide of iron in 500 parts of cold distilled water. Mix the filtered solutions in a matrass, acidulate slightly with lactic acid, and heat in a water-bath, stirring frequently until the double decomposition is completed. Then filter to separate the sulphate of calcium, and evaporate rapidly to one-half, either in an iron vessel, or in a porcelain capsule containing a few turnings of iron. Filter again, and set aside to crystallize; and, having washed the crystals in a funnel with a little alcohol, dry them on bibulous paper. (*Journ. de Pharm.*, 3e sér., ix. 272.) In relation to the precautions to be observed in preparing this lactate, so as to prevent the partial sesquioxidation of the iron, see the paper of M. C. J. Thirault in the *Journal de Pharmacie*, copied into the *Am. Journ. of Pharm.* for Nov., 1853 (p. 556).

Lactate of iron is in greenish-white crystalline crusts or grains, undergoing little change in the air. When in the form of a yellowish or greenish-white powder it is impure. It is but sparingly soluble in water, requiring 48 parts of cold and 12 of boiling water to dissolve it, and is insoluble in alcohol. It has an acid reaction, and possesses a mild, sweetish, ferruginous taste. The aqueous solution quickly becomes yellow, in consequence of the iron passing to a higher state of oxidation. M. Louradour has seen several samples of this lactate, variously adulterated; as with effloresced sulphate of iron, starch, and lactin; the sophistication being concealed by the sale of the salt in powder. These impurities may be detected by appropriate reagents; but M. Louradour recommends, as a simpler way of avoiding them, the rejection of the salt when not in crystalline crusts. "Exposed to heat it froths up, gives out thick, white acid fumes, and becomes black; sesquioxide of iron being left. If it be boiled for fifteen minutes with nitric acid of the sp. gr. 1·20, a white granular deposit of mucic acid will occur on the cooling of the liquid." (*U. S.*) These tests indicate that it is a lactate of iron.

Medical Properties. Lactate of iron has the general medical properties of the ferruginous preparations. It has a marked effect in increasing the appetite. The disease in which it was principally tried in Paris was chlorosis, with or without amenorrhœa; and in this disease, Andral, Fouquier, Bouillaud, and others obtained very favourable results. The dose is one or two grains, repeated at intervals and gradually increased. As much as 12 or even 20 grains may be given in the course of a day. It may be administered in lozenge, pill, or syrup. The *lozenge* may be made of one grain of the lactate to twelve of sugar; and the *pill*, of one grain of the salt, with an equal weight of some inert powder free from astringent matter, and sufficient honey. The following is the formula for a *syrup* proposed by M. Cap, expressed in the nearest weights and measures used in this country. Take of lactate of iron *a drachm;* white sugar *twelve ounces and a half;* boiling distilled water *six fluidounces and a half.* Rub the salt to powder with half an ounce of the sugar; and dissolve the mixture quickly in the boiling water. Pour the solution into a matrass placed on a sand-bath, and add to it the rest of the sugar in small pieces. When the sugar is dissolved, filter the syrup, and, as soon as it is cold, transfer it to bottles which must be well stopped. This syrup has a very light amber colour, and contains about four grains of the salt to the fluidounce. The dose is from two to four fluidrachms. Bread, called *chalybeate bread*, containing lactate of iron in the proportion of about a grain to the ounce, has been used with advantage by chlorotic patients in one of the hospitals of Paris. The bread is not injured in taste or quality. Prof. Brainard, of Chicago, has treated, with success, a large erectile tumour of the orbit, by infiltrating it by injection with a fluidrachm of a solution of lactate of iron, containing eight grains of the salt. (*Ranking's Abstract*, xviii. 253.) B.

FERRI OXALAS. *U. S.* *Oxalate of Iron.*

"Take of Sulphate of Iron *two troyounces;* Oxalic Acid *four hundred and thirty-six grains;* Distilled Water *a sufficient quantity.* Dissolve the Sulphate of Iron in

thirty fluidounces, and the Oxalic Acid in fifteen fluidounces of Distilled Water. Filter the solutions, and, having mixed them with agitation, set aside the mixture until the precipitate is deposited. Decant the clear liquid, wash the precipitate until the washings cease to redden litmus, and dry it with a gentle heat." *U. S.*

Oxalate of iron is a new officinal of the U. S. Pharmacopœia. It is a lemon-yellow, crystalline powder, insoluble in water, but soluble in muriatic acid. "Heated in contact with the air, it decomposes with a faint combustion, and leaves a residue of not less than forty-eight per cent. of red oxide of iron." *U. S.*

It is no doubt capable of acting as a feeble chalybeate, but possesses no advantages over the older preparation. The dose is two to three grains. H. C. W.

FERRI OXIDUM HYDRATUM. *U. S.* Ferri Peroxidum Humidum. *Br.* Ferrugo. *Ed.* *Hydrated Oxide of Iron. Hydrated Peroxide of Iron. Hydrated Sesquioxide of Iron. Moist Peroxide of Iron.*

"Take of Solution of Tersulphate of Iron *a pint;* Water of Ammonia *twenty fluidounces;* Water *a sufficient quantity.* To the Water of Ammonia, mixed with two pints of Water, add, stirring it constantly, the Solution of Tersulphate of Iron, previously mixed with two pints of Water. Then pour the whole on a wet muslin strainer, and wash the precipitate with water until the washings pass nearly tasteless. Lastly, mix the precipitate with sufficient Water to make the mixture measure a pint and a half, and transfer it to a wide-mouthed bottle, which must be well stopped.

"When Hydrated Oxide of Iron is to be made in haste for use as an antidote, the washing may be performed more quickly, though less perfectly, by pressing the strainer forcibly with the hands until no more liquid passes, and then mixing the precipitate with sufficient Water to bring the mixture to the measure of a pint and a half." *U. S.*

The British Pharmacopœia defines this preparation to be hydrated peroxide of iron with about 86 per cent. of uncombined water, and gives the following formula:

"Take of Solution of Persulphate of Iron *four fluidounces;* Solution of Soda *thirty-three fluidounces;* Distilled Water *a sufficiency.* Mix the Solution of Persulphate of Iron with a pint [Imperial measure] of the Distilled Water, and add this gradually to the Solution of Soda, stirring them constantly and briskly. Let the mixture stand two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with Distilled Water, until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, enclose the precipitate, without drying it, in a stoppered bottle or other suitable vessel from which evaporation cannot take place. This preparation, when used, should be recently made." *Br.*

This preparation was introduced into the officinal catalogues on account of its importance as an antidote to arsenious acid. In the former processes the first step was to convert the sulphate of protoxide of iron into the tersulphate of sesquioxide; but in the present the officinal solution of tersulphate of iron (persulphate, *Br.*) is taken already containing the iron in the proper state of oxidation. This is simply treated with water of ammonia (*U. S.*), or diluted solution of soda (*Br.*), which throws down the sesquioxide combined with water, constituting the hydrated sesquioxide required. After due washing, it is mixed with water in order to maintain its pulpy state, and then carefully enclosed in bottles, which should be wide-mouthed, in order to permit its ready extraction.

Besides having this antidote ready formed in the pulpy state, it is the duty of the apothecary to be always prepared to make it, by keeping the necessary solution for its precipitation; namely, the solution of tersulphate of sesquioxide of iron and solution of ammonia. In relation to this subject the reader is referred to a paper by Prof. Procter, in the *American Journal of Pharmacy* for March, 1853 (p. 104).

Properties. Hydrated oxide of iron, as directed to be kept by the U. S. formula, is a soft, moist, reddish-brown magma. If dried at a heat not exceeding 180°, and afterwards pulverized, it forms a reddish-brown powder, not attracted by the magnet, being the sesquioxide in the state of hydrate, containing about 18 per cent. of water. In this state it is wholly and readily soluble in muriatic acid without effervescence;

and the solution gives a copious blue precipitate with the yellow but not with the red prussiate of potash. "A little of it dried at 212°, until it ceases to lose weight, gives off moisture when heated to dull redness in a test tube." *Br.* If exposed to a red heat it loses the combined water, and becomes the anhydrous sesquioxide, less easily soluble in acids, improper for medicinal use, and altogether without effect as an antidote. Hydrated oxide of iron consists of one eq. of sesquioxide 80, and two of water 18 = 98, and is represented by the formula $Fe_2O_3 + 2HO$. Kept for some time in the pulpy state, it loses half its combined water, and becomes less soluble in acids, and less efficient as an antidote.

Medical Properties and Uses. The hydrated oxide of iron is not an eligible ferruginous preparation for medical use. Its antidotal powers in poisoning by arsenic, the manner in which it acts, the circumstances which impair its efficiency, and the mode of using it are fully explained under arsenious acid (*page* 29). Its power of rendering arsenious acid insoluble is readily shown by agitating a solution of the acid with a considerable excess of the moist oxide, filtering, and then testing the filtered solution for the acid; not a trace of the metal can be detected, even by sulphuretted hydrogen. It is stated, however, to be inferior as an antidote to the saccharated oxide of iron. The hydrated oxide, as obtained by the U. S. formula, contains a little ammonia, which is thought by some to assist its antidotal powers. At least it has been ascertained that the sesquioxide, when precipitated by potassa as formerly directed by the Dublin College, is less efficient than when precipitated by ammonia, and must be employed in quantities three or four times as large to produce the same effect. The dry hydrate, rubbed up with water, is in the same proportion weaker than the pulpy hydrate. It has already been mentioned, under arsenious acid, that the officinal subcarbonate of iron (formerly called precipitated carbonate) possesses antidotal powers to arsenic, though in an inferior degree; but this statement will not apply to it, after it has been exposed to a red heat, to which it is improperly subjected by some manufacturing chemists. By ignition it becomes anhydrous, and altogether inefficient as an antidote.

Off. Prep. Ferri Peroxidum Hydratum, *Br.* B.

FERRI OXIDUM MAGNETICUM. *Br. Magnetic Oxide of Iron. Martial Ethiops.*

"Take of Solution of Persulphate of Iron *five and a half fluidounces* [Imperial measure]; Sulphate of Iron *two ounces* [avoirdupois]; Solution of Soda *four pints* [Imp. meas.]; Distilled Water *a sufficiency.* Dissolve the Sulphate of Iron in two pints [Imp. meas.] of the Water, and add to it the Solution of Persulphate of Iron, then mix this with the Solution of Soda, stirring them well together. Boil the mixture, let it stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with Distilled Water, until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, dry the precipitate at a temperature not exceeding 120°." *Br.*

Though the object of this formula is the same as that of the Br. Pharmacopœia of 1864, the proceeding is different. The point aimed at is to get an oxide of iron containing one eq. of the protoxide and one of the sesquioxide (FeO,Fe_2O_3 or Fe_3O_4, *Br.*). This was attained in the former process by converting a portion of sulphate of protoxide of iron by boiling with nitric acid into sulphate of sesquioxide, and then, having mixed this in solution with solution of the sulphate of the protoxide, precipitating the two oxides conjointly with solution of soda. In the present formula the two sulphates are taken already formed; and the process consists essentially in precipitating, as before, their joint solutions by solution of soda; the proportion of the ferruginous salts being so adjusted as to yield an eq. each of the protoxide and sesquioxide. The solution of the salts of iron is directed to be added to that of the alkali; because, if the alkaline be added to the ferruginous solution, as there would be a great excess of the salt of iron, an insoluble basic sulphate would be precipitated, and might wholly or partially escape decomposition. (Redwood, *Pharm. Journ. and Trans.*, April, 1868, p. 464.) Now such a compound oxide corresponds in composition with the native magnetic black oxide. The precipitate is washed to remove sulphate of

sodium, and the washings are known to be completed when the chloride of barium ceases to give a precipitate with them.*

Properties, &c. The artificial magnetic oxide of iron is a brownish-black powder, without taste, and strongly magnetic. According to the Br. Pharmacopœia, it consists of a 3-4 oxide of iron, Fe_3O_4, with about 20 per cent. of water of hydration, and a portion of peroxide (sesquioxide) of iron. It dissolves without effervescence in muriatic acid diluted with half its bulk of water; and the solution gives a blue precipitate both with the ferrocyanide and ferridcyanide of potassium, showing the presence of the protoxide and sesquioxide of iron.†

The Br. Pharmacopœia gives the following tests. "When a small quantity is heated in a dry test tube by the flame of a lamp, a deposit of moisture takes place on the cool part of the tube. Twenty grains dissolved in hydrochloric acid continue to give a blue precipitate with the red prussiate of potash [ferridcyanide of potassium] until 83 grain-measures of the *volumetric solution of bichromate of potash* have been added." The former test simply indicates the presence of water in the oxide; the second the quantity of protoxide present, which must be such as to require the indicated quantity of the bichromate for its sesquioxidation. The dose is from five to twenty grains, given several times a day.

Scales of iron (*ferri squamæ*) were formerly officinal with the Dublin College under the name of black oxide. They were prepared from the scales found at the blacksmith's anvil, by washing them with water, separating them from impurities by means of a magnet, and reducing them to a fine powder. They are of variable composition; being mixtures of the two oxides of iron with metallic iron. In view of their want of uniformity in composition, they were abandoned by the College for the magnetic oxide. B.

FERRI PEROXIDUM HYDRATUM. *Br.* Ferri Peroxidum. *Br.* 1864. *Hydrated Peroxide of Iron. Peroxide of Iron. Sesquioxide of Iron.*

"Take of Moist Peroxide of Iron *one pound* [avoirdupois]. Dry it at a temperature not exceeding 212° until it ceases to lose weight, then reduce it to fine powder." *Br.*

This is the late Dublin process slightly modified. The hydrated oxide (Fe_2O_3, 2HO) loses, by the process, one-half of its combined water, and is converted into the monohydrated sesquioxide (Fe_2O_3,HO), which is the present officinal preparation. As prepared by the Dublin process, in which it was heated to redness, it lost the second eq. of water, and became the anhydrous sesquioxide (Fe_2O_3), identical with the *colcothar* of commerce.

Properties, &c. This oxide is a reddish-brown, tasteless, insoluble powder, differing from colcothar in containing an eq. of water. Hence, "heated to dull redness in a test tube it gives off moisture." *Br.* It should not be deliquescent, and should dissolve entirely in muriatic acid without effervescence. Its solution in diluted muriatic acid yields a copious blue precipitate with the ferrocyanide of potassium, but none with the ferridcyanide; showing that it contains sesquioxide of iron but no protoxide. If it contain copper, its muriatic solution will deposit this metal on a bright piece of iron. M. Dawies states that, if the hydrated oxide recently prepared be kept for four or five days in boiling water, it loses a large proportion of its water, containing at the end of that time only 5·77 per cent. The larger portion of the oxide has, therefore, become dehydrated; and the same thing happens at a lower temperature (106°) in two or three months. It becomes of a brick-red colour, and is but slightly soluble in nitric acid. (*Journ. de Pharm.*, 4e sér., iv. 400.) This oxide is not used as a medicine. It is employed in making iron plaster and reduced iron, for which purposes other forms of oxidized iron would answer as well. The former Dublin *rubigo ferri* or *rust of iron*, formed by exposing moistened iron wire to the air till

* M. G. Tissandier prepares an *anhydrous protoxide of iron* by exposing iron at a red heat to carbonic acid. The product is black, with a brilliant crystalline appearance, and at ordinary temperatures is unchangeable in the air. It dissolves readily in muriatic acid, and is without doubt capable of acting as a chalybeate. (*Journ. de Pharm.*, 4e sér., xv. 379.)—*Note to the fourteenth edition.*

† For a paper on salts of this oxide, see *Journ. de Pharm.*, 4e sér., x. 81.

converted into rust, is essentially the sesquioxide, containing a little carbonate of the protoxide.

Off. Prep. Emplastrum Ferri, *Br.;* Ferrum Redactum, *Br.* B.

FERRI PHOSPHAS. *U.S., Br. Phosphate of Iron.*

"Take of Sulphate of Iron *five troyounces;* Phosphate of Sodium *six troyounces;* Water *eight pints.* Dissolve the Salts separately, each in four pints of the Water; then mix the solutions, and set aside the mixture until the precipitate has subsided. Lastly, having poured off the supernatant liquid, wash the precipitate with hot water, and dry it with a gentle heat." *U. S.*

"Take of Sulphate of Iron *three ounces* [avoirdupois]; Phosphate of Soda *two ounces and a half* [avoird.]; Acetate of Soda *one ounce* [avoird.]; Boiling Distilled Water *four pints* [Imperial measure]. Dissolve the Sulphate of Iron in one-half the Water, and the Phosphate and Acetate of Soda in the remaining half. Mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with hot distilled water, till the filtrate ceases to give a precipitate with chloride of barium. Finally dry the precipitate at a temperature not exceeding 120°." *Br.*

The U. S. preparation is the result of a double decomposition between the saline materials employed. As the medicinal phosphate of sodium is the middle tribasic phosphate, having the composition $2NaO,HO,PO_5$, it follows that it requires two eqs. of sulphate of protoxide of iron for its decomposition, as shown by the following equation: $2(FeO,SO_3)$ and $2NaO,HO,PO_5, = 2FeO,HO,PO_5$ and $2(NaO,SO_3)$. The resulting salts, therefore, are one eq. of the middle tribasic phosphate of iron, the salt under notice, and two eqs. of sulphate of sodium, which are washed away. If the ferruginous sulphate be a perfect sulphate of the protoxide, the precipitate as first thrown down will be white; but it quickly absorbs oxygen and becomes bluish-white. When perfect it consists of two eqs. of protoxide of iron, one of basic water, and one of phosphoric acid; but generally it contains some phosphate of the sesquioxide without basic water (Fe_2O_3,PO_5).

The British phosphate of iron is a different salt; for, while the former has two eqs. of oxide of iron, this has three to one of the acid; the third being supplied by means of the acetate of sodium used in the process. Supposing the double decomposition to have occurred, as in the U. S. process, between two eqs. of the sulphate of iron and one of the double-based phosphate of sodium, producing two eqs. of sulphate of sodium and one of the double-based phosphate of iron; the reaction next takes place between the generated eq. of phosphate of iron, one eq. of sulphate of iron, and one of acetate of sodium, resulting in the production of an additional eq. of sulphate of sodium, an eq. of free acetic acid, and the addition of a third eq. of oxide of iron to the phosphate, which, being insoluble, is precipitated. This latter result arises from the strong disposition of the tribasic phosphoric acid to combine with three bases, which could only be satisfied by the liberation of an eq. of the acetic acid of the acetate. This salt, when first formed, is represented by the formula $3FeO,PO_5$; but the strong affinity of its protoxide for oxygen causes the gradual production of sesquioxide, which, therefore, to a certain extent always exists in the preparation.

Phosphate of iron, by whichever process procured, is in the form of a powder of a bright slate colour, insoluble in water, but soluble in acids. The solution in dilute muriatic acid gives a blue precipitate with both ferridcyanide and ferrocyanide of potassium, but much the more copiously with the former, proving the presence both of protoxide and sesquioxide of iron, but a great preponderance of the protoxide. With ammonia the same solution yields a precipitate insoluble in an excess of the alkali. This is a test of the U.S. Pharmacopœia, probably intended to show that the salt, while containing a portion of phosphate of sesquioxide of iron, has been quite freed by washing from phosphate of sodium; for, though a precipitate is produced by ammonia with the phosphate of the protoxide, it is redissolved by an excess of the precipitant, whereas, with the sesquioxide salt, the precipitate is not redissolved by such excess, unless by the aid of phosphate of sodium or other salt of similar powers. If the preparation contain arsenic, it will be detected by producing a dark precipitate on the surface of a slip of pure copper introduced into the solution. "Twenty grains dissolved in hydrochloric acid, continue to give a blue precipitate with red prussiate of potash until

at least two hundred and fifty grain-measures of the *volumetric solution of bichromate of potash* have been added." *Br.* This shows the presence of 44·75 per cent. of phosphate of iron.*

Phosphate of iron, dissolved to saturation in a boiling solution of metaphosphoric acid (HO,PO_5), under the name of *superphosphate of iron*, was proposed as a new remedy, in Jan. 1851, by Dr. Routh, of London. Mr. Thomas Greenish, of the same city, states that the solution of the salt, on cooling, hardens into a mass of pilular consistence, soluble in water in all proportions, and free from any disagreeable or inky taste. He has prepared from it a syrup, containing five grains of the salt to the fluidrachm.

Medical Properties. Phosphate of iron possesses the general properties of the ferruginous preparations, and has been given with advantage in amenorrhœa and some forms of dyspepsia. It was introduced into the U. S. Pharmacopœia at the suggestion of the late Dr. Hewson, of this city, who found it, after an extensive experience, to be a valuable chalybeate. The dose is from five to ten grains.† B.

FERRI PYROPHOSPHAS. *U. S.* *Pyrophosphate of Iron.*

"Take of Phosphate of Sodium *seven troyounces and a half;* Solution of Tersulphate of Iron *seven fluidounces*, or *a sufficient quantity;* Citric Acid *two troyounces;* Water of Ammonia *five fluidounces and a half*, or *a sufficient quantity;* Water *a sufficient quantity.* Heat the Phosphate of Sodium, in a porcelain capsule, until it undergoes the watery fusion, and continue the heat until it becomes dry. Transfer the dry salt to a shallow iron capsule, and heat it to incipient redness, without fusion. Then dissolve it in three pints of Water, with the aid of heat, and, having filtered the solution and cooled it to the temperature of 50°, add Solution of Tersulphate of Iron until this ceases to produce a precipitate. Stir the mixture thoroughly, and pour it upon a muslin strainer, and, when the precipitate has drained, wash it with water until the washings pass nearly tasteless, and transfer it to a weighed porcelain capsule.

"To the Citric Acid, contained in a suitable vessel, add Water of Ammonia until the Acid is saturated and dissolved. Then add the solution to the precipitate in the

* For a process of estimating iron and alumina in native and other complex phosphates, see *Chem. News*, xxviii. 208. (*Note to the fourteenth edition.*)

† *Compound Syrup of Phosphate of Iron. Chemical Food.* For a formula for a compound syrup of phosphate of iron by Mr. Wiegand, made by introducing into it the phosphates of calcium, potassium, and sodium, and for remarks on the pharmacy of the phosphates by Prof. Procter, see the *Am. Journ. of Pharm.* for March, 1854 (pp. 111 and 112). A formula similar to Mr. Wiegand's, communicated by Mr. Edward Parrish, as probably representing the process for a secret preparation considerably used in this city, may be found in the *Am. Journ. of Pharm.* for Nov. 1857 (p. 573). These formulas are too complicated to have any therapeutic value. Nevertheless, as the preparations have had much vogue, under the name of *chemical food*, we give the formula of Mr. Parrish from the journal referred to. "Take of Protosulphate of Iron ℥x; Phosphate of Soda ℥xii; Phosphate of Lime ℥xii; Glacial Phosphoric Acid ℥xx; Carbonate of Soda ℈ij; Carbonate of Potassa ℥i; Muriatic Acid, Water of Ammonia, each, q. s.; Powdered Cochineal ℥ij; Water q. s. to make f℥xx; Sugar ℔iij (troy); Oil of Orange ♏x. Dissolve the Sulphate of Iron in f℥ij, and the Phosphate of Soda in f℥iv of boiling Water. Mix the solutions, and wash the precipitated phosphate of iron till the washings are tasteless. Dissolve the Phosphate of Lime in f℥iv of boiling Water with sufficient Muriatic Acid to make a clear solution, precipitate it with Water of Ammonia, and wash the precipitate. To the freshly precipitated phosphates add the Phosphoric Acid previously dissolved in Water. When clear add the Carbonates of Soda and Potassa, and afterwards sufficient Muriatic Acid to dissolve the precipitate. Now add Cochineal mixed with the Sugar, apply heat, and when the syrup is formed, strain and flavour it. Each teaspoonful contains about one grain of phosphate of iron and two and a half grains of phosphate of lime, with smaller quantities of the alkaline phosphates, all in perfect solution." The objection to such preparations as this is not that each of the ingredients may not be useful; but that they are so numerous that a morbid state of system must be extremely rare in which they can all be indicated, and every medicine is more or less noxious if given when it is not needed. The probability is that the therapeutic value of the preparation depends mainly on its ferruginous ingredient, and that, as a general rule, its therapeutic effects may be equally as well, if not better obtained, from a simple syrup of phosphate of iron.

Simple Syrup of Phosphate of Iron. Subsequently, Mr. Wiegand gave a formula for a simple syrup of phosphate of iron, made by dissolving the recently precipitated salt in muriatic acid, and adding the requisite quantity of sugar. By a misprint the phosphate of sodium taken is double what it should be. The same writer has proposed to make a syrup of the phosphates of iron and calcium, by dissolving in the above a definite quantity of recently precipitated phosphate of calcium, made by double decomposition between solutions of chloride of calcium and phosphate of sodium. See his formulas in the *Am. Journ. of Pharm.* for March, 1855 (p. 104).—*Notes to the tenth, eleventh and twelfth editions.*

weighed capsule, stir them together, and evaporate until the liquid is reduced to sixteen troyounces. Spread this on plates of glass or porcelain, so that, on drying, the salt may be obtained in scales. Lastly, preserve it in a well-stopped bottle, protected from the light." *U. S.*

This formula appears to be based upon a method, proposed by M. E. Robiquet to the Academy of Medicine at Paris, in Feb. 1857, of preparing pyrophosphate of iron for use, by dissolving a gelatinous precipitate of the salt in a solution of citrate of ammonium, and forming a syrup with the solution. Prof. Procter devised a formula upon this plan, published in the *Am. Journ. of Pharm.* (Nov. 1857, p. 573), the result of which also was a syrup. The officinal formula, which provides for the preparation of the salt in the solid form, capable of being readily made into a syrup if desired, is that of Dr. Squibb published in the same journal (Jan. 1860, p. 37).

The first step in the officinal process is to convert the common tribasic phosphate of sodium ($2NaO,HO,PO_5+24HO$), by moderately igniting it, into the pyrophosphate or bibasic phosphate of sodium ($2NaO,PO_5$), which may be obtained crystallized by dissolving it in boiling water and evaporating, in which state it is represented by the formula $2NaO,PO_5+10HO$. The uncrystallized pyrophosphate is dissolved and mixed with solution of tersulphate of iron, when the pyrophosphate of sesquioxide of iron is deposited. This, while in a pulpy state, is added to a solution of citrate of ammonium formed by a direct union of its constituents, by which it is dissolved. The process is completed by evaporating the solution sufficiently, and then spreading it out to dry on glass or porcelain so that the salt may be obtained in scales. The reactions which result in the formation of the ferruginous salt, contained in this compound, probably take place between three eqs. of the bibasic phosphate of sodium $3(2NaO,PO_5)$ and two eqs. of the tersulphate of iron $2(Fe_2O_3,3SO_3)$, forming six eqs. of sulphate of sodium, and one eq. of sesquiphosphate of sesquioxide of iron, having (according to Gmelin) the equivalent composition represented by the formula $2Fe_2O_3,3PO_5+9HO$.

The preparation is probably an intimate mixture of the ferruginous and ammoniacal salts in the solid form; at least such must be the view of the revisers of the Pharmacopœia, who name it pyrophosphate of iron. It is in scales of an apple-green colour, and an acidulous somewhat saline taste. It is wholly and freely dissolved by water. Ferrocyanide of potassium occasions no precipitate with its solution, though it causes a pale-blue colour, showing that the iron is in the state of sesquioxide, and that there is a substance present (citrate of ammonium) capable of holding ferrocyanide of iron in solution. The salt contains 48 per cent. of anhydrous pyrophosphate of iron. (*U. S.*) It is a very good chalybeate, mild yet efficient in its action on the system, without disagreeable taste, and, from its solubility, readily administered in any form that may be desirable, whether that of pill, simple solution in water, or syrup. The dose is from two to five grains. A syrup may be readily prepared by dissolving it in water, and mixing the solution with simple syrup.*

* This ferruginous pyrophosphate is soluble in pyrophosphate of sodium; and hence, if an excess of pyrophosphate of sodium is used in the double decomposition, the ferruginous pyrophosphate, first thrown down, is redissolved. This solution was proposed as a medicine by M. Persoz in 1848, and by M. Leras in 1849. M. Leras conceives that pyrophosphate of iron, rendered soluble by pyrophosphate of sodium, is the only ferruginous preparation which is not precipitated in the stomach by the agency of the food or gastric juice. Mr. Alex. Ure, of London, tried this solution, calling it *soda-pyrophosphate of iron*, in scrofula, and found it a mild and efficient chalybeate. The same solution, as prepared by M. Leras, has been employed with marked success in anemic diseases, by MM. Follet and Baume, who found it easily administered and rapidly absorbed. In the preparation used by him, the sulphate of sodium, resulting from the double decomposition, was allowed to remain. The same solution, including the sulphate of sodium, has been prepared as a syrup by M. Soubeiran.

Syrup of Pyrophosphate of Iron. M. Soubeiran's formula is as follows. Add 55 *grains* of tersulphate of sesquioxide of iron, dissolved by a gentle heat in two *fluidounces* of water, to 462 grains of crystallized pyrophosphate of sodium, dissolved in 7½ *fluidounces* of water and 3½ *fluidounces* of mint water, and mix. So soon as the precipitate formed redissolves, filter the solution, and add to the filtrate 19 *troyounces* of white sugar, which must be allowed to dissolve without heat. The dose of this syrup, which is easy to take, is a tablespoonful, containing about a third of a grain of iron.

An equivalent preparation may be made from the U. S. pyrophosphate of iron by dissolving 2·6 grains in a fluidounce of syrup; but this would be a feeble preparation; and, besides, the quantity of sugar might be embarrassing to the stomach. A better plan would probably be to

Mr. S. P. Duffield, of Detroit, has failed in obtaining, by the U. S. process, a product capable of being satisfactorily dried in the form of scales, and proposes a modification consisting in digesting the magma of pyrophosphate of iron obtained in the first part of the process with water of ammonia, and then gradually adding solution of citric acid till a solution is effected. If evaporated to the consistence of syrup and spread in thin layers on glass, the product may be obtained in scales. But as the resulting salt does not, according to Mr. Duffield, contain the pyrophosphate of iron at all, but consists of a mixture of citrate of sesquioxide of iron and pyrophosphate of ammonium, however excellent the preparation may be, it cannot properly be considered as the substance officinally aimed at, the main ingredient of which is pyrophosphate of iron. (For the details of Mr. Duffield's process, see *Am. Journ. of Pharm.*, Jan. 1869, p. 58.) Mr. R. W. Gardner, of Bergen, N. J., found, in his first trials, the same difficulty in obtaining the salt in scales; but, having ascertained that he used nitric acid of less than the officinal strength in preparing the solution of tersulphate of iron employed in the formula, and consequently obtained the salt not completely sesquioxidized, and having corrected this error, he afterwards experienced no difficulty, and believes that the U. S. process, if proper attention be given to its details, will always yield satisfactory results. (*Ibid.*, May, 1869.) W.

FERRI SUBCARBONAS. *U. S. Subcarbonate of Iron. Sesquioxide of Iron. Red Oxide of Iron. Precipitated Carbonate of Iron. Aperitive Saffron of Mars.*

"Take of Sulphate of Iron *eight troyounces;* Carbonate of Sodium *nine troyounces;* Water *eight pints.* Dissolve the salts separately, each in four pints of the Water; then mix the solutions thoroughly, and set aside the mixture until the precipitate has subsided. Then pour off the supernatant liquid, wash the precipitate with water until the washings pass nearly tasteless, and dry it on bibulous paper without heat." *U. S.*

When the solutions of carbonate of sodium and sulphate of iron are mixed together, a hydrated carbonate of protoxide of iron, of a pale-blue colour,* is thrown down, and sulphate of sodium remains in solution. The equivalent quantities of the *crystallized salts* for mutual decomposition are 139 of the sulphate and 143·3 of the carbonate. Taking the quantity of sulphate of iron at 8 parts, the U. S. Pharmacopœia orders 9 parts of the carbonate of sodium, which gives a slight excess of the latter. The precipitate, during the washing and drying, absorbs oxygen, and loses nearly all its carbonic acid, whereby it is converted almost entirely into sesquioxide of iron. Hence, the London College gave it the name of *Ferri Sesquioxidum;* but, as this is applicable to the red oxide, obtained by calcining the sulphate, or igniting the hydrated sesquioxide, the U. S. name of *Ferri Subcarbonas*, adopted in allusion to the small quantity of carbonic acid present in it, is more distinctive. Carbonate of sodium is preferred to carbonate of potassium for decomposing the ferruginous sulphate; because it produces in the double decomposition sulphate of sodium, which, from its greater solubility, is more readily washed away than sulphate of potassium. The direction to dry the precipitate without heat is important; as even a moderate elevation of temperature has been shown, by the experiments of Mr. J. A. Rex, to modify the resulting product unfavourably, diminishing its solubility in muriatic acid in proportion to the heat employed. (*Am. Journ. of Pharm.*, May, 1862, p. 193.)

Properties. Subcarbonate of iron is a reddish-brown powder, of a disagreeable, slightly styptic taste; insoluble in water, and not readily dissolved by any acid except the muriatic, with which it effervesces slightly. When of a bright-red colour it

dissolve 20 grains in a fluidounce of syrup, giving 2·5 grains of the salt to each fluidrachm, and making the dose from one to two teaspoonfuls. The salt may be dissolved in a little water before being incorporated with the syrup, care being taken that the resulting liquid should contain 20 grains to the fluidounce.

Dr. Squibb prepares a syrup of the pyrophosphate by adding to 24 parts of the solution of the formula, after filtration, 248 parts of Syrup, and thus obtains a preparation containing about two grains of the officinal salt, or one grain of the anhydrous pyrophosphate in a fluidrachm. (*Notes to the eleventh and twelfth editions.*)

* The carbonate of the protoxide of iron is white if perfectly pure; but as the sulphate of iron used is not absolutely pure, containing almost always a little sesquioxide, this is thrown down with the carbonate, giving it a bluish tinge.

should be rejected, as this colour shows that it has been injured by exposure to heat. After precipitation from its muriatic solution by ammonia or potassa, either of which throws down the sesquioxide of iron, the supernatant liquor should give no indications of containing any metal in solution by the test of sulphuretted hydrogen or ferrocyanide of potassium. It is incompatible with acids and acidulous salts. In composition it is a hydrated sesquioxide of iron, containing a little carbonate of the protoxide. By exposure to a red heat, it absorbs oxygen, and loses water and carbonic acid, being converted into the *astringent saffron of Mars* of the French Codex. After ignition it is no longer a subcarbonate, but is converted into the pure sesquioxide, which is less soluble in acids, and less efficient as a medicine than the preparation in its original state. Hence it is wrong to expose the subcarbonate to a red heat, as some manufacturing chemists are in the habit of doing, in order to give it a bright-red colour.

Medical Properties and Uses. Subcarbonate of iron is tonic, alterative, and emmenagogue, and is employed for all the purposes to which the preparations of iron are generally applicable. It was recommended by Mr. Carmichael in cancer, and is said sometimes to prove useful. Mr. Hutchinson brought it into notice as a remedy for neuralgia; and an extensive experience with it in that disease has established its value. It is also useful in chorea, chlorosis, and, generally, in those diseases in which the blood is deficient in red corpuscles. It has been used by Dr. Woollam, Dr. Shearman, Dr. Elliotson, and others in traumatic tetanus, with success in twelve cases, and failure in three. In the second stage of hooping-cough, Dr. Steymann represents it to be a prompt and efficacious remedy. When prescribed as a tonic, the usual dose is from five to thirty grains three times a day, given in pill or powder, and frequently combined with aromatics and vegetable tonics. In neuralgia, chorea, and tetanus, it is administered in doses of from one to two teaspoonfuls. No nicety need be observed in the dose; as its only obvious effect in very large doses is a slight nausea, and a sense of weight at the stomach. It blackens the stools.

The subcarbonate of iron acts as an antidote to the poison of arsenious acid, provided it has not been exposed to a red heat; and, though not so powerful as the hydrated oxide in the form of magma, should always be used until the latter can be procured. (See *pages* 28, 30.)

Off. Prep. Emplastrum Ferri, *U. S.;* Ferrum Redactum, *U. S.;* Trochisci Ferri Subcarbonatis, *U. S.* B.

FERRI SULPHAS. *U. S., Br. Sulphate of Iron. Green Vitriol.*

"Take of Iron, in the form of wire, and cut in pieces, *twelve troyounces;* Sulphuric Acid *eighteen troyounces;* Water *eight pints.* Mix the Sulphuric Acid and Water, and add the Iron; then heat the mixture until effervescence ceases. Pour off the Solution, and, having added thirty grains of Sulphuric Acid, filter through paper, allowing the lower end of the funnel to touch the bottom of the receiving vessel. Place the filtered liquor in a matrass and evaporate until sufficiently concentrated; then set it aside in a covered vessel to crystallize. Drain the crystals in a funnel, dry them on bibulous paper, and keep them in a well-stopped bottle." *U. S.*

"Take of Iron Wire *four ounces* [avoirdupois]; Sulphuric Acid *four fluidounces* [Imperial measure]; Distilled Water *one pint and a half* [Imp. meas.]. Pour the Water on the Iron placed in a porcelain dish, add the Sulphuric Acid, and, when the disengagement of gas has nearly ceased, boil for ten minutes. Filter now through paper, and, after the lapse of twenty-four hours, separate the crystals which have been deposited from the solution. Let these be dried on filtering paper placed on porous bricks, and preserved in a stoppered bottle." *Br.*

The object of these processes is to make a pure sulphate of protoxide of iron by direct combination. Sulphuric acid, in a concentrated state, acts but imperfectly on iron; but when diluted, a vigorous action takes place, the oxygen of the water converts the metal into protoxide, with which the sulphuric acid unites, and hydrogen is evolved. The equivalent quantities for mutual reaction are 28 of iron to 49 of acid. This proportion is one part of iron to one and three-quarters of acid. The *U. S.* proportion is one part of iron to one and a half of acid, and gives a quantity of iron one-sixth more than the acid can dissolve. The *British Council* uses an excess of acid,

the weight of acid taken being 7·38 avoirdupois ounces, instead of 7. An excess of iron, however, is desirable; as it tends to secure the production of a perfect sulphate of the protoxide. The remaining steps of the U. S. process are peculiar, and are intended to secure the formation of a salt, entirely free from sesquioxide, by the method of Bonsdorff. This chemist found that, when a perfect sulphate of protoxide of iron was formed in solution by heating dilute sulphuric acid with an excess of iron, it might be crystallized free from sesquioxide, provided a little excess of sulphuric acid were added to the liquid before filtration, in order to hold in solution any sesquioxide that may have been formed; at the same time avoiding, as much as possible, the contact of the air. Hence the directions in the U. S. formula to acidulate with sulphuric acid, to cause the funnel to touch the bottom of the receiving vessel, which avoids the dropping of the liquid through the air, and to cover the vessel containing the concentrated liquid, when it is set aside to crystallize. The *London* and *Edinburgh Colleges* prepared this officinal by purifying the impure commercial sulphate; but their plan was superseded by that of the *Dublin College* in the consolidation of the several pharmacopœias in the British.

Properties. Sulphate of iron is in the form of transparent crystals, efflorescent in the air, of a pale bluish-green colour, and having the shape of oblique rhombic prisms. It has a styptic taste, and an acid reaction. As prepared by Bonsdorff's method, it is blue verging to green. When it becomes more green than blue, or entirely green, an indication is afforded that it contains some sesquioxide. By exposure to the air the crystals absorb oxygen, and become first green, and ultimately covered with a yellow efflorescence of monosulphate of the sesquioxide, insoluble in water. Sometimes the crystals are quite permanent when made by Bonsdorff's method, owing to the slight excess of acid which they contain. Sulphate of iron is soluble in about twice its weight of cold water and in three-fourths of its weight of boiling water, but is insoluble in alcohol. The aqueous solution is bluish-green; but by standing it attracts oxygen, and becomes first green and then reddish, depositing, in the mean time, a portion of sesquisulphate of the sesquioxide, having the composition $2Fe_2O_3,3SO_3+8HO$. (Wittstein, *Chemical Gazette*, May 15, 1849; from *Buchner's Repert.*) When heated moderately, it parts with six-sevenths of its water of crystallization, and becomes grayish-white. (See *Ferri Sulphas Exsiccata.*) At a red heat it loses its acid, and is converted into the anhydrous sesquioxide of iron called *colcothar*. It is incompatible with the alkalies and their carbonates, soaps, lime-water, the chlorides of calcium and barium, the borate and phosphate of sodium, nitrate of silver, and the acetate and subacetate of lead. It is decomposed also by astringent vegetable infusions, the tannic and gallic acids of which form, if any sesquioxide be present, a black compound of the nature of ink. The extent to which this change lessens the activity of the salt is not well ascertained. Sulphate of iron, as kept in the shops, is often the impure commercial sulphate, which is not fit for medicinal use.* The perfectly pure salt is precipitated white by ferrocyanide of potassium; but that

* *Commercial Sulphate of Iron.* Ferri Sulphas Venalis. *Lond. Green Vitriol. Copperas.* This was formerly officinal in the London Pharmacopœia, in which it was employed for preparing the pure sulphate. It is manufactured on a large scale for the purposes of the arts, from the native sulphuret of iron, or iron pyrites, by roasting, oxidation by exposure to air and moisture, and lixiviation. The constituents of the mineral become sulphuric acid and protoxide of iron, which, by their union, form the salt. Sulphate of iron is also obtained in many chemical processes as a collateral product, as in the manufacture of alum, in the precipitation of copper from solutions of sulphate of copper by scraps of iron, &c.

Commercial sulphate of iron is far from being pure. Besides containing some sesquioxide of iron, it is generally contaminated with metallic and earthy salts; such as those of copper, zinc, alumina, and magnesia. Two principal kinds occur in the market; one in large grass-green crystals, the surface of which is studded with ochreous spots; the other, of a bluish-green colour, and ordinarily mixed with the powder of the effloresced salt. The commercial sulphate should never be dispensed by the apothecary, until it has undergone a careful purification. The following was the formula of the London College for effecting this object.

"Take of Commercial Sulphate of Iron *four ounces* [*troy*]; Sulphuric Acid *a fluidounce* [Imperial measure]; Iron wire *an ounce* [*troy*]; Distilled Water *four pints* [Imp. meas.]. Mix the Acid with the Water, and add to them the Sulphate and Iron, then apply heat, stirring occasionally, till the Sulphate is dissolved. Filter the solution while hot, and set aside to crystallize. Pour off the liquor, and evaporate it that crystals may again form. Dry all the crystals." (*Note to the twelfth edition.*)

of ordinary purity gives a greenish precipitate, more or less deep, with this test, owing to the presence of some sesquioxide of iron. Copper may be detected by immersing in the solution a bright piece of iron, on which a cupreous film will be deposited. Both copper and zinc may be discovered by sesquioxidizing the iron by boiling the solution of the salt with nitric acid, and then precipitating the iron by an excess of ammonia. If the filtered solution is blue, copper is present; and if it contain zinc, this will be separated in flakes of white oxide, on expelling the excess of ammonia by ebullition. Sulphate of iron, when crystallized, consists of one eq. of acid 40, one of protoxide 36, and seven of water 63 = 139, and its formula is $FeO,SO_3 + 7HO$.

It is often desirable to protect the sulphate of iron against the oxidation to which it is liable on exposure. Sugar acts as a preservative in the case of this salt, as in that of protiodide of iron. It may be added to the solution, or incorporated with the sulphate in substance. M. E. Latour has given a formula for crystallizing the salt with sugar. Mr. Geo. Welborn has found a small lump of camphor, wrapped in tissue paper, and placed in the bottle with the sulphate, to prevent its oxidation. (*Pharm. Journ. and Trans.*, May, 1868, p. 537.) M. Pavesi, of Mortara, effects the same object by incorporating it with an equal weight of gum arabic, by evaporating a joint solution of the two substances with a gentle heat. (*Journ. de Pharm.*, 4e sér., iii. 49.)

Medical Properties and Uses. Sulphate of iron is astringent and tonic. In large doses it is apt to produce nausea, vomiting, griping, and purging; and its use, when long continued, injures the stomach. As its effect is chiefly that of an astringent, it cannot be used with advantage to improve the quality of the blood. As an astringent it is given in diseases attended with immoderate discharges; such as passive hemorrhages, colliquative sweats, diabetes, chronic mucous catarrh, leucorrhœa, gleet, &c. As a tonic it is used in dyspepsia, and in the debility following protracted diseases. In amenorrhœa with deficient action it is resorted to with supposed advantage, either alone or conjoined with the fetid and stimulant gums. Externally, the solution is used in chronic ophthalmia, leucorrhœa, and gleet, made of various strengths, from one or two to eight or ten grains of the salt to the fluidounce of water. M. Velpeau has found it an excellent remedy in erysipelas, applied topically in the form of solution or ointment. In forty cases in which it was tried, it cut short the disease in from 24 to 48 hours. The solution was made of three and a half drachms of the salt to a pint of water, and applied by compresses, kept constantly wet. In a few cases convenience required the application of the ointment, made of eight parts of the salt to thirty of lard. An ointment, made of one or two parts of the sulphate to sixty of lard, was found by M. Devergie to be particularly efficacious in certain skin diseases, especially in the different forms of eczema. In scaly affections it had no effect. The dose is one or two grains, in the form of pill, which should be made from the dry sulphate. (See *Ferri Sulphas Exsiccata.*) When given in solution, the water should be previously boiled to expel the air, which, if allowed to remain, would partially decompose the salt. Taken in an overdose it acts as a poison.

The sulphate of iron has disinfecting properties, and in France is largely used in solution for the disinfection of the fecal matters of animals, manures, slaughter-houses, ditches, and all places giving rise to noxious emanations. It is mixed with the infectious matters, and applied by washing to the surface of all infected places. (*Chem. News*, April 20, 1866, p. 190.) We understand that it is also used for similar purposes in this country. Mixed with hydrated lime, and sprinkled on privy walls, it rapidly corrects the fetid emanations; the protoxide of iron and excess of lime neutralizing the sulphuretted hydrogen.

Off. Prep. Ferri Arsenias, *Br.;* Ferri Carbonas Saccharata, *Br.;* Ferri Oxalas, *U. S.;* Ferri Oxidum Magneticum, *Br.;* Ferri Phosphas, Ferri Subcarbonas, *U. S.;* Ferri Sulphas Exsiccata; Liquor Ferri Persulphatis, *Br.;* Liquor Ferri Subsulphatis, *U. S.;* Liquor Ferri Tersulphatis, *U. S.;* Mistura Ferri Composita; Pilula Aloes et Ferri, *Br.;* Pilulæ Ferri Carbonatis, *U. S.;* Pil. Ferri Compositæ, *U. S.* B.

FERRI SULPHAS EXSICCATA. *U. S., Br. Dried Sulphate of Iron.*

"Take of Sulphate of Iron, in coarse powder, *twelve troyounces.* Expose it, in

an unglazed earthen vessel, to a moderate heat, with occasional stirring, until it has effloresced; then increase the heat to 300°, and maintain it at about that temperature until the salt ceases to lose weight. Lastly, reduce the residue to fine powder, and keep it in a well-stopped bottle." *U. S.*

"Take of Sulphate of Iron *four ounces*. Expose it in a porcelain or iron dish to a heat commencing at 212°, but which may be finally raised to 400°, until aqueous vapour ceases to be given off. Reduce the residue to a fine powder, and preserve it in a stoppered bottle." *Br.*

In these processes six eqs. out of seven of the water of crystallization of the salt are driven off. The heat should not exceed 400°, otherwise the salt itself would suffer decomposition. Dried sulphate of iron is used for making pills, the crystallized sulphate not being adapted to that purpose. In prescribing the dried sulphate it is necessary to recollect that three grains are equivalent to five of the crystallized salt. B.

FERRI SULPHAS GRANULATA. *Br.* *Granulated Sulphate of Iron.*

"Take of Iron Wire *four ounces* [avoirdupois]; Sulphuric Acid *four fluidounces* [Imperial measure]; Distilled Water *one pint and a half* [Imp. meas.]; Rectified Spirit *eight fluidounces* [Imp. meas.]. Pour the Water on the Iron placed in a porcelain capsule, add the Sulphuric Acid, and, when the disengagement of gas has nearly ceased, boil for ten minutes, and then filter the solution into a jar containing the spirit, stirring the mixture so that the salt shall separate in minute granular crystals. Let these, deprived by decantation of adhering liquid, be transferred on filtering paper to porous tiles, and dried by exposure to the atmosphere. They should be preserved in a stoppered bottle." *Br.*

The directions given in the first part of this process are precisely the same as those laid down by the British Council for making Sulphate of Iron; but the hot solution of the iron in the sulphuric acid, instead of being allowed to filter into an empty vessel, is made to drop into a portion of rectified spirit, the mixture being stirred while it cools. The acid directed is in excess; and the filtrate is consequently an acid solution of sulphate of protoxide of iron, mixed with spirit. The stirring as the mixture cools finely granulates the salt, which separates perfectly pure; the spirit holding in solution any tersulphate of sesquioxide of iron which may have been formed, and the excess of acid dissolving any free sesquioxide. This process, in its main features, is the same as that of M. Berthemot, given in the eighth edition of this work. It was adopted from the Dublin Pharmacopœia.

Properties, &c. Granulated sulphate of iron is a crystalline, granular, bluish-white powder. When carefully dried it undergoes no change by keeping. It appears to have been introduced into the catalogue of the Dublin Pharmacopœia of 1850, as the best form of the sulphate for conversion into the officinal dried salt; and its peculiar state of aggregation would seem to fit it for that purpose; yet this intention, if it existed, seems to have been overlooked in the revision of the British Pharmacopœia, in which the granulated salt is not directed in the formula for the dried sulphate. The only reason for its retention was probably that it is less liable to oxidation on exposure than the sulphate in its ordinary form.

Off. Prep. Syrupus Ferri Phosphatis, *Br.* B.

FERRUM REDACTUM. *U. S., Br.* Ferri Pulvis. *U. S.* 1850. *Reduced Iron. Powder of Iron.*

"Take of Subcarbonate of Iron *thirty troyounces*. Wash the Subcarbonate thoroughly with water until no traces of sulphate of sodium are indicated by the appropriate tests, and calcine it in a shallow vessel until free from moisture. Then spread it upon a tray, made by bending an oblong piece of sheet-iron in the form of an incomplete cylinder, and introduce this into a wrought-iron reduction-tube, of about four inches in diameter. Place the reduction-tube in a charcoal furnace; and, by means of a self-regulating generator of hydrogen, pass through it a stream of that gas, previously purified by bubbling successively through solution of subacetate of lead, diluted with three times its volume of water, and through milk of lime, severally

contained in four-pint bottles, about one-third filled. Connect with the further extremity of the reduction-tube, a lead tube bent so as to dip into water. Make all the junctions air-tight by appropriate lutes; and, when the hydrogen has passed long enough to fill the whole of the apparatus to the exclusion of atmospheric air, light the fire, and bring that part of the reduction-tube, occupied by the Subcarbonate, to a dull-red heat, which must be kept up so long as the bubbles of hydrogen, breaking from the water covering the orifice of the lead tube, are accompanied by visible aqueous vapour. When the reduction is completed, remove the fire, and allow the whole to cool to the ordinary temperature, keeping up, during the refrigeration, a moderate current of hydrogen through the apparatus. Withdraw the product from the reduction-tube, and, should any portion of it be black instead of iron-gray, separate such portion for use in a subsequent operation. Lastly, having powdered the Reduced Iron, keep it in a well-stopped bottle. When thirty troyounces of Subcarbonate of Iron are operated on, the process occupies from five to eight hours." *U. S.*

"Take of Hydrated Peroxide of Iron *one ounce* [avoirdupois]; Zinc, granulated, Sulphuric Acid, Chloride of Calcium, each, *a sufficiency.* Introduce the Hydrated Peroxide of Iron into a gun-barrel, confining it to the middle part of the tube by plugs of asbestos. Pass the gun-barrel through a furnace, and when it has been raised to a strong red heat, cause it to be traversed by a stream of hydrogen gas, developed by the action on the Zinc of some of the Sulphuric Acid diluted with eight times its volume of water. The gas before entering the gun-barrel must be rendered quite dry by being made to pass first through the remainder of the Sulphuric Acid, and then through a tube eighteen inches long, packed with small fragments of the Chloride of Calcium. The farther end of the gun-barrel is to be connected by a cork with a bent tube dipping under water; and when the hydrogen is observed to pass through the water at the same rate that it bubbles through the Sulphuric Acid, the furnace is to be allowed to cool down to the temperature of the atmosphere, the current of hydrogen being still continued. The reduced iron is then to be withdrawn, and enclosed in a dry stoppered bottle." *Br.*

This preparation was introduced into the U. S. and Dublin Pharmacopœias of 1850, and is retained in the present edition of our own, and in the British. It consists of metallic iron in fine powder, obtained by reducing the sesquioxide by hydrogen at a dull red heat. The subcarbonate of the U. S. Pharmacopœia, which is essentially the sesquioxide of iron, is deprived of water by calcination, and then subjected to the reducing influence of a stream of hydrogen, purified from sulphuretted hydrogen and other acid by passing successively through a solution of subacetate of lead and milk of lime. The hydrogen unites with the oxygen of the sesquioxide to form water, and leaves the iron in the metallic state. The subcarbonate should be perfectly free from sulphate of sodium, which it is apt to contain when imperfectly washed. If this salt be present it will be reduced by the hydrogen to the state of sulphuret of sodium, which will contaminate and spoil the metallic iron formed, and cause the preparation, when taken, to give rise to unpleasant eructations. The heat should be carefully regulated; for if it fall below dull redness, part of the oxide will escape reduction; and, if it exceed that point considerably, the particles of reduced iron will agglutinate, and the preparation will be heavy and not readily pulverizable. The British process is not so well fitted for practical purposes as that of the U. S. Pharmacopœia. The direction to dry the hydrogen is unnecessary. On the subject of powder of iron, manufacturing chemists will find it useful to consult the paper of MM. Soubeiran and Dublanc, in which full directions are given for purifying the hydrogen, constructing the furnace, regulating the heat, and avoiding explosions. (*Amer. Journ. of Pharm.*, xviii. 303; from the *Journ. de Pharm.*, viii. 187.) Prof. Procter, of Philadelphia, has made some improvements in the process of Soubeiran and Dublanc, which he has communicated in a paper, embracing many useful details. (*Amer. Journ. of Pharm.*, xix. 11.)

Since the tenth edition of this work was published, several processes have been proposed for obtaining powder of iron. Mr. Arthur Morgan, of Dublin, recommends the use of dried ferrocyanide of potassium, thoroughly mixed with anhydrous red oxide of iron, and calcined with pure carbonate of potassium at a low red heat. The

product contains all the iron in a reduced state, mixed with soluble matters, which are carefully washed away. (See *Amer. Journ. of Pharm.*, Sept. 1854, p. 450.) A similar process to the above has been proposed by a German chemist, named Zängerle; the oxalate of protoxide of iron being substituted for the red oxide. (See *Pharm. Journ.*, May, 1857, p. 565.) Prof. Wöhler recommends the use of the same oxalate, not in connection with ferrocyanide of potassium; but as a suitable compound of iron for reduction by hydrogen.* Another eligible compound for reduction is the crystalline powder of oxide of iron, prepared by fusing, in a clay crucible, pure dried sulphate of iron with three times its weight of chloride of sodium, and then washing the melted mass when cold, until everything soluble is removed. (*Wöhler.*) M. Crolas prepares a pure oxide of iron by adding chloride of barium to the solution of the chloride of iron to precipitate the contaminating sulphate, getting rid of the chloride of barium by crystallization and precipitating by solution of ammonia. The chloride of ammonium is driven off by heat. (*Journ. de Pharm.*, 4e sér., xx. 30.) The process of M. Eugene Fegueux consists in reducing the oxide of iron by carbonic oxide, formed by passing a stream of carbonic acid over red-hot charcoal in the reduction-tube, before it reaches the oxide of iron. The carbonic acid, thus reduced to carbonic oxide, is formed again by the deoxidizing of the ferruginous oxide.

Under the name of "*alcoholized iron*," a powder of iron has been introduced into this country, said to be prepared, in the eastern parts of Germany, by attrition of iron filings with honey, by some cheap method, as by attachment to a saw-mill or steam machinery. It has the appearance of powdered plumbago, but under the magnifying glass is seen to contain particles with the metallic lustre, and rounded as if by friction. It is soluble in dilute sulphuric acid, with the escape of hydrogen free or nearly so from sulphur; but a small quantity of a black powder remains undissolved. (*Am. Journ. of Pharm.*, Jan. 1867, p. 11.) The relation of the epithet "alcoholized" to this powder is not very obvious. Prof. Procter authorized us to state that it is not much inferior to reduced iron, and is better than some that is sold by that name.†

Properties. Powder of iron, called by the French, *fer reduit*, is a light, tasteless powder, soft to the touch, of an iron-gray colour, and without metallic lustre. If black, the preparation is to be rejected as not being fully deoxidized. When thrown into a dilute acid, it causes a lively effervescence of hydrogen without odour. A small portion of it, struck on an anvil with a smooth hammer, forms a scale, having a brilliant metallic lustre. It takes fire upon the application of a burning body. On account of its great liability to oxidation, it should be kept in a dry bottle, well stopped. A black powder, having a composition corresponding with that of the magnetic oxide of iron, has been sold in London and Edinburgh under the name of Quevenne's iron. The spurious powder may be known by its having a black instead of an iron-gray colour, and by its effervescing but slightly with acids. In the process for making reduced iron, part of the sesquioxide almost always escapes full deoxidation, and comes out of the tube a black colour. This part should be rejected, instead of being sold as reduced iron, as appears to have been done by some manufacturing chemists. If the preparation has been very badly made, its solution in dilute sulphuric acid will produce an intensely red colour with sulphocyanide of potassium.

Medical Properties. Powder of iron, reduced from the oxide by hydrogen, was first prepared for medicinal purposes by Quevenne and Miquelard, of Paris. The general therapeutic properties of the preparations of iron, and the mode in which they should be given, have been stated under another head. (See *page* 416.) Of these, the pre-

* W. Müller has found that oxide of iron obtained by heating the metal in the air is reduced when moist at 293° C., when quite dry at 305° to 339° C.; the oxalate moist at 278° C. (*Note to the fourteenth edition.*)

† Commercial reduced iron is very often impure. P. Cavers estimates the proportion of iron by the use of a titrated solution of iodine, containing 4·53 grammes of iodine and 5 grammes of iodide of potassium in a hundred cubic centimetres; one cubic centimetre of this solution is equivalent to ·01 gramme of iron. ·1 gramme of the iron to be tested should be put in 5 grammes of water in a matrass and heated. Then the solution should be added from a burette. Sometimes a little continuance of the heat is necessary for the perfection of the reaction, which changes the colour of the liquid persistent yellow. Before accepting the readings of the burette the residue should be tested with muriatic acid. Any effervescence would show that the iron had not fully combined with the iodine. (*Journ. de Pharm.*, 4e sér., xx. 178.)—*Note to the fourteenth edition.*

paration under consideration is among the most important. It is that which introduces the largest proportion of iron into the gastric juice, according to Quevenne, and to M. Costes, of Bordeaux. The chief objection to it is the difficulty of obtaining it well prepared. Much of the powder of iron found in the shops is not to be depended on, in consequence of imperfect reduction. The principal diseases in which it has been employed are anæmia, chlorosis, amenorrhœa, chorea, and enlargement of the spleen following intermittent fever. Its general mode of action is to improve the quality of impoverished blood. Observations to determine its therapeutic value, compared with that of the other ferruginous preparations, were made by M. Costes, for nearly four years, at the hospital Saint-André, of Bordeaux, and with results highly favourable to it. The dose is from three to six grains several times a day, given in powder or pill. It is sometimes prepared with chocolate in the form of lozenges.

Off. Prep. Pilulæ Ferri Iodidi, *U. S.* B.

GLYCERITA.

Glycerites.

Syn. GLYCERINA. *Br. Glycerines.*

These are solutions of medicinal substances in glycerin. In the last edition of the Dispensatory various reasons were adduced for preferring the name glycer*a*tes for these preparations, but as the revisers of the U.S. Pharmacopœia have since adopted that of glycerites these reasons are omitted. The U.S. name is certainly much better than the English.

Glycerin has valuable properties as a solvent and vehicle of medicinal substances. Such are its not unpleasant taste and bland character; its wide range of solvent power, which adapts it sometimes as a menstruum where neither water nor alcohol could be advantageously used, and enables it to retain in solution insoluble substances so frequently deposited from infusions and decoctions; and its preservative influence, which often protects against oxidation, and, by a destructive agency upon all of the lowest forms of vegetable and animal life, prevents the various fermentative processes so destructive of organic bodies. Another important property, as a vehicle for external remedies, is the permanence of its liquid character, so that it does not, like water and alcohol, dry up when applied to the skin; resembling in this respect, as well as in its demulcent quality, the fixed oils, without their tendency to rancidity. Hence it has of late come into extensive use in the preparation of medicinal solutions. which under the name of *Glycérés* found admission into the French Codex of 1866, and are now recognised by both the United States and British Pharmacopœias.

GLYCERITUM ACIDI CARBOLICI. *U. S.* GLYCERINUM ACIDI CARBOLICI. *Br. Glycerite of Carbolic Acid. Glycerine of Carbolic Acid.*

"Take of Carbolic Acid *two troyounces;* Glycerin *half a pint.* Rub them together in a mortar, until the Acid is dissolved." *U. S.*

"Take of Carbolic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar until the Acid is dissolved." *Br.*

For the uses of this preparation, see *Acidum Carbolicum* in *Part* I. It may be used internally or locally, and for both purposes should in general be diluted with water at the time of application. Four and a half minims represent about a grain of the acid. The dose is from five to ten minims.

Off. Prep. Aqua Acidi Carbolici, *U. S.* W.

GLYCERITUM ACIDI GALLICI. *U. S.* GLYCERINUM ACIDI GALLICI. *Br. Glycerite of Gallic Acid. Glycerine of Gallic Acid.*

"Take of Gallic Acid *two troyounces;* Glycerin *half a pint.* Rub them together in a mortar, then transfer to a glass or porcelain capsule, and heat gently until the Acid is dissolved." *U. S.*

"Take of Gallic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar, then transfer the mixture to a porcelain dish, and apply a gentle heat until complete solution is effected." *Br.*

Glycerin is peculiarly fitted for a vehicle of gallic acid, which it readily dissolves, while the acid is but sparingly soluble in water. For the uses of this glycerate, see *Acidum Gallicum* in *Part* II. The solution contains one grain of gallic acid in about four and a half minims of glycerin, and the dose is from twenty to sixty minims. W.

GLYCERITUM ACIDI TANNICI. *U.S.* GLYCERINUM ACIDI TANNICI. *Br.* *Glycerite of Tannic Acid.* *Glycerine of Tannic Acid.*

"Take of Tannic Acid *two troyounces;* Glycerin *half a pint.* Rub them together in a mortar, then transfer to a glass or porcelain capsule, and heat gently until the Acid is dissolved." *U.S.*

"Take of Tannic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar, then transfer the mixture to a porcelain dish and apply a gentle heat until a complete solution is effected." *Br.*

This preparation may be used, both internally and externally, for most of the purposes to which tannic acid is applied. (See *Acidum Tannicum.*) Dr. S. Ringer esteems it highly as a remedy in ozæna and other sanious or purulent discharges from the nostrils and ears, being omitted if the symptoms present an acute form. He has found it also very serviceable in the early stages of eczema, and in impetigo; the scabs being removed before it is applied; and considers it extremely useful in chronic inflammation and superficial ulceration of the fauces, with a relaxed, moist, and granular appearance of the pharyngeal mucous membrane. (*Am. Journ. of Med. Sci.*, Jan. 1869, p. 241.) The solution contains one grain of tannic acid in between four and five minims; and the dose is from ten to forty minims.

On the whole, it is a most useful preparation of tannic acid for external use; as circumstances require it the officinal strength may be altered by directions of the physician; a very concentrated solution, two parts of glycerin to one of tannin, may be made by the aid of a moderate heat. This applied daily to nipples, during the later months of pregnancy, will almost invariably prevent the occurrence of "sore nipples" during suckling. W.

GLYCERITUM AMYLI. GLYCERINUM AMYLI. *Br.* *Glycerite of Starch.* *Glycerine of Starch.*

"Take of Starch *one ounce* [avoirdupois]; Glycerine *eight fluidounces* [Imperial measure]. Rub them together until they are intimately mixed, then transfer the mixture to a porcelain dish, and apply a heat gradually raised to 240°, stirring it constantly until the starch particles are completely broken and a translucent jelly is formed." *Br.*

Of this preparation it is only necessary to say that, with the exception of an inconsiderable difference in the proportions, it is the same with that brought into notice in 1858 by Mr. Schacht under the name of *plasma*, and described under *Glycerin* in *Part* I. of the Dispensatory (*page* 449), to which the reader is referred. W.

GLYCERITUM PICIS LIQUIDÆ. *U.S.* *Glycerite of Tar.*

"Take of Tar *a troyounce;* Carbonate of Magnesium, in powder, *two troyounces;* Glycerin *four fluidounces;* Alcohol *two fluidounces;* Water *ten fluidounces.* Having mixed the Glycerin, Alcohol, and Water, rub the Tar in a mortar, first with the Carbonate of Magnesium, and then with six fluidounces of the mixed liquids gradually added, and strain with expression. Rub the residue in like manner with half the remaining liquid, and strain as before. Repeat the process again with the remaining liquid. Put the residue into a percolator, add gradually the expressed liquids previously mixed, and afterwards a sufficient quantity of water to make the liquid which passes measure a pint." *U.S.*

This is a very excellent preparation of tar, which may be used either externally or internally. The formula is essentially the same, although employing one-third less of the magnesium salt, as that proposed by Mr. J. B. Moore (*American Journal of Pharmacy*, March, 1869, p. 115). As first made it is of a reddish-brown colour; after a time it is apt to deposit pitchy matter, which should be separated by filtration. An ounce of it represents half a fluidrachm of tar. The dose is a drachm to a half ounce. H. C. W.

GLYCERITUM SODII BORATIS. *U. S.* GLYCERINUM BORACIS. *Br.* *Glycerite of Borate of Sodium. Glycerine of Borax.*

"Take of Borate of Sodium *two troyounces;* Glycerin *half a pint.* Rub them together in a mortar, until the Borate of Sodium is dissolved." *U. S.*

"Take of Borax, in powder, *one ounce* [avoirdupois]; Glycerine *four fluidounces.* Rub them together in a mortar until the Borax is dissolved." *Br.*

The demulcent properties and sweet taste of this preparation render it a useful and convenient method of applying borax to the infantile thrush, and other forms of sore-mouth in children.

It has been very highly commended in facial erysipelas by Prof. D. M. Salazar, of Madrid. The part should be freely painted with it and then covered with raw cotton. (*N. Y. Med. Record*, viii. 311.) W.

HYDRARGYRUM.

Preparations of Mercury.

Of the mercurial preparations formerly officinal, the following have been discarded in the recent editions of the U. S. and British Pharmacopœias; *Pure Mercury*, Dub., *Solution of Bichloride of Mercury*, Lond., *Black Oxide of Mercury*, U. S., *Black Sulphuret of Mercury*, U. S., and *Mercury with Magnesia*, Dub. The *Solution of Nitrate of Mercury* has been transferred to the LIQUORES or *Solutions.*

HYDRARGYRI CHLORIDUM CORROSIVUM. *U. S.* HYDRARGYRI PERCHLORIDUM. *Br.* HYDRARGYRUM CORROSIVUM SUBLIMATUM. *Br.* 1864. HYDRARGYRI BICHLORIDUM. *Lond.* *Corrosive Chloride of Mercury. Perchloride of Mercury. Bichloride of Mercury. Corrosive Sublimate.*

"Take of Mercury *twenty-four troyounces;* Sulphuric Acid *thirty-six troyounces;* Chloride of Sodium *eighteen troyounces.* Boil the Mercury with the Sulphuric Acid, by means of a sand-bath, until a dry white mass is left. Rub this, when cold, with the Chloride of Sodium in an earthenware mortar; then sublime with a gradually increasing heat." *U. S.*

"Take of Sulphate of Mercury *twenty ounces* [avoirdupois]; Chloride of Sodium, dried, *sixteen ounces* [avoird.]; Black Oxide of Manganese, in fine powder, *one ounce* [avoird.]. Reduce the Sulphate of Mercury and the Chloride of Sodium each to fine powder, and, having mixed them and the Oxide of Manganese thoroughly by trituration in a mortar, put the mixture in an apparatus adapted for sublimation, and apply sufficient heat to cause vapours of perchloride of mercury to rise into the less heated part of the apparatus which has been arranged for their condensation." *Br.*

In order to understand the above processes, which are the same in principle, it is necessary to premise that corrosive sublimate is a bichloride of mercury, consisting of two eqs. of chlorine and one of mercury. By boiling sulphuric acid in excess with mercury to dryness, a white salt is formed, which is a bisulphate of the deutoxide of mercury. (See *Hydrargyri Sulphas.*) When this is mixed with chloride of sodium (common salt), and the mixture exposed to a subliming heat, a mutual decomposition takes place. The chlorine of the common salt combines with the mercury, and sublimes as bichloride of mercury; while the sodium, oxygen of the deutoxide of mercury, and sulphuric acid unite to form sulphate of sodium, which remains behind. The quantities for mutual decomposition are two eqs. of chloride of sodium, consisting of two eqs. of chlorine and two of sodium; and one eq. of bisulphate of deutoxide of mercury, consisting of one eq. of mercury, two of oxygen, and two of sulphuric acid. The two eqs. of chlorine combine with the one eq. of mercury to form one eq. of corrosive sublimate; and the two eqs., severally, of sodium, oxygen, and sulphuric acid form, by their union, two eqs. of dry sulphate of sodium. The British formula differs from ours in ordering the bisulphate of the deutoxide of mercury ready formed, under the name of sulphate of mercury, instead of preparing it as the first step of the process, and in the use of a small proportion of black oxide of manganese, intended to deutoxidize any portion of protoxide of mercury that may be contained in the sul-

phate, and thereby prevent the formation of protochloride of mercury or calomel. (See *Hydrargyri Sulphas.*)

The names given in the two Pharmacopœias to this important chloride do not exactly correspond. It is called the corrosive chloride of mercury in the U. S. Pharmacopœia, and perchloride in the British. We prefer the former as indicating, beyond any possibility of mistake, as well the article intended as its corrosive property. Perchloride and subchloride are hardly sufficiently distinctive, when a mistake may be so serious as that of confounding corrosive sublimate and calomel. In the first British Pharmacopœia corrosive sublimate was recognised as the officinal title, which was a sufficient guarantee of security; but, unfortunately, it was deemed proper, immediately after the officinal title, and in close connection with it, to define the salt as chloride of mercury, in conformity with the new view, adopted in that work, of the equivalent of mercury. Now this view is by no means universally accepted, and with many, calomel is still the chloride of mercury; so that there is some chance that, should calomel be prescribed by this title, corrosive sublimate may be dispensed for it, with dangerous if not fatal effects to the patient. Indeed, death has, at least in one recorded instance, occurred in consequence of this confusion of nomenclature; and our officinal guides should take especial care to guard against such mistakes, instead of contributing to them.

Preparation on the Large Scale, &c. The first step is to form the bisulphate of the deutoxide of mercury, which is effected by heating the sulphuric acid and metal together in an iron pot, so arranged as to carry off the unwholesome fumes of sulphurous acid, which are copiously generated. The dry salt obtained is then mixed with the common salt, and the mixture sublimed in an iron pot lined with clay, and covered by an inverted earthen pan. The late Dr. A. T. Thomson, of London, took out a patent for forming corrosive sublimate, on the large scale, by the direct combination, by combustion, of gaseous chlorine with heated mercury. The product is stated to be perfectly pure, and to be afforded at a lower price than the sublimate made in the usual way. In order that the combination may take place, the mercury need not be heated to its boiling point, but only to a temperature between 300° and 400°. According to Dr. Maclagan, corrosive sublimate, made by this process, is liable to the objection that a proportion of calomel is always formed, occasionally amounting to 10 per cent.

It may sometimes be useful to know how to make a small quantity of corrosive sublimate on an emergency. This may be done by dissolving deutoxide of mercury (red precipitate) in muriatic acid, evaporating the solution to dryness, dissolving the dry mass in water, and crystallizing. Here a double decomposition takes place, resulting in the formation of water and the bichloride.

Properties. Corrosive chloride of mercury, as obtained by sublimation, is in the form of colourless crystals, or of white, semi-transparent, crystalline masses, of the sp. gr. 5·2, permanent in the air, and of an exceedingly acrid, styptic, metallic, durable taste. Its temperature of sublimation is, according to Guy, 200° F. (*Pharm. Journ.*, Feb. 1868, p. 375.) It dissolves in 16 parts of cold water, and in 3 of boiling water. A boiling saturated solution, upon cooling, lets it fall in a confused mass of crystals. It is soluble also in 2·3 parts of cold alcohol, in about its own weight of boiling alcohol, and in 3 parts of ether. The latter solvent is capable of removing corrosive sublimate, to a considerable extent, from its aqueous solution, when agitated with it. According to M. Mialhe, ether will not dissolve it when accompanied by a considerable quantity of deutoxide of mercury, and a chloride of an alkalifiable metal. Sulphuric, nitric, and muriatic acids dissolve it without alteration. When heated it melts, and readily sublimes in dense, white, acrid vapours, which condense, on cool surfaces, in white shining needles. Its aqueous solution renders green the syrup of violets, and is precipitated brick-red, becoming yellow, by the fixed alkalies and alkaline earths, and white by ammonia. (See *Hydrargyrum Ammoniatum.*) The former precipitate is the hydrated deutoxide of mercury, which has the property of emitting oxygen, and of being reduced to metallic globules when exposed to heat. This oxide is formed in the process for preparing *aqua phagedænica*, called also *lotio flava* or *yellow wash*, which is obtained by mixing half a drachm of corrosive sublimate with a

pint of lime-water. Corrosive sublimate forms, with chloride of ammonium and chloride of sodium, compounds which are more soluble than the uncombined mercurial salt. It is on this account that aqueous solutions of sal ammoniac, or of common salt, dissolve much more corrosive sublimate than simple water. The combination of corrosive sublimate with chloride of ammonium was formerly called *sal alembroth* or *salt of wisdom.* According to F. Hinterberger, corrosive sublimate is capable of combining with quinia and cinchonia. (*Chem. Gaz.*, ix. 211.) By dissolving one part of corrosive sublimate and a hundred parts of common salt in distilled water and evaporating to dryness, a soluble preparation is obtained which does not coagulate albumen. (*Amer. Journ. of Pharm.*, xliv. 11.)

Corrosive sublimate has the property of retarding putrefaction. Animal matters, immersed in its solution, shrink, acquire firmness, assume a white colour, and become imputrescible. On account of this property it is usefully employed for preserving anatomical preparations.

Test of Purity and Incompatibles. Pure corrosive chloride of mercury sublimes, when heated, without residue, and its powder is entirely and readily soluble in ether. Consequently, if a portion of any sample should not wholly dissolve in ether, or if it should not evaporate entirely, the presence of some impurity is proved. If calomel be present, it will not be wholly soluble in water.* Corrosive sublimate is incompatible with many of the metals, the alkalies and their carbonates, soap, lime-water, tartar emetic, nitrate of silver, the acetates of lead, the sulphurets of potassium and sodium, the soluble iodides, and all the hydrosulphates. It is decomposed by many vegetable and some animal substances. According to Dr. A. T. Thomson, it produces precipitates in infusions or decoctions of chamomile, horse-radish, columbo, catechu, cinchona, rhubarb, senna, simaruba, and oak-bark. MM. Mialhe and Lepage have shown that corrosive sublimate is slowly converted into calomel by syrup of sarsaparilla and syrup of honey, but is not changed by contact with pure syrup. B.

Medical Properties and Uses. Corrosive sublimate is a very powerful preparation, operating quickly, and, if not properly regulated, producing violent effects. It is less apt to salivate than most other mercurials. In minute doses, suitably repeated, it may exert its peculiar influence without any obvious alteration of the vital functions, except, perhaps, a slight increase in the frequency of the pulse, and in the secretions from the skin and kidneys. Sometimes, however, it purges; but this effect may be obviated by combining it with a little opium. In larger doses it occasions nausea, vomiting, griping pain in the bowels, diarrhœa, and other symptoms of gastric and intestinal irritation; and in still larger quantities produces all the effects of a violent corrosive poison. It has long been used as a remedy in syphilis, in all stages of which it has been highly recommended. It is said to remove the symptoms more speedily than other mercurials; whilst its action is less unpleasant, as the mouth is less liable to be made sore. For the latter reason it has been much employed by empirics, and is an ingredient in most of those nostrums which have at various periods gained a temporary popularity as anti-venereals. But, while it is extolled by some authors, others, among whom is Mr. Pearson, of London, deny its extraordinary merits, and maintain that, though occasionally useful in arresting the progress of the complaint, particularly in the secondary stage, it does not produce permanent cures, and, in the primary stage, often fails altogether. On the whole it appears to be best adapted to secondary syphilis, in which it occasionally does much good. It is also used advantageously in some chronic cutaneous affections, and in obstinate chronic rheumatism. It is usually associated with alterative or diaphoretic medicines, such as the antimonials, and the compound decoction or syrup of sarsaparilla; and, in order to obviate the irritation it is apt to produce, it may often be advantageously united with opium, or extract of hemlock. There is no doubt that many of the substances, in connection with which it is employed, alter its chemical condition; but it does not follow that, even in its altered state, it may not be very useful as a remedy.

Externally employed, corrosive sublimate is stimulant and escharotic. A solution

* M. Bullot having noticed in some corrosive sublimate an insoluble portion consisting of minute yellowish granules, found on examination that it was an aniline product. He surmised that the drug had been thrown into commerce after having been used in the preparation of aniline dyes. (*Journ. de Pharm.*, 4e sér., xviii. 414.)—*Note to the fourteenth edition.*

in water, containing from an eighth to half a grain in the fluidounce, is employed as an injection in gleet, as a gargle in venereal sorethroat, and as a collyrium in chronic venereal ophthalmia. A stronger solution, containing one or two grains in the fluidounce, is an efficacious wash in lepra, and other scaly eruptions. Dissolved in water, in the proportion of five to ten grains to the fluidounce, it may be used with much benefit in venereal ulcers of the throat, to which it should be applied by means of a camel's-hair pencil. With lime-water it forms the *aqua phagedænica* of the older writers, employed as a wash for ill-conditioned ulcers. The powdered chloride has been used as an escharotic; but is, in general, inferior to nitrate of silver or caustic potassa. In *onychia maligna*, however, it is employed with great advantage, mixed with an equal weight of sulphate of zinc, and sprinkled thickly upon the surface of the ulcer, which is then to be covered with a pledget of lint saturated with tincture of myrrh. The whole diseased surface is thus removed, and the ulcer heals. This practice originated, we believe, with the late Dr. Perkins, of Philadelphia, and was highly recommended by Dr. Physick. We have often employed it with complete success. A solution of corrosive sublimate in collodion, in the proportion of four parts of the former to thirty of the latter, has of late been used as a caustic, for the destruction of nævi materni, and for other purposes. It has the advantages that it may be applied to parts of inconvenient access for ordinary caustics, and forms a well-defined boundary, without risk of spreading. Its use, however, requires care, as fatal poisoning has followed a single application of its alcoholic solution to a moderate surface of ringworm. (*London Lancet*, 1871, ii. 413.) It is applied by means of a camel's-hair pencil.

The dose of corrosive sublimate is from the twelfth to the quarter of a grain, repeated three or four times a day, and given in pill, or dissolved in water or spirit. The pill, which is the preferable form, is usually prepared with crumb of bread; and care should be taken that the medicine be equally diffused through the pilular mass, before it is divided. Mucilaginous drinks are usually given to obviate the irritating effects of the medicine.

Toxicological Properties. Swallowed in poisonous doses, it produces burning heat in the throat, excruciating pain in the stomach and bowels, excessive thirst, anxiety, nausea and frequent retching with vomiting of bloody mucus, diarrhœa and sometimes bloody stools, small and frequent pulse, cold sweats, general debility, difficult respiration, cramps in the extremities, faintings, insensibility, convulsions, and death. The mucous membrane of the stomach exhibits, on dissection, signs of the operation of a violent corrosive poison. These symptoms are sometimes followed or conjoined with others indicating an excessive mercurial action upon the system, such as inflammation of the mouth and salivary glands, profuse salivation, fetid breath, &c. A case is on record of death, in an infant, from the constitutional effects of corrosive sublimate sprinkled upon an excoriated surface; and, in two instances of children, the one seven, and the other nine years old, death, with all the symptoms of internal poisoning, followed the application to the scalp of an ointment, said to consist of one part of the corrosive chloride to four parts of tallow. (*Dub. Quarterly*, Aug. 1854, p. 70.) In the inferior animals, in whatever mode introduced into the system, it is said to occasion irritation of the stomach and rectum, inflammation of the lungs, oppression of the brain, and depression if not inflammation of the heart. (*Christison.*) In the treatment of poisoning by corrosive sublimate, Orfila recommends the free use of the white of eggs beat up with water. The albumen forms an insoluble and comparatively innocent compound with the corrosive sublimate; and the liquid by its bulk dilutes the poison, and distends the stomach so as to produce vomiting. It is, however, asserted by M. Lassaigne that this compound of albumen and corrosive sublimate, when recently precipitated, is soluble in acid and alkaline liquids, and in solutions of the chlorides of potassium, sodium, and calcium. (See *Journ. de Pharm.*, xxiii. 510.) It is also soluble in an excess of albumen, whether introduced into the stomach, or previously existing there. It is, therefore, important, at the same time that the antidote is used, to evacuate the stomach before the newly formed compound can be dissolved. If eggs cannot be procured, wheat flour may be substituted; gluten having, according to M. Taddei, the same effect as albumen. Milk has also been

recommended, in consequence of the insoluble compound which casein forms with the poison. Besides the antidotes mentioned, Peruvian bark, meconic acid, protosulphuret of iron, and iron filings have been proposed, all of which have the property of decomposing corrosive sublimate. The protosulphuret of iron was found quite successful by M. Mialhe in experiments upon dogs, if given immediately after the poison was swallowed, but failed when delayed for ten minutes. Dr. T. H. Buckler, of Baltimore, made some experiments on lower animals upon the antidotal properties of a mixture of gold dust and iron filings, which, proving successful, were published in the *Medical and Surgical Journal* in 1843; and a case of poisoning by corrosive sublimate has been recorded by Dr. Ch. Johnston, of the same city, in which the antidote was employed with the apparent effect of saving life, after albumen had been used without effect. Dr. Johnston, however, employed the reduced iron of the Pharmacopœia, and gold leaf, arranging them in alternate layers, so as to make boluses of convenient size. (*Am. Journ. of Med. Sci.*, April, 1863, p. 340.) The method of operating of this antidote will be understood when the action of gold and iron as a test for corrosive sublimate is explained in the succeeding paragraph. It is of the utmost importance that whatever antidote is used should be given without delay, and in this respect the one nearest at hand may be considered the best. Should neither of the substances mentioned be attainable, mucilaginous drinks should be largely administered; and, in any event, the patient should be made to drink copiously, so long as vomiting continues, or till the symptoms are relieved. Should he be unable to vomit, the stomach should be washed out by means of the stomach-pump. The consecutive inflammation should be treated with general or local bleeding, fomentations, and cooling mucilaginous drinks; and the attendant nervous symptoms should be alleviated by opiates. W.

Tests for Corrosive Sublimate. On account of the extreme virulence of this chloride as a poison, the reagents by which it may be detected form a subject of study of the utmost importance, as connected with medico-legal investigations. The best tests for determining its mercurial nature, mentioned in the order of their delicacy, are ferrocyanide of potassium, lime-water, carbonate of potassium, iodide of potassium, ammonia, sulphuretted hydrogen, and protochloride of tin. *Ferrocyanide of potassium* gives rise to a white precipitate (ferrocyanide of mercury), becoming slowly yellowish, and at length pale-blue. *Lime-water* throws down a yellow precipitate of hydrated deutoxide. *Carbonate of potassium* causes a brick-red precipitate of carbonate of mercury. *Iodide of potassium* produces a very characteristic pale-scarlet precipitate of biniodide of mercury. This precipitate frequently appears at first yellow, especially if the corrosive sublimate be present in minute proportion. *Ammonia* gives rise to a white, flocculent precipitate, the officinal ammoniated mercury, or white precipitate. *Sulphuretted hydrogen* occasions a black precipitate of bisulphuret of mercury; and the same precipitate is thrown down by hydrosulphuret of ammonium. Finally, *protochloride of tin* causes a grayish-black precipitate (mercury in a finely divided state), and, as a test, is not liable to any fallacy. Taking the results of Devergie, the relative delicacy of these tests may be expressed numerically as follows: — Ferrocyanide of potassium $1\frac{1}{2}$; lime-water 4; carbonate of potassium 7; iodide of potassium 8; ammonia 36; sulphuretted hydrogen or hydrosulphuret of ammonia 60; and protochloride of tin 80. To the above the following tests, easily applied even by a person unacquainted with chemistry, may be added. *A bright plate of copper*, immersed in a solution containing corrosive sublimate, is instantly tarnished, and, after the lapse of half an hour, becomes covered with a grayish-white powder. *A polished piece of gold*, moistened with the *clear* mercurial solution, and touched through the liquid with a piece of iron, contracts a white stain. This test, which was proposed by Mr. Sylvester and simplified by Dr. Paris, is conveniently applied by moistening, with the suspected solution, a gold coin or ring, and touching it through the moistened spot with the point of a penknife. The object of the iron is to form with the gold a simple galvanic circle, which enables the latter metal to precipitate the mercury on its surface. Nearly all the above tests merely prove the presence of mercury. To determine whether the metal is united with chlorine, the mercurial liquid may be precipitated by lime-water, and the filtered solution, acidu-

lated with nitric acid, then tested with nitrate of silver. If the mercury is in the state of chloride, the filtered solution will be one of chloride of calcium, which, with nitrate of silver, will yield a heavy, white precipitate (chloride of silver), insoluble in nitric acid, but soluble in ammonia. The nitrate of silver may be added directly to the mercurial liquid; and, if it contain corrosive sublimate, chloride of silver will fall, but probably mixed with calomel.

By the combined indications of the foregoing tests, corrosive sublimate may be infallibly detected, unless it exists in very minute quantity, associated with organic substances, by which its presence is often greatly obscured. When it exists in organic mixtures, made by boiling the contents or substance of the stomach in distilled water, Dr. Christison recommends that a preliminary trial be made with the protochloride of tin, on a small portion filtered for the purpose. If this causes a grayish-black colour, he shakes the mixture, as recommended by Orfila, with a fourth of its bulk of cold ether, which dissolves the corrosive sublimate, and rises to the surface. The ethereal solution is then evaporated to dryness, and the dry salt obtained is dissolved in hot water, whereby a pure solution is procured, in which the poison may be readily detected by the ordinary tests. In using ether, however, it must be borne in mind that, as ascertained by M. Mialhe, the presence of a considerable quantity of deutoxide of mercury, and of a chloride of an alkalifiable metal, prevents the solvent power of ether. If the trial test should produce a light-gray colour, the corrosive sublimate is indicated in still less quantity, and Dr. Christison recommends to proceed in the following manner. Treat the unfiltered mixture with protochloride of tin, as long as any precipitate is formed, which will have a slate-gray colour. Collect, wash, and drain it on a filter, and, having removed it without being dried, boil it, in a glass flask, with a moderately strong solution of caustic potassa, until all the lumps disappear. The alkali will dissolve all animal and vegetable matter; and, on allowing the solution to remain at rest, a heavy grayish-black powder will subside, which consists chiefly of metallic mercury, and in which small globules of the metal may sometimes be seen with the naked eye, or by the aid of a magnifier. Probably advantage might be derived from the process of dialysis, in separating corrosive sublimate, among other crystallizable substances, from the colloidal matters contained in organic mixtures. (See *Dialysis.*)

Off. Prep. Hydrargyri Iodidum Rubrum; Hydrargyri Oxidum Flavum, *U. S.;* Hydrargyrum Ammoniatum; Liquor Hydrargyri Perchloridi, *Br.;* Lotio Hydrargyri Flava, *Br.* B.

HYDRARGYRI CHLORIDUM MITE. *U. S.* Hydrargyri Subchloridum. *Br.* Calomelas. *Br.* 1864. *Mild Chloride of Mercury. Subchloride of Mercury. Calomel.*

"Take of Mercury *forty-eight troyounces;* Sulphuric Acid *thirty-six troyounces;* Chloride of Sodium *eighteen troyounces;* Distilled Water *a sufficient quantity.* Boil, by means of a sand-bath, twenty-four troyounces of the Mercury with the Sulphuric Acid, until a dry white mass is left. Rub this, when cold, with the remainder of the Mercury, in an earthenware mortar, until they are thoroughly mixed. Then add the Chloride of Sodium, and, having rubbed it with the other ingredients until globules of Mercury cease to be visible, sublime the mixture into a large chamber so that the sublimate may fall in powder. Wash the sublimed matter with boiling Distilled Water, until the washings afford no precipitate with water of ammonia, and dry it." *U. S.*

"Take of Sulphate of Mercury *ten ounces* [avoirdupois]; Mercury *seven ounces* [avoird.]; Chloride of Sodium, dried, *five ounces* [avoird.]; Boiling Distilled Water *a sufficiency.* Moisten the Sulphate of Mercury with some of the Water, and rub it and the Mercury together until globules are no longer visible; add the Chloride of Sodium, and thoroughly mix the whole by continued trituration. Sublime by a suitable apparatus into a chamber of such size that the Calomel, instead of adhering to its sides as a crystalline crust, shall fall as a fine powder on its floor. Wash this powder with boiling Distilled Water, until the washings cease to be darkened by a drop of sulphide of ammonium. Finally, dry at a heat not exceeding 212°, and preserve in a jar or bottle impervious to light." *Br.*

The object of the above processes is to obtain the protochloride of mercury. This chloride consists of one eq. of chlorine and one of mercury, and consequently contains precisely half as much chlorine as corrosive sublimate, combined with the same quantity of mercury. In the U. S. process, as in the case of corrosive sublimate, a bisulphate of the deutoxide is first formed; but instead of being immediately sublimed with the chloride of sodium, it undergoes a preparatory trituration with a quantity of mercury equal to that employed in forming it. This trituration may be conceived to take place between one eq. of bisulphate of the deutoxide, and one of metallic mercury, which are thus converted into two eqs. of monosulphate of the protoxide. This change will be easily understood, by adverting to the fact, that the bisulphate of the deutoxide consists of two eqs. of sulphuric acid, two of oxygen, and one of mercury; and, when rubbed up with one additional eq. of mercury, the whole becomes two eqs. of acid, two of oxygen, and two of mercury, evidently corresponding with two eqs. of monosulphate of the protoxide. The two eqs. of monosulphate thus formed, being heated with two of common salt, the two eqs. of chlorine in the latter sublime in union with the two of mercury in the former, and generate two eqs. of protochloride of mercury; while the two eqs. severally, of sulphuric acid, oxygen, and sodium, unite together to form two of dry sulphate of sodium, which remain as a fixed residue. It is hence apparent that the residue of this process and of that for corrosive sublimate is the same.

The calomel, as sublimed, is liable to contain a little corrosive sublimate; and hence the direction of the U. S. Pharmacopœia to wash it with boiling distilled water until ammonia produces no precipitate with the washings. Ammonia occasions a white precipitate (ammoniated mercury) so long as the washings contain corrosive sublimate; and, when it ceases to produce this effect, the operator may rest satisfied that the whole of the poisonous salt has been removed. According to M. Berthé, calomel, in contact with hot water, is converted, to a small extent, into corrosive sublimate; and hence he recommends that the portion of water to be tested should be cold when passed through the calomel.

The British process is a modification of that of the late Dublin Pharmacopœia, including, like that, no directions for making the bisulphate of the deutoxide of mercury; because this salt is made by a separate formula, being designated as *sulphate of mercury*. It omits, however, as unnecessary, a partial preliminary sublimation, directed by the Dublin College, to test the production of corrosive sublimate, and, immediately after a thorough mixture of the materials, proceeds to the final sublimation. A special proceeding, in which the Dublin process is followed, is to cause the vapours to enter for condensation a chamber of considerable size, so that they may fall in powder, instead of condensing on the sides of the receiver in a crystalline mass. The necessity of pulverizing the calomel is thus avoided. As our own, the Br. Pharmacopœia directs the powder to be washed; but, instead of using ammonia as a test of the absence of corrosive sublimate in the washings, directs for the purpose sulphide of ammonium, which throws down a black precipitate if corrosive sublimate is present.

Preparation on the Large Scale. The process for making calomel, by means of the bisulphate of deutoxide of mercury, was originally practised at Apothecaries' Hall, London. The proportions taken and the mode of proceeding in that establishment are, according to Mr. Brande, as follows: 50 lbs. of mercury are boiled to dryness with 70 lbs. of sulphuric acid, in a cast-iron vessel; and 62 lbs. of the dry salt formed are triturated with 40½ lbs. of mercury till the globules disappear, and the whole is mixed with 34 lbs. of common salt. The mixture is sublimed from an earthenware retort into an earthenware receiver, and the product is from 95 to 100 lbs. of calomel in mass. This is then ground to an impalpable powder, and washed with a large quantity of distilled water.

The object of bringing calomel into a state of minute division is more perfectly accomplished by the method of Mr. Joseph Jewell, of London, improved by M. Ossian Henry. It consists in causing the calomel in vapour to come in contact with steam in a large receiver, whereby it is condensed into an impalpable powder, and perfectly washed from corrosive sublimate in the same operation. Calomel made by

this process, sometimes called Jewell's or Howard's *hydrosublimate of mercury*, is free from all suspicion of containing corrosive sublimate, is much finer than when obtained by levigation and elutriation, and possesses more activity as a medicine. This kind of calomel is included in the French Codex under a distinct name (*mercure doux à la vapeur*). M. Soubeiran, of Paris, has perfected a process for obtaining calomel as an impalpable powder, by substituting the agency of cold air for that of steam for the purpose of condensing it; a process which he believes to be precisely the same as that pursued by the English manufacturers, and which produces a calomel equal to the best English. A description of his apparatus may be found in the *Journal de Pharmacie* (3e sér., ii. 507), and of the English apparatus, as described by F. C. Calvert, in the same journal (3e sér., iii. 121). Both these papers are copied into the *Am. Journ. of Pharm.* (xv. 89 and 93). In the recent revision of the Pharmacopœia the suggestion of Soubeiran was adopted, and the calomel is obtained in a fine powder by condensation in a large chamber.

Prof. Wöhler has proposed to obtain calomel, in the humid way, by precipitating a solution of corrosive sublimate by a stream of sulphurous acid, taking advantage of a reaction first observed by Vogel. Calomel obtained in the humid way, called *precipitated calomel*, was formerly officinal with the Dublin College, and was adopted in the French Codex. This form of calomel is of doubtful utility; and, when obtained by Prof. Wöhler's process, it is a crystalline powder, which is unfit for use unless after elaborate levigation and elutriation.*

Properties. Mild chloride of mercury is a tasteless, inodorous substance, insoluble in water, alcohol, and ether, less volatile than corrosive sublimate, unalterable in the air, but blackening by long exposure to the light. When in mass its form and appearance depend on the shape and temperature of the subliming vessel. In this state it is generally in the form of a white, fibrous, crystalline cake, the interior surface of which is often studded with shining transparent crystals, having the shape of quadrangular prisms, and a texture somewhat horny and elastic. When the mass is scratched it yields a yellow streak, which is very characteristic. Its sp. gr. is 7·2. The officinal form of this chloride is that of powder, in which state it is always kept in the shops. The powder has a light buff or ivory colour, if obtained by the levigation of sublimed masses; but if condensed at once in the form of an impalpable powder, as is the case with Jewell's calomel and in the officinal processes, it is perfectly white. To protect it from the action of the light, it should be kept in a dark place, or in bottles painted black, or covered with black paper. By the action of the fixed alkalies or alkaline earths it immediately becomes black, in consequence of the formation of protoxide, reducible by heat to the metallic state. The preparation employed under the name of *lotio nigra* or *black wash*, as a local application to syphilitic ulcers, &c., is made by adding *a drachm* of calomel to *a pint* of lime-water. By double decomposition between the calomel and lime, the black protoxide precipitates, and chloride of calcium remains in solution, indicated by yielding a copious white precipitate with nitrate of silver. The oxide, however, is not pure, but associated with undecomposed calomel. Before being applied, the wash should be well shaken.

* It would seem to be a very rare thing for a pharmacist at the present day to make his own calomel, and Prof. O. Oldberg is probably right in asserting that the officinal U. S. method is not adapted for the preparation of the drug upon the small scale. He proposes (*Amer. Journ. of Pharm.*, April, 1871, p. 155) the following formula as superior for that purpose.

"One pound of pure nitric acid (sp. gr. 1·25) is put into a matrass heated by means of a sand-bath, and one and a half pounds of mercury (or an excessive quantity) is added. They are warmed together first until no more red fumes are evolved, and afterwards the digestion is continued for one hour or more, or until the liquid begins to become discoloured or yellowish, when the matrass must be at once removed and the contents transferred to a capacious evaporating dish. (The digestion must not be interrupted.) To the warm concentrated solution in the evaporating dish is now added without delay and during constant agitation a boiling hot mixture of twelve pounds of distilled water and half a pound (more) of the nitric acid. This free acid is added in order to prevent subsequent precipitation of basic salt when water is mixed with the solution. The mixture, thus diluted and made sour, should now be tested, to ascertain that it can be further diluted with water without decomposition, because, otherwise, basic salt may be thrown down with the calomel when the solution is finally added to the dilute hydrochloric acid. The solution, after becoming cold, is next filtered, to free it perfectly from all basic salt which may be undissolved. This clear cold solution of protonitrate of mercury is poured into a mixture of one and three-quarter pounds of hydrochloric acid (sp. gr. 1·18) and twenty pounds of water, with uninterrupted stirring. The precipitate is washed by decantation and afterwards on a filter." (*Note to the fourteenth edition.*)

Tests of Purity and Incompatibles. Calomel, when pure, completely sublimes on the application of heat, a property which detects all fixed impurities, such as carbonate, sulphate, and phosphate of calcium, sulphate of barium, and carbonate of lead. Under the influence of an elevated temperature, especially in the presence of alcohol or water, it gives rise to a small quantity of corrosive sublimate. (*M. Berthé.*) Calomel strikes a black colour, free from reddish tinge, by the action of the fixed alkalies; and the black oxide thus produced is brought by heat to the metallic state. The buff colour indicates the absence of corrosive sublimate; but whiteness by no means shows the presence of this impurity. Its freedom from the corrosive chloride may be determined by washing a portion of it in warm distilled water, and then testing the water with ammonia, which will cause a white precipitate (ammoniated mercury), should the water have taken up any of the poisonous chloride. An easy method of detecting corrosive sublimate, proposed by M. Bonnewyn, is to put some of the suspected powder upon a well-polished surface of iron, and then moisten it with a drop of alcohol or ether. If the calomel be pure the surface will remain quite unaffected, while it will be blackened by corrosive sublimate if present only in the proportion of one to 50,000. (*Journ. de Pharm. et de Chim.*, 4e sér., ii. 79.) The presence of any soluble chloride whatever in the calomel would be detected by the production of a precipitate with the washing by nitrate of silver. Soluble salts of mercury may be detected by rubbing the suspected calomel with ether on a bright surface of copper, when the metal will become amalgamated, and exhibit a white stain. When this test shows impurity, the soluble salt present is probably corrosive sublimate. Calomel, containing corrosive sublimate, acts violently on the bowels; and, when the impurity has been present in considerable amount, has been known to cause death. Besides being incompatible with the alkalies and alkaline earths, calomel is also decomposed by the alkaline carbonates, soaps, hydrosulphates, and, according to some authorities, by iron, lead, and copper. By boiling with the alkaline formiates it is decomposed, and metallic mercury liberated. (H. Rose, *Annal. der Physik und Chem.*, cvi. 500.) According to M. Lebeaux, calomel should not be prescribed with iodine; unless the prescriber intends to give biniodide (red iodide) of mercury, when the dose must be reduced accordingly. (*Annuaire de Thérap.*, 1857, p. 180.) It should not be given at the same time with nitromuriatic acid, for fear of generating corrosive sublimate. One of the authors has been informed of a case, in which death, with symptoms of violent gastro-intestinal irritation, followed their joint use. Agreeably to the experiments of M. Deschamps, calomel is decomposed by bitter almonds and by hydrocyanic acid. In the former case corrosive sublimate, bicyanide of mercury, and chloride of ammonium are formed; in the latter, corrosive sublimate and bicyanide only. Hence this writer considers it very dangerous to associate calomel with bitter almonds or hydrocyanic acid in prescription. This conclusion has been confirmed by M. Mialhe and M. Prenleloup; and, more recently, it has been shown by Dr. E. Riegel that cherry-laurel water has the power of converting calomel into corrosive sublimate. According to M. Mialhe, calomel is in part converted into corrosive sublimate and metallic mercury by chloride of ammonium, and by the chlorides of sodium and potassium, even at the temperature of the body; and hence he believes that the conversion may take place in the primæ viæ. Popular belief coincides with M. Mialhe's views in regard to the power of common salt to increase the activity of calomel. More recently M. Mialhe has extended his observations, and now believes that all the preparations of mercury yield a certain amount of corrosive sublimate by reacting with solutions of the chlorides of potassium, sodium, and ammonium. The deutoxide and similarly constituted compounds are most prone to undergo this change. Even metallic mercury digested with the chlorides named, is partly converted, under the influence of the air, into corrosive sublimate. Dr. Gardner denies the assertion of M. Mialhe, that calomel is converted into corrosive sublimate by chlorides of the alkalifiable metals, maintaining that it is merely rendered soluble by their solutions. The results, however, of M. Mialhe have been confirmed experimentally by Dr. A. Fleming, of Pittsburg, Pa. (*Am. Journ. of Pharm.*, Sept. 1857.) M. Bauwens, of Ghent, recognising the conversion of calomel into corrosive sublimate in the body by these chlorides, explains by this fact the relatively less powerful action of large

than of small doses of calomel. He also states that physicians near the sea, where the water is brackish, seldom prescribe calomel, and that naval surgeons have been obliged to abstain from giving it to sailors who eat salt meat. Dr. H. Peake, of Arkadelphia, Arkansas, has known many instances in which salivation has been induced by the joint use of calomel and vegetable acids, in the forms of sour fruit, vinegar, buttermilk, &c., where the mercurial alone would not have induced it. (*N. O. Med. and Surg. Journ.*, Nov. 1858, p. 724.) G. Velpius asserts that when calomel is rubbed up with white sugar, calcined magnesia, hydrated carbonate of magnesium, or bicarbonate of sodium, corrosive sublimate is formed within twenty-four hours; rather large quantities of it are found in powders of bicarbonate of sodium, sugar and calomel which have been kept some time, especially if they have been in a damp place. (*Chem. News*, xxvi. 215.) B.

Medical Properties and Uses. Calomel unites to the general properties of the mercurials those of a purgative and anthelmintic. It is the most valuable of the mercurial preparations, and in extent of employment is inferior to few articles of the Materia Medica. Whether the object is to bring the system under the general influence of mercury, or to produce its alterative action upon the hepatic or other secretory function, calomel, on account both of its certainty and mildness, is preferred to all other preparations, with the single exception of the blue pill, which, though less certain, is still milder, and is sometimes preferably employed. When used with the above objects, the tendency to purge which it sometimes evinces, even in very small doses, must be restrained by combining it with opium. In sialagogue or alterative doses, it is often prescribed with other medicines, which, while they give it a direction to certain organs, have their own peculiar influence increased by its co-operation. Thus it renders squill more diuretic, nitre and the antimonials more diaphoretic, and seneka more expectorant.

As a purgative, calomel owes its chief value to its tendency to the liver, the secretory function of which it powerfully stimulates. It is usually slow and somewhat uncertain in its cathartic effect, and, though itself but slightly irritating, sometimes occasions severe griping pain with bilious vomiting, attributable to the acrid character of the bile which it causes the liver to secrete. It is peculiarly useful in the commencement of bilious fevers, in hepatitis, jaundice, bilious and painter's colic, dysentery, especially that of tropical climates, and all other affections attended with congestion of the portal system, or torpidity of the hepatic function. The difficulty with which it is thrown from the stomach renders it highly useful in some cases of obstinate vomiting, when other remedies are rejected. In the cases of children it is peculiarly valuable from the facility of its administration; and, in the febrile complaints to which they are subject, appears to exercise a curative influence, depending on some other cause than its mere purgative effect, and perhaps referrible to its action upon the liver. In the treatment of worms, it is one of the most efficient remedies, acting probably not only as a purgative, but also as an irritant to the worms, either by its immediate influence, or that of the acrid bile which it causes to flow. The slowness and uncertainty of its action, and its liability to salivate if too long retained in the bowels, render it proper either to follow or combine it with other cathartics, in order to ensure its purgative effect. When given alone, it should be followed, if it do not operate in six or seven hours, by a dose of castor oil or sulphate of magnesium. The cathartics with which it is most frequently combined are jalap, rhubard, aloes, scammony, colocynth, and gamboge. It is often added in small quantities to purgative combinations, with a view to its influence on the liver.

In very large doses, calomel is supposed by some to act directly as a sedative, and with this view has been given in yellow and malignant bilious fevers, violent dysentery, malignant cholera, &c. The quantities which have been administered in such affections, with asserted impunity and even advantage, are almost incredible. A common dose is one or two scruples, repeated every half hour, or hour, or less frequently, according to the circumstances of the case. We have had no experience in this mode of administering calomel.

It is sometimes used as an errhine in amaurosis, mixed with twice its weight of sugar, or other mild powder; and in the same combination is occasionally employed

to remove specks and opacity of the cornea. For the latter purpose Dupuytren recommended particularly the calomel prepared according to the plan of Mr. Jewell. M. Giraud-Teulon prefers using calomel in impalpable powder, without addition, and ascribes the remarkable success he has met with to his method of using it. (*Ann. de Thérap.*, 1867, p. 136.) Dr. Hennequin relates the case of a child, in which he applied calomel for a length of time for opacity of the cornea, without any effect, good or bad; but, having put the patient on the internal use of iodide of potassium, and returned to the insufflations which he had abandoned, he found violent inflammation of the eye produced, threatening even the loss of sight; and though the inflammation was subdued, and the specks disappeared with it, the remedy appears too hazardous for repetition. (*Journ. de Pharm. et de Chim.*, Nov. 1867, p. 325.) Calomel is also sometimes employed externally in herpetic and other eruptions, in the shape of an ointment.

In syphilis, calomel vapor-baths once or twice a week are often of service. They may be extemporized by pouring an ounce and a half of water into a dish, putting a scruple of calomel in it, and heating by means of a spirit lamp, the patient being seated on a chair over the dish, and surrounded by blankets closely wrapped around the neck, spread out below.

The dose as an alterative, in functional derangement of the liver, is from half a grain to a grain every night, or every other night, followed in the morning, if the bowels are not opened, by a gentle saline laxative. When the stomach or bowels are very irritable, as in cholera and diarrhœa, from an eighth to a quarter of a grain may be given every hour or two, so as to amount to one or two grains in the course of the day. With a view to salivation, the dose is from half a grain to a grain three or four times a day, to be increased considerably in urgent cases. Sometimes, very minute doses, as the twelfth of a grain or less, given very frequently, so as to amount to the ordinary quantity in twenty-four hours, will operate more effectually as a sialagogue than larger doses. When large doses are given with this view, it is often necessary to combine them with opium. As a purgative, from five to fifteen grains or more may be exhibited. Calomel has the peculiarity that its cathartic action is not increased in proportion to the dose, and enormous quantities have been given with impunity. In yellow fever, tropical dysentery, &c., from twenty grains to a drachm have been given, and repeated at short intervals, without producing hypercatharsis; but this practice is justifiable only in cases of extreme urgency, in which the constitutional action of mercury as well as purgation is indicated. Even in very small doses of not more than one, two, or three grains, calomel purges some individuals briskly. In these persons, large doses, though they do not proportionably increase the evacuation, often occasion spasmodic pain in the stomach and bowels. For children larger doses are generally required in proportion than for adults. Not less than from three to six grains should be given as a purge to a child two or three years old; and this quantity often fails to act, unless assisted by castor oil or some other cathartic. Calomel may be given in pill made with gum arabic and syrup, or in powder mixed with syrup or molasses.

Off. Prep. Lotio Hydrargyri Nigra, *Br.;* Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.;* Pilulæ Catharticæ Compositæ, *U. S.;* Unguentum Hydrargyri Subchloridi, *Br.* W.

HYDRARGYRI CYANIDUM. *U. S.* Hydrargyri Cyanuretum. *U. S.* 1850. *Cyanide of Mercury. Cyanuret of Mercury. Bicyanide of Mercury. Prussiate of Mercury.*

"Take of Ferrocyanide of Potassium *five troyounces;* Sulphuric Acid *four troyounces and one hundred and twenty grains;* Red Oxide of Mercury, in fine powder, Water, each, *a sufficient quantity.* Dissolve the Ferrocyanide of Potassium in twenty fluidounces of Water, and add the solution to the Sulphuric Acid, previously diluted with ten fluidounces of Water, and contained in a glass retort. Distil the mixture nearly to dryness into a receiver, containing ten fluidounces of Water and three troyounces of Red Oxide of Mercury. Set aside two fluidounces of the distilled liquid, and to the remainder add, with agitation, sufficient Red Oxide to destroy the odour

of hydrocyanic acid. Then filter the solution, and, having added the reserved liquid, evaporate the whole in a dark place, in order that crystals may form. Lastly, dry the crystals, and keep them in a well-stopped bottle, protected from the light." *U. S.*

This is an entirely different formula from that of the Pharmacopœia of 1850, in which the ferrocyanide of iron and red oxide of mercury were brought together under circumstances favourable to reaction, with the result of producing bicyanide of mercury, the protoxide and sesquioxide of iron, and an undetermined compound of cyanogen. The present formula is based upon that of Winkler, given in the eleventh edition of the U. S. Dispensatory. Hydrocyanic acid is generated by the action of sulphuric acid on the ferrocyanide of potassium, and, being received in a vessel containing water and a portion of red oxide of mercury, reacts with the oxide, generating by double decomposition, water, and bicyanide of mercury which is held in solution. The reaction takes place between one equivalent of the red oxide of mercury which is a binoxide, and two eqs. of hydrocyanic acid. The two eqs. of oxygen of the binoxide take two eqs. of hydrogen of the acid to form two eqs. of water, and the two liberated eqs. of cyanogen combine with the single liberated eq. of mercury to form the bicyanide of that metal. Sufficient red oxide of mercury is not used at first to saturate the whole of the hydrocyanic acid generated, because, should there happen to be any excess of the red oxide, there would be produced on evaporation, instead of the substance wanted, a peculiar salt composed of bicyanide and red oxide of mercury, which would crystallize in small acicular crystals. Hence, a portion of the water still containing uncombined hydrocyanic acid is set aside, to be added to the liquid in which the acid had been completely saturated by the addition of red oxide, and thus at least neutralize any oxide of mercury that might be present in it in excess. A surplus of hydrocyanic acid would be of no disservice, except the loss of material incurred, as it is evaporated in the subsequent concentration.

Properties, &c. Cyanide of mercury is permanent in the air, and crystallizes in anhydrous right square prisms, which are sometimes transparent, but usually white and opaque. It has a disagreeable styptic taste. It is but sparingly soluble in alcohol, but dissolves readily in cold water, and much more abundantly in hot. When acted on by muriatic acid, hydrocyanic acid is evolved, recognisable by its odour, and bichloride of mercury is left, which is wholly volatilizable by heat. When heated it yields cyanogen, and a black matter is left containing globules of mercury.

In composition, according to the view taken in the U. S. Pharmacopœia, it is a bicyanide of mercury, consisting of one eq. of the metal 200, and two of cyanogen $52 = 252$; its formula being $HgCy_2$. But with those who consider the eq. of mercury as 100, the salt is a protocyanide, with one eq. of each of its constituents (HgCy), and its combining number would be 126. The reader is already aware that the former opinion is still admitted in this work.

Cyanide of mercury acts on the animal economy as a potent poison. In medicinal doses it sometimes causes ptyalism, but does not produce epigastric pain like corrosive sublimate. It has been occasionally used as a remedy in syphilis, and in the treatment of that disease it is preferred by some practitioners to corrosive sublimate, on account of its not giving rise to pain, and not being decomposed by alkalies and organic substances. M. Desmartis, of Bordeaux, considers it superior to all the other preparations of mercury in the treatment of syphilitic complaints; particularly in cases in which the patients have suffered, for a long period, from obscure pains. The dose is from the sixteenth to the eighth of a grain, which should not be exceeded; as the medicine may meet with free muriatic acid in the stomach. B.

HYDRARGYRI IODIDUM RUBRUM. *U. S., Br. Red Iodide of Mercury. Biniodide of Mercury.*

"Take of Corrosive Chloride of Mercury *a troyounce;* Iodide of Potassium *a troyounce and one hundred and twenty grains;* Distilled Water *a sufficient quantity.* Dissolve the Chloride of Mercury in a pint and a half, and the Iodide of Potassium in half a pint of Distilled Water, and mix the solutions. Collect the precipitate upon a filter, and, having washed it with Distilled Water, dry it with a gentle heat, and keep it in a well-stopped bottle." *U. S.*

"Take of Perchloride of Mercury *four ounces* [avoirdupois]; Iodide of Potassium *five ounces* [avoird.]; Boiling Distilled Water *four pints* [Imperial measure]. Dissolve the Perchloride of Mercury in three pints [Imp. meas.], and the Iodide of Potassium in the remainder of the Water, and mix the two solutions. When the temperature of the mixture has fallen to that of the atmosphere, decant the supernatant liquor from the precipitate, and, having collected the latter on a filter, wash it twice with cold distilled water, and dry it at a temperature not exceeding 212°." *Br.*

In the above processes for forming biniodide of mercury, which may be considered as identical, a double decomposition takes place between corrosive sublimate and iodide of potassium, resulting in the formation of chloride of potassium which remains in solution, and biniodide of mercury which precipitates. The precipitate is soluble in the reacting salts, and hence a loss of part of it is incurred by an excess of either. It is best, however, to have a slight excess of the iodide of potassium, which is furnished by the proportion taken in the formulas; as then the decomposition of the whole of the corrosive sublimate is ensured, and any contamination of the biniodide by it prevented. The late process of the Edinburgh College consisted in a combination of the ingredients by trituration in due proportion with the aid of alcohol; but, after the red powder was obtained, it was treated with a boiling solution of common salt, which dissolved the biniodide to the exclusion of any contaminating protiodide; and the solution, thus obtained, on cooling, deposited the pure biniodide in crystals. Mr. F. R. Williams states that in the manufacture of the red iodide on a large scale the amount of water required by the officinal processes is very troublesome. He remedies it by using chloride of ammonium, so as to get a very concentrated solution of corrosive sublimate, which he adds to a concentrated solution of the iodide. (*Pharm. Journ. and Trans.*, June, 1873.)

Properties. Biniodide of mercury is a scarlet-red powder, of the sp. gr. 6·3, insoluble in water, sparingly soluble in alcohol, freely so in ether, and soluble in muriatic acid and in solutions of iodide of potassium, chloride of sodium, and many of the mercurial salts. As obtained by the late Edinburgh process, it is in splendid crimson acicular crystals. When heated it fuses readily into a yellow liquid, and sublimes in yellow rhombic scales, which become red on cooling. "It is entirely volatilized by a heat under redness." *Br.* Biniodide of mercury is a dimorphous substance, having a different crystalline form in its red and yellow states. According to Schiff, it is only in its yellow form that it is soluble in alcohol; and hence it is that, when separated by water from its alcoholic solution, it falls in this condition. (*Ann. der Chem. und Pharm.*, cix. 371.) It forms definite compounds with the iodides of the alkalifiable metals. The compound formed with iodide of potassium has been used as a medicine. (See *Iodohydrargyrate of Potassium*, in *Part* III.) "When digested with solution of soda it assumes a reddish-brown colour, and the fluid, cleared by filtration and mixed with solution of starch, gives a blue precipitate on being acidulated with nitric acid," showing that it is an iodide. Biniodide of mercury consists of one eq. of mercury 200, and two of iodine 252·6 = 452·6, and its formula is HgI_2. In the Br. Pharmacopœia, which recognises 100 as the eq. of mercury, it is considered as the neutral iodide, with the formula HgI. It combines with the protiodide, so as to form a yellow *sesquiodide*, represented by the formula $HgI + HgI_2$ or Hg_2I_3.

Medical Properties and Uses. Biniodide of mercury is a powerful irritant poison. It has been used in similar diseases with the protiodide, namely, in scrofula and syphilis, but is much more active. Dr. Fuller, physician to St. George's Hospital, London, has found it a valuable remedy in rheumatism, dependent on a syphilitic taint, having cured several cases in which corrosive sublimate had been given in vain. He also employed it with good results in two cases of epilepsy, dependent on injuries to the head, in which he suspected thickening of the dura mater, or deposit between it and the bone. (*Ranking's Abstract*, No. 25, p. 51.) The dose of this iodide is the sixteenth of a grain, gradually increased to the fourth, given in pill or dissolved in alcohol. A preferable mode of administering it, is dissolved in a solution of iodide of potassium. This mode was adopted by Dr. Fuller, who attributes his success with

the remedy, in great measure, to its having been given in this way. The preparation thus made is really a solution of iodohydrargyrate of potassium.

M. Cazenave considers biniodide of mercury as the best topical application in lupus. He applies it in thin layers, every six or eight days, to small portions of the ulcerated surface at a time, in the form of a caustic ointment, made of equal parts of the iodide, oil, and lard. The application produces severe pain, and gives rise to a sharp inflammation, which soon terminates, leaving the ulcer in an improved condition, with a tendency to cicatrize smoothly, and on a level with the surrounding skin. (*Ann. de Thérap.*, 1852, p. 175.)

Off. Prep. Liquor Arsenici et Hydrargyri Iodidi, *U. S.;* Unguentum Hydrargyri Iodidi Rubri, *Br.* B.

HYDRARGYRI IODIDUM VIRIDE. *U.S.*, *Br.* Hydrargyri Iodidum. *U. S.* 1850. *Green Iodide of Mercury. Protiodide of Mercury. Iodide of Mercury.*

"Take of Mercury *a troyounce;* Iodine *three hundred grains;* Stronger Alcohol *a sufficient quantity.* Mix the Mercury and Iodine in a mortar, and, having added half a fluidounce of Stronger Alcohol, triturate the mixture until the ingredients are thoroughly incorporated. Stir the mixture occasionally, and, at the end of two hours, triturate again, with considerable pressure, until it is nearly dry. Then rub it up with Stronger Alcohol, gradually added, until it is reduced to a uniformly thin paste; and, having transferred this to a filter, wash it with Stronger Alcohol until the washings cease to produce a permanent cloudiness when dropped into a large quantity of water. Lastly, dry the Iodide in the dark with a gentle heat, and keep it in a well-stopped bottle, protected from the light." *U. S.*

"Take of Mercury, by weight, *one ounce* [avoirdupois]; Iodine *two hundred and seventy-eight grains;* Rectified Spirit *a sufficiency.* Rub the Iodine and Mercury in a porcelain mortar, occasionally moistening the mixture with a few drops of the Spirit, and continue the trituration until metallic globules are no longer visible, and the whole assumes a green colour. The product thus obtained should be dried in a dark room, on filtering paper, by simple exposure to the air, and preserved in an opaque bottle." *Br.*

This process for forming the protiodide of mercury is a case of simple combination, the alcohol facilitating the union by dissolving the iodine. It may also be prepared by precipitation, by adding a solution of iodide of potassium to one of nitrate of protoxide of mercury; but, as it is difficult to prepare the nitrate of the protoxide, without being mixed with some binitrate of deutoxide, the protiodide, when thus obtained, is apt to be contaminated with biniodide. M. Roland Seeger suggests double decomposition between protacetate of mercury and iodide of potassium. (*Am. Journ. of Pharm.*, May, 1859, p. 204.) M. Boutigny proposes to decompose calomel by iodide of potassium, and gives the following formula. Twenty-nine drachms of calomel are mixed with twenty of pulverized iodide of potassium in a glass mortar, and twelve ounces of boiling distilled water poured upon the mixture. After cooling the liquid is decanted, and the precipitate washed on a filter with distilled water, and dried in the shade. (See *Am. Journ. of Pharm.*, viii. 326.) This process did not succeed with Mr. Charles Bullock, of this city, when he used the reacting ingredients in quantities six times those recommended by M. Boutigny. Mr. John Canavan, of New York, ascribes the failure to insufficient trituration, which, to ensure complete reaction, must be long continued. If the reaction be imperfect, the water washes away not only chloride of potassium, but also iodide of potassium, holding in solution a part of the protiodide of mercury formed, which is ultimately decomposed into biniodide and metallic mercury. The experiments of Mr. J. M. Maisch, of this city, tend to confirm this view. He further found that a boiling temperature enables chloride of potassium to decompose the protiodide perceptibly, and infers that the use of cold water would give a purer product. He therefore concludes that the process of Boutigny cannot be depended upon for giving a pure protiodide, and that we must fall back on the Pharmacopœia process. As prepared by the U.S. formula of 1850, it was liable to contain a little biniodide; but

this is obviated in the present edition by the direction to wash it, near the close of the operation, with stronger alcohol. It is known to be free from the biniodide when the alcoholic washings produce no permanent cloudiness with a large quantity of water. According to Mr. F. R. Williams, a boiling solution of common salt is much more efficacious as well as much more economical than alcohol as a solvent for washing out the red from the green iodide. (*Pharm. Journ. and Trans.*, June, 1873, p. 1016.) Even when purified, however, it generally contains a little metallic mercury, and, according to Dr. Squibb, a considerable portion of the yellow or subiodide; but these are of little consequence compared with the biniodide, which should always be carefully sought for, and separated if found. (See Mr. Maisch's paper, *Am. Journ. of Pharm.*, Jan. 1857.) M. P. Yrou has prepared the protiodide by subliming iodine with an excess of mercury, and subsequently washing it with dilute nitric acid. (*Journ. de Pharm.*, 4e sér., xviii. p. 167.)

From experiments by Mr. C. H. Wood, it appears that the green powder resulting from the British formula is a mixture of the protiodide with a large proportion of biniodide and metallic mercury. By continuing the trituration, the powders become more and more yellow, and at length have only a tinge of green. He infers that the pure protiodide is yellow, and that the green colour is owing to an admixture of the blue of the mercury with the yellow of the protiodide. (*Pharm. Journ.*, May, 1868, p. 503.)

Properties. Iodide of mercury is in the form of a greenish-yellow powder, insoluble in water, alcohol, and solution of chloride of sodium, and, according to the Br. Pharmacopœia, in ether also. Its sp. gr. is 7·75. When exposed to the light it is partially decomposed, and becomes of a dark-olive colour. If quickly and cautiously heated, it sublimes in red crystals which afterwards become yellow. "Gradually heated in a test tube, it yields a yellow sublimate, which, upon friction, or after cooling, becomes red, while globules of metallic mercury are left in the bottom of the tube." *Br.* It is a protiodide of mercury HgI, consisting of one eq. of mercury 200, and one of iodine 126·3 = 326·3. The Br. Pharmacopœia considers it a subiodide, with the formula Hg_2I; the eq. of mercury being 100.

Medical Properties and Uses. Iodide of mercury has been given in scrofula and scrofulous syphilis. The dose is a grain daily, gradually increased to three or four grains. It should never be given at the same time with iodide of potassium, which converts it immediately into biniodide and metallic mercury. (Mialhe, *Journ. de Pharm.*, 3e sér., iv. 36.) B.

HYDRARGYRI OXIDUM FLAVUM. *U.S., Br. Yellow Oxide of Mercury.*

"Take of Corrosive Chloride of Mercury *four troyounces;* Solution of Potassa *seventeen troyounces;* Distilled Water *a sufficient quantity.* Dissolve the Corrosive Chloride of Mercury in five pints of Distilled Water, and mix with the Solution of Potassa; after the precipitate has subsided, pour off the supernatant liquid, and wash with Distilled Water until the washings cease to be affected by a solution of nitrate of silver. Then dry the precipitate on bibulous paper, in a dark place, and preserve it in bottles, protected from the light." *U. S.*

"Take of Perchloride of Mercury *four ounces;* Solution of Soda *two pints;* Distilled Water *a sufficiency.* Dissolve the Perchloride of Mercury in four pints of Distilled Water, aiding the solution by the application of heat, and add this to the Solution of Soda. Stir them together; allow the yellow precipitate to subside; remove the supernatant liquor by decantation; thoroughly wash the precipitated oxide on a calico filter with distilled water, and finally dry it by the heat of a water-bath." *Br.*

This is a new officinal of the Pharmacopœias. The process adopted for its preparation is that of Dr. Hoffmann. Both the Pharmacopœias direct the alkaline solution in excess, and the addition of the corrosive sublimate to the alkali. Both these points are important, for if the corrosive sublimate be in excess, brown oxychloride will be formed towards the last of the decomposition; and when the alkali is added to the solution of corrosive sublimate, the same compound will be formed from the first, and is with difficulty decomposed by an excess of alkali. The solution of

potassa should be as free as possible from carbonate to prevent the formation of brown carbonate of mercury. The bichloride of mercury is precipitated by the alkalies, chloride of potassium or of sodium being left in solution. The object of the subsequent washing is to remove the chloride of potassium and the excess of the alkali.

Properties. The officinal yellow oxide is of a yellow colour similar to that of the yelk of eggs, and is a completely amorphous powder, exhibiting no evidence of crystalline particles even under the microscope. Yellow oxide of mercury differs only from the red, by being amorphous and in much more minute state of division; the red oxide, by trituration, acquiring an orange and finally a yellow colour. In consequence of its different state of aggregation, it presents some peculiarities in its chemical relations; being much more quickly acted on by reagents than the red oxide. Thus, oxalic acid, which acts on the red oxide only with the aid of heat, immediately combines with the yellow oxide at ordinary temperatures, producing the white oxalate; and while the latter oxide, in contact with chlorine, gives up oxygen to that element, forming hypochloric acid and calomel, the former exercises scarcely any influence on the gas at common temperatures. On being heated it assumes a red colour; then, if the heat be increased, it evolves oxygen, and finally the mercury evaporates, without residue.

Medical Properties. The attention which has been recently paid to the yellow oxide, is owing to its peculiar applicability to the local treatment of diseases of the eye, in consequence of its amorphous character. Mr. B. Squire, of England, was the first to notice publicly this use of the oxide (see *Pharm. Journ.*, 2d ser., vi. 512); but a subsequent communication from Drs. Pagenstecher and Hoffmann, of Wiesbaden, in the *Ophthalmic Review* (July, 1865), has given greater importance to the subject, as adding the weight of experience to that of theory. The red oxide, however carefully it may be triturated, even though in a perfectly impalpable state, still shows under the microscope crystalline particles, which, in contact with the conjunctiva, cause more or less irritation; and it can, therefore, be readily understood that, in the ordinary mode of preparing it for use as an ointment, it may sometimes be productive of serious annoyance. From this objection the yellow oxide is entirely exempt; and its consequent superiority for the purpose of an eye-ointment was fully determined by Dr. Pagenstecher, who was induced to employ it at the recommendation of Dr. Hoffmann.

Off. Prep. Unguentum Hydrargyri Oxidi Flavi, *U. S.* W.

HYDRARGYRI OXIDUM RUBRUM. *U. S.*, *Br.* Hydrargyri Nitrico-oxidum. *Lond.* *Red Oxide of Mercury.* *Red Precipitate.*

"Take of Mercury *thirty-six troyounces;* Nitric Acid *twenty-four troyounces;* Water *two pints.* Dissolve the Mercury, with the aid of a gentle heat, in the Acid and Water previously mixed, and evaporate to dryness. Rub the dry mass into powder, and heat it in a very shallow vessel until red vapours cease to rise." *U. S.*

"Take of Mercury, by weight, *eight ounces* [avoirdupois]; Nitric Acid *four fluidounces and a half* [Imperial measure]; Water *two fluidounces* [Imp. meas.]. Dissolve half the Mercury in the Nitric Acid diluted with the Water, evaporate the solution to dryness, and with the dry salt thus obtained, triturate the remainder of the Mercury until the two are uniformly blended together. Heat the mixture in a porcelain dish, with repeated stirring, until acid vapours cease to be evolved, and, when cold, enclose the product in a bottle." *Br.*

In these processes the mercury is first oxidized at the expense of a portion of the nitric acid, the remainder of which unites with the oxidized metal to form either nitrate of deutoxide of mercury, or a mixture of this with nitrate of the protoxide. The resulting mass when exposed to a strong heat is decomposed, giving out red nitrous fumes, and assuming successively a yellow, orange, and brilliant purple-red colour, which becomes orange red on cooling. These changes are owing to the gradual separation and decomposition of the nitric acid, by the oxygen of which the protoxide of mercury, if any be present, is converted into deutoxide, while nitric oxide gas escapes, and becomes hyponitric acid vapour on contact with the air. The deutoxide of mercury is left behind; but in general not quite free from the nitrate,

which cannot be wholly decomposed by heat, without endangering the decomposition of the oxide itself, and the volatilization of the metal. The preparation is commonly called *red precipitate.* The name of *red oxide of mercury*, by which it is now designated in most of the Pharmacopœias, is appropriate, as nitrate of mercury exists in it merely as an accidental impurity; and there is no occasion to distinguish the preparation from the pure deutoxide obtained by calcining mercury, the latter not being officinal, and perhaps never employed.

In the preparation of this mercurial, various circumstances influence the nature of the product, and must be attended to, if we desire to procure the oxide with that fine bright orange-red colour, and shining scaly appearance, usually considered desirable. Among these circumstances is the condition of the nitrate of mercury submitted to calcination. According to Gay-Lussac, it should be employed in the form of small crystalline grains. If previously pulverized, as directed in the officinal processes, it will yield an orange-yellow powder; if it be in the state of large and dense crystals, the oxide will have a deep-orange colour. Care must also be taken that the mercury and acid be free from impurities. It is highly important that sufficient nitric acid be employed fully to saturate the mercury. M. Payssé, who paid great attention to the manufacture of red precipitate, recommended 70 parts of nitric acid from 34° to 38° Baumé, to 50 parts of mercury. This, however, is an excess of acid. We have been told by a skilful practical chemist of Philadelphia that he has found, by repeated experiment, 7 parts of nitric acid of 35° Baumé, to be sufficient fully to saturate 6 parts of mercury. Less will not answer, and more will be useless. It is not necessary that the salt should be removed from the vessel in which it is formed; and it is even asserted that the product is always more beautiful when the calcination is performed in the same vessel. A matrass may be used with a large flat bottom, so that an extended surface may be exposed, and all parts heated equally. The metal and acid having been introduced, the matrass should be placed in a sand-bath, and covered with sand up to the neck. The solution of the mercury should be favoured by a gentle heat, which should afterwards be gradually increased till red vapours appear, then maintained as equably as possible till these vapours cease, and at last slightly elevated till oxygen gas begins to escape. This may be known by the increased brilliancy with which a taper will burn if placed in the mouth of the matrass, or by its rekindling if partially extinguished. Too high a temperature must be carefully avoided, as it decomposes the oxide, and volatilizes the mercury. At the close of the operation, the mouth of the vessel should be stopped, and the heat gradually diminished, the matrass being still allowed to remain in the sand-bath. These last precautions are said to be essential to the fine red colour of the preparation. It is best to operate upon a large quantity of materials, as the heat may be thus more uniformly maintained. The direction in the British, taken from the late Ed. Pharmacopœia, to rub a portion of mercury with the nitrate before decomposing it, renders the process more economical; as the nitric acid, which would otherwise be dissipated, is thus employed in oxidizing an additional quantity of the metal.

As the process is ordinarily conducted in laboratories, the nitrate of mercury is decomposed in shallow earthen vessels, several of which are placed upon a bed of sand, in the chamber of an oven or furnace, provided with a flue for the escape of the vapours. Each vessel may conveniently contain ten pounds of the nitrate. There is always loss in the operation thus conducted.

Under the name of *Hydrargyri Oxydum Rubrum*, the Dublin College formerly directed a preparation, called by the elder chemists *hydrargyrum præcipitatum per se*, or *precipitate per se*, and sometimes *calcined mercury*, made by exposing the metal to a heat near its boiling point, or about 600° F., in a matrass with a broad bottom and narrow mouth. The vapours rising were condensed in the upper part of the vessel; and a circulation was thus kept up within it, during which the mercury slowly combined with oxygen, being converted first into a black and then into a red powder. But the process was very slow, requiring several weeks for the complete oxidization of the metal; and, as the product, which was pure deutoxide, had no peculiar virtues to recommend it over the oxide procured in the ordinary mode, it was properly discarded by the College. The oxide made in this way is in

minute, sparkling, crystalline scales, of a deep-red colour, becoming still deeper by heat.

The same oxide of mercury, prepared by precipitation, was recognised in a former London Pharmacopœia by the name of *Hydrargyri Binoxidum* or *binoxide of mercury*. In this form it is now officinal in both Pharmacopœias as the yellow oxide.

Properties, &c. Red precipitate, well prepared, has a brilliant red colour, with a shade of orange, a shining scaly appearance, and an acrid taste. It is very slightly soluble in water, of which Dr. Barker found 1000 parts to take up 0·62 of the oxide. Dr. Christison found 1 part of the oxide to be dissolved by about 7000 parts of boiling water, and the solution to give a black precipitate with sulphuretted hydrogen. Tannic acid precipitates metallic mercury from its aqueous solution, especially when heated. (Bullock, *Proceed. of Am. Pharm. Assoc.*, 1858, p. 306.) It is insoluble in cold alcohol and ether. (*Ibid.*) Nitric and muriatic acids dissolve it without effervescence. It yields oxygen when heated, and at a red heat is decomposed and entirely dissipated. It is essentially the deutoxide (peroxide) of mercury, consisting of one equivalent of the metal 200, and two of oxygen 16 = 216, or, according to the Br. Pharmacopœia, the protoxide, consisting of one eq. of mercury 100, and one of oxygen 8 = 108; but, in its ordinary state, it always contains a minute proportion of nitric acid, probably in the state of subnitrate. According to Brande, when rubbed and washed with a solution of potassa, edulcorated with distilled water, and carefully dried, it may be regarded as nearly pure deutoxide. It is said to be sometimes adulterated with brickdust, red lead, &c.; but these may be readily detected, as the oxide of mercury is wholly dissipated if thrown upon red-hot iron. The disengagement of red vapours, when it is heated, indicates the presence of nitrate of mercury. The same or some other saline impurity would be indicated, should water, in which the oxide has been boiled, afford a precipitate with lime-water.

Medical Properties and Uses. This preparation is too harsh and irregular in its operation for internal use; but is much employed externally as a stimulant and escharotic either in the state of powder or of ointment. In the former state it is sprinkled on the surface of chancres, and indolent, flabby, or fungous ulcers; and, mixed with 8 or 10 parts of finely powdered sugar, is sometimes blown into the eye to remove opacity of the cornea. The powder should be finely levigated. The ointment is officinal.*

* *Black Oxide of Mercury. Oxidum Hydrargyri Nigrum.* U. S. 1850. Though discarded from the Pharmacopœia, this preparation still has claims to notice. It was obtained by the following officinal process.

"Take of Mild Chloride of Mercury [calomel], Potassa, each, *four ounces;* Water *a pint.* Dissolve the Potassa in the Water, and, when the dregs have subsided, pour off the clear solution. To this add the Mild Chloride of Mercury, and stir them constantly together till the Black Oxide is formed. Having poured off the supernatant liquor, wash the Black Oxide with distilled water, and dry it with a gentle heat." *U. S.* 1850.

The object of this process is to obtain the protoxide or black oxide of mercury, which was at one time believed to be the active constituent of those preparations in which the metal is minutely divided by trituration. The calomel is completely decomposed by the solution of potassa; its chlorine uniting with potassium to form chloride of potassium, which remains in solution, and the mercury with the oxygen of the potassa to form protoxide of mercury, which subsides. More potassa is employed than by calculation would seem to be requisite; but it has been ascertained by experiment that a considerable excess is necessary for the complete decomposition of the calomel. The use of the officinal solution of potassa is preferable, on the score of economy, to that of a solution extemporaneously prepared from the caustic alkali. In order to ensure the success of the process, the calomel, very finely levigated, should be rubbed quickly with the alkaline solution in a mortar; and the resulting oxide should be dried in the dark with a very gentle heat, as it is decomposed by the agency both of light and of an elevated temperature. For the same reason it should be preserved in an opaque bottle. This mode of preparing the black oxide of mercury originated with Mr. Donovan.

The oxide may also be prepared by decomposing a solution of nitrate of protoxide of mercury by solution of potassa. This nitrate may be obtained by treating 20 parts of mercury with 18 parts of nitric acid of 25° Baumé, adding, when nitrous vapours cease to rise, 10 parts of warm distilled water, boiling for a short time, decanting the clear liquor, and setting it aside to crystallize. The mother-waters by evaporation will furnish a new product of crystals of nitrate of protoxide. (Ratier, *Pharm. Franç.*) The London College formerly prepared this oxide by decomposing calomel with lime-water; but it is extremely difficult to effect a complete decomposition in this way, and the preparation was consequently almost always mixed with calomel. The preparation, officinal in a former Dublin Pharmacopœia under the name of *Pulvis Hydrargyri Cinereus*, made by adding carbonate of ammonium to a solution of mercury in heated nitric acid, was a mixture of

Off. Prep. Hydrargyri Cyanidum, *U. S.;* Liquor Hydrargyri Nitratis, *U. S.;* Unguentum Hydrargyri Oxidi Rubri. W.

HYDRARGYRI SULPHAS. *Br.* *Sulphate of Mercury.*

"Take of Mercury, by weight, *twenty ounces* [avoirdupois]; Sulphuric Acid *twelve fluidounces* [Imperial measure]. Heat the Mercury with the Sulphuric Acid in a porcelain vessel, stirring constantly, until the metal disappears, then continue the heat until a dry white salt remains." *Br.*

Mercury is not acted on by cold sulphuric acid; but, when boiled with an excess of this acid to dryness, it is deutoxidized at the expense of part of the acid, sulphurous acid being copiously evolved; and the deutoxide formed unites with the undecomposed portion of the sulphuric acid, so as to form bisulphate of deutoxide of mercury, which is the officinal sulphate.

Sulphate of mercury, as obtained by a separate formula, is peculiar to the British Pharmacopœia; but it is formed as the first step of the processes of the U. S. Pharmacopœia for preparing corrosive sublimate, calomel, and turpeth mineral. The adoption of a separate formula and distinct officinal name for this salt is certainly a convenience; as it obviates the necessity of repeating the directions for obtaining the same substance in several formulas. On account of its various uses, it requires to be made on a large scale by the manufacturing chemist; and the process is generally performed in a cast-iron vessel, which should be conveniently arranged for the escape and decomposition of the sulphurous acid fumes, which otherwise become a serious nuisance to the neighbourhood. The best way to effect this purpose is to allow them to pass off through a very lofty chimney, mixed with abundance of coal smoke.

Properties, &c. Sulphate of mercury is in the form of a white crystalline powder, becoming yellow by the affusion of water, and entirely volatilizable by heat. It consists of two eqs. of acid 80 and one of deutoxide of mercury 216 = 296; or, according to the Br. Pharmacopœia, of one eq. of acid 40 and one of protoxide of mercury 108 = 148. It has no medical uses.

Off. Prep. Hydrargyri Perchloridum, *Br.;* Hydrargyri Subchloridum, *Br.* B.

HYDRARGYRI SULPHAS FLAVA. *U. S.* *Yellow Sulphate of Mercury. Turpeth Mineral.*

"Take of Mercury *four troyounces;* Sulphuric Acid *six troyounces.* Mix them

subnitrate of mercury and ammonia with protoxide of mercury. Both the London and Dublin Colleges abandoned the protoxide in the latest editions of their Pharmacopœias.

Properties, &c. As first prepared, this oxide is greenish-black; but, as found in the shops, it is almost always of an olive colour. It is inodorous, tasteless, and said to be insoluble in water and alkaline solutions; but, according to Mr. Charles Bullock, it is appreciably soluble in cold water, and to a greater extent in boiling water, but is insoluble in cold alcohol and ether. (*Proceedings of the Am. Pharm. Assoc.*, 1858, p. 302.) It consists of one eq. of mercury 200, and one of oxygen 8 = 208. On exposure to light or heat it is decomposed, one part assuming the metallic state, in consequence of the loss of its oxygen, which converts another part into the deutoxide. The preparation, therefore, becomes a mixture of the protoxide, deutoxide, and metallic mercury, with which calomel is sometimes associated, in consequence of the incomplete decomposition of that employed in the process. By a strong heat it is completely dissipated, and metallic globules are sublimed. When pure it is soluble in acetic and nitric acids, and entirely insoluble in muriatic acid, which forms with it water and calomel. If it contain the deutoxide, this will be dissolved by muriatic acid, and may be detected in the solution by the production of a white precipitate with water of ammonia, and a yellow one with solution of potassa. Calomel, if present, may be discovered by boiling the powder with a solution of potassa, thus forming chloride of potassium, which, when the solution is saturated with nitric acid, will afford a white precipitate of chloride of silver on the addition of nitrate of silver. (*Phillips.*)

Medical Properties and Uses. The black oxide is alterative, sialagogue, and purgative. It may be employed for the same purposes as calomel, over which, however, it has not in our hands exhibited any superiority, while, from the occasional presence of the deutoxide, it must be liable to operate harshly. Dr. B. H. Coates, of this city, informed us some years since that he used it habitually as a mercurial, and found it to answer an excellent purpose. The idea under which it was introduced into use, that it was the basis of the blue pill, is erroneous. Made into an ointment with lard, according to the process of Donovan, it may be applied externally with good effect in bringing the system under the mercurial influence. (See *Unguentum Hydrargyri.*) Its dose as an alterative is one-fourth or half of a grain daily, as a sialagogue from one to three grains two or three times a day, given in the form of pill. It was used by Mr. Abernethy for mercurial fumigation; the patient being placed, covered with under-garments, in a vapour-bath, and exposed for 15 or 20 minutes to the vapours arising from two drachms of the oxide, put upon heated iron within the bath. W.

in a glass vessel, and boil, by means of a sand-bath, until a dry white mass remains. Rub this into powder, and throw it into boiling water. Pour off the supernatant liquor, wash the yellow precipitate repeatedly with hot water, and dry it." *U. S.*

By referring to the articles on corrosive sublimate and calomel, it will be found that the peculiar salt which is generated by boiling sulphuric acid with mercury to dryness, is directed to be made as the first step for obtaining these chlorides; and here the same salt is again directed to be formed in preparing turpeth mineral. We have already stated that this salt is the bisulphate of deutoxide of mercury. When thrown into boiling or even warm water it is instantly decomposed, and an insoluble salt is precipitated, which is the turpeth mineral. According to Berzelius, turpeth mineral is a basic sesquisulphate of deutoxide of mercury, and the supernatant solution contains a supersulphate, consisting of six eqs. of acid and one of base. The same composition for turpeth mineral is given by Gay-Lussac; and its accuracy was verified by Sir Robert Kane of Dublin. (See *Pharm. Journ.*, August, 1842.) The composition above given of turpeth mineral implies the decomposition of four eqs. of bisulphate of deutoxide, and the manner in which the reaction takes place is shown by the following equation; $4(HgO_2,2SO_3) = \text{turpeth mineral}, 3HgO_2,2SO_3$, and supersulphate of mercury, $HgO_2,6SO_3$.

Properties, &c. Yellow sulphate of mercury is a lemon-yellow powder, of a somewhat acrid taste. It dissolves in 2000 parts of cold, and about 600 of boiling water. Exposed to a moderate heat, it becomes first red and afterwards brownish-red, but regains its original colour on cooling. (*Barker.*) At a red heat it is decomposed and dissipated, sulphurous acid being evolved, and metallic globules sublimed. It was originally called *turpeth* mineral, from its resemblance in colour to the root of *Ipomæa Turpethum*.

Medical Properties and Uses. Turpeth mineral is alterative, and powerfully emetic and errhine. As an alterative, it has been given in leprous disorders and glandular obstructions. It has been usefully employed as an emetic, repeated every few days, in chronic enlargement of the testicle. It operates with great promptness, and sometimes excites ptyalism. Dr. Hubbard, of Maine, considers it a valuable emetic, in cases requiring an equalizing and revulsive effect, apart from any cathartic operation, which he has never known it to produce. He recommends it highly as an emetic in croup, on the ground of its promptness and certainty, and of its not producing catharsis, or the prostration caused by antimony. The dose for a child two years old is two or three grains, repeated in fifteen minutes, if it should not operate. As an errhine, it has been used with benefit in chronic ophthalmia; but it sometimes produces salivation when thus employed. The dose as an alterative is from a quarter to half a grain; as an emetic from two to five grains. When employed as an errhine, one grain may be mixed with five of starch or powdered liquorice root.

Turpeth mineral, in an overdose, acts as a poison. A case of death in a boy aged sixteen, caused by swallowing a drachm, is reported by Dr. Letheby in the *London Medical Gazette* for March, 1847. B.

HYDRARGYRI SULPHURETUM RUBRUM. *U. S.* Cinnabaris. *Ed.* *Red Sulphuret of Mercury. Bisulphuret of Mercury. Cinnabar.*

"Take of Mercury *forty troyounces;* Sulphur *eight troyounces.* To the Sulphur, previously melted, gradually add the Mercury, with constant stirring, and continue the heat until the mass begins to swell. Then remove the vessel from the fire, and cover it closely to prevent the contents from inflaming. When the mass is cold, rub it into powder, and sublime." *U. S.*

This preparation has been discarded, we think somewhat prematurely, by the British Council.

Mercury and sulphur, when heated together, unite with great energy, and a product is obtained, which by sublimation becomes the red or bisulphuret of mercury. In order to render the combination more prompt, the sulphur is first melted; and the addition of the mercury should be made gradually, while the mixture is constantly stirred. Dr. Barker recommends the addition of the metal by straining it upon the melted sulphur through a linen cloth, whereby it falls in a minutely divided state

When the temperature has arrived at a certain point, the combination takes place suddenly with a slight explosion, attended with the inflammation of the sulphur, which must be extinguished by covering the vessel. A black mass will thus be formed, containing generally an excess of sulphur, which, before the sublimation is performed, should be got rid of by gently heating the matter, reduced to powder, on a sand-bath. The sublimation is best performed, on a small scale, in a loosely stopped glass matrass, which should be placed in a crucible containing sand, and, thus arranged, exposed to a red heat. The equivalent quantities for forming this sulphuret are 32 of sulphur and 200 of mercury.

Preparation on the Large Scale. Cinnabar is seldom prepared on a small scale, being made in large quantities for the purposes of the arts. Until within a few years it was nearly all manufactured in Europe, but it is now made to an enormous extent in this country. In Holland, where it is largely manufactured, the sulphur is melted in a cast-iron vessel, and the mercury is added in a divided state, by causing it to pass through chamois leather. As soon as the combination has taken place, the iron vessel is surmounted by another, into which the cinnabar is sublimed. The larger the quantity of the materials employed in one operation, the finer will be the tint of the product. It is also important in the manufacture to use the materials pure, and to drive off any uncombined sulphur which may exist in the mass, before submitting it to sublimation. In the United States, Martin's method, consisting of the agitation together of quicksilver, sulphur, and an alkaline sulphuret appears to have the preference.*

Properties, &c. Red sulphuret of mercury is in the form of heavy, brilliant, crystalline masses, of a deep-red colour and fibrous texture. It is inodorous and tasteless, and insoluble in water and alcohol. It is not acted on by nitric, muriatic, or cold sulphuric acid, or by solutions of the caustic alkalies; but is soluble in nitromuriatic acid, on account of the free chlorine which the mixed acid contains. When heated with potassa, it yields globules of mercury. In the open air it is decomposed by heat, the sulphur becoming sulphurous acid, and the mercury being volatilized. In close vessels at a red heat it sublimes without decomposition, and condenses in a mass, composed of a multitude of small needles. When duly levigated, it furnishes a brilliant red powder, which is the paint called *vermilion.* The same compound occurs native, being the sole ore from which mercury is extracted. The preparation, if purchased in powder, should be carefully examined; as, in that state, it is sometimes adulterated with red lead, dragon's blood, or chalk. If red lead be present, acetic acid, digested with it, will yield a yellow precipitate (iodide of lead) with iodide of potassium. Dragon's blood may be detected by alcohol, which will take up the colouring matter of that substance, if present; and, if chalk be mixed with it, effervescence will be excited on the addition of an acid. This sulphuret consists of one eq. of mercury 200, and two of sulphur $32 = 232$.

Medical Properties and Uses. Cinnabar was formerly thought to be alterative and anthelmintic, but is at present seldom given internally. It is sometimes employed by fumigation, as a rapid sialagogue, in venereal ulcers of the nose and throat, in cases in which it is important to bring the system under the influence of mercury in the shortest possible time. The dose internally is from ten grains to half a drachm, in the form of electuary or bolus. When used by fumigation, half a drachm may be thrown on a red-hot iron, and the fumes inhaled as they arise. These consist of sulphurous acid gas and mercurial vapour, the former of which must prove highly irritating to the patient's lungs. A better substance for mercurial fumigation is the black oxide of mercury.† B.

* For a modification of this method, see *Journ. de Pharm.*, Avril, 1875, p. 363. (*Note to the fourteenth edition.*)

† *Black Sulphuret of Mercury. Ethiops Mineral. Hydrargyri Sulphuretum Nigrum.* Though very properly discarded from the Pharmacopœias, this has too long occupied a place in the catalogue of the Materia Medica to be passed over entirely without notice. The following was the formula of the U. S. Pharmacopœia of 1850, for its preparation.

"Take of Mercury, Sulphur, each, *a pound.* Rub them together till all the globules disappear." *U. S.*

Mercury and sulphur have a strong affinity for each other, as is shown by the fact, that, when they are triturated together in quantities, the mixture grows hot, cakes, and exhales a sulphurous

HYDRARGYRUM AMMONIATUM. *U. S.*, *Br.* Hydrargyri Precipitatum Album. *Ed.* Hydrargyri Ammonio-chloridum. *Lond.* *Ammoniated Mercury. White Precipitate.*

"Take of Corrosive Chloride of Mercury *six troyounces;* Water of Ammonia *eight fluidounces;* Distilled Water *eight pints.* Dissolve the Corrosive Chloride of Mercury in the Distilled Water, with the aid of heat, and to the solution, when cold, add the Water of Ammonia, frequently stirring. Wash the precipitate with water until the washings become nearly tasteless, and dry it." *U. S.*

"Take of Perchloride of Mercury *three ounces* [avoirdupois]; Solution of Ammonia *four fluidounces;* Distilled Water *three pints* [Imperial measure]. Dissolve the Perchloride of Mercury in the Water with the aid of a moderate heat; mix the Solution with the Ammonia, constantly stirring; collect the precipitate on a filter, and wash it well with cold Distilled Water until the liquid which passes through ceases to give a precipitate when dropped into a solution of nitrate of silver acidulated with nitric acid. Lastly, dry the product at a temperature not exceeding 212°." *Br.*

The Pharmacopœias now agree in obtaining white precipitate by precipitating a solution of corrosive sublimate by ammonia. When ammonia, in slight excess, is added to a cold solution of corrosive sublimate, chloride of ammonium is formed in solution, and the white precipitate of the Pharmacopœias is thrown down. The precipitate is washed, according to the U.S. formula, until the washings become nearly tasteless, according to the British, with greater precision, until they cease to give evidence of the presence of a chloride by producing a precipitate with nitrate of silver acidulated with nitric acid. The matter washed away is chloride of ammonium and the excess of ammonia employed; and hence the washings, agreeably to the directions of the British formula, are tested with an acid solution of nitrate of silver. A method of making white precipitate, said to be employed by large manufacturers, substitutes sal ammonia and carbonate of sodium for ammonia. As the product contains less mercury than the officinal preparation, it is important to be able to distinguish the two. According to Prof. Redwood this can be done by heating, the officinal preparation volatilizing without fusing, the unauthorized fusing before volatilizing; Prof. Attfield has, however, shown that fusibility does not necessarily indicate that the specimen contains only 65 per cent. of mercury, or infusibility demonstrate that it contains the officinal proportion of 79½ per cent. According to Sir

odour. During the trituration, the mixture should be sprinkled from time to time with a little water or alcohol, to prevent the dust from rising, which exposes the operator to serious inconvenience. When rubbed together in equal weights, as directed in the formula, they are supposed to unite chemically; but the proportion of sulphur is much greater than is necessary to form a definite compound. Only two sulphurets of mercury have been admitted by chemists generally, the protosulphuret, and bisulphuret or cinnabar; but the quantity of sulphur directed in the process is much more than sufficient to form even the latter. It is still undetermined what is the exact nature of the officinal black sulphuret, or *ethiops mineral.* Mr. Brande, from his experiments, considers it to be the bisulphuret mixed with sulphur. Thus, he found that, when boiled repeatedly in solution of potassa, sulphur was dissolved, and a black insoluble powder was left, which sublimed without decomposition, and yielded a substance having all the characters of cinnabar.

Ethiops mineral is sometimes obtained by melting sulphur in a crucible, and adding to it an equal weight of mercury; but, when thus prepared, the sulphur is apt to become acidified, and the preparation to acquire an activity which does not belong to it when obtained by trituration.

Properties, &c. Black sulphuret of mercury is a heavy, tasteless, insoluble powder. When exposed to heat, it becomes of a dark-violet colour, emits the excess of sulphur in sulphurous acid fumes, and sublimes in brilliant red needles without residue. If charcoal be present it will remain behind. When well prepared, no globules of mercury are discernible in it when viewed with a magnifier; and, if rubbed on a gold ring, it should not communicate a white stain. Ivory-black is detected in it by throwing a small portion on red-hot iron, when a white matter (phosphate of calcium) will be left behind. Adulteration by sulphuret of antimony is shown, if muriatic acid, boiled on a portion of the powder, acquires the property of causing a precipitate of oxychloride of antimony when added to water. According to the views of Mr. Brande, ethiops mineral consists of one eq. of bisulphuret of mercury, mixed with about ten and a half eqs. of sulphur in excess.

Medical Properties. Ethiops mineral is supposed to be alterative, and as such has been sometimes prescribed in glandular affections and cutaneous diseases, especially in the cases of scrofulous children, to which, from the mildness of its operation, it has been thought to be well adapted. The dose generally given was from five to thirty grains, repeated several times a day; but it has often been administered in much larger doses, without producing any obvious impression on the system. At present it is very little used as a medicine. E.

Robert Kane, white precipitate has a composition corresponding to one eq. of bichloride of mercury, united with one eq. of a compound consisting of one eq. of mercury combined with two eqs. of a hypothetical body represented by one eq. of ammonia *minus* one eq. of hydrogen. This hypothetical body, represented by NH_2, he has named *amidogen*, the *amide* of some chemists. The reaction may be supposed to take place between four eqs. of ammonia and two of bichloride of mercury. Two eqs. of ammonia by parting with one eq., each, of hydrogen, become two eqs. of amidogen, which unite with the mercury of one eq. of the bichloride to form the binamide of mercury; while the two liberated eqs. of hydrogen of the ammonia combine with the two liberated eqs. of chloride of the bichloride, forming two eqs. of muriatic acid; and the binamide then unites with the second eq. of the bichloride to produce the insoluble chloro-amide of mercury or white precipitate, which falls. The two eqs. of muriatic acid combine with a like number of ammonia, and remain in solution as two eqs. of chloride of ammonium. In symbols, the reaction is thus denoted: $4NH_3$ and $2HgCl_2 = Hg,2NH_2 + HgCl_2$ and $2(NH_3,HCl)$. The analysis of Kane agrees virtually with those of Guibourt and Hennell.

Properties, &c. Ammoniated mercury is in powder or pulverulent masses, perfectly white, insoluble in water, alcohol, and ether, decomposed by boiling water, and having a taste at first earthy, and afterwards metallic. It dissolves without effervescence in muriatic acid. When heated with a solution of caustic potassa, it yields ammonia and becomes yellow. Exposed to a strong heat it is entirely dissipated, and resolved into nitrogen, ammonia, and protochloride of mercury. Adulteration with white lead, chalk, or sulphate of calcium may be detected by exposing a sample to a strong red heat, when these impurities will remain. Should starch be mixed with it, a charry residue will be obtained on the application of heat. Lead or starch may be found by digesting it with acetic acid, and testing the acetic solution with the compound solution of iodine, which will give a yellow precipitate if lead, and a blue one if starch be present. The absence of protoxide of mercury is shown by its not being blackened when rubbed with lime-water. Ammoniated mercury is used only as an external application.

A variety of white precipitate, distinguished as being fusible, was formerly officinal, and is said to be still occasionally made by the manufacturing chemist, from its greater cheapness and facility of preparation, and to be still found in commerce. It was made by precipitating a mixture of equal parts of sal ammoniac and corrosive sublimate in solution by one of the fixed alkalies. It differs somewhat from the present officinal preparation in composition, containing only half the proportion of mercury, and in properties by fusing before being volatilized, while the genuine article sublimes without melting. It is said to produce an ointment more translucent and less beautifully white than the genuine, and more apt to become yellow on being kept. (Mr. J. Borland, *Pharm. Journ.*, Dec. 1867, p. 262.)

Ammoniated mercury has been swallowed by mistake. It is highly poisonous, producing gastric pain, nausea, and purging. A case of recovery, after taking what was estimated to be half a drachm, is reported in the *London Lancet* for July 4, 1857.* The remedies employed were an emetic of sulphate of zinc, and milk to allay the gastro-intestinal irritation.

Off. Prep. Unguentum Hydrargyri Ammoniati. B.

HYDRARGYRUM CUM CRETA. *U. S.*, *Br.* *Mercury with Chalk. Gray Powder.*

"Take of Mercury *three troyounces;* Prepared Chalk *five troyounces.* Rub them together until the globules cease to be visible, and the mixture acquires a uniform gray colour." *U. S.*

"Take of Mercury, by weight, *one ounce;* Prepared Chalk *two ounces.* Rub the Mercury and Chalk in a porcelain mortar until metallic globules cease to be visible to the naked eye, and the mixture acquires a uniform gray colour." *Br.*

When mercury is triturated with certain dry and pulverulent substances, such as chalk or magnesia, it gradually loses its fluidity and metallic lustre, and becomes a

* For other cures of poisons, see *Half-Yearly Abstract*, July, 1875.

blackish or dark-gray powder. A similar change takes place when it is rubbed with viscid or greasy substances, such as honey or lard. The globules disappear, so as in some instances not to be visible even through a good lens; and the mercury is said to be extinguished. It was formerly thought that the metal was oxidized in the process. At present, the change is generally ascribed to the mechanical division of the metal, which in this state is supposed to be capable of acting on the system. There is good reason, however, to believe that in this, as in all the analogous preparations of mercury, in which the metal is extinguished by trituration, a very small portion is converted into protoxide, while by far the greater part remains in the metallic state.

Mercury with chalk is a smooth grayish powder, insoluble in water. Globules of mercury can generally be seen in it with the aid of a microscope; as the metal can scarcely be completely extinguished with chalk alone by any length of trituration. Mr. Jacob Bell found that, by powerfully pressing it, a considerable quantity of metal was separated in the form of globules. Mr. Phillips states that the extinguishment of the mercury is greatly accelerated by the addition of a little water. Dr. Stewart, of Baltimore, proposed the following process, by which he stated that the preparation might be completed in a short time, so that no globules should be visible with a powerful lens. Three ounces of mercury and six ounces of resin are to be rubbed together for three hours; five ounces of chalk are to be added, and the trituration continued for an hour; the mixture is then to be heated with alcohol so as to dissolve the resin; and the remaining powder is to be dried on bibulous paper, and well rubbed in a mortar. (*Am. Journ. of Pharm.*, xv. 162.) But Professor Procter has shown that the preparation thus made contains deutoxide of mercury, and is, therefore, injuriously harsh in its operation. (*Ibid.*, xxii. 113.) It is said that the precipitated black oxide is sometimes added with a view to save time in the trituration; but this must be considered as an adulteration, until it can be shown that the same oxide exists, in the same proportion, in the preparation made according to the officinal directions. Dr. Ed. Jenner Coxe, of New Orleans, found that the extinguishment of the mercury may be effected much more speedily than in the ordinary manner, by putting the ingredients into a quart bottle, to be well corked, and kept in constant agitation till the object is attained. A portion of the chalk may be thus shaken with the metal until no globules can be seen, and the process completed by trituration with the remainder of the chalk in a mortar. This mode of proceeding was suggested to Dr. Coxe by Mr. W. Hewson, of Augusta, Ga. (*Ibid.*, xxii. 317.) Dr. Squibb, having ascertained that the preparation cannot be satisfactorily made in this way on a large scale (*Proceed. of Am. Pharm. Assoc.*, 1858, p. 424), has invented a machine for accomplishing the same object, by which the requisite motion is imparted to the materials contained in two large bottles, and which is said to answer the purpose well. By means of this apparatus, Dr. Squibb prepares mercury with chalk on a large scale, mixing the materials in the officinal proportions, but aiding the extinguishment of the metal by adding about one-seventh of its weight of honey, and making the chalk into a paste with water before putting it into the bottles. (*Ibid.*, 1859, p. 359.) It has been shown that the preparation thus made resists oxidation most effectually; owing probably to the presence of saccharine matter. (I. P. Remington, *Am. Journ. of Pharm.*, Jan. 1869.) As found in commerce, mercury with chalk, instead of being the mild preparation intended, sometimes acts very harshly, causing vomiting, gastric pains, &c.* This has been ascribed to the presence of antimony or arsenic, which, however, must be rare; and the ordinary cause of the harshness is no doubt peroxide of mercury, produced in minute proportion either during the trituration, or by the spontaneous change which occurs with time; the protoxide being deutoxidized by the influence of light. The only sure method to guard against such results is carefully to test the preparation before dispensing it. If the mercury contained in it be volatilized by heat, and the remaining chalk be dissolved by dilute acetic acid, the solution should not be coloured by sul-

* M. J. Ellwood believes that a very dark specimen he met with in the London market had been prepared from mercury obtained by precipitating the bichloride with bichloride of tin. (*Pharm. Journ. and Trans.*, Nov. 1870, p. 414.)—*Note to the fourteenth edition.*

phuretted hydrogen. The presence of any probable metallic impurity may be detected in this way. To detect peroxide of mercury, a portion of the powder may be treated with dilute muriatic acid with a moderate heat, and the solution tested by protochloride of tin, which, if there be any peroxide present, will cause a precipitation of metallic mercury as a black powder.

Medical Properties and Uses. Mercury with chalk is a very mild mercurial, similar in its properties to the blue pill, but much weaker. It is sometimes used as an alterative, particularly in the complaints of children attended with deficient biliary secretion, indicated by white or clay-coloured stools. The chalk is antacid, and, though in small quantity, may sometimes be a useful accompaniment of the mercury in diarrhœa. Eight grains of the U. S. preparation contain three grains of mercury. The dose is from five grains to half a drachm twice a day. Two or three grains is the dose for a child. It should not be given in pill with substances which become hard on keeping; as the contraction of the mass presses together the particles of mercury, which, in time, appear in globules in the interior of the pill. W.

INFUSA.

Infusions.

These are aqueous solutions obtained by treating with water, without the aid of ebullition, vegetable products only partially soluble in that liquid. The water employed may be hot or cold, according to the objects to be accomplished. Infusions are generally prepared by pouring boiling water upon the vegetable substance, and macerating in a lightly closed vessel till the liquid cools. The soluble principles are thus extracted more rapidly, and, as a general rule, in a larger proportion than at a lower temperature. Some substances, moreover, are dissolved in this manner, which are nearly or quite insoluble in cold water. A prolonged application of heat is in some instances desirable; and this may be effected by placing the vessel near the fire. Cold water is preferred when the active principle is highly volatile, when it is injured by heat, or when any substance of difficult solubility at a low temperature exists in the vegetable, which it is desirable to avoid in the infusion. A longer continuance of the maceration is necessary in this case; and, in warm weather, there is sometimes danger that spontaneous decomposition may commence before the process is completed. When a strong infusion is required, the *process of percolation* may be advantageously resorted to. The water employed should be free from saline impurities, which frequently produce precipitates and render the infusion turbid. Fresh river, rain, or distilled water is usually preferable to that of pumps or springs.

The substance to be acted on should be sliced or bruised, or in the state of powder; but, unless when percolation is employed, this last condition is seldom requisite, and is always inconvenient, as it requires that the infusion should be filtered through paper in order completely to separate the undissolved portion. In other cases, it is sufficient to strain through fine linen or muslin. When percolation is resorted to, the substance should be more or less finely powdered. Infusions are usually prepared in glazed earthenware or porcelain vessels fitted with covers. Mr. Brande suggests the use of clean metallic vessels, which, when finely polished, retain the heat for a longer time; but they are also more liable to chemical alteration, and may sometimes injuriously affect the preparation. Vessels of block-tin are generally well adapted for the purpose.*

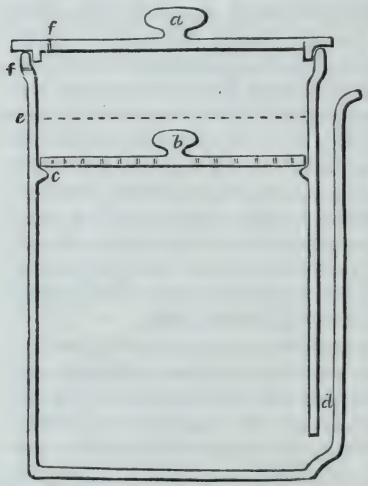
As infusions do not keep well, especially in warm weather, they should be made extemporaneously and in small quantities. In this country they are usually prepared in families, and the propriety of their introduction into the Pharmacopœia has been doubted; but it is desirable to have certain fixed standards for the regulation of the medical practitioner; and it is sometimes convenient to direct infusions from the apothecary, for whose guidance officinal formulas are necessary. Physicians would, indeed, find their advantage in more frequently directing them from the shops, instead of leaving their preparation to the carelessness or want of skill of attendants

* *Alsop's Infusion Jar.* This presents a very neat and effectual method of making the hot infu-

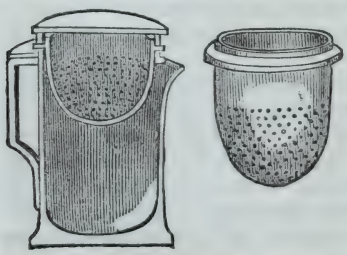
upon the sick. For a mode of preserving infusions, the reader is referred to the introductory observations. By making very concentrated infusions, as suggested by Mr. Donovan, with a mixture of three parts of water and one of alcohol, they may be long kept, and when used can be diluted with water to the proper strength. Thus, if made four times as strong as the officinal infusion, they may be diluted with three measures of water. The proportion of alcohol would thus be very small; but it might still be medically injurious; and infusions should not be prepared in this way unless with the cognizance of the prescriber.

Mr. Battley, of London, has introduced a new set of preparations, which he calls *inspissated infusions*, the advantages of which are that the virtues are extracted by cold water, are not injured by heat used in the evaporation, are in a concentrated state, and are not impaired by time. To prepare them he macerates the material, coarsely powdered, bruised, or finely sliced, in twice its weight of cold distilled water, pressing the solid matter into the liquid repeatedly by a rammer or the hand; then allows the liquid to drain out, or expresses it in the case of highly absorbent substances; and repeats the process, with an amount of water equal to that which has been separated, until the strength is exhausted. Four or six hours of maceration are usually sufficient. The infusion is then to be concentrated by evaporation at a temperature not exceeding 160° to the sp. gr. 1·200, and as much alcohol is to be added as will make its sp. gr. 1·100. These preparations are very analogous to the *fluid extracts* already treated of. As a general rule, it would probably be preferable to prepare the infusion by the process of percolation. The inspissated infusions must

sions. It consists of an earthenware mug, represented in the marginal figure, with a spout (*d*) proceeding from the bottom, and placed closely to the side of the vessel to prevent fracture; a perforated plate or diaphragm (*b*), supported on a ledge (*c*) at about one-quarter or one-third of the height of the vessel from the top; and a lid (*a*), which may be fastened on by a string through holes (*ff*). The material to be submitted to infusion is placed on the perforated plate, and the hot water poured in so as to cover it, the vessel having been previously warmed so as not to chill the liquid. As the water becomes impregnated, it acquires an increased specific gravity, and sinks to the bottom, its place being supplied by the unsaturated portion; and this circulation goes on until the whole of the soluble matter is extracted. In order to maintain a due warmth, the vessel may be placed upon a stove or an iron plate near the fire. The advantage of the process is that the material is subjected to the solvent power of the least impregnated portion of the menstruum. Such jars may now be had in Philadelphia. In order that the vessel may be adapted for the preparation of different quantities of infusions, it will be proper to have ledges arranged within at different heights, so that the diaphragm may be supported at any desirable point. The surface of the liquid (*e*) should of course always be above the medicinal substance placed upon the diaphragm. (See *Am. Journ. of Pharm.*, viii. 89.)



Squire's Infusion Jar. Mr. Squire, of London, has modified this jar by adding a colander of queensware, which is closely covered with a lid, and descends into the jar so as to form a diaphragm for the support of the substance to be infused. It has the advantage that the material, after having been exhausted, may be lifted out without disturbing the infusion. In the margin is a figure of Squire's implement. It consists of a queensware mug, of the capacity of two pints, into which a thimble-shaped colander descends to somewhat less than half its depth, supported on the rim of the mug by a projecting ledge, with a carefully fitted cover, which closes the whole. The substance to be submitted to infusion is introduced into the colander either before or after it has been fitted to the mug; the water, hot or cold, as the case may be, is then poured in so as to fill the lower vessel, and cover the materials in the upper; and, the cover having been applied, the vessel is set aside for the length of time required. The colander is then to be lifted out, and the infusion is ready for use. For preparing small quantities of infusion, a pint for example, the mug must be made of a smaller size.



be diluted when administered. The presence of alcohol, though in small quantity, would in some instances be a serious objection. (*Pharm. Journ.*, x. 129.)

As we have already treated of the chemical relations and medical properties of the substances used in infusion, it would be useless repetition to enlarge upon these points in the following details. We shall touch upon them only in cases of peculiar interest, or where changes requiring particular notice may grow out of the nature of the process.

The former officinal preparations of this class, omitted in the present U. S. and Br. Pharmacopœias, are the *Infusions of Horseradish*, U. S., Lond., of *Pale Peruvian Bark*, Lond., Dub., Ed., and of *Simaruba*, Ed., Dub.; the *Inspissated Infusions of Yellow and Pale Bark*, Lond.; and the *Compound Infusion of Senna*, Ed. The U. S. *Infusions of Sassafras Pith* and of *Slippery-elm Bark* have been transferred to the *Mucilages*. W.

INFUSUM ANGUSTURÆ. *U. S.* Infusum Cusparіæ. *Br. Infusion of Angustura. Infusion of Cusparia.*

"Take of Angustura [Bark], in moderately coarse powder, *half a troyounce;* Water *a sufficient quantity*. Moisten the powder with two fluidrachms of Water, pack it firmly in a conical percolator, and gradually pour Water upon it until the filtered liquid measures a pint.

"Or, macerate the Angustura in a pint of Boiling Water, for two hours, in a covered vessel, and strain." *U. S.*

"Take of Cusparia Bark, in coarse powder, *half an ounce* [avoirdupois]; Distilled Water, at 120°, *ten fluidounces*. Infuse in a covered vessel, for two hours, and strain." *Br.*

The dose of the infusion is two fluidounces, repeated every two, three, or four hours. W.

INFUSUM ANTHEMIDIS. *U. S., Br. Infusion of Chamomile.*

"Take of Chamomile *half a troyounce;* Boiling Water *a pint*. Macerate for ten minutes in a covered vessel, and strain." *U. S.*

"Take of Chamomile Flowers *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces*. Infuse in a covered vessel, for fifteen minutes, and strain." *Br.*

The infusion of chamomile has the odour and taste of the flowers. It affords precipitates with gelatin, yellow Peruvian bark, sulphate of iron, tincture of chloride of iron, nitrate of silver, corrosive chloride of mercury, and the acetates of lead. (*London Dispensatory.*) As a tonic it is given cold, in the dose of two fluidounces several times a day. To assist the operation of emetic medicines it should be administered in the tepid state, and in large draughts. The infusion prepared by maceration in cold water is more grateful to the palate and stomach than that made with boiling water, but is less efficient as an emetic. W.

INFUSUM AURANTII. *Br. Infusion of Orange Peel.*

"Take of Bitter Orange Peel, cut small, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces*. Infuse in a covered vessel, for fifteen minutes, and strain." *Br.*

This infusion is given as a grateful stomachic, in the dose of two or three fluidounces. W.

INFUSUM AURANTII COMPOSITUM. *Br. Compound Infusion of Orange Peel.*

"Take of Bitter Orange Peel, cut small, *one quarter of an ounce* [avoirdupois]; Fresh Lemon Peel, cut small, *sixty grains;* Cloves, bruised, *thirty grains;* Boiling Distilled Water *ten fluidounces* [Imperial measure]. Infuse in a covered vessel for a quarter of an hour, and strain."

A grateful stomachic in the dose of one or two fluidounces. W.

INFUSUM BUCHU. *U. S., Br. Infusion of Buchu.*

"Take of Buchu *a troyounce;* Boiling Water *a pint*. Macerate for two hours in a covered vessel, and strain." *U. S.*

"Take of Buchu Leaves, bruised, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces*. Infuse in a covered vessel, for one hour, and strain." *Br.*

This is the *Infusum Diosmæ* of former Pharmacopœias. It has the odour, taste, and medical virtues of the leaves, and affords a convenient method of administering the medicine. The dose is one or two fluidounces. W.

INFUSUM CALUMBÆ. *U.S., Br.* INFUSUM COLOMBÆ. *U.S.* 1850. *Infusion of Columbo. Infusion of Calumba.*

"Take of Columbo, in moderately coarse powder, *half a troyounce;* Water *a sufficient quantity*. Moisten the powder with two fluidrachms of Water, pack it firmly in a conical percolator, and gradually pour Water upon it until the filtered liquid measures a pint. Heat the filtrate to the boiling point, and strain when cold.

"Or, macerate the Columbo in a pint of boiling Water, for two hours, in a covered vessel, and strain." *U.S.*

"Take of Calumba Root, cut small, *half an ounce* [avoirdupois]; Cold Distilled Water *ten fluidounces*. Macerate in a covered vessel, for one hour, and strain." *Br.*

The infusion of Columbo is apt to spoil very quickly, especially in warm weather. It has been generally supposed that the cold infusion would keep better than the hot, because it contains no starch. Mr. Thomas Greenish, however, upon comparing specimens of the two infusions, found that the spontaneous change began sooner in the cold than the hot, though the former was clearer. Columbo contains starch and albumen. Cold water extracts the latter without the former; hot water the former with comparatively little of the latter, which is partially coagulated by the heat. Both starch and albumen are liable to spontaneous change; but the former is much the more permanent of the two. Hence it is, according to Mr. Greenish, that the hot infusion keeps best. Indeed, he ascribes the change which takes place in the starch of the hot infusion chiefly to the agency of a little albumen, which has escaped coagulation. According to these views, the best plan of preparing infusion of columbo is to exhaust the root with cold water, by which the starch is left behind, and then to heat the infusion to the boiling point in order to coagulate the albumen. (*Am. Journ. of Pharm.*, xviii. 141; from *Pharm. Journ.*) Upon comparing specimens of the cold and hot infusion, we have not found the results of Mr. Greenish fully confirmed. The cold infusion appeared to keep better than the hot. Nevertheless, the plan of preparing the infusion above proposed is probably the best. The infusion of columbo is not disturbed by salts of iron, and may be conveniently administered in connection with them. The dose is two fluidounces three or four times a day. W.

INFUSUM CAPSICI. *U.S. Infusion of Capsicum.*

"Take of Capsicum, in coarse powder, *half a troyounce;* Boiling Water *a pint*. Macerate for two hours in a covered vessel, and strain." *U.S.*

This infusion is used chiefly as a gargle. It may, however, be given internally in the dose of half a fluidounce. W.

INFUSUM CARYOPHYLLI. *U.S., Br. Infusion of Cloves.*

"Take of Cloves, bruised, *one hundred and twenty grains;* Boiling Water *a pint*. Macerate for two hours in a covered vessel, and strain." *U.S.*

"Take of Cloves, bruised, *a quarter of an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces*. Infuse in a covered vessel, for half an hour, and strain." *Br.*

The infusion of cloves affords precipitates with lime-water, and with the soluble salts of iron, zinc, lead, silver, and antimony. (*Phillips.*) The dose is about two fluidounces. W.

INFUSUM CASCARILLÆ. *U.S., Br. Infusion of Cascarilla.*

"Take of Cascarilla, in moderately coarse powder, *a troyounce;* Water *a sufficient quantity*. Moisten the powder with half a fluidounce of Water, pack it firmly in a conical percolator, and gradually pour Water upon it until the filtered liquid measures a pint.

"Or, macerate the Cascarilla, with a pint of boiling Water, for two hours, in a covered vessel, and strain." *U.S.*

"Take of Cascarilla Bark, in coarse powder, *one ounce* [avoirdupois]; Boiling

Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

This infusion affords precipitates with lime-water, infusion of galls, nitrate of silver, acetate and subacetate of lead, sulphate of zinc, and sulphate of iron. (*London Dispensatory.*) The medium dose is two fluidounces. W.

INFUSUM CATECHU COMPOSITUM. *U. S.* INFUSUM CATECHU. *Br. Compound Infusion of Catechu. Infusion of Catechu.*

"Take of Catechu, in fine powder, *half a troyounce;* Cinnamon, in moderately fine powder, *sixty grains;* Boiling Water *a pint.* Macerate for an hour in a covered vessel, and strain." *U. S.*

"Take of Catechu, in coarse powder, *one hundred and sixty grains;* Cinnamon Bark, bruised, *thirty grains;* Boiling Distilled Water *ten fluidounces* [Imperial measure]. Infuse in a covered vessel, for half an hour, and strain." *Br.*

This is an elegant mode of administering catechu. The dose is from one to three fluidounces, repeated three or four times a day, or more frequently. W.

INFUSUM CHIRATÆ. *Br. Infusion of Chiretta.*

"Take of Chiretta, cut small, *a quarter of an ounce* [avoirdupois]; Distilled Water, at 120°, *ten fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

The dose of this simple bitter is from one to three fluidounces. W.

INFUSUM CINCHONÆ FLAVÆ. *U. S., Br. Infusion of Yellow Cinchona. Infusion of Yellow Bark.*

"Take of Yellow Cinchona, in moderately fine powder, *a troyounce;* Aromatic Sulphuric Acid *a fluidrachm;* Water *a sufficient quantity.* Mix the Acid with a pint of Water. Then moisten the powder with half a fluidounce of the mixture, and, having packed it firmly in a conical glass percolator, gradually pour upon it the remainder of the mixture, and afterwards Water, until the filtered liquid measures a pint." *U. S.*

"Take of Yellow Cinchona Bark, in coarse powder, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for two hours, and strain." *Br.*

Though the infusion with boiling water is more quickly prepared than the cold infusion, and therefore better adapted to cases of emergency, yet the latter is a more elegant preparation, not turbid like the former, and at least equally efficient. We, therefore, prefer the process of the U. S. Pharmacopœia, provided it be skilfully conducted.

The U. S. infusion is an elegant and very efficient preparation. Water extracts from bark the kinates of quinia and cinchonia, but leaves behind the compounds which these principles form with the cinchotannic acid. The simple infusion, therefore, is rather feeble. But the addition of the acid ensures the solution of all or nearly all the active matter. We have been long in the habit of using this infusion, and have had reason to be satisfied with its efficacy. It would be best that the bark should be macerated with the acidulated water some time before being introduced into the instrument.

The infusion of cinchona, made without acid, affords precipitates with the alkalies, alkaline carbonates, and alkaline earths; the soluble salts of iron, zinc, and silver; corrosive chloride of mercury, arsenious acid, and tartar emetic; gelatinous solutions; and various vegetable infusions and decoctions, as those of galls, chamomile, columbo, cascarilla, horseradish, cloves, catechu, orange-peel, foxglove, senna, rhubarb, valerian, and simaruba. In some instances the precipitate occurs immediately, in others not for several hours. (*London Dispensatory.*) Few, however, of these substances diminish the efficacy of the infusion, as they do not affect the active principles. The alkalies, alkaline earths, and vegetable astringents are really incompatible. As gallic, tartaric, and oxalic acids form salts with quinia of somewhat difficult solubility, the neutral and soluble gallates, tartrates, and oxalates produce in the infusion slight precipitates of corresponding salts of the alkaloids; but these are redissolved by an excess of the acid. Tartrate of antimony and potassium does not precipitate the alkaloids. Solutions of iodine are incompatible, forming with the alkaloids insoluble compounds.

For an account of the chemical reactions of the infusions of different varieties of Peruvian bark, see the *Am. Journ. of Pharm.* (ix. 128).

The simple infusion of cinchona may be advantageously administered in cases which require tonic treatment, but do not call for the full powers of the bark. The acid infusion has, we believe, all the powers of cinchona itself, and may be given for the same purposes. The medium dose is two fluidounces, equivalent to a drachm of the bark, to be repeated three or four times a day as a tonic, but more frequently as an antiperiodic. W.

INFUSUM CINCHONÆ RUBRÆ. *U.S.* INFUSUM CINCHONÆ COMPOSITUM. *U.S.* 1850. *Infusion of Red Cinchona. Compound Infusion of Peruvian Bark. Infusion of Red Bark.*

"Take of Red Cinchona, in moderately fine powder, *a troyounce;* Aromatic Sulphuric Acid *a fluidrachm;* Water *a sufficient quantity.* Mix the Acid with a pint of Water. Then moisten the powder with half a fluidounce of the mixture, and, having packed it firmly in a conical glass percolator, gradually pour upon it the remainder of the mixture, and afterwards Water, until the filtered liquid measures a pint." *U.S.*

The remarks made in relation to infusion of yellow bark are equally applicable to this. W.

INFUSUM CUSSO. *Br. Infusion of Kousso.*

"Take of Kousso, in coarse powder, *one half of an ounce* [avoirdupois]; Boiling Distilled Water *eight fluidounces.* Infuse in a covered vessel, for fifteen minutes, without straining." *Br.*

The whole may be taken for a dose. W.

INFUSUM DIGITALIS. *U.S., Br. Infusion of Digitalis.*

"Take of Digitalis [dried leaves], in coarse powder, *sixty grains;* Tincture of Cinnamon *a fluidounce;* Boiling Water *half a pint.* Macerate the Digitalis with the Water for two hours in a covered vessel, and strain; then add the Tincture of Cinnamon, and mix." *U.S.*

"Take of Digitalis Leaves, dried, *thirty grains;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The U. S. infusion is essentially the same as that employed by Withering. It affords precipitates with sulphate of iron, acetate of lead, tannic acid, and infusion of Peruvian bark. The dose has usually been stated at half a fluidounce, repeated twice a day under ordinary circumstances, every eight hours in urgent cases, until the system is affected. The proportion of digitalis is scarcely half as great in the British preparation, and the dose is proportionably larger. It will not escape the close observer, that the stated dose of digitalis in infusion is much larger than in substance, for which there does not appear to be a good reason. It would be safer to give only half the quantity, and increase if necessary. The British Pharmacopœia, though its infusion has only about half the strength of ours, gives its dose as from two to four fluidrachms. W.

INFUSUM DULCAMARÆ. *Br. Infusion of Dulcamara.*

"Take of Dulcamara, bruised, *one ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The dose is one or two fluidounces three or four times a day. W.

INFUSUM ERGOTÆ. *Br. Infusion of Ergot.*

"Take of Ergot, in coarse powder, *a quarter of an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

The dose of this infusion is two fluidounces for a woman in labour. W.

INFUSUM EUPATORII. *U.S. Infusion of Thoroughwort.*

"Take of Thoroughwort [the dried herb] *a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U.S.*

As a tonic, this infusion should be taken cold in the dose of one or two fluidounces three or four times a day, or more frequently; as an emetic and diaphoretic, in large tepid draughts. W.

INFUSUM GENTIANÆ COMPOSITUM. *U. S., Br. Compound Infusion of Gentian.*

"Take of Gentian, in moderately coarse powder, *half a troyounce;* Bitter Orange Peel, in moderately coarse powder, Coriander, in moderately coarse powder, each, *sixty grains;* Alcohol *two fluidounces;* Water *a sufficient quantity.* Mix the Alcohol with fourteen fluidounces of Water, and, having moistened the mixed powders with three fluidrachms of the menstruum, pack them firmly in a conical percolator, and gradually pour upon them first the remainder of the menstruum, and afterwards Water, until the filtered liquid measures a pint." *U. S.*

"Take of Gentian Root, sliced, Bitter-Orange Peel, cut small, of each, *sixty grains;* Fresh Lemon Peel, cut small, *one quarter of an ounce;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The use of the alcohol is to assist in dissolving the bitter principle, and at the same time to contribute towards the preservation of the infusion, which, without this addition, is very apt to spoil. It has, however, been abandoned by the British Pharmacopœia, and lemon peel substituted; a very doubtful improvement. The dose is a fluidounce repeated three or four times a day. W.

INFUSUM HUMULI. *U. S.* INFUSUM LUPULI. *Br. Infusion of Hops.*

"Take of Hops *half a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.*

"Take of Hop *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for two hours, and strain." *Br.*

The dose of this infusion is one or two fluidounces. W.

INFUSUM JUNIPERI. *U. S. Infusion of Juniper.*

"Take of Juniper, bruised, *a troyounce;* Boiling Water *a pint.* Macerate for an hour in a covered vessel, and strain." *U. S.*

The whole quantity made may be taken in twenty-four hours, in doses of two or three fluidounces. W.

INFUSUM KRAMERIÆ. *U. S., Br. Infusion of Rhatany.*

"Take of Rhatany, in moderately coarse powder, *a troyounce;* Water *a sufficient quantity.* Moisten the powder with half a fluidounce of Water, and, having packed it firmly in a conical glass percolator, gradually pour Water upon it until the filtered liquid measures a pint." *U. S.*

"Take of Rhatany Root, bruised, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The infusion of rhatany is probably most efficient, prepared by the mode of percolation, with cold water, from the root in a state of moderately coarse powder, as directed in the U. S. process. The dose of the infusion is one or two fluidounces. W.

INFUSUM LINI COMPOSITUM. *U. S.* INFUSUM LINI. *Br. Compound Infusion of Flaxseed. Infusion of Linseed.*

"Take of Flaxseed *half a troyounce;* Liquorice Root, bruised, *one hundred and twenty grains;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.*

"Take of Linseed *one hundred and sixty grains;* Fresh Liquorice Root, sliced, *sixty grains;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for four hours, and strain." *Br.*

This is a useful demulcent drink in inflammatory affections of the mucous membrane of the lungs and urinary passages. It may be taken *ad libitum.* W.

INFUSUM MATICÆ. *Br. Infusion of Matico.*

"Take of Matico Leaves, cut small, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for half an hour, and strain." *Br.*

The dose of this infusion is two fluidounces. W.

INFUSUM PAREIRÆ. *U. S. Infusion of Pareira Brava.*

"Take of Pareira Brava, bruised, *a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.*

The infusion of pareira brava is highly esteemed by some English practitioners as a remedy in irritation and chronic inflammation of the urinary passages, and has been found useful in catarrh of the bladder. The dose is one or two fluidounces. Brodie employed a *decoction* of the root, which he prepared by boiling half an ounce in three pints of water down to a pint, and gave in the quantity of from eight to twelve fluidounces daily. The Br. Pharmacopœia has substituted the decoction for the infusion. W.

INFUSUM PICIS LIQUIDÆ. *U. S. Infusion of Tar. Tar Water.*

"Take of Tar *a pint;* Water *four pints.* Mix them, and shake the mixture frequently during twenty-four hours. Then pour off the infusion, and filter through paper." *U. S.*

Water takes from tar a small portion of acetic acid, empyreumatic oil including creasote, and resinous matter, acquiring a sharp empyreumatic taste, the odour of tar, and the colour of Madeira wine. Thus impregnated it is stimulant and diuretic, and may be taken in the quantity of one or two pints daily. It is also used as a wash in chronic cutaneous affections, and is said to have proved beneficial, by injection into the bladder, in some cases of chronic cystitis. W.

INFUSUM PRUNI VIRGINIANÆ. *U. S. Infusion of Wild-cherry Bark.*

"Take of Wild-cherry bark, in fine powder, *half a troyounce;* Water [cold] *a sufficient quantity.* Moisten the powder with six fluidrachms of Water, let it stand for an hour, pack it gently in a conical glass percolator, and gradually pour Water upon it until the filtered liquid measures a pint." *U. S.*

This is a peculiarly suitable object for officinal direction, as, in consequence of the volatile nature of one of its active ingredients, and for another reason (see Art. *Prunus Virginiana*), it is better prepared with cold water than in the ordinary mode. The infusion of wild-cherry bark is one of the preparations to which the process of percolation or displacement is well adapted. In this way the virtues of the bark can be more rapidly and thoroughly exhausted than by maceration alone. In order to allow time for the reaction necessary to the production of the hydrocyanic acid, an hour's preliminary maceration is directed, which might perhaps be advantageously somewhat lengthened. If kept in a warm place this preparation undergoes a rapid alteration, and even under the best of circumstances is unstable. According to the experiments of Mr. I. B. Moore (*Amer. Journ. of Pharm.*, 1873, p. 242) two fluidounces of glycerin to the pint of menstruum is of great advantage in delaying the change. When properly made, infusion of wild-cherry bark is beautifully transparent, has the colour of Madeira wine, and the agreeable bitterness and peculiar flavour of the bark. The dose is two or three fluidounces three or four times a day, or more frequently when a strong impression is required. W.

INFUSUM QUASSIÆ. *U. S., Br. Infusion of Quassia.*

"Take of Quassia, rasped, *one hundred and twenty grains;* Water [cold] *a pint.* Macerate for twelve hours, in a covered vessel, and strain." *U. S.*

"Take of Quassia Wood, in chips, *sixty grains;* Cold Distilled Water *ten fluidounces.* Macerate in a covered vessel, for half an hour, and strain." *Br.*

The proportion of Quassia directed in the former London and Edinburgh Pharmacopœias was much too small. The London infusion contained the strength of only two grains of quassia in a fluidounce, and the Edinburgh three grains; while the dose of quassia in substance is from twenty grains to a drachm, and of the extract not less than five grains. This error has been corrected in the British Pharmacopœia. Boiling water may be employed when it is desirable to obtain the preparation quickly; but cold water affords a clearer infusion. The half-hour maceration directed in the British Pharmacopœia, considering that cold water is used, appears to us to be too short for the exhaustion of the wood. The dose is two fluidounces three or four times a day. W.

INFUSUM RHEI. *U. S., Br. Infusion of Rhubarb.*

"Take of Rhubarb, bruised, *one hundred and twenty grains;* Boiling Water *half a pint.* Digest for two hours in a covered vessel, and strain." *U. S.*

"Take of Rhubarb Root, in thin slices, *a quarter of an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

In order that the rhubarb may be exhausted, it should be digested with the water near the fire, at a temperature somewhat less than that of boiling water. It is customary to add some aromatic, such as cardamom, fennel-seed, or nutmeg, which improves the taste of the infusion, and renders it more acceptable to the stomach. One drachm of either of these spices may be digested in connection with the rhubarb.

This infusion may be given as a gentle laxative, in the dose of one or two fluidounces, every three or four hours till it operates. It is occasionally used as a vehicle of tonic, antacid, or more active cathartic medicines. The stronger acids and most metallic solutions are incompatible with it. W.

INFUSUM ROSÆ COMPOSITUM. *U. S.* INFUSUM ROSÆ ACIDUM. *Br. Compound Infusion of Rose. Acid Infusion of Roses.*

"Take of Red Rose [dried petals] *half a troyounce;* Diluted Sulphuric Acid *three fluidrachms;* Sugar [refined], in coarse powder, *a troyounce and a half;* Boiling Water *two pints and a half.* Pour the Water upon the Rose in a covered glass or porcelain vessel; add the Acid, and macerate for half an hour. Lastly, dissolve the Sugar in the liquid, and strain." *U. S.*

"Take of Dried Red-rose Petals, broken up, *a quarter of an ounce* [avoirdupois]; Diluted Sulphuric Acid *one fluidrachm;* Boiling Distilled Water *ten fluidounces.* Add the Acid to the Water, infuse the Petals in the mixture in a covered vessel, for half an hour, and strain." *Br.*

The red roses serve little other purpose than to impart a fine red colour and a slight astringent flavour to the preparation, which owes its medicinal virtues almost exclusively to the sulphuric acid. According to Mr. J. B. Barnes, one part of glycerin added to eight or nine parts of infusion of rose increases greatly its brightness and transparency. It is refrigerant and astringent, and affords a useful and not unpleasant drink in hemorrhages and colliquative sweats. It is much used by British practitioners as a vehicle for saline medicines, particularly sulphate of magnesium, the taste of which it serves to cover. It is also employed as a gargle, usually in connection with acids, nitre, alum, or tincture of Cayenne pepper. The dose is from two to four fluidounces. W.

INFUSUM SALVIÆ. *U. S. Infusion of Sage.*

"Take of Sage *half a troyounce;* Boiling Water *a pint.* Macerate for half an hour in a covered vessel, and strain." *U. S.*

This preparation is less used internally than as a gargle, or as a vehicle for other substances, such as alum, employed in this way. W.

INFUSUM SENEGÆ. *Br. Infusion of Seneka.*

"Take of Senega Root, bruised, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

The efficacy of the officinal decoction of seneka has been proved by so long an experience, that we should be cautious in allowing it to be superseded by the infusion on hypothetical grounds. The dose of the preparation is from one to three fluid ounces. W.

INFUSUM SENNÆ. *U. S., Br. Infusion of Senna.*

"Take of Senna *a troyounce;* Coriander, bruised, *sixty grains;* Boiling Water *a pint.* Macerate for an hour in a covered vessel, and strain." *U. S.*

"Take of Senna *one ounce* [avoirdupois]; Ginger, sliced, *thirty grains;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for one hour, and strain." *Br.*

We prefer the coriander of the U. S. Pharmacopœia to the ginger of the British. The strength of the British preparation has been doubled in the present edition of the Pharmacopœia, and is now nearly twice as great as that of the U. S. infusion. The infusion deposits, on exposure to the air, a yellowish precipitate, which is said to aggravate its griping tendency; it should, therefore, not be made in large quantities. It is customary to connect with it manna and some one of the saline cathartics,

which increase its efficacy, and render it less painful in its operation. The following is a good formula for the preparation of senna tea. Take of senna *half an ounce;* sulphate of magnesium, manna, each, *an ounce;* fennel-seed, *a drachm;* boiling water *half a pint.* Macerate in a covered vessel till the liquid cools. One-third may be given for a dose, and repeated every four or five hours till it operates. Such a combination as this is called *the black draught* by English writers. The dose of the infusion of the U. S. Pharmacopœia is about four fluidounces.

The cold infusion, especially if made by percolation from the coarsely powdered leaves, while probably not inferior in strength to that prepared with boiling water, is said to be less unpleasant to the taste. W.

INFUSUM SERPENTARIÆ. *U. S., Br. Infusion of Serpentaria.*

"Take of Serpentaria, in moderately coarse powder, *half a troyounce;* Water *a sufficient quantity.* Moisten the powder with two fluidrachms of Water, pack it firmly in a conical percolator, and gradually pour Water upon it until the filtered liquid measures a pint.

"Or, macerate the Serpentaria in a pint of Boiling Water, for two hours, in a covered vessel, and strain." *U. S.*

"Take of Serpentary Root, bruised, *a quarter of an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel for two hours, and strain." *Br.*

This is the ordinary form in which serpentaria is employed. The dose is one or two fluidounces, repeated every two hours in low forms of fever, but less frequently in chronic affections. W.

INFUSUM SPIGELIÆ. *U. S. Infusion of Spigelia.*

"Take of Spigelia *half a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.*

The dose of this infusion, for a child two or three years old, is from four fluidrachms to a fluidounce; for an adult, from four to eight fluidounces, repeated morning and evening. A quantity of senna equal to that of the spigelia is usually added, in order to ensure a cathartic effect. W.

INFUSUM TABACI. *U. S.* ENEMA TABACI. *Br. Infusion of Tobacco.*

"Take of Tobacco *sixty grains;* Boiling Water *a pint.* Macerate for an hour in a covered vessel, and strain." *U. S.*

For the mode of preparing the British *Enema Tabaci*, see *page* 1159.

This is used only in the form of enema in strangulated hernia, obstinate colic, and retention of urine from spasm of the urethra. Only half of the pint of the U. S. infusion should be employed at once; and, if this should not produce relaxation in half an hour, the remainder may be injected. Fatal consequences have resulted from too free a use of tobacco in this way. W.

INFUSUM TARAXACI. *U. S. Infusion of Dandelion.*

"Take of Dandelion, bruised, *two troyounces;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.*

This has been substituted in the U. S. Pharmacopœia for the decoction. The dose is a wineglassful two or three times a day, or oftener. W.

INFUSUM UVÆ URSI. *Br. Infusion of Bearberry.*

"Take of Bearberry Leaves, bruised, *half an ounce* [avoirdupois]; Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel, for two hours, and strain through calico." *Br.*

The dose is one or two fluidounces three or four times a day. W.

INFUSUM VALERIANÆ. *U. S., Br. Infusion of Valerian.*

"Take of Valerian, in moderately coarse powder, *half a troyounce;* Water *a sufficient quantity.* Moisten the powder with two fluidrachms of Water, pack it firmly in a conical percolator, and gradually pour Water upon it until the filtered liquid measures a pint.

"Or, macerate the Valerian in a pint of Boiling Water, for two hours, in a covered vessel, and strain." *U. S.*

"Take of Valerian Root, bruised, *one hundred and twenty grains;* Boiling Distilled Water *ten fluidounces.* Infuse in a covered vessel for one hour, and strain." *Br.*

The dose of this infusion is two fluidounces, repeated three or four times a day, or more frequently. W.

INFUSUM ZINGIBERIS. *U.S.* *Infusion of Ginger.*

"Take of Ginger, bruised, *half a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U.S.*

The dose of this infusion is two fluidounces. W.

INJECTIONES.

Hypodermic Injections.

This is a new class of preparations, which was, as we think, very foolishly introduced among the addenda to the British Pharmacopœia. On what ground it was separated from the Liquors it is hard to perceive; moreover, the solutions of the alkaloids are so prone to undergo decomposition that they should always be prepared fresh for use.

INJECTIO MORPHIÆ HYPODERMICA. *Br.* *Hypodermic Injection of Morphia.*

"Take of Hydrochlorate of Morphia *eighty-eight grains;* Solution of Ammonia, Acetic Acid, Distilled Water, of each, *a sufficiency.* Dissolve the Hydrochlorate of Morphia in two ounces of Distilled Water, aiding the solution by a gentle heat; then add Solution of Ammonia, so as to precipitate the Morphia and render the liquid slightly alkaline; allow it to cool, collect the precipitate on a filter, wash it with distilled Water, and allow it to drain; then transfer the Morphia to a small porcelain dish, with about an ounce of Distilled Water, apply a gentle heat, and carefully add Acetic Acid until the Morphia is dissolved and a very slightly acid solution is formed. Add now sufficient Distilled Water to make the solution measure exactly two fluidounces. Filter and preserve the product in a stopped bottle, excluded from the light." *Br.*

A fluidrachm of this contains five grains of the acetate of morphia. H. C. W.

LINIMENTA.

Liniments.

These are preparations intended for external use, of such a consistence as to render them conveniently applicable to the skin by gentle friction with the hand. They are usually thicker than water, but thinner than the ointments, and are always liquid at the temperature of the body. The former officinal preparations, belonging to this class, which have been omitted in the present editions of the U. S. and Br. Pharmacopœias, are the *Liniments of Verdigris*, Lond., and of *Sesquicarbonate of Ammonium*, Lond.; the *Compound Liniment of Ammonia*, Ed.; the *Camphorated Soap Liniment*, or *Opodeldoc*, U.S.; and the *Simple Liniment*, Ed.

LINIMENTUM ACONITI. *U.S., Br.* *Liniment of Aconite.*

"Take of Aconite Root, in fine powder, *eight troyounces;* Glycerin *a fluidounce;* Alcohol *a sufficient quantity.* Moisten the powder with four fluidounces of Alcohol, and let it macerate for twenty-four hours; then pack it in a conical percolator, and gradually pour Alcohol upon it until two pints of tincture have been obtained. Distil off a pint and a half of alcohol, and evaporate the remainder until it measures seven fluidounces; to this add the Glycerin, and mix them thoroughly." *U.S.*

"Take of Aconite Root, in coarse powder, *twenty ounces* [avoirdupois]; Camphor *one ounce* [avoird.]; Rectified Spirit *a sufficiency.* Moisten the Aconite Root with some of the Spirit, and macerate in a close vessel for three days; then transfer to a percolator, and adding more Spirit percolate slowly into a receiver containing the Camphor, until the product measures one pint [Imperial measure]." *Br.*

The British preparation is simply a very strong tincture of aconite root and camphor; that of the United States is almost equivalent to a fluid extract of aconite. (See

Aconiti Radicis.) Either may be applied alone by means of a camel's-hair pencil, or in connection with two parts or more of soap liniment or chloroform liniment, by rubbing it on the part affected. Experiments made by Mr. W. Donovan with a tincture prepared by macerating the fresh root, sliced, in rectified spirit for only twenty-four hours, proved that the preparation thus made, though acting in the same way, was much more powerful than the officinal (*Br.*). (*Pharm. Journ.*, 2d ser., vi. 57.) The inference is that the fresh root should be used in preparing this liniment, and that a simple maceration is all that is required. There is a great waste both of aconite and of spirit in the process; as no provision is made, either by displacement with water, or by expression, to separate from the mass in the percolator the strongly impregnated spirit retained in it. According to Mr. J. T. Porter, it requires twenty-eight parts, by measure, for every sixteen parts, by weight, of the dry root. On expressing the marc the loss of spirit was reduced to from six to twelve per cent. (*Ibid.*, xi. 66.) W.

LINIMENTUM AMMONIÆ. *U. S.*, *Br.* *Liniment of Ammonia. Volatile Liniment.*

"Take of Water of Ammonia *a fluidounce;* Olive Oil *two troyounces.* Mix them." *U. S.*

"Take of Solution of Ammonia *one fluidounce;* Olive Oil *three fluidounces.* Mix together with agitation." *Br.*

The U. S. and British Pharmacopœias agree at present very nearly in the strength of this liniment; the U. S. preparation being somewhat the stronger. In the process, the ammonia reacts with the oil to form a soap, which is partly dissolved, partly suspended in the water, producing a white, opaque emulsion. M. Rother states that the lower grades of commercial oil will often not satisfactorily saponify with the amount of ammonia used in the Pharmacopœia; a 16 or even 18 per cent. ammonia is often required. If a liniment so made be too thick, its consistency may be reduced by adding one-sixteenth of its volume of alcohol. The liniment is an excellent rubefacient, frequently employed in inflammatory affections of the throat, catarrhal and other pectoral complaints of children, and in rheumatic pains. It is applied by rubbing it gently upon the skin, or placing a piece of flannel saturated with it over the affected part. Should it occasion too much inflammation, it must be diluted with oil. W.

LINIMENTUM BELLADONNÆ. *Br.* *Liniment of Belladonna.*

This is prepared from Belladonna Root precisely as the Liniment of Aconite is prepared from Aconite Root; and the same remarks are applicable as to its strength and use; especially in relation to the waste incurred in the process. According to Mr. C. Umney, the belladonna root is not more than 40 per cent. extracted. (*Pharm. Journ.*, v. 281.) (See *Linimentum Aconiti.*) H. C. W.

LINIMENTUM CALCIS. *U. S.*, *Br.* *Lime Liniment.*

"Take of Solution of Lime *eight fluidounces;* Flaxseed Oil *seven troyounces.* Mix them." *U. S.*

"Take of Solution of Lime, Olive Oil, of each, *two fluidounces.* Mix together with agitation." *Br.*

The lime forms a soap with the oil, of which there is a great excess, that separates upon standing. Olive oil, as directed by the British Pharmacopœia, is often substituted for that of flaxseed, but possesses no other advantage than that of having a less unpleasant odour. This is a very useful liniment in recent burns and scalds. It is sometimes called *Carron oil*, from having been much employed at the Carron iron works in Scotland. It is recommended to be applied upon carded cotton. W.

LINIMENTUM CAMPHORÆ. *U. S.*, *Br.* *Liniment of Camphor.*

"Take of Camphor *three troyounces;* Olive Oil *twelve troyounces.* Dissolve the Camphor in the Oil." *U. S.*

"Take of Camphor *one ounce* [avoirdupois]; Olive Oil *four fluidounces.* Dissolve the Camphor in the Oil." *Br.*

This is employed as an anodyne embrocation in sprains, bruises, rheumatic or gouty affections of the joints, and other local pains. It is also supposed to have a discutient effect when rubbed upon glandular swellings.

Mr. Wm. B. Price, of Burlington, N. J., proposes a modification of this liniment, founded on the solvent power of chloroform over camphor, whereby the preparation is made stronger with camphor, and acquires also additional anodyne influence from the chloroform. The proposed liniment consists of *an ounce and a half* of camphor, *two fluidrachms* of chloroform, and *two fluidounces* of olive oil. It is useful in rheumatic and neuralgic pains. (*N. J. Med. Reporter*, ii. 217.) J. Weichzelbaum has found camphor liniment to be a specific for the itching produced by cowhage. (*Am. Journ. of Pharm.*, xlii. 519.)

Off. Prep. Linimentum Chloroformi, *Br.;* Linimentum Hydrargyri, *Br.;* Linimentum Terebinthinæ Aceticum, *Br.* W.

LINIMENTUM CAMPHORÆ COMPOSITUM. *Br. Compound Liniment of Camphor.*

"Take of Camphor *two ounces and a half* [avoirdupois]; Oil of Lavender *one fluidrachm;* Strong Solution of Ammonia *five fluidounces;* Rectified Spirit *fifteen fluidounces.* Dissolve the Camphor and Oil of Lavender in the Spirit; then add the Solution of Ammonia gradually, shaking them together until a clear solution is formed." *Br.*

This is used as a rubefacient and at the same time anodyne embrocation in local pains, particularly of a rheumatic character. W.

LINIMENTUM CANTHARIDIS. *U.S., Br.* 1864. Liquor Epispasticus. *Br. Liniment of Cantharides. Blistering Liquid.*

"Take of Cantharides, in fine powder, *a troyounce;* Oil of Turpentine *half a pint.* Digest the Cantharides with the Oil for three hours in a close vessel, by means of a water-bath, and strain." *U. S.*

"Take of Cantharides, in powder, *eight ounces* [avoirdupois]; Acetic Acid *four fluidounces;* Ether *a sufficiency.* Mix the Cantharides and Acetic Acid; pack them in a percolator, and at the expiration of twenty-four hours pour ether over the contents of the percolator, and allow it to pass slowly through till twenty fluidounces are obtained. Keep it in a stoppered bottle." *Br.*

Oil of turpentine dissolves, especially with the aid of heat, the active principle of cantharides, and, when impregnated with it, acquires in addition to its own rubefacient properties those of a powerful epispastic. The U. S. liniment was introduced into notice by the late Dr. Joseph Hartshorne, of Philadelphia, who employed it with advantage as an external stimulant in the prostrate states of typhus fever. Caution, however, is necessary in its use, both to graduate its strength to the circumstances of the case, and not to apply it very extensively, lest it may produce troublesome, if not dangerous vesication. If too powerful, it may be diluted with olive or linseed oil. The British preparation is a solution of the active matter of the flies in acetic acid and ether, and, as the ether must quickly evaporate, conjoins the influence of the cantharides and the acid. From the name conferred upon it at the late revision of the Pharmacopœia, it would appear to be intended rather as a vesicating than a rubefacient agent. W.

LINIMENTUM CHLOROFORMI. *U.S., Br. Liniment of Chloroform.*

"Take of Purified Chloroform *three troyounces;* Olive Oil *four troyounces.* Mix them." *U. S.*

"Take of Chloroform, Liniment of Camphor, of each, *two fluidounces.* Mix." *Br.*

This is an excellent local application in painful affections, though the common commercial chloroform would have answered quite as well as the purified, directed in the U. S. formula. As the chloroform rapidly evaporates, it is desirable, in order to obtain its full anodyne effect, to guard against this by oiled silk or some other impermeable covering. As some object to the greasy residue left on the skin by the evaporation of the chloroform, the soap liniment, which can readily be removed with a little warm water, may be substituted for the olive oil of the U. S., or the camphor liniment of the British preparation. W.

LINIMENTUM CROTONIS. *Br. Liniment of Croton Oil.*

"Take of Croton Oil *one fluidounce;* Oil of Cajuput, Rectified Spirit, of each, *three fluidounces and a half.* Mix." *Br.*

This is a pustulating preparation, the irritant influence of which has been increased by the substitution of the oil of cajuput and the spirit for the olive oil of the original formula, which tended to weaken the croton oil. From ten to thirty minims or more may be rubbed upon a limited surface, and repeated twice a day or oftener till an eruption is produced. W.

LINIMENTUM HYDRARGYRI. *Br.* *Liniment of Mercury.*

"Take of Ointment of Mercury *one ounce* [avoirdupois]; Solution of Ammonia, Liniment of Camphor, of each, *one fluidounce.* Liquefy the Ointment of Mercury in the Liniment of Camphor, with a gentle heat, then add the Solution of Ammonia gradually and mix with agitation." *Br.*

This is a stimulating liniment, employed for the discussion of chronic glandular enlargements, swellings of the joints, and venereal tumours, and to promote the absorption of collections of fluid. It is said to be more apt to salivate than mercurial ointment. One drachm of it may be rubbed upon the affected part night and morning. W.

LINIMENTUM IODI. *Br.* *Liniment of Iodine.*

"Take of Iodine *one ounce and a quarter* [avoirdupois]; Iodide of Potassium *half an ounce* [avoird.]; Camphor *one-fourth of an ounce;* Rectified Spirit *ten fluidounces.* Dissolve the Iodine, Iodide of Potassium, and Camphor in the Spirit." *Br.*

This is an alcoholic solution of iodine, in which the iodide of potassium acts by increasing the solubility of the active ingredient. The strength of the solution has been reduced one-half in the present liniment. See for its effects the article on *Iodine* in the first part of this work. W.

LINIMENTUM OPII. *Br.* *Liniment of Opium. Anodyne Liniment.*

"Take of Tincture of Opium, Liniment of Soap, of each, *two fluidounces.* Mix." *Br.*

This is commonly called *anodyne liniment*, and is employed as an anodyne and gently rubefacient embrocation in sprains, bruises, and rheumatic and gouty pains. We are informed that the preparation which has commonly been used, under the name of *anodyne liniment*, in this city, is that of the late London Pharmacopœia, as given in former editions of the U. S. Dispensatory, consisting of one part by measure of tincture of opium and three of soap liniment, and consequently having only half the opiate strength of the present British liniment. W.

LINIMENTUM PLUMBI SUBACETATIS. *U. S.* *Liniment of Subacetate of Lead.*

"Take of Olive Oil *three troyounces;* Solution of Subacetate of Lead *two troyounces.* Mix them." *U. S.*

This is a new officinal preparation. Why it was introduced is not very easy to understand. It may be used as a sedative application in superficial inflammations. H. C. W.

LINIMENTUM POTASSII IODIDI CUM SAPONE. *Br.* *Liniment of Iodide of Potassium and Soap.*

"Take of Hard Soap, cut small, Iodide of Potassium, of each, *one ounce and a half* [avoirdupois]; Glycerine *one fluidounce;* Oil of Lemon *one fluidrachm;* Distilled Water *ten fluidounces.* Dissolve the Soap in seven fluidounces of the Water by the heat of a water-bath. Dissolve the Iodide of Potassium and Glycerine in the remainder of the Water, and mix the two solutions together. When the mixture is cold add the Oil of Lemon and mix the whole thoroughly." *Br.*

This preparation is apparently intended, by application to the surface, which may be attended with a gentle friction, to produce the absorption of the iodide, and thus to obtain its alterative and deobstruent effects through the circulation. The soap and glycerin act as demulcents, and thus obviate in some measure the local irritation of the salt.* W.

* It seems to have been clearly established by the discussion carried on in the *Pharm. Journ. and Trans.*, 2d ser., xi., that Castile soap, and even individual brands of Castile soap, vary so much that it is impossible to get uniform results from the officinal process; the preparation sometimes being beautifully transparent and jelly-like, at other times opaque and ointment-like. Various remedies were proposed, but finally Mr. N. Smith called attention to the fact that the

LINIMENTUM SAPONIS. *U.S.*, *Br.* TINCTURA SAPONIS CAMPHORATA. *U.S.* 1850. *Soap Liniment. Camphorated Tincture of Soap.*

"Take of Soap, in shavings, *four troyounces;* Camphor *two troyounces;* Oil of Rosemary *half a fluidounce;* Water *four fluidounces;* Alcohol *two pints.* Digest the Soap in the Water until it is dissolved; dissolve the Camphor and Oil in the Alcohol; mix the solutions, and filter through paper." *U. S.*

"Take of Hard Soap, cut small, *two ounces and a half* [avoirdupois]; Camphor *one ounce and a quarter* [avoird.]; Oil of Rosemary *three fluidrachms;* Rectified Spirit *eighteen fluidounces;* Distilled Water *two fluidounces.* Mix the Water with the Spirit, and add the Oil of Rosemary, the Soap, and the Camphor. Macerate for seven days at a temperature not exceeding 70°, with occasional agitation, and filter." *Br.*

It is necessary, in preparing this liniment, that the soap employed should not have been made with animal oil, as otherwise the preparation will not be fluid at ordinary temperatures. The soap indicated by the U. S. Pharmacopœia is that "prepared from soda and olive oil," commonly called *Castile soap.*

In the last revision of the U. S. Pharmacopœia, the process for this preparation was altered, seemingly, in conformity with the suggestions of Mr. J. B. Moore.* It will be seen that the British process is in accord with that formerly officinal in the U.S. Pharmacopœia but in disagreement with the present U.S. formula, its directing the maceration of the soap in alcohol, and not its solution in water. In 1859, Mr. Deane showed that oleate of sodium is freely soluble in alcohol, while the margarate is nearly insoluble, consequently the latter salt is left behind in the British process. Inquiry among pharmaceutists indicates that the U.S. formula does not work satisfactorily if the soap be very dry. Although olive oil contains a large per cent. of oleic acid, yet it has been proposed to substitute almond oil† for it as still richer. The economy of this is, however, very doubtful. Castor oil has also been suggested. (*Am. Journ. of Pharm.*, xliv. 529.)

G. H. Barckhaunn states that the potassa soaps are perfectly soluble in alcohol, and suggests rape-seed oil as a good base. (*Am. Journ. of Pharm.*, Jan. 1873, p. 17.)

In former editions of the U.S. Pharmacopœia, this preparation, though commonly called *Soap liniment*, received the name of *Tinctura Saponis Camphorata*, to distinguish it from a similar preparation called *Opodeldoc*, which, having a soft semi-solid consistence, was introduced with the title of *Linimentum Saponis Camphoratum.* This, having been discarded in 1860, the Tincture reverted to its place among the liniments, and is now called simply Linimentum Saponis. But, as the old Camphorated Soap Liniment or *Opodeldoc* is an excellent preparation, and still somewhat in use, we give here the process of the Pharmacopœia of 1850 for its preparation, with some remarks on the subject.

"Take of Common Soap, sliced, *three ounces;* Camphor *an ounce;* Oil of Rosemary, Oil of Origanum, each, *a fluidrachm;* Alcohol *a pint.* Digest the Soap with the Alcohol, by means of a sand-bath, till dissolved; then add the Camphor and Oils, and when they are dissolved, pour the liquid into broad-mouthed bottles. This liniment has, when cold, the consistence of a soft ointment."

This preparation differs from the officinal Linimentum Saponis chiefly in being prepared with common white soap, made with animal fat, instead of Castile soap, which is made of olive oil. The former is peculiarly adapted to the purposes of this formula, in consequence of assuming, when its alcoholic solution cools, the consistence

formula adopted by the reviewers of the Pharmacopœia differs from the original one of Dr. Rumsey. This Mr. Smith states to be as follows: "Take of White Curd Soap (made from Russian tallow) two ounces; Iodide of Potassium one ounce and a half; Glycerin one ounce; Distilled Water ten ounces; Essential Oil of Lemons one drachm. Reduce the Soap into fine shreds, and melt in a water-bath, with the whole of the Water and the Glycerin; when the Soap is perfectly dissolved pour it into a No. 9 Wedgwood mortar in which the iodide of potassium has been previously reduced to fine powder; mix briskly, and continue the trituration until the mortar has become cool and the liniment assumes the character of ice cream. Set aside for an hour, after which gently rub in the Oil of Lemons." (*Note to the fourteenth edition.*)

* The formula of Mr. Moore may be found in the last edition of the U. S. Dispensatory, or in the *Amer. Journ. of Pharm.*, March, 1869, p. 121. (*Note to the fourteenth edition.*)

† A formula for making almond oil soap on the small scale may be found in the *Pharm. Journ. and Trans.*, 2d ser., xi. 417. (*Note to the fourteenth edition.*)

characteristic of the liniment. It is customary, after the solution of the soap has been effected, to pour the liquid into small wide-mouthed glass bottles, containing about four fluidounces, in which it concretes into a soft, translucent, uniform, yellowish-white mass. This liniment melts with the heat of the body, and therefore becomes liquid when rubbed on the skin.

The Soap liniment is much used, as an anodyne and gently rubefacient embrocation, in sprains, bruises, and rheumatic or gouty pains.

Off. Prep. Linimentum Opii, *Br.* W.

LINIMENTUM SINAPIS COMPOSITUM. *Br. Compound Liniment of Mustard.*

"Take of Oil of Mustard *one fluidrachm;* Ethereal Extract of Mezereon *forty grains;* Camphor *one hundred and twenty grains;* Castor Oil *five fluidrachms;* Rectified Spirit *four fluidounces.* Dissolve the Extract of Mezereon and Camphor in the Spirit, and add the Oil of Mustard and Castor Oil." *Br.*

This is a new officinal of the British Pharmacopœia, which affords a convenient method of applying the volatile oil of mustard, and may often be appropriately used as a substitute for sinapisms. The extract of mezereon is also a very energetic irritant. The castor oil seems to be added in order somewhat to increase the consistence of the liniment, and was probably chosen from among oleaginous substances in consequence of its solubility in alcohol. The camphor may have some effect in moderating the pain without diminishing the rubefacient action. The effect is increased if the liniment be applied on flannel, and volatilization guarded against by covering it with oiled silk. For the circumstances calling for the use of this liniment, see the article on Sinapis (*Part* I., page 843). W.

LINIMENTUM TEREBINTHINÆ. *U. S., Br. Liniment of Turpentine.*

"Take of Resin Cerate *twelve troyounces;* Oil of Turpentine *half a pint.* Add the Oil to the Cerate previously melted, and mix them." *U. S.*

"Take of Soft Soap *two ounces* [avoirdupois]; Camphor *one ounce* [avoird.]; Oil of Turpentine *sixteen fluidounces.* Dissolve the Camphor in the Oil of Turpentine, then add the Soap, rubbing them together until they are thoroughly mixed." *Br.*

The U. S. preparation is the liniment originally proposed by Dr. Kentish, and subsequently so highly lauded as a remedy in burns and scalds. It should be applied as soon after the occurrence of the accident as possible, and should be discontinued when the peculiar inflammation excited by the fire is removed. The best mode of application is to cover the burnt or scalded surface with pledgets of patent lint saturated with the liniment. It should not be allowed to come in contact with the sound parts. This liniment may also be successfully applied in other cases of cutaneous inflammation requiring stimulation, as in certain conditions of erysipelas. The present British preparation, so far as regards its rubefacient operation, may be looked upon as almost undiluted oil of turpentine; the soft soap having little other effect than to give consistence to the liniment, and the camphor acting as an anodyne; and both being too small in bulk materially to dilute the oil. It is quite different from the liniment of the Pharmacopœia of 1864, which was a mixture of the oil with resin ointment, almost identical with the U.S. liniment. W.

LINIMENTUM TEREBINTHINÆ ACETICUM. *Br. Liniment of Turpentine and Acetic Acid.*

"Take of Oil of Turpentine, Acetic Acid, Liniment of Camphor, of each, *one fluidounce.* Mix." *Br.*

This is a powerful rubefacient liniment, combining the irritant properties of the oil of turpentine and acetic acid, though somewhat diluted by the camphor liniment. W.

LIQUORES.

Solutions.

The U. S. Pharmacopœia includes, in this class of preparations, all *aqueous* solutions in which the substance acted on is wholly soluble in water, excluding those in

which the dissolved matter is gaseous or very volatile, as in the Aquæ or Waters. The *Solution of Gutta-percha* is the only one in which water is not used as the menstruum; and that seems to have been placed in the present category because no better position could be found for it.

In the British Pharmacopœia it has been deemed expedient, in almost all instances in which the substance to be dissolved is an isolated solid body, to make the solutions of uniform strength, without regard to the physiological powers of the medicine, or its ordinary dose. The solutions of this kind contain four grains of the medicine to an Imperial fluidounce of the menstruum, or half a grain in a fluidrachm. There is a convenience in this plan to the prescriber, in relation to all medicines which habitually present themselves to his mind in the solid state; but to alter the strength of a solution which has been long known, and the dose of which is familiar, in order to make it conform with others, is to endanger frequent serious errors for the sake of an idea. In such medicines, for example, as Fowler's solution, the dose is fixed in the mind of the practitioner in reference to the solution, and not to the solid medicinal substance it may contain. On the whole, therefore, we prefer the method of the U. S. Pharmacopœia, which regulates the strength of its solutions in regard to the properties of the medicine, and not in accordance with an ideal standard. W.

LIQUOR AMMONII ACETATIS. *U. S.* Liquor Ammoniæ Acetatis. *Br.* Spiritus Mindereri. *Solution of Acetate of Ammonium. Spirit of Mindererus.*

"Take of Diluted Acetic Acid *two pints;* Carbonate of Ammonium *a sufficient quantity.* Add the Carbonate gradually to the Acid until this is saturated, and filter. This preparation, when dispensed, should be freshly made.

"Solution of Acetate of Ammonium may also be prepared by mixing together the following solutions. Take of Carbonate of Ammonium *six hundred and forty grains;* Distilled Water *a sufficient quantity.* Dissolve the Carbonate of Ammonium in *twelve fluidounces* of Distilled Water, and filter through paper, adding *a sufficient quantity* of Distilled Water, through the filter, to make the solution measure a pint. Take of Acetic Acid *four fluidounces;* Distilled Water *twelve fluidounces.* Mix them. These solutions must be kept in well-stopped bottles, and mixed in equal quantities when dispensed." *U. S.*

"Take of Acetic Acid *ten fluidounces* [Imperial measure]; Carbonate of Ammonia *three ounces and a quarter* [avoirdupois], or *a sufficiency;* Distilled Water *two and a half pints* [Imp. meas.]. Reduce the Carbonate of Ammonia to powder, and add it gradually to the Acetic Acid, until a neutral solution is formed, then add the Water." *Br.*

This preparation is an aqueous solution of acetate of ammonium.† The U. S. process by which it is formed constitutes a case of single elective affinity. The acetic acid combines with the ammonia of the carbonate, forming the acetate of ammonium, and disengaging the carbonic acid with effervescence. Distilled vinegar was formerly used, but has been abandoned for diluted acetic acid, which is much to be preferred; because, besides furnishing a solution of the acetate of uniform strength, a result which cannot be attained by the employment of distilled vinegar, it avoids the production of a brownish solution, which uniformly follows the use of the latter, especially when it has been condensed in a metallic worm. The quantity of carbonate of ammonium, necessary to saturate a given weight of the acid of average strength, cannot be laid down with precision, on account of the variable quality of the salt. The preparation, when made with the diluted acetic acid of the U. S. Pharmacopœia, contains about 6 per cent. of acetate of ammonium. It is more convenient to add the salt to the acid than the acid to the salt; as the point of saturation is thus more easily attained. In ascertaining this point by test-paper, the alkaline reaction will begin, though a portion of free acetic acid may still remain; a little of it being insufficient to overcome the natural alkaline reaction of the salt. (See *page* 21.) A com-

* For curious observations on behaviours of *super-saturated saline solutions* on exposure to the air, see *Chem. News*, 1871, xxiv. 64. (*Note to the fourteenth edition.*)

† For method of making dry acetate of ammonium, see *Amer. Journ. Pharm.*, Jan. 1, 1875, p. 25. (*Note to the fourteenth edition.*)

plication is caused by the presence of free carbonic acid, which may be expelled from the liquid towards the end of the saturation by warming it. Supposing the carbonic acid got rid of, the best rule, perhaps, is to cease adding the carbonate of ammonium, upon the occurrence of the least sign of alkalinity.

The present British process corresponds essentially with ours; but in that of the Br. Pharmacopœia of 1864, the strong solution of ammonia was used instead of the carbonate, and the ammonia combined directly with the acetic acid, without other reaction. The solution was much stronger than that of the U. S. Pharmacopœia, or of the former Pharmacopœias of Great Britain, being made with undiluted ingredients, probably because it keeps better when thus made. To reduce it to the strength of the U. S. preparation, it required to be diluted with about four measures of distilled water. There was an advantage in this process in the use of ammonia instead of its carbonate; as the difficulty of ascertaining the precise point of saturation arising from carbonic acid was avoided; but in this solution, as in the neutral mixture, a great benefit remedially is gained by the presence of that acid, which reconciles the stomach to the medicine, and sometimes even allays vomiting in febrile diseases. With this view of the subject, it is better to use the carbonate of ammonium; and the change has been made in the present Br. Pharmacopœia.

Properties. Solution of acetate of ammonium, when made of pure materials, is a limpid and colourless liquid without smell. Its taste is saline, and resembles that of a mixture of nitre and sugar. When it contains an excess of alkali, its taste is bitterish. It should be freshly prepared at short intervals; as its acid becomes decomposed, and a portion of carbonate of ammonium is generated. As formerly prepared, under the name of *spiritus Mindereri*, it was made from the impure carbonate of ammonium containing animal oil, which modified the preparation by giving rise to a portion of ammoniacal soap. When pure it is not coloured by hydrosulphuric acid, nor precipitated by chloride of barium. Nitrate of silver precipitates crystals of acetate of silver, soluble in water, and especially in nitric acid. An insoluble precipitate with this test is chloride of silver, and shows the presence of muriatic acid. Potassa disengages ammonia; sulphuric acid, acetous vapours. When evaporated to dryness, the residue is wholly dissipated by heat with the smell of ammonia. It is incompatible with acids, the fixed alkalies and their carbonates, lime-water, magnesia, sulphate of magnesium, corrosive sublimate, the sulphates of iron, copper, and zinc, and nitrate of silver. When it contains free carbonic acid, it produces with the acetate or subacetate of lead a precipitate of carbonate of lead, which, being mistaken for the sulphate, has sometimes led to the erroneous conclusion that sulphuric acid was present in the distilled vinegar, when this has been employed. Acetate of ammonium is a salt of difficult crystallization, and very deliquescent. When perfect it probably has an alkaline reaction, like the acetates of potassium and sodium. It may be obtained by sublimation from a mixture of equal parts of dry acetate of potassium or of calcium, and chloride of ammonium. It consists of one eq. of acetic acid 51, and one of ammonia 17 = 68, with seven eqs. of water 63, when crystallized. It may be viewed as acetate of ammonium, containing 6 eqs. of water.

Medical Properties and Uses. Solution of acetate of ammonium is a valuable diaphoretic, much employed in febrile and inflammatory diseases. According to the indications to be answered by its use, it is variously combined with nitre and antimonials, camphor and laudanum. If, instead of promoting its determination to the skin by external warmth, the patient walk about in a cool air, its action will be directed to the kidneys. In large doses, it is said to relieve painful menstruation. It is sometimes used externally as a discutient. Mr. Brande speaks of it as very useful in mumps, applied hot upon a piece of flannel. In the hydrocele of children, it is strongly recommended by Dr. Maushner, applied by means of compresses kept constantly moist. Mixed in the quantity of a fluidounce with seven fluidounces of rose-water, and two fluidrachms of laudanum, it forms a useful collyrium in chronic ophthalmia. The late Dr. A. T. Thomson used it as a lotion with good effect in porrigo affecting the scalp. The dose of the U. S. preparation is from half a fluidounce to a fluidounce and a half, every three or four hours, mixed with water and sweetened with sugar. It proves sometimes very grateful to febrile patients, when prescribed

with an equal measure of carbonic acid water. In the present Br. Pharmacopœia the dose is stated at from two to six fluidrachms. B.

LIQUOR AMMONIÆ CITRATIS. *Br. Solution of Citrate of Ammonia.*

"Take of Citric Acid *three ounces* [avoirdupois]; Strong Solution of Ammonia *two fluidounces and three-quarters* [Imperial measure], or *a sufficiency;* Distilled Water *one pint* [Imp. meas.]. Dissolve the Citric Acid in the Water and add the Solution of Ammonia until the solution is neutral to test paper." *Br.*

This may be used for the same purposes as the preceding in the dose of from two to six fluidrachms. W.

LIQUOR ANTIMONII CHLORIDI. *Br.* LIQUOR ANTIMONII TERCHLORIDI. *Br.* 1864. *Solution of Chloride of Antimony. Solution of Terchloride of Antimony.*

"Take of Black Antimony *one pound* [avoirdupois]; Hydrochloric Acid *four pints* [Imperial measure]. Place the Black Antimony in a porcelain vessel; pour upon it the Hydrochloric Acid, and, constantly stirring, apply to the mixture, beneath a flue with a good draught, a gentle heat, which must be gradually augmented as the evolution of gas begins to slacken, until the liquid boils. Maintain it at this temperature for fifteen minutes; then remove the vessel from the fire, and filter the liquid through calico into another vessel, returning what passes through first, that a perfectly clear solution may be obtained. Boil this down to the bulk of two pints [Imp. meas.], and preserve it in a stoppered bottle." *Br.*

When tersulphuret of antimony is dissolved with the aid of heat in muriatic acid, a double decomposition takes place, resulting in the formation of terchloride of antimony and hydrosulphuric acid (sulphuretted hydrogen), which gives rise to effervescence. As this gas is exceedingly offensive and deleterious, the materials, during the reaction, are directed to be placed under a flue with a good draught. When the reaction is over, the resulting aqueous solution of terchloride, after having been strained, is boiled down to a determinate volume.

Properties. Solution of chloride of antimony is a transparent, pale-yellow, dense liquid, possessing caustic properties. When of a deep-red colour, it is impure from the presence of iron. Its sp. gr., concentrated to the extent directed in the Br. Pharmacopœia, is 1·470. "A little of it dropped into water gives a white precipitate, and the filtered solution lets fall a copious deposit on the addition of nitrate of silver. If the white precipitate formed by water be treated with sulphuretted hydrogen it becomes orange-coloured." (*Br.*) These reactions show that it contains antimony and chlorine. A fluidrachm of it, mixed with four fluidounces of water in which is dissolved a quarter of an ounce (avoirdupois) of tartaric acid, forms a clear solution, from which sulphuretted hydrogen throws down an orange precipitate (tersulphuret of antimony), weighing, when washed and dried at 212°, at least 22 grains. (*Br.*) When it is distilled, water, the excess of muriatic acid, and any tersulphuret of arsenic that may happen to be present, are first expelled, and afterwards the terchloride volatilizes. The pure terchloride may be obtained by changing the receiver, as soon as the distilled product concretes on cooling. Pure terchloride of antimony, called by the earlier chemists *butter of antimony*, is a white, readily fusible solid, of the consistence of butter, deliquescent and powerfully caustic, and volatilizable under an obscure red heat. It was formerly used in medicine as a caustic. It usually acts without causing much pain or inflammation; and, after the separation of the eschar, a clean, healthy ulcer is left.

Solution of terchloride of antimony was a new officinal of the Dublin Pharmacopœia of 1850, and is probably retained in the British not as a therapeutic agent, but simply as a source of the officinal oxide of antimony.

Off. Prep. Antimonii Oxidum, *Br.* B.

LIQUOR ARSENICI CHLORIDI. *U.S.* LIQUOR ARSENICI HYDROCHLORICUS. *Br. Solution of Chloride of Arsenic. Hydrochloric Solution of Arsenic.*

"Take of Arsenious Acid, in small pieces, *sixty-four grains;* Muriatic Acid *two*

fluidrachms; Distilled Water *a sufficient quantity.* Boil the Arsenious Acid with the Muriatic Acid and four fluidounces of Distilled Water, until the Arsenious Acid is entirely dissolved, and, when the solution is cold, add enough Distilled Water to make it measure a pint." *U. S.*

"Take of Arsenious Acid, in powder, *eighty grains;* Hydrochloric Acid *two fluidrachms;* Distilled Water *a sufficiency.* Boil the Arsenious Acid with the Hydrochloric Acid, and four [fluid]ounces of the Water until it is dissolved, then add Distilled Water to make the bulk up to one pint [Imperial measure]."

The solution of chloride arsenic was first recognised by the U. S. Pharmacopœia at the last revision. It is a colourless liquid, of the sp. gr. 1·009, and an acid reaction. With sulphuretted hydrogen it gives a bright-yellow precipitate of sulphuret of arsenic. One fluidounce of it (441·5 grains), boiled for five minutes with twenty grains of bicarbonate of sodium, and then diluted with six fluidounces of distilled water to which a little mucilage of starch has been added, does not give with the *volumetric solution of iodine* a permanent blue colour until 808 grain-measures have been added, corresponding to four grains of arsenious acid in one fluidounce.

The medical properties of this solution are the same as those of Fowler's solution, with which it corresponds in strength, being nearly three times as strong as the former London solution of chloride of arsenic. The dose is from two to eight minims. W.

LIQUOR ARSENICI ET HYDRARGYRI IODIDI. *U. S. Solution of Iodide of Arsenic and Mercury. Solution of Hydriodate of Arsenic and Mercury. Donovan's Solution.*

"Take of Iodide of Arsenic, Red Iodide of Mercury, each, *thirty-five grains;* Distilled Water *half a pint.* Rub the Iodides with half a fluidounce of the Water, and, when they have dissolved, add the remainder of the Water, and filter through paper." *U. S.*

This solution was introduced to the notice of the medical profession in 1839, by Mr. Donovan, of Dublin, as a therapeutic agent combining the medical virtues of its three ingredients, and was adopted as an officinal preparation in the U. S. and Dublin Pharmacopœias of 1850. The former has retained it; but on the absorption of the latter in the British Pharmacopœia it was discarded. The formula of the U. S. Pharmacopœia is the simplified one of Prof. Procter, which consists essentially in dissolving equal weights of the teriodide of arsenic and biniodide (red iodide) of mercury in a measured quantity of distilled water. The proportion of equal weights corresponds nearly to single equivalents of the component iodides. The Dublin formula was more complicated. In it the proper quantities of arsenic, mercury, and iodine were caused to unite by first rubbing them together with alcohol, and then boiling the product with distilled water, which was afterwards added, so as to give the whole a determinate bulk. The iodides of arsenic and mercury, formed by the trituration, were assumed by Mr. Donovan to become, by solution, hydriodates severally of arsenious acid (white oxide of arsenic), and of deutoxide of mercury (red precipitate).

Properties. This solution has a pale-yellow colour, and a slightly styptic taste. Sometimes, however, the colour is orange-yellow, owing to the presence of free iodine. This may be neutralized by rubbing the solution with a little metallic mercury or arsenic, in fine powder, and the proper hue thus restored. The solution is incompatible with laudanum and the soluble salts of morphia. On the supposition that it is an aqueous solution of iodides, it will contain them in the proportion of one eq. of teriodide of arsenic 453·9 to one of biniodide of mercury 452·6, which are nearly equal weights. On the theory of their conversion into hydriodates by solution, five eqs. of water 45 would be required, three for the arsenical teriodide, and two for the mercurial biniodide; and the result would be one eq. of arsenious acid 99, one of deutoxide of mercury 216, and five of hydriodic acid 636·5, the latter containing five eqs. of iodine 631·5. The solution here supposed would contain about two and one-sixth times as much deutoxide of mercury as of arsenious acid.

Medical Properties. This preparation has been found decidedly useful as an alterative in various diseases of the skin, such as the different forms of psoriasis, impetigo, porrigo, lepra, pityriasis, lupus, and venereal eruptions, both papular and scaly. In

support of its efficacy in these affections, Mr. Donovan has adduced the testimony of a number of respectable practitioners, who have communicated to him the results of their experience. The disease in some of the cases cured had existed for several years. Many American physicians also have used it advantageously in cutaneous diseases, and found more prompt effects from it than from the remedies usually resorted to. The dose is from five to twenty drops three times a day, given preferably in distilled water. The latter dose contains the twenty-fourth of a grain of arsenious acid, a little over the twelfth of a grain of deutoxide of mercury, and about a quarter of a grain of iodine. Dr. E. I. Taylor, of New York, who has employed it in many cases, never exceeded five drops, three times a day. Sometimes the medicine deranges the stomach, confines the bowels, and causes headache, giddiness, and confusion of mind. When these effects are produced, it must be laid aside, and a purgative administered. After an interval varying from ten days to three weeks, it may be resumed, but in a smaller dose. The treatment must often be persevered in for several months. Sometimes the medicine produces moderate salivation. The solution, diluted with an equal bulk of water, has occasionally been used with advantage as an application to the ulcers or eruptions, at the same time that it was given internally. (See three papers by Mr. Donovan, contained in the *Dublin Journal of Medical Science* for Nov. 1839, Sept. 1840, and Nov. 1842.) B.

LIQUOR ATROPIÆ. *Br.* *Solution of Atropia.*

"Take of Atropia *four grains;* Rectified Spirit *one fluidrachm;* Distilled Water *seven fluidrachms.* Dissolve the Atropia in the Spirit, and add this gradually to the Water, shaking them together." *Br.*

For the effects of this solution, see *Atropia.* If given internally the dose to begin with should be extended four minims. But, as we have in the extract of belladonna a preparation which may generally be depended on for obtaining the effects of the medicine, it seems hardly advisable to make use internally of so powerful and dangerous a preparation. It may be applied to the eye for diluting the pupil, or injected into the subcutaneous tissue for obtaining the effects of belladonna on the system. W.

LIQUOR ATROPIÆ SULPHATIS. *Br.* *Solution of Sulphate of Atropia.*

"Take of Sulphate of Atropia *four grains;* Distilled Water *one fluidounce* [Imperial measure]. Dissolve." *Br.*

This is a convenient form for administering atropia. The solution is of the same strength, and is used for the same purposes as the preceding. W.

LIQUOR BARII CHLORIDI. *U. S.* *Solution of Chloride of Barium. Solution of Muriate of Baryta.*

"Take of Chloride of Barium *a troyounce;* Distilled Water *three fluidounces.* Dissolve the Chloride in the Distilled Water, and filter through paper." *U. S.*

This has been omitted from the list of preparations in the British Pharmacopœia, but is contained in the Appendix as a test solution; having the strength of one ounce to ten fluidounces.

Chloride of barium, not being used in the solid state, is here dissolved for convenience in prescribing. The solution is nearly saturated, and is probably too strong for convenient use. It should be limpid and colourless; and in making it, the salt in crystals, and not in powder, should be employed.

Medical Properties and Uses. This solution is deobstruent and anthelmintic, and in large doses poisonous; its action, according to some, being analogous to that of arsenic. It was introduced into practice by Dr. Crawford as a remedy for cancer and scrofula. Its value in the latter disease has been insisted on by Hufeland. This physician considers it to act more particularly on the lymphatic system, in the irritated states of which he esteems it a valuable remedy. Hence he recommends it in the scrofulous affections of delicate and irritable organs, such as the eyes, lungs, &c. In the commencement of scrofulous phthisis, he views it as one of the best remedies to which we can have recourse. It is also employed in diseases of the skin, in ulcers, and ophthalmia. The dose for an adult is about five drops, given twice or thrice a day, and gradually but cautiously increased, until it produces nausea, or some other

sensible impression. When taken in an overdose it causes violent vomiting and purging, vertigo, and other dangerous symptoms. To combat its poisonous effects, recourse must be had immediately to a weak solution of sulphate of magnesium, which acts by converting the poison into the insoluble sulphate of barium. If vomiting does not come on, it should be induced by tickling the fauces, or by the administration of an emetic. A case of poisoning by three drachms of the solid salt, taken by mistake for sulphate of magnesium, was successfully treated with dilute sulphuric acid and castor oil, by Dr. C. Wolf, a German physician. The chief symptoms were tormina and vomiting, weak and irregular pulse, cold extremities, weak voice, want of muscular power in the hands and feet, and paralysis of the left eyelid. B.

LIQUOR BISMUTHI ET AMMONIÆ CITRATIS. *Br. Solution of Citrate of Bismuth and Ammonia.*

"Take of Purified Bismuth *four hundred and thirty grains;* Nitric Acid *two fluidounces* [Imperial measure]; Citric Acid *two ounces* [avoirdupois]; Solution of Ammonia, Distilled Water, of each, *a sufficiency.* Mix the Nitric Acid with a [fluid] ounce of Distilled Water, and add the Bismuth in successive portions. When effervescence has ceased apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluidounces; then add the Citric Acid previously dissolved in four [fluid]ounces of Distilled Water, and afterwards the Solution of Ammonia in small quantities at a time until the precipitate formed is redissolved, and the solution is neutral or slightly alkaline to test paper. Dilute with Distilled Water to the volume of one pint [Imp. meas.]." *Br.*

This is not the formula that we would recommend for the preparation of the "*Solution of Citrate of Bismuth and Ammonia*," placed at the head of this article. Indeed, the product of the formula is not the substance it purports to be; but probably nitrate of bismuth held in solution by means of citrate of ammonium. The first step is to make a very concentrated solution of nitrate of bismuth, to which is then added a solution of citric acid, containing water enough to cause a partial precipitate of subnitrate of bismuth, which is dissolved again by the addition of ammonia. This neutralizes the citric acid, and the resulting citrate of ammonium holds the reformed nitrate of bismuth in solution; or the two acids may divide the two bases between them, forming a mixture of nitrate and citrate of ammonium and bismuth. At all events, the nitric acid is retained in the preparation; and, as all its salts are much more irritating than the corresponding salts of citric acid, we have a preparation likely to irritate the stomach, instead of the mild insoluble salts of bismuth which it is intended to represent, or the mild citrate of bismuth and ammonia which it purports to be. In all other processes we have seen, pains are taken to get rid of the nitric acid.

Though the insolubility of the officinal preparations of bismuth is probably one of the causes of their efficiency in certain diseases of the alimentary mucous membrane, enabling them by deposition on the surface to protect it against irritation from the contents of the stomach and bowels, yet a soluble form of the metal has been sought for, in the hope that it might, in this condition, operate on the *system* in smaller doses, and with greater certainty and efficiency. This want was to some extent supplied by a secret preparation, made and sold by Mr. Schacht, of Clifton, England, which, under the name of *Liquor Bismuthi*, had been used to a considerable extent in Great Britain. Mr. Ch. R. C. Tichborne, having analyzed the liquid, and found it to contain oxide of bismuth, ammonia, and citric acid, announced the discovery at a meeting of the Pharmaceutical Society, when Mr. Schacht, being present, acknowledged the correctness of the analysis, stating, at the same time, that he had never made a secret of the composition of his solution to medical practitioners, and that a fluidrachm of his liquid contained one grain of the teroxide. (*Pharm. Journ.*, Jan. 1864, p. 301.) A formula for the preparation was given by Mr. Tichborne, which, however, on repeated trial by Mr. N. Gray Bartlett, of Chicago, proved to be impracticable. After numerous experiments, Mr. Bartlett succeeded in making a solution which had all the desired qualities, and a formula for which he published in the *American Journal of Pharmacy* for January, 1865. He first prepares a *citrate of*

bismuth by dissolving a *troyounce* of the subcarbonate of bismuth in 720 *grains* of nitric acid, diluting the solution after effervescence has ceased with *a fluidounce and a half* of distilled water gradually introduced, and then adding this solution, slowly and with constant stirring, to another solution made by dissolving 600 *grains* of citrate of potassium in *two pints* of distilled water. By an interchange of principles, nitrate of potassium and citrate of bismuth are formed, the latter of which, being insoluble, is precipitated, and is obtained by throwing the whole upon a filter, thoroughly washing the salt with distilled water, and then drying it on bibulous paper with a gentle heat. The next step is to prepare the *citrate of bismuth and ammonium.* This is done by rubbing the citrate of bismuth with sufficient distilled water to make a paste, and adding to this gradually, and with constant trituration, stronger water of ammonia until the citrate is dissolved, care being taken to avoid an excess of ammonia. The solution is now filtered, and spread on glass to dry.

Various modifications of Mr. Bartlett's process have been suggested, though it may be doubted whether any one, on the whole, is preferable to the original. Besides processes offered by Mr. T. P. Blunt and Mr. Tichborne, in England, two pharmaceutists of this country, Mr. A. E. Ebert, of Chicago, and Mr. Geo. F. H. Markoe, of Boston, have each proposed a modification of Mr. Bartlett's process, the former in a communication to the *Am. Journ. of Pharm.* (Jan. 1866, p. 1); the latter in a paper published in the *Proceedings of the Am. Pharm. Association* for 1868, copied in the *Am. Journ. of Pharm.* (March, 1869, p. 151), to which the reader is referred for details. In Mr. Ebert's formula the solution of nitrate of bismuth is decomposed by caustic potassa in the presence of citric acid, instead of the citrate of potassium already formed; in Mr. Markoe's, crystallized carbonate of sodium is substituted for the caustic alkali, to which various objections exist. After precipitating the solution of nitrate of bismuth to which citric acid has been added, with carbonate of sodium, washing the precipitate to get rid of the nitrate of sodium, and dissolving the residue of the precipitate in water of ammonia, Mr. Markoe completes the process by determining the proportion of teroxide of bismuth contained in the solution, and then diluting the liquid so that each fluidrachm shall contain one grain of teroxide. It is obvious that this process requires for its proper execution the practised pharmaceutist.*

Citrate of bismuth and ammonium, obtained by Mr. Bartlett's process, is in fine, glossy, translucent, colourless scales, of a slightly acidulous, somewhat metallic, not disagreeable taste, very soluble in water, but not deliquescent, and of an acid reaction. From an analysis by Mr. Bartlett, it appears to consist of one eq. of teroxide of bismuth 237, one of ammonia 26, and one of citric acid 165, with 5 eqs. of water $45 = 473$; and its formula is $BiO_3NH_4O,C_{12}H_5O_{11} + 5HO$.

There is no occasion for a permanent solution of this salt, as it may at any time be dissolved when wanted for use. But, as it is in the liquid form that it has obtained its present reputation, we give a formula for a permanent solution prepared by Mr. Bartlett. Dissolve 260 *grains* of citrate of bismuth and ammonium in *fourteen fluidounces* of distilled water, neutralize the solution with water of ammonia, and add *two fluidounces* of alcohol. The solution of the salt without addition is liable to spontaneous decomposition; but, in the opinion of Mr. Bartlett, it is completely pro-

* Mr. C. H. Wood proposes the following formula as exceedingly simple and satisfactory. Its result has the same strength as the officinal liquor. Take of Oxide of Bismuth nine ounces; Citric Acid sixteen ounces; Strong Solution of Ammonia twelve fluidounces or q. s. Dissolve eight ounces of citric acid in four ounces of hot water, and carefully neutralize it with some of the solution of ammonia (about seven fluidounces), mixed with half its volume of water. Then add the other eight ounces of citric acid, and when it has dissolved introduce the oxide of bismuth. Heat the mixture to near its boiling point for fifteen minutes with frequent stirring, then add about a pint of water, and introduce sufficient ammonia to dissolve the insoluble portion and render the liquid slightly alkaline. Augment the solution to the volume of one gallon, and filter through paper. Mr. C. Meher (*Amer. Journ. of Pharm.*, Dec. 1873, p. 541) states that in this process an excess of citric acid is employed, and offers the following substitute. Dissolve pure bismuth in three times its weight of nitric acid; set aside to crystallize; evaporate the mother liquid until all acid is driven off; unite the crystals and pour upon them a hot concentrated solution of citric acid, in such amount that there shall be one equivalent of citric acid for each of bismuth (about equal weights); to half of this solution add ammonia in sufficient quantity to redissolve the precipitate first formed and then add the other half; wash the white precipitate of citrate of bismuth until the water no longer becomes acid. This citrate dissolves readily in ammonia. (*Note to the fourteenth edition.*)

tected by the ammonia and alcohol, so that in this state it will keep indefinitely. The uses of this preparation are essentially the same as those of the insoluble salts, except in so far as the latter are connected with the condition of insolubility. (See *Bismuthi Subnitras.*) The dose of the solid citrate is two grains, that of the solution a fluidrachm. For further particulars in regard to the preparation of the salt and its solution, the reader is referred to Mr. Bartlett's paper in the *Am. Journ. of Pharm.* (Jan. 1865) already noticed. W.

LIQUOR CALCII CHLORIDI. *U.S.* *Solution of Chloride of Calcium.* *Solution of Muriate of Lime.*

"Take of Marble, in small pieces, *six troyounces;* Muriatic Acid *twelve troyounces;* Distilled Water *a sufficient quantity.* Mix the Acid with half a pint of Distilled Water, and gradually add the Marble. Towards the close of the effervescence apply a gentle heat, and, when the action has ceased, pour off the clear liquid and evaporate to dryness. Dissolve the residue in one and a half times its weight of Distilled Water, and filter through paper." *U.S.*

This is not included among the preparations of the British Pharmacopœia, but is placed in the Appendix as a test solution, of the strength of one ounce to ten fluidounces.

By the above process chloride of calcium is first formed, and then dissolved in a certain proportion of water. The solution contains 1 part of the chloride in about 2·5 parts.

The solution of chloride of calcium has a disagreeable, bitter, acrid taste. It is decomposed by sulphuric acid and the soluble sulphates; by potassa, soda, and their carbonates; by carbonate of ammonium, tartrate of potassium and sodium, nitrate of silver, nitrate and acetate of mercury, and acetate of lead. The mode of preparing chloride of calcium, and its chemical properties, are detailed under the head of *Calcii Chloridum* in the first part of this work.

Medical Properties and Uses. Chloride of calcium is considered tonic and deobstruent, and is said to promote the secretion of urine, perspiration, and mucus. It was first brought into notice as a remedy by Fourcroy, and was at one time much used in scrofulous diseases and goitre. It still continues in favour with some physicians, but is less employed than formerly. It has been especially recommended in tabes mesenterica. Cazenave has employed it advantageously in chronic eczema and impetigo, connected with a lymphatic temperament. When too largely taken, it sometimes occasions nausea, vomiting, and purging, and in excessive doses may even produce fatal effects; but it is a much safer remedy than chloride of barium, which has been recommended in the same complaints. The dose of the solution is from thirty minims or drops to a fluidrachm, to be repeated twice or three times a day, and gradually increased to two, three, or even four fluidrachms. It may be given in milk or sweetened water.

Off. Prep. Calcii Carbonas Præcipitata, *U.S.* W.

LIQUOR CALCIS. *U.S., Br.* *Solution of Lime.* *Lime-water.*

"Take of Lime *four troyounces;* Distilled Water *eight pints.* Upon the Lime, first slaked with a little of the Distilled Water, pour the remainder, and stir them together. Then immediately cover the vessel, and set it aside for three hours. Keep the solution, together with the undissolved Lime, in a well-stopped bottle, and pour off the clear liquor when wanted for use. Water free from saline or other obvious impurity, though not distilled, may be employed in this process." *U.S.*

"Take of Slaked Lime *two ounces* [avoirdupois]; Distilled Water *one gallon* [Imperial measure]. Put the Lime into a stoppered bottle containing the Water; and shake well for two or three minutes. After twelve hours the excess of lime will have subsided, and the clear solution may be drawn off with a siphon as it is required for use, or transferred to a green-glass bottle furnished with a well-ground stopper." *Br.*

A solution of lime in water is the result of these processes. By the slaking of the lime it is reduced to powder, and rendered more easily diffusible through the water. According to both Pharmacopœias, the solution is to be kept in bottles with a portion of undissolved lime, which causes it always to be saturated whatever may be the

temperature, and to whatever extent it may be exposed to the air. If care be taken to have a considerable quantity of the solution in the bottle, and to avoid unnecessary agitation, the upper portion will always remain sufficiently clear for use. The employment of distilled water as the solvent may seem a useless refinement; and it certainly is unnecessary when pure spring or river water is attainable; but in many places the common water is very impure, and wholly unfit for a preparation, one of the most frequent uses of which is to allay irritation of stomach. Water dissolves but a minute proportion of lime, and, contrary to the general law, less when hot than cold. Hence the propriety of employing cold water in the process. According to Mr. Phillips, a pint of water (the wine pint of the U. S. Pharm.) at 212° dissolves 5·6 grains of lime, at 60°, 9·7 grains, and at 32°, 11·0 grains. When the officinal solution is heated, a deposition of lime takes place, but is redissolved on cooling.

Properties. Lime-water is colourless, inodorous, and of a disagreeable alkaline taste, changes vegetable blues to green, and forms an imperfect soap with oils. Exposed to the air it attracts carbonic acid, and becomes covered with a pellicle of insoluble carbonate of calcium, which, subsiding after a time, is replaced by another, and so on successively till the whole of the lime is exhausted. Hence the necessity of keeping lime-water, either in closely corked bottles which should be full, or, what is more convenient, in bottles with an excess of lime. "Ten fluidounces of it require for neutralisation at least 200 grain-measures of the *volumetric solution of oxalic acid*, which corresponds to 5·6 grains of lime, CaO." *Br.*

Medical Properties and Uses. Lime-water is antacid, tonic, and astringent, and is very usefully employed in dyspepsia with acidity of stomach, diarrhœa, diabetes, and gravel attended with superabundant secretion of uric acid. Mixed with an equal measure of milk, which completely covers its offensive taste, it is one of the best remedies in our possession for nausea and vomiting dependent on irritability of stomach. We have found a diet exclusively of lime-water and milk to be more effectual than almost any other plan of treatment in dyspepsia accompanied with vomiting of food. In this case one part of the solution to two or three parts of milk is usually sufficient. Lime-water is also thought to be useful by dissolving the intestinal mucus in cases of worms, and in other complaints connected with an excess of this secretion. Externally it is employed as a wash in tinea capitis and scabies, as an application to foul and gangrenous ulcers, as an injection in leucorrhœa and ulceration of the bladder or urethra, and, mixed with linseed or olive oil, as a liniment in burns and scalds. Having been found to possess the property of dissolving false-membrane, it was naturally employed as a local remedy in pseudomembranous croup. Dr. B. W. Wilson, of Philadelphia, reported, in the *Medical and Surgical Reporter* (Aug. 27, 1867, p. 355), several cases in which the remedy was used successfully; and other instances have been since recorded of cures of undoubted cases of the disease. There are two methods of applying the remedy; one by directing lime-water spray, produced by the atomizer, so that it shall be inhaled by the patient; the other, which is recommended by Dr. Wilson, by causing the patient to inhale freely the vapours arising from lime undergoing the process of slaking with water. The dose is from two to four fluidounces several times a day. When employed to allay nausea, it is usually given in the dose of a tablespoonful mixed with the same quantity of new milk, and repeated at intervals of half an hour, an hour, or two hours. If too long continued it debilitates the stomach.

Pharm. Uses. In preparing Argenti Oxidum, *Br.;* Lotio Hydrargyri Flava, *Br.;* Lotio Hydrargyri Nigra, *Br.*

Off. Prep. Linimentum Calcis. W.

LIQUOR CALCIS CHLORATÆ. *Br. Solution of Chlorinated Lime.*

"Take of Chlorinated Lime *one pound* [avoirdupois]; Distilled Water *one gallon* [Imperial measure]. Mix well the Water and the Chlorinated Lime by trituration in a large mortar, and, having transferred the mixture to a stoppered bottle, let it be well shaken several times for the space of three hours. Pour out now the contents of the bottle on a calico filter, and let the solution which passes through be preserved in a stoppered bottle. The sp. gr. of this liquid is 1·035." *Br.*

For the properties and uses of this preparation, see *Calx Chlorinata*. The British Pharmacopœia gives the following test of its strength. "Sixty grains mixed with twenty grains of iodide of potassium dissolved in four fluidounces of water, when acidulated with two fluidrachms of hydrochloric acid, gives a red solution, which requires for the discharge of its colour 500 grain-measures of the *volumetric solution of hyposulphite of soda*, corresponding to 13 grains of available chlorine in a fluidounce." This determines its strength in chlorine, by determining the quantity of iodine which the chlorine contained in it is capable of separating from iodide of potassium. Notwithstanding, however, that a test of its character is thus given by the Pharmacopœia, its strength must vary according to the quality of the chlorinated lime employed. It is one of the best antidotes for hydrosulphuric acid, hydrosulphate of ammonium, sulphuret of potassium, and hydrocyanic acid. The dose for internal use is from twenty minims to a fluidrachm. For external application the solution may be diluted with twice its bulk of water, or may be used of the full strength in some cutaneous affections. W.

LIQUOR CALCIS SACCHARATUS. *Br.* *Saccharated Solution of Lime.*

"Take of Slaked Lime *one ounce* [avoirdupois]; Refined Sugar, in powder, *two ounces* [avoird.]; Distilled Water *one pint* [Imperial measure]. Mix the Lime and the Sugar by trituration in a mortar. Transfer the mixture to a bottle containing the Water, and, having closed this with a cork, shake it occasionally for a few hours. Finally separate the clear solution with a siphon, and keep it in a stoppered bottle. The sp. gr. is 1·052. One fluidounce (460·2) requires for neutralisation 254 grain-measures of the *volumetric solution of oxalic acid*, which corresponds to 7·11 grains of lime in one fluidounce." *Br.*

Sugar forms with lime certain definite compounds which may be looked upon as saccharates. According to M. S. Benedikt (*Journ. de Pharm.*, 4e sér., xix. 96) there are at least four of these combinations. Some, if not all, of them are much more soluble than the lime itself, so that in this way a much stronger solution of lime can be obtained than by the instrumentality of water alone. Saccharated solution of lime may be used in diarrhœa with acidity, in vomiting, in affections of the urinary organs requiring antacid treatment, and for all other therapeutical purposes to which lime is applied. The dose equivalent to a fluidounce of lime-water is about a fluidrachm.* W.

* *Syrup of Lime.* "*Saccharate of Lime.*" Under the latter name a preparation has been introduced into notice, made by saturating pure syrup with lime, and filtering. The sugar forms a soluble compound with the lime, large quantities of which are dissolved by the syrup. The syrup remains perfectly transparent, and is in no degree disturbed by dilution with water. It has a decidedly alkaline and even caustic taste, and should always be largely diluted when administered. It was first prepared by M. Beral; and its practical use was originally suggested by Dr. Capitaine, of Paris. Trousseau has employed it in the chronic diarrhœa of infants, and recommends it as an addition, in very small proportion, to the milk employed as a diet for children liable to this complaint. For this purpose he adds about eight grains of the syrup to the quart of milk. He gives the saturated syrup of lime to a child in the quantity of fifteen or thirty grains in the course of the day; to an adult, in five times the quantity. (*Trait de Thérap.*)—*Note to the tenth edition.*

Dr. E. R. Squibb gives the following formula for the preparation of *Syrup of Lime*. Take of good, clean, well-burned lime 400 grains; dry, granulated white sugar 2300 grains. Triturate well together in a mortar, and then add the powder to f℥viij of boiling water contained in a proper vessel (well-tinned iron or bright copper answers) and boil the mixture with constant stirring for five minutes. Then dilute to two parts with cold water, and filter through white paper. Finally evaporate to whatever consistence may be desired. If reduced to a pint, each fluidounce will contain 24 grains of caustic lime; and the syrup will be about as dense as can be conveniently dispensed. If desired, the evaporation may be carried to dryness, care being observed to avoid burning by constant stirring, till a little taken from the melted mass will crumble between the fingers on cooling. The contents of the vessel may then be allowed to cool, and when dry and solid should be rubbed into fine powder, which will contain from 8 to 10 per cent. of lime.

Dr. Charles E. Buckingham, of Boston, says, in relation to this syrup, that it should not be taken either in pill or dissolved in water, as it will occasion nausea or produce a caustic effect. He gives it in milk, and considers thirty drops every three hours as a sufficient dose. He has never known it to cause alkaline urine. (*Boston Med. and Surg. Journ.*, April 4, 1867, p. 186.) Dr. Buckingham has used the syrup of lime with great success in acute rheumatism; twelve cases having been treated with this remedy exclusively, with an average duration of ten days. (*Ibid.*, April 11, 1867, p. 105.) Others have tried the remedy with a similar experience. (*Note to the thirteenth edition.*)

Liquid Glue. It is stated that a glue which remains liquid at ordinary temperatures and is very

LIQUOR FERRI CHLORIDI. *U.S.* Liquor Ferri Perchloridi Fortior. *Br. Solution of Chloride of Iron. Strong Solution of Perchloride of Iron.*

"Take of Iron, in the form of wire, and cut in small pieces, *three troyounces;* Muriatic Acid *seventeen troyounces and a half;* Nitric Acid, Distilled Water, each *a sufficient quantity.* Put the Iron into a flask measuring two pints, pour upon it eleven troyounces of the Muriatic Acid, and let the mixture stand until effervescence ceases; then heat to the boiling point, decant the liquid, filter through paper, and, having rinsed the flask with a little Distilled Water, boiling hot, pour the washings upon the filter. Put the filtered liquid into a porcelain capsule measuring four pints, mix with the residuary Muriatic Acid, and, having heated the mixture nearly to the boiling point, add a troyounce and a half of Nitric Acid. Upon the cessation of effervescence, drop in Nitric Acid until it no longer occasions effervescence; and, when the liquid becomes cool, add enough Distilled Water to make it measure a pint." *U.S.*

"Take of Iron Wire *two ounces* [avoirdupois]; Hydrochloric Acid *twelve fluidounces;* Nitric Acid *nine fluidrachms;* Distilled Water *eight fluidounces.* Mix eight fluidounces of the Hydrochloric Acid with the Distilled Water, and in this dissolve the Iron at a gentle heat. Filter the solution, add to it the remainder of the Hydrochloric Acid and the Nitric Acid, heat the mixture briskly until, on the sudden evolution of red fumes, the liquid becomes of an orange-brown colour, then evaporate by the heat of a water-bath until it is reduced to ten fluidounces." *Br.*

By the reaction between the muriatic acid and iron a chloride of that metal is produced, which by the subsequent agency of the muriatic and nitric acids is converted into the sesquichloride, or, as denominated in the Br. Pharmacopœia, the perchloride, which is held in solution by the water.

This preparation was included in the original British Pharmacopœia, but was not officinal with us before the last revision. The original British formula (1864) was defective in several respects. For an account of these the reader is referred to the last edition of the Dispensatory.

The solution of perchloride of iron, properly made, is of a reddish-brown colour and a strongly astringent, chalybeate taste. Water and alcohol unite with it in all proportions. When diluted with water, it gives a white precipitate with nitrate of silver, and and a blue one with the ferrocyanide of potassium;* but not with the ferridcyanide. The British preparation is a very little stronger than the U.S. officinal, the sp. gr. of the former being 1·338, of the latter, 1·355. A fluidrachm of the British liquor diluted with two fluidounces of water gives, upon the addition of an excess of solution of ammonia, a reddish-brown precipitate, which, when well washed and incinerated, weighs 15·62 grains; the same amount of the U.S. preparation similarly treated yields 14·625 grains. When this test is answered, the solution is about four times as strong in iron as the U.S. Tincture of the Chloride.†

From the experiments of M. Adrian it appears that sugar has the property, when

adhesive, may be prepared by dissolving glue in a solution of saccharate of lime. (*Amer. Journ. of Pharm.*, 1872, p. 562.)—*Note to the fourteenth edition.*

* The U. S. Pharmacopœia states that it gives no precipitate with ferrocyanide of potassium; this is evidently a misprint for ferridcyanide. (*Note to the fourteenth edition.*)

† This solution, when kept, has a disposition to deposit the insoluble oxychloride of iron, and the resulting excess of muriatic acid is apt to render it injuriously irritating. To obviate this disadvantage, M. Burin du Buisson recommends the following mode of preparation. "Saturate as quickly as possible pure and colourless muriatic acid with [gelatinous] hydrated peroxide of iron; evaporate the solution to somewhat less than one-half over a gentle fire; and then continue the evaporation by means of the salt-bath, taking care to remove the aqueous vapours, which would cause the formation of muriatic acid, and a deposition of insoluble oxychloride. When the solution has attained the consistence of thick syrup (in which state it curdles on cooling, without, however, becoming a solid mass), cease evaporating, add an excess of the gelatinous hydrate diluted with a little water, agitate for a quarter of an hour, and afterwards allow the liquor to rest for several hours. Next add distilled water sufficient to bring the solution to the density of 30° Baumé, and allow it to stand for eight days in contact with an excess of the hydrate; after which filter, and again allow it to stand for two weeks." This strength of the solution is required for the cure of varices. For injection into aneurismal tumours, it is sufficient to employ a solution of 20° or even 15°. These degrees of Baumé are equivalent, 30° to 29·70 per cent. of the dry salt, 20° to 17·05 per cent., and 15° to 12·10 per cent. (See *Ferri Chloridum*, U.S., *page* 1211.)

mixed in certain proportions with solution of sesquichloride (perchloride) of iron, of converting it partly into protochloride. The alteration commences immediately on the addition of sugar, as shown by the deeper colour of the liquid; after some hours ferridcyanide of potassium will indicate the presence of a proto-salt; and, after 24 hours, the greater proportion of the sesqui-salt has undergone the change. (*Bost. Med. and Surg. Journ.*, March 12, 1868, p. 85; from *Revue Méd.*, Dec. 31, 1867.)

Medical Uses. This preparation was brought prominently into notice by M. Pravaz, a surgeon of Lyons, who found that a few drops of a strong solution, injected into a blood-vessel, produced coagulation of all the blood in the vessel for the extent of an inch or more. Its use as a styptic was the necessary result of this observation. In this capacity it has been used in the cure of varices, and has even been recommended as an injection in ordinary aneurisms. In arresting hemorrhages from cut surfaces or wounded vessels it has proved remarkably successful. It has also been found advantageous as an application to nasal polypi, erectile tumours or *nævi materni* in infants, in ulcers about the nails, and in various cutaneous affections. (See *Chloride of Iron.*) Attempts have been made to cure nævi materni by the injection of the solution into the erectile tumour; but this proceeding is hazardous; and a fatal result is recorded as having occurred in an infant a month old. Five drops of the solution, introduced into the centre of the tumour, were followed instantly by a sharp cry, a brief convulsion, and death. (*Ann. de Thérap.*, 1867, p. 117.) Several other similar cases have occurred. Injection of it in cystic goitre has been strongly recommended by Dr. Morell Mackenzie (*London Lancet*, May 11, 1872), and has also been practised with advantage by some other surgeons. It has been used externally with asserted success in varicose veins (*Med. and Surg. Reporter*, April, 1874, 1342; *New York Med. Journ.*, April, 1870, 202; *Amer. Journ. Med. Sci.*, April, 1874, 553). It may be used internally, properly diluted, for the general purposes of the chalybeates, and especially as a substitute for the tincture of the chloride of iron, when the alcohol of that preparation may be objectionable. In the *Southern Journ. of Med. Sci.* (Nov. 1867), Dr. G. W. Lenoir states that he has tried this solution, with uniform success, in several cases of intermittent fever, in which he had failed with quinia. In only one case was there a recurrence of a paroxysm, and in this only once. He gave from 8 to 15 drops every 4 or 6 hours. (*Am. J. of Med. Sci.*, Jan. 1868, p. 284.) For ordinary purposes the dose would be from two to ten minims. In post partum hemorrhage it has been largely used by various English obstetricians, a solution of it varying in strength from a drachm to the half ounce to the pint, being thrown directly into the relaxed and bleeding uterus. It is used in the preparation of the tincture of the chloride.

Off. Prep. Liquor Ferri Perchloridi, *Br.;* Tinctura Ferri Chloridi, *U. S.;* Tinctura Ferri Perchloridi, *Br.* W.

LIQUOR FERRI CITRATIS. *U. S. Solution of Citrate of Iron.*

"Take of Citric Acid, in coarse powder, *five troyounces and three hundred and sixty grains;* Solution of Tersulphate of Iron *a pint;* Water of Ammonia *twenty fluidounces;* Distilled Water *a sufficient quantity.* To the Water of Ammonia, mixed with two parts of Distilled Water, add the solution of Tersulphate of Iron previously mixed with two pints of Distilled Water, stirring constantly; transfer the precipitate formed to a muslin strainer, and wash it with water until the washings are nearly tasteless. When the precipitate is drained, put half of it in a porcelain capsule on a water-bath, heated to 140°, add the Citric Acid, and stir the mixture until the precipitate is nearly dissolved. Then add so much of the reserved precipitate as may be necessary fully to saturate the Acid. Lastly, filter the liquid, and evaporate it, at a temperature not above 140°, until it is reduced to the measure of a pint." *U. S.*

In this process, the hydrated sesquioxide of iron is first obtained by treating solution of the tersulphate with ammonia, and is then combined, with the aid of heat, with the citric acid, thus forming a solution of the citrate of the sesquioxide of iron, consisting of one eq. of acid and one of sesquioxide. It might appear, from the phraseology of the process, that, in the direction to add the citric acid to the precipitated sesquioxide, the addition of water to hold the resulting citrate in solution had been omitted; but the fact is, that the precipitate, even after draining, retains

mechanically quite sufficient water for the purpose, so much, indeed, that evaporation is necessary at the end of the process to reduce the bulk to the required standard. The temperature is limited to 140°, because, though a moderate heat promotes the solution, a high degree of it diminishes the solubility of the oxide, and thus interferes with the process.

The solution has a deep reddish-brown colour, and a slight not unpleasant chalybeate taste. It keeps for a long time without change, and answers admirably well for preparing solid citrate of iron, and the chalybeate salts containing it, and for introducing it into extemporaneous mixtures. Each fluidounce of it contains half a troyounce of citrate of iron. It may be given, for the general purposes of the ferruginous preparations, in the dose of ten minims, equivalent to five grains of the salt, several times a day.

Off. Prep. Ferri Citras, *U. S.;* Ferri et Ammonii Citras, *U. S.;* Ferri et Quiniæ Citras, *U. S.* W.

LIQUOR FERRI NITRATIS. *U.S.* Liquor Ferri Pernitratis. *Br. Solution of Nitrate of Iron. Solution of Pernitrate of Iron. Solution of Ternitrate of Sesquioxide of Iron.*

"Take of Iron, in the form of wire, and cut in pieces, *two troyounces and a half;* Nitric Acid [sp. gr. 1·42] *five troyounces;* Distilled Water *a sufficient quantity.* Mix the Iron with twelve fluidounces of Distilled Water in a wide-mouthed bottle, and add to the mixture, in small portions at a time, with frequent agitation, three troyounces of the Nitric Acid, previously mixed with six fluidounces of Distilled Water, moderating the reaction by setting the vessel in cold water, in order to prevent the occurrence of red fumes. When the effervescence has nearly ceased, agitate the solution with the undissolved iron until a portion of the liquid, on being filtered, exhibits a pale-green colour. Then filter the liquid, and, having poured it into a capacious porcelain capsule, heat it to the temperature of 130°, and add the remainder of the Nitric Acid. When the effervescence has ceased, continue the heat until no more gas escapes, and then add sufficient Distilled Water to bring the liquid to the measure of thirty-six fluidounces." *U. S.*

"Take of fine Iron Wire, free from rust, *one ounce* [avoirdupois]; Nitric Acid *four and a half fluidounces* [Imperial measure]; Distilled Water *a sufficiency.* Dilute the Nitric Acid with sixteen [fluid]ounces of the Water, introduce the Iron Wire into the mixture, and leave them in contact until the metal is dissolved, taking care to moderate the action, should it become too violent, by the addition of a little more Distilled Water. Filter the solution, and add to it as much Distilled Water as will make its bulk one pint and a half [Imp. meas.]. The specific gravity is 1·107." *Br.*

The above U. S. formula has been substituted for the one adopted in the second edition of the Pharmacopœia, published in Dec. 1855, which upon trial was found by Prof. Procter to have defects, which, it is believed, have been corrected in the present. In the existing formula, nitric acid (sp. gr. 1·42), diluted, is gradually added to an *excess* of iron, mixed with water, so as to ensure the production of the mononitrate of protoxide of iron, which is filtered from the excess of iron. To this is added a quantity of nitric acid, equal to two-thirds of that originally directed, which converts the mononitrate of the protoxide into the ternitrate of the sesquioxide, attended with a violent effervescence of red hyponitric acid vapours. The preparation is finished by giving it a determinate bulk by the addition of water. In this process, the two portions of nitric acid used are correctly adjusted to produce the intended result. Thus, six eqs. of mononitrate, containing six eqs. of nitric acid, require exactly four additional eqs. of acid to effect the conversion; one eq. of the additional acid being expended in converting the six eqs. of protoxide into three eqs. of sesquioxide, and the three remaining eqs. in completing three eqs. of ternitrate.*

* Prof. Procter has proposed the following formula for a *syrup of the nitrate of protoxide of iron*, a preparation considerably used, in Philadelphia, as an astringent in chronic diarrhœa. Take of Iron Wire, in pieces (card teeth), *two ounces;* Nitric Acid (sp. gr. 1·42) *three fluidounces;* Water *thirteen fluidounces;* Sugar, in powder, *two pounds.* Put the iron in a wide-mouthed bottle, kept cool by standing in cold water, and pour upon it three fluidounces of water. Then mix the acid with ten fluidounces of water, and add the mixture in portions of half a fluidounce to the iron, agitating frequently until the acid is saturated, using litmus paper. When the saturation is com-

The peculiarity of the above process is the addition of the nitric acid in two portions at different times; the first portion not larger than is necessary to form the nitrate of the protoxide, and the second sufficient to convert this into the ternitrate of the sesquioxide. The object gained by this procedure seems to be to obviate the tendency which nitric acid has to sesquioxidize a larger portion of iron than can be neutralized by what remains of the acid, unless this be employed in such a proportion as to endanger an excess in the resulting solution. By this excess of sesquioxide, a subsalt is formed, which is not readily held in solution with the neutral sesquinitrate, and is therefore apt to be slowly deposited from the officinal preparation, unless care is taken to prevent its production.

The U. S. solution of nitrate of iron has a sp. gr. between 1·060 and 1·070, a pale-amber colour, and a strong astringent acid taste. It contains no protoxide of iron, and does not give a blue precipitate with ferridcyanide of potassium. A fluidounce of it, on the addition of an excess of ammonia, yields a reddish-brown precipitate, which, when washed, dried, and ignited, weighs between eight and ten grains. (*U. S.*) The British preparation is of a reddish-brown colour, of the sp. gr. 1·107, and gives a blue precipitate with the yellow prussiate of potash [ferrocyanide of potassium]. The precipitate obtained from a fluidrachm of it by the addition of an excess of ammonia, when washed, dried, and incinerated, weighs 2·6 grains. (*Br.*) It is, therefore, about twice as strong as the U. S. solution.

Ternitrate of sesquioxide of iron, as described by Mr. J. M. Ordway, of Massachusetts, is in the form of oblique rhombic prisms, which are either colourless, or of a delicate lavender colour. It is somewhat deliquescent, very soluble in water, and sparingly soluble in nitric acid. It consists of three eqs. of nitric acid, one of sesquioxide of iron, and eighteen of water. (*Silliman's Journ.*, Jan. 1850.) S. Hausmann found only twelve eqs. of water. (*Chem. Gaz.*, June 1, 1854.)

Medical Properties. This solution was introduced to the notice of the profession by Mr. William Kerr, in 1832. Its virtues are those of a tonic and astringent. Dr. R. J. Graves, of Dublin, praises it as a remedy in chronic diarrhœa, especially when occurring in delicate and nervous women, in which there is no thirst, redness of tongue, tenderness of the abdomen on pressure, or other indication of inflammation. Mr. Kerr attributed to it the property of diminishing the irritability of the intestinal mucous membrane. It is particularly applicable to the treatment of mucous diarrhœa, attended with pain, but not to cases in which ulcerations of the intestines exist. Dr. T. C. Adams, of Michigan, also reports favourably of this remedy in chronic diarrhœa, considering it, like Mr. Kerr, to act as a sedative as well as astringent. He employed it, likewise with good effect, in menorrhagia, and both internally and by injection in leucorrhœa, when occurring in pale, exsanguine, and feeble subjects. The dose, according to Dr. Graves, is seven or eight drops, gradually increased to fifteen, sufficiently diluted, given in the course of the day. Dr. Adams gave it in doses of ten drops, two, three, or four times a day, and sometimes increased it to twenty-five drops. Dr. Garrod and Mr. Squire, the two most prominent expounders of the British Pharmacopœia, state the dose of the British preparation, though twice as strong in iron as our own, at from thirty minims to a fluidrachm. Considering that a fluid-

plete, filter the solution into a bottle containing the sugar, and marked to contain thirty fluidounces. If the whole does not measure that bulk, pass water through the filter to make up the deficiency. When all the sugar is dissolved, strain if necessary, and introduce the syrup into suitable vials, and seal them. This syrup is thick, permanent, of a light-greenish colour, perfectly transparent, neutral, and yields a greenish precipitate with ammonia. (*Am. Journ. of Pharm.*, Oct. 1851, p. 314.) Mr. W. W. D. Livermore has given a formula for a similar syrup. (*Ibid.*, p. 315.) A third formula has been proposed by Mr. Thomas Lancaster, of this city, in which the nitrate of protoxide of iron is obtained by double decomposition between nitrate of calcium and sulphate of protoxide of iron. (*Ibid.*, Sept. 1854, p. 400.) These syrups should not contain an excess of acid; for if they do, they are apt to deposit, after keeping, white granular masses of grape sugar, as observed by Mr. W. Tozier, of Kingstown, Ireland, in consequence of the action of the acid upon the cane sugar. According to Mr. Joseph Laidley, of Richmond, Va., the so-called syrup of the nitrate of sesquioxide of iron is an unscientific preparation, containing protoxide if an excess of acid is avoided, and liable to let fall a precipitate of oxalate of iron when the acid is in excess. Hence Mr. Laidley believes that the only nitrate, proper to be formed into a syrup, is the nitrate of the protoxide, where alone the protective influence of sugar is required. (*Ibid.*, March, 1853, p. 97.)—*Note to the tenth and eleventh editions.*

drachm of the British solution contains 7·865 grains of the salt, this appears to us a very large dose; and the doses recommended by Drs. Graves and Adams would probably be safer. As an injection, Dr. Adams employed it sufficiently diluted to cause only a slight heat and smarting in the vagina. B.

LIQUOR FERRI PERCHLORIDI. *Br. Solution of Perchloride of Iron.*

"Take of Strong Solution of Perchloride of Iron *five fluidounces;* Distilled Water *fifteen fluidounces.* Mix." *Br.*

This is of one-fourth the strength of the *Liquor Ferri Perchloridi* of the Br. Pharmacopœia of 1864, which is the *Liquor Ferri Perchloridi Fortior* of the present edition. It is of the same ferruginous strength as the British Tincture of Perchloride of Iron. W.

LIQUOR FERRI SUBSULPHATIS. *U. S. Solution of Subsulphate of Iron. Solution of Persulphate of Iron. Monsel's Solution.*

"Take of Sulphate of Iron, in coarse powder, *twelve troyounces;* Sulphuric Acid *a troyounce and thirty grains;* Nitric Acid *a troyounce and three hundred grains;* Distilled Water *a sufficient quantity.* Mix the Acids with half a pint of Distilled Water, in a capacious porcelain capsule, and, having heated the mixture to the boiling point, add the Sulphate of Iron, one-fourth at a time, stirring after each addition until effervescence ceases. Then keep the solution in brisk ebullition until nitrous vapours are no longer perceptible, and the colour assumes a deep ruby tint. Lastly, when the liquid is nearly cold, add sufficient Distilled Water to make it measure twelve fluidounces." *U. S.*

This process is essentially that of Dr. Squibb, published in the *American Journal of Pharmacy* for January, 1860 (p. 33). The object is to obtain in solution *Monsel's Persulphate of Iron*, improperly so called, as it differs both in composition and properties from the salt of iron properly named persulphate. This consists of one eq. of sesquioxide of iron and three of sulphuric acid ($Fe_2O_3,3SO_3$), and is a neutral salt, while Monsel's persulphate consists of two eqs. of the sesquioxide and five of the acid ($2Fe_2O_3,5SO_3$), and, having one-half of an eq. less than is necessary for saturation, is properly a subsalt, as it is very appropriately designated in the U. S. Pharmacopœia. With this preliminary explanation, the process will be easily understood.

In its preparation the protoxide of iron of the protosulphate is sesquioxidized at the expense of the nitric acid; but the sulphuric acid, mixed with the nitric, is in quantity insufficient to the increased demand by the sesquioxide for neutralization. Thus, for each equivalent of the sesquioxide produced an additional eq. of acid would be necessary to constitute the neutral tersulphate of the sesquioxide, while the quantity added is only the half of one equivalent. The sesquioxide is therefore but partially saturated and a subsalt results, having the constitution above mentioned.*

The solution of subsulphate of iron is of a syrupy consistence, a ruby-red colour, inodorous, of an extremely astringent but not acrid taste, without causticity, and of the sp. gr. 1·552. It mixes with water and alcohol in all proportions without decomposition. With ammonia it yields a copious reddish-brown precipitate of sesquioxide of iron. A little sulphuric acid decolorizes the liquid in a considerable degree, and an excess of the same acid converts it into a white, soft, pasty solid, resembling plaster of Paris when it has begun to solidify after mixture with water. This test,

* Mr. J. Creuse offers the following formula for the preparation of the solutions of *ter* and *subsulphate of iron*, claiming them to be superior to the officinal because they require no especial apparatus, and generate no noxious vapours.

For the tersulphate, Take of Sulphate of Iron, in coarse powder, twelve troyounces; Sulphuric Acid two troyounces and sixty grains; Chlorate of Potassium three hundred and forty-eight grains; Boiling Water twelve fluidounces. Dissolve the sulphate of iron in the boiling water in a glass matrass, or any convenient bottle; add the sulphuric acid gradually, and, while the liquid is hot, add the chlorate of potassium by small portions. When all is dissolved, filter, and complete twenty-four fluidounces. The following formula explains the reaction. $12(FeOSO_3)+6SO_3+KO,ClO_5=6(Fe_2O_33SO_3)+KCl$.

For the subsulphate, Take of the ingredients as above enumerated, respectively, twelve troyounces, one troyounce and thirty grains, three hundred and forty grains, ten fluidounces; proceed as before; evaporate to twelve fluidounces, and filter. (*Am. Journ. of Pharm.*, xliii. p. 169.) The solutions thus obtained are contaminated with chloride of potassium. (*Note to the fourteenth edition.*)

according to Dr. Squibb, is quite characteristic. (*Transact. King's Co. Med. Soc.*, in *N. Y. Journ. of Med.*, March, 1860, p. 173.)

By evaporation, upon a glass surface, with a moderate heat, the solution yields the subsulphate of the sesquioxide of iron in the form of thin transparent scales, of a light reddish-brown colour, deliquescent, and readily soluble in water.

Attention was first called to the special styptic virtues of sulphate of peroxide of iron by M. Monsel in 1852; but it was not till a later period that he discovered the peculiar salt which now goes by his name, and the solution of which is the subject of the present article. It was in 1857 that he published a formula for the salt. (See *Journ. de Pharm.*, Sept. 1857, and Juillet, 1859.) The remedy soon became generally known in Europe; and a paper on the subject was published by Dr. Hutchinson in the *New York Journ. of Medicine* for January, 1859; but it seems to have come into more general use in this country, through the published experience of Dr. H. H. Toland and others in the *Pacific Medical and Surgical Journal* of California.

In consequence of its deficiency of sulphuric acid, this salt is less irritant than the tersulphate of the sesquioxide, while it has at least equal if not greater astringency. It is therefore very efficacious as a styptic, and peculiarly adapted, through the power of coagulating the blood, to cases of hemorrhage from incised wounds, or surfaces in which it is specially desirable to avoid irritation. It is said also to have been found peculiarly efficacious in chancre. The solution may be applied by means of a small sponge or pencil of spun-glass to the bleeding surface or vessel. In cases of hæmoptysis, it has been used with advantage, by inhalation, in the form of spray, by means of the atomizer. For this purpose, however, it should be diluted with distilled water. It has also been used internally; and there is little doubt that it would prove efficacious as a styptic in hemorrhage from the stomach and bowels, and by injection into the rectum in bleeding from that part. It may be given in a dose of from five to fifteen grains. W.

LIQUOR FERRI TERSULPHATIS. *U. S.* Liquor Ferri Persulphatis. *Br.* *Solution of Tersulphate of Iron. Solution of Persulphate of Iron.*

"Take of Sulphate of Iron, in coarse powder, *twelve troyounces;* Sulphuric Acid *two troyounces and sixty grains;* Nitric Acid *a troyounce and three hundred and sixty grains;* Water *a sufficient quantity.* Mix the acids with half a pint of Water in a capacious porcelain capsule, and, having heated the mixture to the boiling point, add the Sulphate of Iron, one-fourth at a time, stirring after each addition until effervescence ceases. Then continue the heat until the solution acquires a reddish-brown colour, and is free from nitrous odour. Lastly, when the liquid is nearly cold, add sufficient Water to make it measure a pint and a half." *U. S.*

"Take of Sulphate of Iron *eight ounces* [avoirdupois]; Sulphuric Acid, Nitric Acid, of each, *six fluidrachms;* Distilled Water *twelve fluidounces*, or *a sufficiency.* Add the Sulphuric Acid to ten [fluid]ounces of the Water, and dissolve the Sulphate of Iron in the mixture, with the aid of heat. Mix the Nitric Acid with the remaining two [fluid]ounces of Water, and add the dilute acid to the solution of Sulphate of Iron. Concentrate the whole by boiling, until, upon the sudden disengagement of ruddy vapours, the liquid ceases to be black and acquires a red colour. A drop of the solution is now to be tested with red prussiate of potash [ferridcyanide of potassium], and if a blue precipitate forms, a few additional drops of Nitric Acid should be added, and the boiling renewed, in order that the whole of the sulphate may be converted into persulphate of iron. When the solution is cold, make the quantity eleven fluidounces by the addition, if necessary, of Distilled Water." *Br.*

The sulphate of iron used in these formulas is a sulphate of the protoxide of iron. The nitric acid in the process gives up enough of its oxygen to convert the protoxide entirely into sesquioxide, and the effervescence is owing to the escape of nitric oxide becoming red hyponitric acid by contact with the air. The conversion of protoxide into sesquioxide is incomplete until the effervescence ceases, and the colour, from black, as it was at first, has become reddish-brown. Indeed, in order to sesquioxidize the whole of the protoxide of the sulphate, it is necessary to continue the heat

until nitrous odour ceases to be evolved; and thus, moreover, the entire absence of nitric or nitrous acid from the solution is ensured. But in consequence of the higher oxidation of the iron the sulphuric acid of the sulphate is insufficient to saturate it, and just in proportion to the additional oxygen. Enough sulphuric acid, therefore, is added to meet this demand, that is, in such proportion as to give an eq. of the acid for each additional eq. of oxygen in the oxide. The process is completed by adding enough water to make a definite measure. The U. S. and British formulas are the same in principle; but in the latter, the additional precaution is taken, in order to ensure the complete change of protoxide into sesquioxide, of testing the liquid with ferridcyanide of potassium, which will produce a blue precipitate so long as any of the protoxide remains.

This solution, prepared according to the U. S. formula, is a perfectly clear and mobile liquid, in no degree viscid, of a reddish-brown colour, almost inodorous, of a sour, extremely astringent and somewhat acrid taste, and miscible in all proportions, without decomposition, with water and alcohol. The sp. gr. of the U. S. solution is 1·320; and a *fluidounce* of it yields, on the addition of ammonia in excess, a bulky precipitate, of a reddish-brown colour, and without blackish tinge, which, when washed, dried, and ignited, weighs 69 grains. The solution, diluted with water, gives a white precipitate with chloride of barium, showing that it contains a sulphate, and a blue precipitate with ferrocyanide of potassium, but none with the ferridcyanide, showing that the sulphate is that of sesquioxide of iron. It keeps well; and we have seen a specimen three or four years old, which retained all its properties unchanged, and had deposited nothing. The *British* solution is considerably stronger than ours, having the sp. gr. 1·441, and yielding from a *fluidrachm*, on precipitation by ammonia, a precipitate, which, when washed and incinerated, weighs 11·44 grains. It is described in the Br. Pharmacopœia as a dense solution of a dark-red colour. Prof. Procter has found that a preparation containing 120 grains of sesquioxide to the fluidounce is apt to deposit the anhydrous sulphate on standing.

This solution, though possessed of astringent properties rendering it useful as a styptic, is inferior remedially to that of the subsulphate of iron, which is less irritant, and certainly not less efficacious. The chief use of it is in making other ferruginous preparations, in which the sesquioxide of iron is wanted; and it should always be kept on hand, if for nothing else, for the quick preparation of the hydrated sesquioxide of iron, to be used as an antidote in cases of arsenical poisoning.

Off. Prep. Ferri et Ammonii Citras, *U. S.;* Ferri et Ammoniæ Citras, *Br.;* Ferri et Ammonii Sulphas, *U. S.;* Ferri et Ammonii Tartras, *U. S.;* Ferri et Potassii Tartras, *U. S.;* Ferri et Quiniæ Citras, *Br.;* Ferri Ferrocyanidum, *U. S.;* Ferri Oxidum Hydratum, *U. S.;* Ferri Oxidum Magneticum, *Br.;* Ferri Peroxidum Humidum, *Br.;* Ferri Pyrophosphas, *U. S.;* Ferrum Tartaratum, *Br.;* Liquor Ferri Citratis, *U. S.;* Tinctura Ferri Acetatis, *Br.* W.

LIQUOR GUTTA-PERCHÆ. *U.S., Br. Solution of Gutta-percha.*

"Take of Gutta-percha, in thin slices, *a troyounce and a half;* Purified Chloroform *seventeen troyounces;* Carbonate of Lead, in fine powder, *two troyounces.* To twelve troyounces of the Chloroform, contained in a bottle, add the Gutta-percha, and shake occasionally until it is dissolved. Then add the Carbonate of Lead, previously mixed with the remainder of the Chloroform, and, having several times shaken the whole together, at intervals of half an hour, set the mixture aside, and let it stand for ten days, or until the insoluble matter has subsided, and the solution become limpid, and either colourless or of a pale-straw colour. Lastly, decant the liquid, and keep it in a well-stopped bottle." *U. S.*

"Take of Gutta-percha, in thin slices, *one ounce;* Chloroform *eight fluidounces;* Carbonate of Lead, in fine powder, *one ounce.* Add the Gutta-percha to six fluidounces of the Chloroform in a stoppered bottle, and shake them together frequently until the solution has been effected. Then add the Carbonate of Lead previously mixed with the remainder of the Chloroform, and having several times shaken the whole together, set the mixture aside, and let it remain at rest until the insoluble matter has subsided. Lastly, decant the clear liquid and keep it in a well-stoppered bottle." *Br.*

Difficulty is often experienced in obtaining a clear solution of gutta-percha in chloroform of the proper consistence for use, in consequence of its viscidity, and the strong affinity with which it holds on to the colouring matter. It cannot be clarified by filtration; and the carbonate of lead is therefore resorted to, which unites with the colouring matter, and, in consequence of its weight, gradually subsides, carrying undissolved substances along with it, and leaving a clear and colourless or nearly colourless solution behind. The use of carbonate of lead for the purpose was first suggested by Mr. Wm. Hodgson, jun., of Philadelphia. Something in the success of the process appears to depend on the quality of the gutta-percha used. Should the operator be unable to procure a clear solution by acting in precise accordance with the formula, he would be justifiable in adding more chloroform, filtering if necessary, and evaporating by a very moderate heat to the due consistence. When the preparation becomes too viscid in consequence of the spontaneous evaporation of the menstruum on exposure, we have always found that the addition of a little chloroform, with agitation, restores it without difficulty to the due condition. The ordinary commercial chloroform may be used in the process, as the preparation is exclusively for external use. It should be kept in small glass vials, with accurately fitting glass stoppers, and not containing more than may be wanted at once, say a fluidounce.

We have nothing, on the whole, so convenient and effective as this preparation, as a protective to the surface, in slight cases of superficial inflammation and abrasion. By the rapidity with which the chloroform evaporates, a thin elastic nearly colourless film is left after its application, sufficient to prevent injurious influence from the air, wholly without irritating properties, not shrinking inconveniently, and, in consequence of its softness, not mechanically disturbing the part, as sometimes happens with collodion. A little of it applied by the end of the finger, or by means of a small brush, or a glass rod, over eruptive affections, abrasions or slight excoriations, inflammation from friction, chaps on the lips or hand, and slight superficial wounds that have ceased bleeding, will often enable the parts beneath to heal almost immediately, while, if unprotected, they might go on for an indefinite period, giving annoyance, and often increasing. Surfaces yet sound, that are liable to irritation and abrasion from contact, pressure, friction, and the application of acrid substances, may often be protected by a coating of this material. The agreeable odour of chloroform is another recommendation over other preparations, of a similar character, made with ether or benzole. We have so often experienced its advantages that we wish to press it upon the attention of the profession, which it has not yet received to the degree that it merits. One cause of this, perhaps, is the difficulty of obtaining it in the shops, a large proportion of which, either from the difficulties in its preparation, or want of demand, are insufficiently supplied.

Off. Prep. Charta Sinapis. W.

LIQUOR HYDRARGYRI NITRATIS. *U. S.* Liquor Hydrargyri Nitratis Acidus. *Br.* *Solution of Nitrate of Mercury. Acid Solution of Nitrate of Mercury.*

"Take of Mercury *three troyounces;* Nitric Acid *five troyounces;* Distilled Water *six fluidrachms.* Dissolve the Mercury, with the aid of a gentle heat, in the Acid previously mixed with the Distilled Water. When reddish vapours cease to arise, evaporate the liquid to seven troyounces and a half, and keep it in a well-stopped bottle.

"Solution of Nitrate of Mercury may also be prepared as follows: Take of Red Oxide of Mercury *three troyounces and one hundred and twenty grains;* Nitric Acid *three troyounces and three hundred grains;* Distilled Water *six fluidrachms.* Mix the Acid with the Water, dissolve the Oxide of Mercury in the mixture, and evaporate to seven troyounces and a half." *U. S.*

"Take of Mercury *four ounces* [avoirdupois]; Nitric Acid *five fluidounces* [Imperial measure]; Distilled Water *one fluidounce and a half.* Mix the Nitric Acid with the Water in a flask; and dissolve the Mercury in the mixture without the application of heat. Boil gently for fifteen minutes, cool, and preserve the solution in a stoppered bottle." *Br.*

In the first process of the U. S. Pharmacopœia, and in the British process, mercury is dissolved, with the assistance of heat, in an excess of nitric acid, and there is formed an acid binitrate of deutoxide of mercury, which is brought to a determinate bulk by evaporation. The nitric acid taken weighs five ounces. This proportion is sufficient not only to deutoxidize the mercury and generate a bisalt, but to furnish a large excess of acid. Solution of nitrate of mercury is a dense, transparent, nearly colourless liquid, of a strongly acid taste, of the sp. gr. 2·165 as prepared by the U. S. process, and 2·246 by the British. Its distinguishing properties, as given in the U. S. and Br. Pharmacopœias, are that it is not precipitated by distilled water; gives when diluted a dull-yellow precipitate with potassa and a bright-red one soluble in an excess of the precipitant with iodide of potassium; does not produce a precipitate when dropped into muriatic acid diluted with twice its bulk of water; when dropped on a bright surface of copper instantly occasions a mercurial coating; and, finally, causes a crystal of sulphate of iron dropped into it, as well as the liquid around the salt, to assume a dark colour. These tests show that the salt contained in it is a nitrate and not a sulphate, and that its base is deutoxide of mercury, without the presence of any protoxide of that metal. The rather loose direction, at the close of the British process, to boil for fifteen minutes, cannot but lead to somewhat uncertain results, unless care is taken by the operator to bring the sp. gr. of the solution to the point indicated in the description of the solution given in the Pharmacopœia.

Binitrate of deutoxide of mercury (the salt present in this preparation) is uncrystallizable, unless when exposed in a freezing mixture to a temperature of 5°, when it crystallizes with the formula $HgO_2,2NO_5+16HO$. (*H. S. Ditten.*) According to the new view of the equivalent of mercury, adopted in the Br. Pharmacopœia, the salt is a nitrate of protoxide of mercury, and is represented by the formula, independently of water of crystallization, HgO,NO_5.

Medical Properties. This preparation is frequently used in Europe, and has been employed to some extent in this country, as a caustic application to malignant ulcerations and cancerous affections. It has been used by Biett in lupus, by Bennett and others in ulceration of the neck of the uterus, and by Recamier in cancer. It is applied to the diseased surface by a camel's-hair brush, or preferably by a brush made of spun-glass. The parts touched immediately become white, the surrounding parts inflame, and in a few days a yellow scab is formed, which gradually falls off. Sometimes the application produces salivation. When it is desirable to avoid this result, the cauterized part should be washed with water immediately after the application of the caustic.

Acid nitrate of mercury is extensively used by Mr. Startin in the Hospital for Cutaneous Diseases, London.* He has employed it with advantage in acne, boils, carbuncle, lupus, sloughing ulcers, and other external affections. In acne, a very minute drop of the solution is placed, by means of a finely pointed glass brush, on the top of each indolent tubercle. The application, if carefully made, leaves no scar. In treating boils, a full-sized drop is applied to the apex of the furuncle. (*Med. Times and Gaz.*, Jan. 1855, p. 9.) B.

LIQUOR HYDRARGYRI PERCHLORIDI. *Br. Syn.* Liquor Hydrargyri Bichloridi. *London. Solution of the Perchloride of Mercury.*

"Take of Perchloride of Mercury, Chloride of Ammonium, of each, *ten grains;* Distilled Water *one pint* [Imp. meas.]. Dissolve." *Br.*

This solution may be used as affording a convenient method of exhibiting corrosive sublimate. The dose is from half a fluidrachm to two fluidrachms. W.

LIQUOR IODINII COMPOSITUS. *U. S.* Liquor Iodi. *Br. Compound Solution of Iodine. Solution of Iodine.*

"Take of Iodine *three hundred and sixty grains;* Iodide of Potassium *a troyounce and a half;* Distilled Water *a pint.* Dissolve the Iodine and Iodide of Potassium in the Distilled Water." *U. S.*

* The acid nitrate, used by Mr. Startin, does not correspond, in the proportions employed, with the British preparation. It is made by dissolving two ounces of mercury in four ounces of nitric acid (sp. gr. 1·5).

"Take of Iodine *twenty grains;* Iodide of Potassium *thirty grains;* Distilled Water *one fluidounce.* Dissolve." *Br.*

In this solution iodine is dissolved in water with the assistance of iodide of potassium. Iodine dissolves sparingly in water, but freely in a solution of that salt. In using iodide of potassium to render iodine more soluble in water, the iodide is generally taken in a quantity twice the weight of the iodine; and this is the proportion adopted in the U. S. formula. The preparation is a *concentrated* solution of iodine with iodide of potassium, and is intended to facilitate the administration of the combination in drops. A solution of the same kind, though weaker, was directed in the Edinburgh Pharmacopœia, but was omitted in the British. In the present Br. Pharmacopœia a solution is directed of the same strength in iodine as the U. S. solution, but considerably weaker in iodide of potassium; the former having only thirty grains in the fluidounce, the latter forty-five grains; the difference in the fluidounce of the two Pharmacopœias being too small to enter into the calculation. The medicinal properties of the solution depend mainly on the free iodine contained in it, by which the dose must be regulated, and not by the iodide of potassium. According to Mr. Lloyd, of St. Bartholomew's Hospital, London, it acts differently from iodide of potassium, which, when given alone, does not produce the same effects. In a case of constitutional syphilis under his care, the compound solution of iodine effected a rapid cure, after the iodide of potassium had been taken in large doses, for several months, without benefit. The dose is six drops, containing about a quarter of a grain of iodine, three times a day, given in four tablespoonfuls of sweetened water, and gradually increased. The dilution should always be large, in order to favour the absorption of the medicine, and to avoid any irritation of the stomach. For children the dose to begin with is two drops. B.

LIQUOR LITHIÆ EFFERVESCENS. *Br.* *Effervescing Solution of Lithia. Lithia Water.*

"Take of Carbonate of Lithia *ten grains;* Water *one pint* [Imperial measure]. Mix in a suitable apparatus, and pass into it as much pure washed carbonic acid, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles well closed, to prevent the escape of the compressed gas." *Br.*

This solution is clear and sparkling, has an agreeable acidulous taste, and, when evaporated, leaves a white solid residue of carbonate of lithium, in the proportion of five grains to half a pint (Imp. meas.), or about ten fluidounces. It is an appropriate method of administering carbonate of lithium; as this salt, compared with other alkaline carbonates, is sparingly soluble in pure water, and is readily dissolved by carbonic acid water. The quantity of carbonic acid is unnecessarily large; the pressure of five atmospheres, as directed in the U. S. formula for carbonic acid water, being sufficient for all practical purposes.

For the properties and uses of carbonate of lithium, see the article upon this salt in *Part* I. of the Dispensatory. The dose of the solution is from five to ten fluidounces. W.

LIQUOR MAGNESLÆ CARBONATIS. *Br.* *Solution of Carbonate of Magnesia. Fluid Magnesia.*

"Take of Sulphate of Magnesia *two ounces* [avoirdupois]; Carbonate of Soda *two ounces and a half* [avoird.]; Distilled Water *a sufficiency.* Dissolve the two salts separately, each, in half a pint [Imperial measure] of Water. Heat the Solution of Sulphate of Magnesia to the boiling point, then add to it the Solution of Carbonate of Soda, and boil them together till carbonic acid ceases to be evolved. Collect the precipitated carbonate of magnesia on a calico filter, and wash it with Distilled Water until what passes ceases to give a precipitate with chloride of barium. Mix the washed precipitate with a pint [Imp. meas.] of Distilled Water, and, putting them into a suitable apparatus, pass into it pure washed carbonic acid gas obtained by the action of sulphuric acid on chalk. Let the mixture remain in contact with excess of carbonic acid, retained there under pressure for about 24 hours, then filter the liquid to remove any undissolved carbonate of magnesia, and again pass carbonic acid

gas into the filtered solution. Finally, keep the solution in a bottle securely closed, to prevent the escape of carbonic acid." *Br.*

The object of this process is to obtain a solution of carbonate of magnesium, by means of carbonic acid; the carbonate being insoluble in pure water. The first step is to prepare a freshly precipitated hydrated carbonate of magnesium, which is more readily dissolved than the carbonate which has been kept for some time. As the carbonate of magnesium of the Br. Pharmacopœia consists of three eqs. of the neutral carbonate and one of magnesia with 5 eqs. of water, it follows that, in its preparation from the two salts used in the process, a portion of carbonic acid escapes; and the boiling is directed to be continued until the escape of the gas ceases, so that the normal composition is ensured, and a longer heat, which might affect the constitution of the carbonate so as to diminish its solubility, avoided. The precipitate is thoroughly washed so as to remove every trace of sulphate of sodium, which is indicated by the non-action of the test of chloride of barium. The next step is to dissolve the precipitated carbonate in water impregnated with carbonic acid gas; and, as the solution even thus favoured is slowly effected, the carbonate is directed to remain exposed to the action of carbonic acid gas, under pressure, for 24 hours; and still the whole of the carbonate is not dissolved, and filtration is necessary. According to the Pharmacopœia, the "solution contains about 13 grains of carbonate of magnesia in a fluidounce." Were the results exactly in accordance with the proportion of sulphate of magnesium used, the quantity of carbonate dissolved would be 40 grains to the fluidounce. On exposure to the air some of the carbonic acid escapes, and a portion of the salt is deposited. Prof. Redwood proposes to remedy this by reducing the strength of the solution. (*Pharm. Journ. and Trans.*, 2d ser., xi. 397.) Indeed, it has been shown by Mr. C. Muncy that the preparation as kept in the shops is usually much below the standard strength.

This solution is but slightly effervescent, is clear, and is stated in the Br. Pharmacopœia to be free from bitterness. Nevertheless its taste is disagreeable, much more so than that of the undissolved carbonate. "A fluidounce of it, evaporated to dryness, yields a white solid residue, which, after being calcined, weighs not less than five grains." This residue is insoluble in water, and answers to the tests for magnesia.

A preparation, for which this was no doubt intended as an officinal substitute, has for many years been more or less used under the name of *Dinneford's Magnesia*, or *fluid magnesia* (see *page* 563); but this is of uncertain strength as found in the shops, and made according to no constant formula. Hence a deficiency which has existed in practical pharmacy has been supplied by this formula.* Our own experience with it, however, has not been so favourable as to induce us to prefer it to the undissolved carbonate, if prepared by rubbing this up well with a little ginger syrup, and then mixing it with the ordinary carbonic acid water of the shops. In this form the medicine is almost tasteless so far as the magnesia is concerned, is easily administered, and sits well upon the stomach.

The dose of the officinal solution, as an antacid laxative, is one or two fluidounces. W.

LIQUOR MAGNESII CITRATIS. *U. S.* Liquor Magnesiæ Citratis. *Br.* *Solution of Citrate of Magnesium.*

"Take of Carbonate of Magnesium *two hundred grains;* Citric Acid *four hundred grains;* Syrup of Citric Acid *two fluidounces;* Bicarbonate of Potassium *forty grains;* Water *a sufficient quantity.* Dissolve the Citric Acid in four fluidounces of Water, and, having added the Carbonate of Magnesium, stir until it is dissolved. Filter the solution into a strong twelve-ounce bottle containing the Syrup of Citric Acid. Then add the Bicarbonate of Potassium, and sufficient Water to nearly fill the bottle, which must be closed with a cork secured with twine. Lastly, shake the mixture occasionally until the Bicarbonate is dissolved." *U. S.*

"Take of Carbonate of Magnesia *one hundred grains;* Citric Acid *two hundred*

* Messrs. Dinneford and Co. prepare this solution, upon a large scale, of the officinal strength. For some account of their method of proceeding, see the *London Med. Times and Gaz.* (April, 1868, p. 383.)—*Note to the thirteenth edition.*

grains; Syrup of Lemons *one-half fluidounce* [Imperial measure]; Bicarbonate of Potash, in crystals, *forty grains;* Water *a sufficiency.* Dissolve the Citric Acid in two ounces of the Water, and, having added the Carbonate of Magnesia, stir until it is dissolved. Filter the solution into a strong half-pint bottle, add the syrup and sufficient water to nearly fill the bottle, then introduce the Bicarbonate of Potash, and immediately close the bottle with a cork which should be secured with string or wire. Afterwards, shake the bottle until the Bicarbonate of Potash has dissolved." *Br.*

This formula first appeared in the second edition of the U. S. Pharmacopœia of 1850. The original formula was soon found to have defects. Four-fifths of the carbonate was dissolved in the citric acid, and the solution filtered into a bottle containing the syrup of citric acid; and then the reserved fifth, mixed with water, was added to the acid citrate, and the bottle tightly corked. The addition of the reserved carbonate was intended to impregnate the preparation with carbonic acid by its solution in the excess of citric acid. To effect the solution of this reserved carbonate required at least half an hour. But the chief objection to the formula, as originally framed, was that the citrate of magnesium, when the solution was kept for some days, underwent a molecular change, resulting in the formation of a white granular precipitate, which rendered the solution unfit for medical use. This precipitate was found by Prof. Procter to consist of one eq. of citric acid, three of magnesia, and fourteen of water. This still occurs to some extent, although more slowly, and probably cannot be avoided except by a very great reduction in the amount of magnesia.* The use of bicarbonate of potassium introduces citrate of potassium, but in too small a proportion to be of any consequence.

Properties, &c. This officinal solution is founded on a preparation proposed by M. Rogé Delabarre, and improved by M. Rabourdin, of Paris. It is an aqueous solution of citrate of magnesium, containing an excess of citric acid, impregnated with carbonic acid, and sweetened with syrup. When properly prepared, it is a clear liquid, having an agreeable taste like that of lemonade. Overlooking the excess of acid which it contains, the salt present is that tribasic citrate, in which the three eqs. of basic water in the crystallized acid are replaced by three eqs. of magnesia. Accordingly it con-

* *Extemporaneous Liquor Magnesii Citratis.* The following formula has been proposed by Mr. J. C. Wharton as a means of always giving a customer a fresh solution of the citrate, which is substantially the same as that of the U. S. Pharmacopœia. Syrup No. 1. "Take of simple Syrup two pints; Spirit of Lemon sixty-four minims; Bicarbonate of Potassium six hundred and forty grains. Mix, and make solution, and keep ready for use. Syrup No. 2. Take of Calcined Magnesia eighty-eight grains, Citric Acid four hundred and eight grains; Distilled Water a sufficient quantity. Mix the Magnesia and Citric Acid in a mortar and add one and a half fluidounces of Water. Stir with a pestle, and break up the lumps of acid if there be any. After solution is effected, add sufficient Water to make up the amount of one bottle nearly full, when mixed with two fluidounces of the Syrup No. 1. These two solutions are to be kept separately. When Syrup of Citrate of Magnesium is called for, pour into the bottle Syrup No. 1 first, without touching the mouth or sides of the bottle; then pour in along the sides of the bottle Syrup No. 2, so as to avoid as far as possible mixing them, cork and agitate." (*Note to the fourteenth edition.*)

"*Effervescing Granular Citrate of Magnesia.*" The preparations first introduced into the American market under this name, were of English origin and of various composition, but containing no citrate of magnesium. Indeed not long since an English druggist was fined under the Adulteration Act for selling one of these preparations, which, although denominated citrate of magnesium, contained no magnesia. (*Pharm. Journ. and Trans.*, Nov. 1873.) Some of the best known contain *tartrate of sodium*, and are stated (*Journ. de Pharm.*, Jan. 1875) to be made according to the following formula. "Take of pulverized Tartaric Acid seven hundred and fifty parts; powdered Bicarbonate of Sodium three hundred parts; Distilled Water three hundred parts. Mix in a porcelain capsule, add the Water little by little, stirring with a glass or wooden spatula, and empty upon a sieve, placed upon a stove; under the influence of the heat the mixture granulates, and after cooling is to be rubbed through. Also take of Tartaric Acid four hundred parts; Bicarbonate of Sodium one hundred and fifty parts. Proceed as before. Mix the products." Ellis's American preparation, which has become popular, is, as is stated by Mr. H. C. Archibald (*Amer. Journ. of Pharm.*, xlii. 232), to be made according to the following formula. "Take of Citric Acid four pounds; of Calcined Magnesium (Jenning's) one and a half pounds; Bicarbonate of Sodium (Chance's) three pounds; Tartaric Acid three pounds; white Sugar six pounds; Oil of Lemon half a fluidounce; Stronger Alcohol q. s. To the powdered Citric Acid add the Sugar and mix thoroughly; then add the Soda, Magnesia, and Tartaric Acid, pass the whole through a No. 40 sieve three times to insure its being thoroughly mixed, moisten the powder with Stronger Alcohol and pass through a No. 8 sieve, and place on a wooden tray in a warm room to dry: then add the Oil of Lemon and bottle instantly. It usually takes twenty-four hours and a temperature of 120° to perfectly dry the salt." (*Note to the fourteenth edition.*)

sists of one eq. of citric acid and three of magnesia. It is advisable in preparing the solution to introduce the magnesia by small portions; as if too hastily added it disposes to the formation of the neutral citrate, which cannot afterwards be dissolved. (*Am. Journ. of Pharm.*, Jan. 1867, p. 1.)*

Dorvault makes a solid citrate of magnesium which is perfectly and readily soluble, by melting on a sand-bath 100 parts of crystallized citric acid in its water of crystallization, and thoroughly incorporating with it 29 parts of calcined magnesia. A pasty mixture is formed, which soon hardens, and may be pulverized for use. Citrate of magnesium, thus prepared, is soluble in twice its weight of water. When in saturated solution it soon precipitates as a nearly insoluble hydrate; but with eight or ten times its weight of water, it forms a permanent solution. See the report on the solid citrate, made by E. Parrish and A. Smith, to the Philadelphia College of Pharmacy (*Am. Journ. of Pharm.*, April, 1852, p. 113). See also M. E. Robiquet's paper on lemonades of citrate of magnesium (*Journ. de Pharm.*, Avril, 1852, p. 295), and his formula for preparing a soluble citrate of magnesium. (*Am. Journ. of Pharmacy* for July, 1855.) M. Simonin finds that an insoluble citrate of magnesium may be restored in solubility in boiling water, by being thoroughly rubbed up with water so as to form a paste. The necessary trituration is abridged, if a little citric acid be added. (*Ann. de Thérap.*, 1857, p. 124.)†

Medical Properties. This solution is a cooling cathartic, and operates mildly. It has come into extensive use in the United States, on account of the facility with which it may be taken, and its acceptability to the stomach. The dose as a full purge is the whole quantity directed in the formula, or twelve fluidounces; as a laxative, half that quantity or less.

Metatartrate of magnesium has been proposed, in the place of the citrate, by M. Léger, who, however, states that as a purgative it is more powerful than the citrate, resembling the sulphate. On account of its pleasant taste it might, perhaps, be substituted for Epsom salts. M. Léger prepares *metataric acid* in the following manner. Into a porcelain capsule put a small amount of tartaric acid, and heat it, with occasional agitation, on a slow fire until it fuses; then add successively small portions of the acid, so as not to cool the mass, less it solidify and burn. When the capsule is two-thirds full cease putting more in, but continue the heat until the mass, at first puffed-up and doughy, is completely melted into an amber-coloured liquid. Withdraw from the fire, and when sufficiently cooled form into pebbles, which must be kept in closely-stopped bottles on account of their being hygrometric. This acid is very soluble in

* Prof. Remington informs us that he has found that the excess of carbonic acid may be best preserved by pouring the syrup into a bottle containing the solution along the sides, so as not to mix with the solution, but to form a thick layer at the bottom. Into this stratum the crystals of the bicarbonate are dropped, and the bottle corked before any action occurs. (*Note to the fourteenth edition.*)

† *Solid Citrate of Magnesium.* This salt as heretofore prepared, though soluble at first, is apt to become more or less insoluble, when kept, in consequence of molecular change. The following process, by M. de Letter, of Brussels, yields a salt which is said to retain its solubility indefinitely. "Take of Citric Acid 20 parts, and of Carbonate of Magnesium 12 parts. Powder the acid finely, and mix it intimately with the carbonate, also in fine powder. Allow the mixture to stand, at the ordinary temperature, for four or five days, or until it ceases to manifest reaction when a little is thrown into water. During this time the powder slowly swells up, and gradually assumes the appearance of a spongy mass. Dry this at 86° F., pulverize it, and keep the powder in closely-stopped vials." According to M. de Letter, water, in a certain quantity, favours the formation of an insoluble hydrate; and hence the success of his process, in which no other water is present than that which is solidified in the dry materials. (See *Am. Journ. of Pharm.*, July, 1863, p. 312.)

M. Hager has been unable to prepare a soluble salt by the process of M. de Letter. He considers citrate of magnesium as presenting itself in three forms; 1. *crystallizable*, soluble in from 80 to 90 parts of water, with the formula $3MgO,Ci + 14HO$; 2. *amorphous*, soluble in two parts of water; and 3. *metamorphous*, soluble in 8 or 10 parts of water, with a strong tendency to crystallize. It is the crystalline variety, presenting the form of microscopic needles, that occasions the difficulty; and its production should be avoided. M. Hage proceeds in the following manner. Rub 40 parts of citric acid and 25 of carbonate of magnesium, both in powder, with sufficient alcohol of ·833 to make a thick mixture; and, having allowed this to stand for several days, at a medium temperature, dry it at a heat of 113° F. The product is the amorphous salt, soluble in 2·5 parts of water, in half an hour at 60°, immediately at 86°. Its solution, whether made with hot or cold water, retains its clearness after long standing. The salt is neutral, and contains about 13 eqs. of water. To succeed certainly it is necessary that the carbonate of magnesium be free from dust and impurities. (*Ibid.*, Jan. 1864, p. 19.)—*Note to the twelfth edition.*

water, and in this state greedily attacks the carbonate of magnesium, forming with it a salt which is permanent even when in solution. (*Journ. de Pharm.*, xix. 226.)

B.

LIQUOR MORPHIÆ ACETATIS. *Br.* *Solution of Acetate of Morphia.*

"Take of Acetate of Morphia *four grains;* Diluted Acetic Acid *eight minims;* Rectified Spirit *two fluidrachms* [Imperial measure]; Distilled Water *six fluidrachms.* Mix the Acid, the Spirit, and the Water, and dissolve the Acetate of Morphia in the mixture." *Br.*

Acetate of morphia often contains a little uncombined morphia, in consequence of the escape of a portion of the acid during its evaporation, and especially when this is pushed to dryness. Hence the addition of the diluted acetic acid, which at the same time neuteralizes the alkaloid in excess, and enables the solution to be completely effected. The spirit is added for its preservative effect. The dose is from 15 to 30 minims, equivalent to from one-eighth to one-quarter of a grain of the acetate, and about as many drops of laudanum as minims of the solution. The preparation is only one-half the strength of the old London preparation of the same name. W.

LIQUOR MORPHIÆ HYDROCHLORATIS. *Br.* LIQUOR MORPHIÆ MURIATIS. *Dub.* *Solution of Hydrochlorate of Morphia. Solution of Muriate of Morphia.*

"Take of Hydrochlorate of Morphia *four grains;* Dilute Hydrochloric Acid *eight minims;* Rectified Spirit *two fluidrachms;* Distilled Water *six fluidrachms.* Mix the Hydrochloric Acid, the Spirit, and the Water, and dissolve the Hydrochlorate of Morphia in the Mixture." *Br.*

The use of the alcohol is to prevent spontaneous decomposition, that of the acid probably to assist in the solution of the salt. It is unfortunate that, in the solutions of the salts of morphia, the same degree of strength should not have been directed by the U.S. and Br. Pharmacopœias. As they now are, the medical practitioner and apothecary must be on their guard to avoid serious results. The strength of this solution is four times that of our officinal solution of sulphate of morphia. one fluidounce of the former containing four grains, of the latter only one grain of their respective salts. The full dose of the British solution for an adult is from fifteen to thirty minims or drops, containing from an eighth to a quarter of a grain of the hydrochlorate, and about equivalent to as many drops of laudanum. W.

LIQUOR MORPHIÆ SULPHATIS. *U.S.* *Solution of Sulphate of Morphia.*

"Take of Sulphate of Morphia *eight grains;* Distilled Water *half a pint.* Dissolve the Sulphate of Morphia in the Distilled Water." *U.S.*

Sulphate of morphia, as found in the shops, is not always entirely soluble in water. This sometimes, perhaps, arises from adulterations; but more frequently, in all probability, from the mode of making the sulphate. As this salt was formerly prepared. the quantity of water employed for the suspension of the morphia was sometimes insufficient to hold the resulting sulphate in solution; and the consequence was that, upon the addition of sulphuric acid, the crystallization of the sulphate took place before the whole of the morphia was saturated by the acid. A portion of uncombined morphia was therefore necessarily mixed with the salt. Under such circumstances, the addition of a little sulphuric acid usually remedied the defect, and rendered the whole soluble. Pure sulphate of morphia is readily and entirely soluble in water.

This solution is very convenient, by enabling the physician to prescribe a minute dose, which, in consequence of the great energy of the preparations of morphia, is often necessary. It has the advantage that it may be kept for a very considerable length of time unchanged. The full dose for an adult is from one to two fluidrachms, containing from an eighth to a quarter of a grain of the sulphate.

Unfortunately, in some parts of the Union, the formula of Magendie for this solution, containing 16 grains in a fluidounce, is habitually employed under the name of solution of sulphate of morphia. This is the proper name of the officinal solution.

which is much weaker; and the most dangerous results may ensue from the confusion. Magendie's solution should never be prescribed or sold, unless under some special designation. W.

LIQUOR PLUMBI SUBACETATIS. *U. S.*, *Br. Solution of Subacetate of Lead.*

"Take of Acetate of Lead *sixteen troyounces;* Oxide of Lead [Litharge], in fine powder, *nine troyounces and a half;* Boiling Water *a sufficient quantity.* Put the Acetate and Oxide into four pints of Distilled Water, in a glass or porcelain vessel, and boil for half an hour, occasionally adding Boiling Water to preserve the measure, and filter through paper. Lastly, keep the liquid in a well-stopped bottle." *U. S.* The sp. gr. of this solution is 1·267.

"Take of Acetate of Lead *five ounces* [avoirdupois]; Oxide of Lead, in powder, *three ounces and a half* [avoird.]; Distilled Water *one pint* [Imperial measure], or *a sufficiency.* Boil the Acetate of Lead and the Oxide of Lead in the Water for half an hour, constantly stirring; then filter, and, when the liquid is cold, add to it more Distilled Water, until the product measures twenty fluidounces. Keep the clear solution in stoppered bottles." *Br.* The sp. gr. of the solution is 1·260.

Crystallized acetate of lead consists of one equivalent of acetic acid 51, of protoxide of lead 111·6, and three of water 27 = 189·6. Litharge, as usually found in the shops, is an impure protoxide of lead. When the solution of the former is boiled with the latter, a large quantity of the protoxide is dissolved, and a subacetate of lead is formed which remains in solution. The precise composition of the subacetate varies with the proportion of acetate of lead and of litharge employed. When the quantity of the latter exceeds that of the former by one-half or more, the acetic acid of the acetate unites, according to the highest chemical authorities, with two additional equivalents of protoxide, forming a trisacetate; when the two substances are mixed in proportions corresponding with their equivalent numbers, that is, in the proportion of 189·6 of salt to 111·6 of oxide, or 10 to 6 nearly, only one additional equivalent of protoxide unites with the acid, and a diacetate of lead is produced. In the officinal process, the proportions appear to have been arranged in reference to this result. In executing the process, the litharge should be employed in very fine powder, and, according to Thenard, should be previously calcined in order to decompose the carbonate of lead, which it always contains in greater or less proportion, and which is not dissolved by the solution of the acetate.

In former editions of the London and Dublin Pharmacopœias, a different process was directed, consisting in boiling litharge with distilled vinegar, the former being in much larger proportion than necessary to form the neutral acetate. A diacetate was thus produced; but, as the vinegar was of uncertain strength, there was necessarily more or less inequality of strength in the preparation. This process, therefore, has been abandoned. The solution prepared from litharge and distilled vinegar has a pale greenish-straw colour, owing to impurities in the vinegar. Made with common vinegar it is brown.

M. Nevning states that a solution of subacetate of lead more permanent than the officinal one may be prepared by simply allowing litharge to remain for twenty-four hours in a solution of acetate of lead, with occasional agitation. This preparation probably contains much less of the oxide of lead than does the officinal solution.

Properties. The solution of subacetate of lead of the Pharmacopœias is colourless, and of a sweetish, astringent taste.* When concentrated by evaporation, it deposits on cooling crystalline plates, which, according to Dr. Barker, are flat, rhomboidal prisms, with dihedral summits. It has an alkaline reaction, tingeing the syrup of violets green, and reddening turmeric paper. One of its most striking properties is the extreme facility with which it is decomposed. Carbonic acid throws down a

* *Crystallized Subacetate of Lead.* M. Jeannel prepares crystallized subacetate of lead in accordance with the following formula. Triturate six parts of neutral acetate of lead, with two parts of pure litharge, and add one part of water. Heat in a porcelain capsule, stirring with a glass rod, until fusion, and finally ebullition occurs. After two or three minutes of boiling, filter through paper in a funnel heated by a sand-bath. Allow to cool and crystallize. (*Journ. de Pharm.*, 4 sér., xi. 54.)—*Note to the fourteenth edition.*

white precipitate of carbonate of lead; and this happens by mere exposure to the air, or by mixture even with distilled water, if this has had an opportunity of absorbing carbonic acid from the atmosphere. It affords precipitates also with the alkalies, alkaline earths, and their carbonates, with sulphuric and muriatic acids free or combined, with hydrosulphuric acid and the hydrosulphates, with the soluble iodides and chlorides, and, according to Thenard, with solutions of all the neutral salts. Solutions of gum, tannin, most vegetable colouring principles, and many animal substances, particularly albumen, produce with it precipitates consisting of the substance added and oxide of lead. It should be kept in well-stopped bottles. It is known to contain a salt of acetic acid by emitting an acetous smell when treated with sulphuric acid; and a salt of lead, by yielding a white precipitate with an alkaline carbonate, a yellow one with iodide of potassium, and a black one with hydrosulphuric acid. It is distinguished from the solution of acetate of lead by being precipitated by gum arabic. Six fluidrachms (413·8 grains) of the Br. solution require for perfect precipitation 810 grain-measures of the *volumetric solution of oxalic acid. Br.*

Medical Properties and Uses. This solution is astringent and sedative, but is employed only as an external application. It is highly useful in inflammation arising from sprains, bruises, burns, blisters, &c., to which it is applied by means of linen cloths, which should be removed as fast as they become dry. It always, however, requires to be diluted. From four fluidrachms to a fluidounce, added to a pint of distilled water, forms a solution sufficiently strong in ordinary cases of external inflammation. When applied to the skin denuded of the cuticle, the solution should be still weaker; as constitutional effects might result from the absorption of the lead. Paralysis is said to have been produced by its local action; and a case of poisoning by its injection into the urethra for gonorrhœa is reported in the *Dublin Journal of Med. Science*, 1874, p. 150. The solution has the common name of *Goulard's extract*, derived from a surgeon of Montpellier by whom it was introduced into general notice, though previously employed.

Off. Prep. Ceratum Plumbi Subacetatis, *U. S.;* Linimentum Plumbi Subacetatis, *U. S.;* Liquor Plumbi Subacetatis Dilutus; Unguentum Plumbi Subacetatis Compositum, *Br.* W.

LIQUOR PLUMBI SUBACETATIS DILUTUS. *U.S., Br. Diluted Solution of Subacetate of Lead. Lead-water.*

"Take of Solution of Subacetate of Lead *three fluidrachms;* Distilled Water *a pint.* Mix them." *U. S.*

"Take of Solution of Subacetate of Lead, Rectified Spirit, of each, *two fluidrachms;* Distilled Water *nineteen fluidounces and a half.* Mix, and filter through paper. Keep the clear solution in a stoppered bottle." *Br.*

This preparation is convenient; as, in consequence of the subsidence of the carbonate of lead usually formed on the dilution of the strong solution, it enables the apothecary to furnish clear lead-water when it is called for. In our comments on the U. S. process of 1850, it was stated that the strength of our officinal preparation, though double what it formerly was, might be still further increased with propriety. In the present edition of the U. S. Pharmacopœia the proportion has been increased from two to three fluidrachms to the pint. The Br. preparation, though stronger than the old one of the London College, is still feeble. The old French Codex directed two drachms of the strong solution to a pound of distilled water, and an ounce of alcohol of 22° Baumé, and thus formed the *vegeto-mineral water* of Goulard. The minute proportion of proof spirit in the British solution can have little effect. The preparation should be as much as possible excluded from the air. W.

LIQUOR POTASSÆ. *U. S., Br. Solution of Potassa.*

"Take of Bicarbonate of Potassium *fifteen troyounces;* Lime *nine troyounces;* Distilled Water *a sufficient quantity.* Dissolve the Bicarbonate in four pints of Distilled Water, and heat the solution until effervescence ceases. Then add Distilled Water to make up the loss by evaporation, and heat the solution to the boiling point. Mix the Lime with four pints of Distilled Water, and, having heated the mixture to the

boiling point, add it to the alkaline solution, and boil for ten minutes. Then transfer the whole to a muslin strainer, and, when the liquid portion has passed, add sufficient Distilled Water, through the strainer, to make the strained liquid measure seven pints. Lastly, keep the liquid in well-stopped bottles of green glass. Solution of potassa, thus prepared, has the sp. gr. 1·065, and contains 5·8 per cent. of hydrate of potassa.

"Solution of Potassa may also be prepared in the following manner.

"Take of Potassa *a troyounce;* Distilled Water *a pint.* Dissolve the Potassa in the Distilled Water, and allow the solution to stand until the sediment subsides. Then pour off the clear liquid, and keep it in a well-stopped bottle of green glass." *U. S.*

"Take of Carbonate of Potash *one pound* [avoirdupois]; Slaked Lime *twelve ounces* [avoird.]; Distilled Water *one gallon* [Imperial measure]. Dissolve the Carbonate of Potash in the Water; and, having heated the solution to the boiling point, in a clean iron vessel, gradually mix with it the Slaked Lime; and continue the ebullition for ten minutes with constant stirring. Then remove the vessel from the fire; and, when by the subsidence of the insoluble matter the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond with the tests of sp. gr. and neutralising power. The sp. gr. is 1·058." *Br.*

The object of the first U. S. and of the British process is to separate carbonic acid from the carbonate or bicarbonate of potassium, so as to obtain the alkali in a caustic state. This separation of the carbonic acid is effected by hydrate of lime; and the chemical changes which take place are most intelligibly explained by supposing the occurrence of a double decomposition. The lime of the hydrate of lime, by its superior affinity, combines with the carbonic acid, and precipitates as carbonate of calcium; while the water of the hydrate of lime unites with the potassa and remains in solution as hydrate of potassa. The proportion indicated by theory for this decomposition would be 69·2 of the dry carbonate to 28 of lime, or one equivalent of each; but in practice it is found necessary to use an excess of lime. The bicarbonate is preferred in the U. S. process, as affording a purer product, being itself free from the contaminations usually found in the carbonate; and the application of heat to the solution of the bicarbonate is to drive off a portion of the carbonic acid and thus bring the salt to the state of a carbonate. The proportion of water employed has a decided influence on the result. If the water be deficient in quantity, the decomposing power of the lime, on account of its sparing solubility, will be lessened; and more of it will be required to complete the decomposition of the carbonate than if the solutions were more dilute. Straining must not be used; as it causes a prolonged contact with the air, and risk of the absorption of carbonic acid, and is apt, moreover, to introduce organic matter from the strainer into the solution. The direction to keep the solution in green glass bottles is judicious; as white flint glass is slightly acted on, and contaminates the solution with lead.*

As the solution of potassa is made by the manufacturing chemist in considerable quantities, the following details, taken from Berzelius, of the best mode of conducting the process, may not be without their use. Dissolve one part of carbonate of potassium in from seven to twelve parts of water in a bright iron vessel, and decant the solution after it has become clear by standing. Boil the solution in an iron vessel, and, while it is boiling, add at intervals small quantities of slaked lime, reduced to a thin paste with water; allowing the solution to boil a few minutes after each addition. One and a half parts of pure lime will be more than sufficient to decompose one part of the carbonate. When about half the hydrate of lime has been added, take out about a teaspoonful of the boiling solution, and, after dilution and filtration through paper,

* For remarks by Prof. Redwood, of London, in relation to the preparation of this Solution, and for a new process for which various advantages are claimed, the reader is referred to the *London Pharmaceutical Journal* for March, 1861, p. 450. The following are the outlines of the process. Into a stoppered bottle of green glass is introduced a mixture of ℥viiss of slaked lime and three Imperial pints of distilled water; and to this mixture is added, in small quantities at a time, a solution of ℥viiss of carbonate of potassium in one Imperial pint of distilled water, the bottle being shaken for some minutes after each addition. After the last addition, continue the shaking until a portion of the liquid filtered through calico no longer gives out carbonic acid, upon adding an excess of muriatic acid. (*Note to the twelfth edition.*)

test it by adding it to some nitric acid, or by mixing it with an equal bulk of lime-water. If the solution has not been completely freed from carbonic acid, the first reagent will cause an effervescence, and the second a milky appearance; in either of which events the addition of the lime must be continued as before, until the above-mentioned tests give negative indications. In conducting the process, several advantages are gained by keeping the solution constantly boiling. One is that the carbonate of calcium formed is in this way rendered granular and heavy, and more disposed to subside; another, that it prevents the precipitated carbonate from coalescing into a mass at the bottom of the vessel, an occurrence which causes the ebullition, when subsequently renewed, to take place imperfectly and by jerks; and a third, that any silica present is precipitated in combination with lime and potassa. The process here described is essentially the same with those introduced into the last editions of the Edinburgh and Dublin Pharmacopœias.

According to Prof. Wöhler, solution of pure hydrate of potassa for analytic purposes may be conveniently obtained by exposing for half an hour to a moderate red heat, in a copper crucible, one part of pure nitre, and two or three parts of copper cut into small pieces. The resulting mass, consisting of hydrate of potassa and black oxide of copper, is treated with water, and the solution poured into a narrow cylindrical vessel, where it is left until it gets perfectly clear by the deposition of the oxide of copper. It is then drawn off, and kept in well-stopped bottles. (*Chem. Gaz.*, Nov. 15, 1853, p. 429.) Graf and Riegel assert that hydrate of potassa, thus obtained, contains nitrate and nitrite of potassium; and Dr. A. Geuther found it perfectly pure, when the process was properly conducted. (*Chem. Gaz.*, June 1, 1856.) A pure hydrate may also be obtained by the process of Dr. Mohr, of Coblentz, which consists in precipitating solution of sulphate of potassium with caustic baryta, obtained from the nitrate. Thus procured, the alkali is entirely free from chlorine, silica, and sulphuric acid. (*Pharm. Journ.*, xvi. 310.)

Properties, &c. Solution of potassa is a limpid, colourless liquid, without smell, of an acrid caustic taste, and alkaline reaction. It acts rapidly on animal and vegetable substances, and, when rubbed between the fingers, produces a soapy feel, in consequence of a partial solution of the cuticle. It dissolves gum, resins, and extractive matter, and forms soap with oily and fatty bodies. The Br. solution is never pure, but contains either undecomposed carbonate, or free lime, in addition to minute portions of sulphate of potassium, chloride of potassium, silica, and alumina; impurities usually present in the carbonate of potassium used in their preparation. The U. S. solution, being obtained from the bicarbonate of potassium, is purer. Undecomposed carbonate may be detected in the manner explained in a preceding paragraph, and free lime by the production of a milky appearance on the addition of a few drops of carbonate of potassium, which precipitates the lime as a carbonate. When saturated with nitric acid, the solution should give little or no precipitate with carbonate of sodium, chloride of barium, or nitrate of silver. The presence of lead is detected by a black precipitate produced by hydrosulphate of ammonium. When solution of potassa is used as a test for diabetic urine, it should be free from lead, the presence of which renders the indications of the test ambiguous. (See *Wood's Practice of Med.*, 4th ed., ii. 586.) With bichloride of platinum it produces a yellow precipitate, showing that the alkali present is potassa. It is incompatible with acids, acidulous salts, and all metallic and earthy preparations held in solution by an acid; also with all ammoniacal salts, and with calomel, and corrosive sublimate. The two officinal solutions of potassa vary in strength; the U. S. solution having the sp. gr. 1·065 and the Br. 1·058. These solutions are very dilute; that of the U. S. Pharmacopœia, which is the strongest, containing only 5·8 per cent. of hydrate of potassa. There must, however, be some mistake either in the U. S. or British statement; for, while the greater sp. gr. given by the former indicates greater strength, the percentage of the hydrate of potassa as stated in the Br. Pharmacopœia is 5·84, or somewhat greater than the American. One fluidounce of the British solution (462·9 grains) requires for neutralization 482 grain-measures of the *volumetric solution of oxalic acid. Br.* On account of its strong attraction for carbonic acid, solution of potassa should be carefully preserved from contact with the air. In consideration of the change to which

it is liable by keeping, it may sometimes be advantageously prepared extemporaneously, according to the second U. S. process, by dissolving the hydrate in water.

Medical Properties and Uses. Solution of potassa is antacid, diuretic, and antilithic. It has been much employed in calculous complaints, under the impression that it has the property of dissolving urinary concretions in the kidneys and bladder; but experience has proved that the stone once formed cannot be removed by remedies internally administered; and the most that the alkaline medicines can effect, is to correct that disposition to the superabundant secretion of uric acid, or the insoluble urates, upon which gravel and stone often depend. For this purpose, however, the carbonated alkalies are preferable to caustic potassa, as they are less apt to irritate the stomach, and to produce injurious effects when long continued. It has been proposed to dissolve calculi by injecting immediately into the bladder the solution of potassa in a tepid state, and so much diluted that it can be held in the mouth; but this mode of employing it has not been found to answer in practice. This solution has also been highly recommended in lepra, psoriasis, and other cutaneous affections; and is said to have proved peculiarly useful in scrofula; but in all these cases it probably acts simply by its antacid property, and is not superior to the carbonate of potassium or of sodium. Externally it has been used, in a diluted state, as a stimulant lotion in rachitis and arthritic swellings, and, concentrated, as an escharotic in the bite of rabid or venomous animals. The dose is from ten to thirty minims, repeated two or three times a day, and gradually increased in cutaneous affections to one or two fluidrachms; but the remedy should not be too long continued, as it is apt to debilitate the stomach. It may be given in sweetened water or some mucilaginous fluid. Veal broth and table beer have been recommended as vehicles; but the fat usually present in the former would be apt to convert the alkali into soap, and the acid in the latter would neutralize it. In dyspeptic cases it may be associated with the simple bitters. In excessive doses it irritates, inflames, or corrodes the stomach. The antidotes are oils and milder acids, such as vinegar and lemon-juice, which operate by neutralizing the alkali.

Pharm. Uses. In preparing Atropia, *U. S.;* Hydrargyri Oxidum Flavum, *U. S.;* Sulphurated Antimony, *U. S.;* and Oxide of Silver, *U. S.*

Off. Prep. Potassa, *U.S.;* Potassa Caustica, *Br.;* Potassii Bromidum, *Br.;* Potassii Iodidum, *Br.* W.

LIQUOR POTASSII ARSENITIS. *U.S.* Liquor Arsenicalis. *Br.* *Solution of Arsenite of Potassium. Arsenical Solution. Fowler's Solution.*

"Take of Arsenious Acid, in small pieces, Bicarbonate of Potassium, each, *sixty-four grains;* Compound Spirit of Lavender *half a fluidounce;* Distilled Water *a sufficient quantity.* Boil the Arsenious Acid and Bicarbonate of Potassium, in a glass vessel, with half a fluidounce of Distilled Water, until the Acid is entirely dissolved, and add twelve fluidounces of Distilled Water. Then add the Compound Spirit of Lavender, and afterwards enough Distilled Water to make it measure a pint." *U. S.*

"Take of Arsenious Acid, in powder, Carbonate of Potash, of each, *eighty grains;* Compound Tincture of Lavender *five fluidrachms* [Imperial measure]; Distilled Water *a sufficiency.* Place the Arsenious Acid and Carbonate of Potash in a flask with ten [fluid]ounces of the Water, and apply heat until a clear solution is obtained. Allow this to cool. Then add the Compound Tincture of Lavender, and as much Distilled Water as will make the bulk one pint [Imp. meas.]." *Br.* The sp. gr. of this solution is 1·009.

This preparation originated with the late Dr. Fowler, of Stafford, England, and was intended as a substitute for the celebrated remedy known under the name of "the *tasteless ague drop.*" It is an arsenite of potassium dissolved in water, and is formed by the combination of the arsenious acid with the potassium of the bicarbonate or carbonate, the carbonic acid being evolved. In the present U. S. process, the bicarbonate has been substituted for the carbonate, because more readily obtained pure. Its eq. corresponds so nearly with that of arsenious acid that, practically, the equal quantities directed will serve the purposes of the formula. According to M. H. Buignet, ebullition disengages the carbonic acid slowly; so that, after four hours' boiling, the solution still retains about one-sixth of this acid. (*Journ. de Pharm.*,

Dec. 1856, p. 440.) The name by which the preparation is designated in the U. S. Pharmacopœia is the most correct. It has, however, been denied that the carbonate of potassium is decomposed by the arsenious acid, which is supposed to be merely held by it in solution; and, in this view of the nature of the preparation, the British name of Arsenical Solution would be appropriate. The spirit of lavender is added to give it taste, and prevent its being mistaken for water. The U. S. preparation is of about the same strength as the British; for, although one-fourth more acid and alkali is taken in the latter formula, yet the Imperial pint is nearly one-fourth larger than the wine pint.

In making this preparation, care should be taken that the arsenious acid is pure. This object is best secured by using the acid in small pieces instead of in powder. Sulphate of calcium is a common impurity in the powdered acid, and if present will remain undissolved, and cause the solution to be weaker than it should be. Another insoluble impurity in the powdered acid is arsenite of calcium, which is sometimes present to the amount of 25 per cent. (*Buignet.*) Hence, if the arsenious acid does not entirely dissolve, the solution must be rejected.

Properties. Solution of arsenite of potassium is a transparent liquid, having the colour, taste, and smell of the spirit of lavender. It has a strong alkaline reaction. It is decomposed by the usual reagents for arsenic, such as nitrate of silver, the salts of copper, lime-water, and sulphuretted hydrogen; and is incompatible with the infusions and decoctions of cinchona. Before sulphuretted hydrogen will act, the solution must be acidulated with some acid, as the muriatic or acetic. If very long kept in flint glass, it is apt to suffer partial decomposition, exhaling a garlicky odour, and giving the inner surface of the bottle a metallic lustre, owing to the lead of the glass being revived. (Canavan, *N. Y. Journ. of Pharm.*, i. 131.) According to Dr. R. Fresenius, solutions of alkaline arsenites, by keeping, absorb oxygen from the air, and are in part converted into arseniates. Hence the propriety of keeping this solution in small bottles quite filled. Mohr states that the alkaline reaction of the officinal solution delays the change.

Medical Properties and Uses. This solution has the general action of the arsenical preparations on the animal economy, already described under the head of *Arsenious Acid*. Its liquid form makes it convenient for exhibition and gradual increase; and it is the preparation generally resorted to when arsenic is given internally. It has been much employed in intermittent fever. The late Prof. Thomas K. Mitchell, of Jefferson Medical College, gave the result of his experience, as to its efficacy and safety in this disease, when exhibited in the large dose of fifteen or twenty drops three times a day. It is a valuable resource in the intermittents of children, who are with difficulty induced to swallow bark or even sulphate of quinia. The late Dr. Dewees related the case of a child only six weeks old, affected with a severe tertian, in which this solution was given with success. A fluidrachm was diluted with twelve fluidrachms of water; and of this six drops were given every four hours.

Fowler's solution is useful in many diseases. It has been employed with great success in lepra and other inveterate cutaneous affections. The late Dr. S. Calhoun published an account of five cases of nodes successfully treated by it; and Dr. Baer, of Baltimore, and the late Dr. Eberle afterwards gave it a trial in this affection, and obtained satisfactory results. Several cases of chorea, cured by it, are reported by Mr. Martin, Mr. Slater, and Dr. Gregory, in the *Medico-chirurgical Transactions* of London. Two interesting cures of periodical headache, performed by the solution, were related by the late Dr. Otto, of Philadelphia, in the *North American Med. and Surg. Journal* (vols. iv. and v.). Mr. H. Hunt found it useful in menorrhagia, but prefers arsenious acid, as less apt to produce unpleasant effects. Dr. Fuller, of London, praises its effects in rheumatic gout, attended with turbid urine, in the dose of from eight to fifteen minims, conjoined with solution of potassa, or acetate of potassium. For an account of the successful use of Fowler's solution in five cases of snake-bite, see *page* 25. A diluted solution, in the proportion of a fluidrachm to the fluidounce of water, has been used with advantage as a topical application to foul ulcers.

Each fluidrachm of the solution contains half a grain of arsenious acid. The average dose for an adult is ten drops two or three times a day. For the peculiar

effects which it produces in common with the other arsenical preparations, the reader is referred to the article *Arsenious Acid.*

Duflos's antidote to the poisonous effects of Fowler's solution, and of the salts of the acids of arsenic generally, is the acetate of the sesquioxide of iron with excess of base, made by dissolving freshly precipitated sesquioxide in acetic acid to saturation, adding an equal quantity of the oxide to the solution, and diluting the whole with water to the consistence of cream. B.

LIQUOR POTASSII CITRATIS. *U. S.* *Solution of Citrate of Potassium.*

"Take of Citric Acid *half a troyounce;* Bicarbonate of Potassium *three hundred and thirty grains;* Water *half a pint.* Dissolve the Acid and Bicarbonate in the Water, and strain the solution through muslin." *U. S.*

MISTURA POTASSII CITRATIS. *U. S.* LIQUOR POTASSÆ CITRATIS. *U. S.* 1850. *Mixture of Citrate of Potassium. Neutral Mixture.*

"Take of Lemon-juice, fresh, *half a pint;* Bicarbonate of Potassium *a sufficient quantity.* Add the Bicarbonate gradually to the Lemon-juice until the acid is completely saturated; then strain through muslin." *U. S.*

We consider these preparations here together, because essentially connected in practice; one being substituted for the other according to circumstances unconnected with their real remedial effects, as the presence or absence of fresh lemons or limes in the market, the taste of the patient, &c. In the present formula for solution of citrate of potassium the volatile oil of lemons has been omitted; which we should also regret, were it not easy to supply the omission extemporaneously if required. Two minims of the oil, rubbed up with the citric acid before it is dissolved, will materially improve the flavour, and give the preparation a closer resemblance to the original neutral mixture made from lemon-juice, from which it was copied. In both the above preparations, the potassium of the bicarbonate unites with the citric acid, and the carbonic acid is liberated. A portion of the latter remains in the solution, and a portion escapes with effervescence. The result, therefore, is a solution of citrate of potassium in water impregnated with carbonic acid. When lemon-juice is employed, the solution has a greenish-yellow colour; but prepared with the pure acid it is colourless. In the U. S. Pharmacopœia of 1850, bicarbonate of potassium was substituted for the carbonate before used. As the preparation was formerly made, a flocculent precipitate was apt to exhibit itself in small quantity, owing to the silicate of potassium generally present as an impurity in the carbonate. This gave up its base to the citric acid, and the silica was deposited in the state of a hydrate. The bicarbonate is free from this impurity, and consequently hydrated silica is not thrown down; nevertheless, the solution is still directed to be filtered; a direction which may be useful, when fresh lemon-juice is used, by separating the undissolved matters of the juice, and in other instances is only surplusage. About 48 grains of the crystals of the bicarbonate, 33 grains of the pure and perfectly dry carbonate, or 45 grains of the hydrated carbonate found in the shops, are sufficient to saturate a fluidounce of good lemon-juice; but the strength of the juice is variable, and the carbonate is apt to absorb moisture from the air, so that precision as to quantities cannot be readily attained. Hence the propriety of the direction in the process for the neutral mixture, to add the alkaline carbonate to saturation. The point of saturation may be determined by the cessation of effervescence, the absence of either an acid or alkaline taste, and still more accurately by litmus paper, which should not be rendered bright-red by the solution, nor blue if previously reddened by an acid.

The inequality of strength in the lemon-juice renders the neutral mixture prepared with it more or less uncertain; though, if the apothecary select ripe and sound fruit, and express the juice himself, the preparation will be found to approach sufficiently near a uniform standard for all practical purposes. Nevertheless, if the physician wish absolute precision, he may order the neutral mixture to be made with crystallized citric acid, as directed in the first officinal formula; or he may pursue the following plan, suggested in former editions of this work. Dissolve two drachms of bicarbonate of potassium in two fluidounces of water; saturate the solution with good fresh lemon-

juice, and strain; and, lastly, add enough water to make the mixture measure six fluidounces. A fluidounce of this solution may be given for a dose.

Another mode of preparing the neutral mixture, officinal in 1850, but omitted in the present edition of the Pharmacopœia, is simply to dissolve citrate of potassium in water, in the proportion of six drachms to half a pint. The preparation may be improved in flavour, and rendered more agreeable to the stomach, by rubbing a drop or two of oil of lemon with the six drachms of citrate before dissolving it, and substituting carbonic acid water for water as the menstruum.

Effervescing Draught. Under this name, the citrate of potassium is often prepared extemporaneously, and given in the state of effervescence. The most convenient mode of exhibition is to add to a fluidounce of a mixture consisting of equal parts of lemon-juice and water, half a fluidounce of a solution containing fifteen grains of carbonate of potassium, or twenty grains of the bicarbonate. Should effervescence not occur, as sometimes happens, when the carbonate is used, in consequence of the weakness of the lemon-juice, more of the juice should be added; as, unless sufficient acid is present to neutralize the potassa, part of the carbonate passes into the state of bicarbonate, and the gas is thus prevented from escaping. A solution of citric acid of the strength of that directed in the officinal formula may be substituted for lemon-juice, if this is not to be had. The fifteen grains of carbonate of potassium above mentioned are scarcely sufficient to saturate the lemon-juice, if of ordinary strength; but a little excess of the acid renders the preparation more agreeable to the taste. Some prefer the bicarbonate in the preparation of the effervescing draught, because it will always effervesce with lemon-juice, no matter what may be the strength of the latter. But this is an objection. The carbonate serves, by the absence of effervescence, to indicate when the lemon-juice is very weak in acid; and the defect may then be easily remedied by the addition of more juice. When the bicarbonate is used, if there should be a deficiency of acid, it is not discovered; and the patient takes a considerable portion of undecomposed bicarbonate, instead of the full quantity of citrate intended.

Medical Properties and Uses. The solution of citrate of potassium has long been used under the name of *neutral mixture*, *saline mixture*, or *effervescing draught*. It is an excellent refrigerant diaphoretic, adapted to almost all cases of fever with a hot dry skin, and especially to the paroxysms of our remittent and intermittent fevers. The *effervescing draught* is peculiarly useful. The carbonic acid serves to cover the taste of the citrate of potassium, and adds to the diaphoretic powers of the salt its own cordial influence upon the stomach. No preparation with which we are acquainted is equally efficacious in allaying irritability of stomach and producing diaphoresis in our remittent fevers. It is usually also very grateful to the patient. In order to increase the sedative and diaphoretic properties of the neutral mixture, it is customary to add to it a portion of tartar emetic; and a little sweet spirit of nitre will be found an excellent adjuvant in fevers with nervous disturbance. Should the solution irritate the bowels, as occasionally happens, it may be combined with a little laudanum or solution of sulphate of morphia. Sugar may be added if desired.

The dose of the officinal solution is a tablespoonful, or half a fluidounce, which should be somewhat diluted when taken. The whole of each effervescing draught, prepared as above stated, is to be taken at once. Each dose should be repeated every hour, two, or three hours, according to the urgency of the symptoms. W.

LIQUOR POTASSÆ EFFERVESCENS. *Br. Effervescing Solution of Potash.*

"Take of Bicarbonate of Potash *thirty grains;* Water *one pint* [Imperial measure]. Dissolve the Bicarbonate of Potash in the Water and filter the solution; then pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas." *Br.*

This is one of the preparations of the old Colleges, which, discarded by the framers of the first British Pharmacopœia, has been admitted into the present edition of that

work. It is nothing more than a solution of bicarbonate of potassa in carbonic acid water; and, in the pharmacy of this country, is more conveniently prepared for extemporaneous use by introducing a solution of the bicarbonate, of a given strength, or even the salt itself, into a strong green-glass bottle, and filling the bottle with carbonic acid water at the fountain. The proportion of the salt is far too small to the water for medical use. Little effect can be expected from bicarbonate of potassium as an antacid or antilithic, or even with a view to the alkalizing of the blood, in a dose less than thirty grains twice or thrice daily; and 20 fluidounces of liquid is much too large to be taken at once, or even in two doses. We have generally prescribed a solution containing a drachm of the bicarbonate in eight or ten fluidounces of carbonic acid water, to be given in two doses, with generally a little ginger syrup to improve the flavour. The advantages of carbonic acid as a vehicle are that it renders the medicine less disagreeable to the taste and more acceptable to the stomach, while by its stimulant impression it obviates the debility of the digestive organs often consequent on the use of alkaline medicines. W.

LIQUOR POTASSII PERMANGANATIS. *U. S.* LIQUOR POTASSÆ PERMANGANATIS. *Br.* *Solution of Permanganate of Potassium.*

"Take of Permanganate of Potassium *sixty-four grains;* Distilled Water *a pint.* Dissolve the Permanganate of Potassium in the Distilled Water." *U. S.*

"Take of Permanganate of Potash *eighty grains;* Distilled Water *one pint* [Imperial measure]. Dissolve." *Br.*

This is a simple solution of permanganate of potassium, in the proportion, as nearly as may be, of one part by weight to 114 (110 *Br.*) parts of water; and is intended to be of standard strength. But, while for some purposes it is too strong, for others it is too feeble; and we prefer M. Reveil's normal solution of 10 parts to 90, so that the solution shall contain 10 per cent. of the salt, which may be used of its full strength when required, or diluted more or less according to circumstances. For details on this point the reader is referred to the article on permanganate of potassium (*page* 744). The solution is used as a gargle in fetid affections of the throat, and for washing the hands after dissections, in the proportion of one part to thirty or forty of water.

W.

LIQUOR SODÆ. *U. S., Br.* *Solution of Soda.*

"Take of Carbonate of Sodium *twenty-six troyounces;* Lime *eight troyounces;* Distilled Water *a sufficient quantity.* Dissolve the Carbonate in three pints and a half of Distilled Water, and heat the solution to the boiling point. Mix the Lime with three pints of Distilled Water, and, having heated the mixture to the boiling point, add it to the solution of the Carbonate, and boil for ten minutes. Then transfer the whole to a muslin strainer, and, when the liquid portion has passed, add enough Distilled Water, through the strainer, to make the strained liquid measure six pints. Lastly, keep the liquid in well-stopped bottles of green glass. Solution of Soda has the sp. gr. 1·071, and contains 5·7 per cent. of hydrate of soda." *U. S.*

The British Pharmacopœia takes of Carbonate of Soda *twenty-eight ounces* [avoirdupois]; Slaked Lime *twelve ounces* [avoird.]; Distilled Water *one gallon* [Imperial measure], and prepare the solution in the manner directed for Liquor Potassæ. The sp. gr. of the British solution is 1·047; and the proportion of hydrated soda contained in it is 4·1.

Solution of soda is prepared in the same way as solution of potassa. By a double decomposition between carbonate of sodium and hydrate of lime, there are formed hydrate of soda in solution, and carbonate of calcium which precipitates. In both the processes an excess of lime is used, which is necessary to ensure a full decomposition of the carbonate. One fluidounce of the British solution (458 grains) requires for neutralization 470 grain-measures of the *volumetric solution of oxalic acid*, and contains 18·8 grains of the hydrated alkali. *Br.*

Properties, &c. Solution of soda, sometimes called solution of *caustic* soda, is a colourless liquid, having a caustic taste and alkaline reaction. Its properties and tests are the same as those of solution of potassa, with the exception that no precipitate is produced by bichloride of platinum or tartaric acid. The alkali dissolved

must be viewed as hydrate of soda (NaO,HO), consisting of one eq. of soda 31·3, and one of water 9 = 40·3.

Pharm. Uses. In preparing Antimonium Sulphuratum, *Br.;* Cinchoniæ Sulphas. *U.S.;* Ferri Oxidum Magneticum, *Br.;* Ferri Peroxidum Humidum, *Br.;* Quiniæ Sulphas, *Br.*

Off. Prep. Soda Caustica, *Br.;* Sodæ Valerianas. B.

LIQUOR SODÆ CHLORINATÆ. *U.S.* Liquor Sodæ Chloratæ. *Br. Solution of Chlorinated Soda. Labarraque's Disinfecting Liquid.*

"Take of Chlorinated Lime *twelve troyounces;* Carbonate of Sodium *twenty-four troyounces;* Water *twelve pints.* Dissolve the Carbonate of Sodium in three pints of the Water, with the aid of heat. Triturate the Chlorinated Lime, a little at a time, with small portions of the Water, gradually added, until a smooth, uniform mixture is obtained. Mix this intimately with the remainder of the Water, and set the mixture aside for twenty-four hours. Then decant the clear liquid, and, having transferred the residue to a muslin strainer, allow it to drain until sufficient liquid has passed to make, with the decanted liquid, eight pints. Mix the liquid thoroughly with the solution of Carbonate of Sodium, transfer the mixture to a muslin strainer, and allow it to drain, adding water, if necessary, towards the close, until eleven pints and a half of liquid have passed. Lastly, keep the liquid in well-stopped bottles, protected from the light." *U.S.* The sp. gr. of this solution is 1·045.

"Take of Carbonate of Soda *twelve ounces* [avoirdupois]; Black Oxide of Manganese *four ounces* [avoird.]; Hydrochloric Acid *fifteen fluidounces* [Imperial measure]; Distilled Water *two pints* [Imp. meas.]. Dissolve the Carbonate of Soda in thirty-six [fluid]ounces of the Distilled Water and put the solution into a glass vessel. Mix the Oxide of Manganese and Hydrochloric Acid in a glass flask with a bent tube, attached, by means of a cork, to its mouth, apply a gentle heat, and with a suitable arrangement of apparatus cause the gas which is evolved to pass first through a wash-bottle containing four [fluid]ounces of Water, and then into the solution of carbonate of soda, regulating the heat so that the gas shall be slowly but constantly introduced. When the disengagement of chlorine has ceased, transfer the solution in which it has been absorbed to a stoppered bottle, and keep it in a cool and dark place." *Br.* The sp. gr. of this solution is 1·103.

This solution was first brought into notice as a disinfecting agent by Labarraque, an apothecary of Paris. It was afterwards found to possess valuable therapeutic properties. The U.S. process is that of Payen, adopted in the French Codex of 1837. It consists in decomposing a solution of carbonate of sodium by one of chlorinated lime. Carbonate of calcium is precipitated and the chlorinated soda remains in solution. The proportion employed gives an excess of carbonate of sodium, the presence of which renders the solution more permanent. The British process is that of Labarraque. All the chlorine generated from the prescribed quantity of materials for forming that gas, is passed into the solution of carbonate of sodium; and, when the chlorine is limited to this quantity, no carbonic acid is disengaged. The chlorine is first passed through water to free it from muriatic acid, which, if suffered to come over, would convert the alkali into common salt.

The bicarbonate of sodium is recommended instead of the carbonate, on account of the state of crystalline powder in which the carbonate of calcium is precipitated, rendering its separation from the supernatant solution very easy, while the precipitate produced by the carbonate of sodium is a kind of magma from which the liquor is not readily decanted. It is stated also that a little excess of the bicarbonate is useful in various ways. (*Ann. de Thérap.*, A.D. 1866, p. 107.)

Properties. The U.S. solution is transparent, of a greenish-yellow colour, a faint smell of chlorine, a sharp saline taste, and an alkaline reaction. With lime-water it yields a precipitate of carbonate of calcium, known to be a carbonate by its dissolving with effervescence in an acid. This precipitate is caused by the excess of carbonate of sodium. Owing to the presence of loosely-combined chlorine, it rapidly destroys the colour of sulphate of indigo. It produces a copious, light-brown pre-

cipitate with the sulphate of iron. The British solution is a colourless alkaline liquid, of an astringent taste, and a feeble smell of chlorine. With muriatic acid it effervesces, and evolves chlorine and carbonic acid, and forms a solution which is not precipitated by bichloride of platinum, thus showing the absence of potassa. It is not precipitated by oxalate of ammonium, showing that it contains no lime. "Seventy grains added to a solution of 20 grains of iodide of potassium in four fluidounces of water, and acidulated with two fluidrachms of hydrochloric acid, require for the discharge of the brown colour which the mixture assumes, 500 grain-measures of the *volumetric solution of hyposulphite of soda.*" (*Br.*) This test is intended to determine the chlorine strength of the solution. The hydrochloric acid liberates the chlorine, which then separates from the iodide of potassium an equivalent quantity of iodine, by which the solution is rendered brown; and, the iodine being converted into hydriodic acid by the hyposulphite of sodium, the solution again becomes colourless. The quantity of the solution of the latter salt required to bleach the liquid measures the proportion of iodine, and this that of the chlorine which separates it. The colour of turmeric is first rendered brown, and afterwards destroyed. When it is boiled, chlorine is not given off, nor is its bleaching property sensibly impaired; and when carefully evaporated, a mass of damp crystals is obtained, which, when redissolved in water, possesses the properties of the original liquid. Both solutions, when exposed to the air, absorb carbonic acid and slowly evolve chlorine. It is on this property of gradually evolving chlorine that their disinfecting power depends.

Nature and Composition. The chemical nature of these solutions is different. Assuming the chlorinated lime to be essentially hypochlorite of calcium with chloride of calcium (see *page* 199), the U. S. solution, after decantation from the precipitated carbonate of calcium, will contain *hypochlorite of sodium* with *chloride of sodium;* $CaO,ClO + CaCl$ and $2(NaO,CO_2) = NaO,ClO + NaCl$ and $2(CaO,CO_2)$. Besides these there will be present more or less *carbonate of sodium*, according as there happens to be in the chlorinated lime less or more chlorine to decompose it. In all cases, however, there will be an excess of carbonate of sodium; as the best chlorinated lime does not contain sufficient chlorine to effect its entire decomposition, in the proportion in which it is taken in the formula. The constitution of the British preparation is more complicated. As it is a peculiarity in its formation that no carbonic acid is evolved, it is necessary to assume the presence of all the carbonic acid of the carbonate of sodium; and hence it is considered to be a combination of *hypochlorite of sodium*, *chloride of sodium*, and *bicarbonate of sodium.* The reaction is supposed to take place between four eqs. of carbonate of sodium and two of chlorine. By a transfer of carbonic acid from two eqs. of carbonate to the remaining two eqs. of the same salt, two eqs. of bicarbonate are formed, and two of soda left. The sodium and oxygen of one eq. of soda unite, each, with one eq. of chlorine, so as to form one eq. of chloride of sodium, and one of hypochlorous acid. This acid then unites with the remaining eq. of soda to form hypochlorite of sodium. The view here taken makes the U. S. and British solutions analogous in constitution; but differing in one containing the carbonate, the other the bicarbonate of sodium. In the latter, half the soda is bicarbonated; in the former, from a half to a third is monocarbonated, according to the quality of the chlorinated lime used. According to Millon's view, both solutions contain *oxychloride of sodium,* $Na\left\{\begin{matrix}O\\Cl_2\end{matrix}\right.$, or, which is the same thing, bichloride of soda (NaO,Cl_2); thus making the compound assimilate in constitution to the teroxide of sodium (NaO_3). On Millon's view, one eq. of carbonate of sodium would decompose two of chloride of calcium, with the result of forming one eq. of bichloride of sodium, one of carbonate of calcium, and one of free lime; $2(CaO,Cl)$ and $NaO,CO_2 = NaO,Cl_2$ and CaO,CO_2 and CaO. M. Millon's view doubles the proportion of the chlorine to the soda. Mr. B. Kavanagh, of Dublin, finds that a solution of alum has its alumina precipitated upon being added to the British chlorinated soda liquid, without effervescence of carbonic acid, but with the evolution of chlorine on the application of heat. Hence he infers that the soda, not combined with carbonic acid in the preparation, is united with chlorine and not with hypochlorous acid, and, accordingly, conceives that he has proved the correctness of Mil

lon's views. Upon the whole, analyses are wanting before we can determine the true constitution of the officinal solutions of chlorinated soda. The British solution, though made on Labarraque's plan, is considerably stronger than his preparation; for in the British process the carbonate is dissolved in about three times its weight of water, before the chlorine is transmitted; whereas Labarraque dissolved it in four times its weight.

Medical Properties and Uses. Solution of chlorinated soda is stimulant, antiseptic, and resolvent. Internally it has been employed in diseases termed *putrid* or *malignant*, as typhus fever, scarlatina maligna, &c. The conditions which indicate the propriety of its use are great prostration of strength, fetid evacuations, and dry and furred tongue. Under these circumstances it promotes urine, creates a moisture on the skin, and improves the secretions and evacuations. It has also been given in dysentery accompanied with peculiarly fetid stools, in dyspepsia attended with putrid eructations, and in glandular enlargements and chronic mucous discharges. Other complaints in which it has been recommended, are secondary syphilis, scrofula, bilious disorders, and chronic diseases of the skin. M. Chailly speaks in praise of it in suppressed or deficient menstruation. In asphyxia from sulphuretted hydrogen it forms, like chlorinated lime, an efficacious antidote. The dose is from thirty drops to a teaspoonful, given in a cupful of water or mild aqueous liquid, and repeated every two or three hours.

As a local remedy it is found useful in all affections attended with fetor, such as gangrenous, cancerous, scrofulous, and syphilitic ulcers, ulceration of the gums, carbuncle, ozæna, mortification, putrid sorethroat, &c. In these cases it is applied as a gargle, wash, ingredient of poultices, or imbibed by lint. In the sloughing of the fauces occurring in severe cases of scarlatina, Dr. Jackson, late of Northumberland, Pa., found it efficacious, used as a gargle, or injected into the throat. In small-pox Mr. John Gabb employed this solution with great benefit, as a wash and gargle for the mouth and throat, and as an application to the skin to allay itching. In the soremouth from ptyalism, it forms a good mouth-wash, when diluted with eight parts or more of water. In fetid discharges from the vagina, uterus, and bladder, it has been employed with advantage as an injection, diluted with from fifteen to thirty parts of water for the vagina and uterus, and with sixty parts when the object is to wash out the bladder by means of a double cannula. The solution of chlorinated soda has also been applied successfully to burns, and to cutaneous eruptions, particularly psoriasis, tinea capitis, scabies, and obstinate herpetic affections. In these cases it is diluted with from ten to thirty parts of water, the strength varying according to circumstances. For the cure of sore nipples, Dr. Chopin found nothing so successful as frequently repeated lotions with this solution. Dr. M. F. Gavin, of Boston, has found glycerin to be in many instances preferable as a diluent to water, as it tends to prevent irritation of the sound skin, and, in consequence of its non-drying properties, is not evaporated like the water. (*Boston Med. & Surg. Journ.*, Feb. 2, 1865, p. 47.)

Solution of chlorinated soda is a powerful disinfectant, better suited for disinfecting operations on a small scale than chlorinated lime. In the chambers of the sick, especially with infectious diseases, it is highly useful, sprinkled on the floor or bed, and added to the vessels intended to receive the excretions.

Off. Prep. Cataplasma Sodæ Chloratæ, *Br.* B.

LIQUOR SODÆ EFFERVESCENS. *Br.* *Effervescing Solution of Soda. Soda Water.*

This is prepared by the British Pharmacopœia from Bicarbonate of Sodium and Water, in the same manner precisely and with the same quantities as the "*Effervescing Solution of Potash;*" and the remarks made upon that preparation are equally applicable to this. W.

LIQUOR SODII ARSENIATIS. *U. S.* Liquor Sodæ Arseniatis. *Br.* *Solution of Arseniate of Sodium.*

"Take of Arseniate of Sodium, rendered anhydrous by a heat not exceeding 300°, *sixty-four grains;* Distilled Water *a pint.* Dissolve the Arseniate of Sodium in the Water." *U. S.*

"Take of Arseniate of Soda (rendered anhydrous by a heat not exceeding 300°) *four grains;* Distilled Water *one fluidounce.* Dissolve." *Br.*

This is simply an officinal form for the administration of arseniate of sodium. (See *Sodii Arsenias.*) The salt is directed to be dried, in order that the solution may be of a uniform strength; as, from the mode in which the arseniate of sodium is ordered to be prepared, it is scarcely possible that it should always contain precisely the same quantity of water of crystallization. It is important in drying it to limit the heat to 300°, lest a portion of the arsenic should be volatilized. The commencing dose is from three to five minims or drops, to be very cautiously increased if necessary. Its arsenical strength is about the same as that of the British solution of arsenite of potassa. W.

LIQUOR STRYCHNIÆ. *Br.* *Solution of Strychnia.*

"Take of Strychnia, in crystals, *four grains;* Dilute Hydrochloric Acid *six minims;* Rectified Spirit *two fluidrachms;* Distilled Water *six fluidrachms.* Mix the Hydrochloric Acid with four [fluid]drachms of the Water, and dissolve the Strychnia in the mixture by the aid of heat. Then add the Spirit and the remainder of the Water." *Br.*

This is in fact a solution of the muriate of strychnia. The spirit is added for its preservation. Two fluidrachms of it contain a grain of strychnia, and the commencing dose is from five to ten minims, equal respectively to the twenty-fourth and the twelfth of a grain of the alkaloid. W.

LIQUOR ZINCI CHLORIDI. *U. S.*, *Br.* *Solution of Chloride of Zinc.*

"Take of Zinc, in small pieces, *six troyounces;* Nitric Acid, Precipitated Carbonate of Zinc, each, *one hundred and fifty grains;* Muriatic Acid, Distilled Water, each, *a sufficient quantity.* To the Zinc, contained in a glass or porcelain vessel, add gradually enough Muriatic Acid to dissolve it; then strain the solution, add the Nitric Acid, and evaporate to dryness. Dissolve the dry mass in five fluidounces of Distilled Water, add the Precipitated Carbonate of Zinc, and agitate the mixture occasionally during twenty-four hours; then filter through paper, adding enough Distilled Water, through the filter, to make the liquid measure a pint." *U. S.*

"Take of Granulated Zinc *one pound* [avoirdupois]; Hydrochloric Acid *forty-four fluidounces* [Imperial measure]; Solution of Chlorine *a sufficiency;* Carbonate of Zinc *half an ounce* [avoird.], or *a sufficiency;* Distilled Water *one pint* [Imp. meas.]. Mix the Hydrochloric Acid and Water in a porcelain dish, add the Zinc, and apply a gentle heat to promote the action until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow the product to cool. Filter it into a bottle and add Solution of Chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odour of chlorine. Add the Carbonate of Zinc in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter the liquid into a porcelain basin, and evaporate until it is reduced to the bulk of two pints [Imp. meas.]." *Br.*

The chloride of zinc is made, in the usual way, by dissolving zinc in muriatic acid. The solution of chlorine in the British process and the nitric acid in the U. S. process are added in order that any iron present may be converted into the sesquichloride, from which it is afterwards precipitated by the carbonate of zinc. In the Dublin process the former object was accomplished by the use of solution of chlorinated lime, the latter by chalk. This is a decided improvement; as the use of the chalk as a precipitant introduced into the preparation some chloride of calcium; while the carbonate of zinc adds to the chloride of zinc in solution. The preparation is completed by bringing it to a certain bulk by the addition of distilled water, and by filtration to separate the precipitated iron and any excess of the carbonate.

As procured by the Dublin process, solution of chloride of zinc was a dense, colourless liquid, having a burning, nauseous taste even when dilute. It contained 175 grains of zinc in the Imp. fluidounce, and had the sp. gr. 1·593. The British solution must be of the same or very nearly the same strength; as the proportion of zinc to the volume of the resulting solution is the same in the two codes. The American solution is a little stronger, containing 180 grains to the fluidounce [wine measure].

This solution is equivalent to Burnett's disinfecting fluid noticed below It is a powerful disinfectant, and, when applied, duly diluted with water, to cancerous and other offensive ulcers, destroys their fetor so long as the dressings are kept moist with it. The solution is recommended by M. Gaudriot in gonorrhœa in both sexes, as having remarkable remedial powers. For men he uses an injection, composed of from twenty-four to thirty-six drops in four fluidounces of water. A small quantity only is injected about an inch up the urethra, two or three times a day. For women he employs a vaginal suppository, formed of five drops of the solution, half a grain of sulphate of morphia, and three drachms of a paste consisting of a drachm and a half of starch, a drachm of mucilage of tragacanth, and half a drachm of sugar. The suppository is introduced every day, or every second day.

Burnett's disinfecting fluid, like the officinal solution, is an aqueous solution of chloride of zinc. It contains 200 grains of zinc in each Imperial fluidounce, and has the sp. gr. 2. It is, therefore, considerably stronger than the Dublin solution. It is so called after Sir William Burnett, who introduced it into use, in 1840, as a powerful deodorizing and disinfecting agent in neutralizing noxious effluvia, and in arresting animal and vegetable decomposition. Diluted with water it forms Sir William's patent preservative against the dry rot. The concurrent testimony of a number of observers shows that it acts as an excellent disinfectant for ships, hospitals, dissecting rooms, water-closets, privies, &c. (See Extracts from the *British Navy Reports* on chloride of zinc as a disinfectant, in the *Lond. Med. Times and Gaz.*, Oct. 1853, p. 341.) Injected into the blood-vessels, it preserves bodies for dissection, without impairing their texture, and is said not to injure the knives employed; but the accuracy of the latter statement is doubtful. The advantage is claimed for it, that, while it destroys putrid odours, it has no smell of its own. For preserving anatomical subjects, one part of the disinfecting fluid to eighteen of water will form a solution of the proper strength. For disinfecting operations on a large scale, a pint of the fluid may be mixed with four gallons of water. B.

LITHIA.

Preparation of Lithia.

LITHII CITRAS. *U. S.* LITHIÆ CITRAS. *Br.* *Citrate of Lithium.*

"Take of Carbonate of Lithium *one hundred grains;* Citric Acid, in crystals, *two hundred grains;* Distilled Water *two fluidounces.* Dissolve the Citric Acid in the water gently heated, and to the solution, gradually add the Carbonate of Lithium until perfectly dissolved, heating the solution so long as effervescence is produced. Evaporate, by means of a steam or sand-bath, to a viscid consistence, dry the residue in an oven, at a temperature of about 240°, then rapidly pulverize it, and preserve the powder in a well-stopped bottle." *U. S.*

"Take of Carbonate of Lithia *fifty grains;* Citric Acid, in crystals, *ninety grains;* Warm Distilled Water *one fluidounce.* Dissolve the Citric Acid in the Water, and add the Carbonate of Lithia, in successive portions, applying heat until effervescence ceases, and a perfect solution is obtained. Evaporate by a steam or sand-bath till water ceases to escape, and the residue is converted into a viscid liquid. This should be dried in an oven or air-chamber at the temperature of about 240°, then rapidly pulverized, and enclosed in a stoppered bottle." *Br.*

The British Pharmacopœia gives, as the composition of citrate of lithium, three eqs. of lithium and one of citric acid ($3LO,C_{12}H_5O_{11}$); this acid being tribasic. The eq. of carbonate of lithium being 37, and three eqs. entering into the constitution of the salt, 111 parts of the carbonate will of course require 201 parts or one eq. of crystallized citric acid for saturation. Consequently, to saturate the 50 grains of carbonate of lithium directed by the British Pharmacopœia, 90·54 grains of the crystallized acid will be required; so that there is a slight deficiency on the part of the acid; whereas it should be in slight excess, and, according to Mr. Squire, 100 grains of the acid should be used instead of 90 grains. This proportion is employed in the U. S. Pharmacopœia.

Citrate of Lithium, thus prepared, is in the form of a white powder, deliquescent, and soluble, without residue, in 2·5 parts of water. (*Squire.*) Heated to redness it

blackens, evolving inflammable gases; and the residue, neutralized by hydrochloric acid, yields with rectified spirit a solution which burns with a crimson flame. (*Br.*) This test proves that the base is lithia, and the acid organic. That the salt is a citrate will be shown by its solution becoming turbid when boiled with lime-water, but clear again on cooling. (*Brande and Taylor.*) "Twenty grains of it, burned at a low red heat, with free access of air, leave 10·6 grains of white residue." (*Br.*) In other words, 20 grains of the salt yield 10·6 grains of carbonate of lithium; for all the acid with its carbon must be consumed in the process. If the salt consist, as stated in the British Pharmacopœia, of 3 eqs. of lithia = 45, and one eq. of citric acid ($C_{12}H_5O_{11}$) = 165, without water, 210 parts of it should yield 111 parts of the carbonate, which is almost exactly the result given by the Pharmacopœia; so that the citrate must be considered as anhydrous.

Medical Properties and Uses. These are essentially the same as those of the carbonate, as, before entering the circulation, the citric acid is decomposed, and the lithia circulates with the blood, and passes out with the urine in the form of carbonate. While thus capable of producing the antacid, antilithic, and diuretic effects of the carbonate, it has the advantages over that salt of having a less disagreeable taste, and of being less disposed to irritate the stomach; the same advantages that, in many instances, the citrate of potassium has over the carbonate of that alkali. The dose is stated at from five to ten grains; but probably much more might sometimes be given with advantage, especially when employed with the object of dissolving depositions of urate of sodium. W.

LOTIONES.

Lotions.

This class has been introduced into the Br. Pharmacopœia, in order to give officinal recognition to two preparations, the *black wash* or *lotio nigra*, and the *yellow wash* or *lotio flava*, which have been long in use, and which will be found treated of under Calomel and Corrosive Sublimate at *pages* 1246 and 1240 of this work. Nothing more will be necessary here than to give the British formulas.

LOTIO HYDRARGYRI FLAVA. *Br. Yellow Mercurial Lotion.*

"Take of Perchloride of Mercury [Corrosive Sublimate] *eighteen grains;* Solution of Lime *ten fluidounces.* Mix."

LOTIO HYDRARGYRI NIGRA. *Br. Black Mercurial Lotion.*

"Take of Subchloride of Mercury [Calomel] *thirty grains;* Solution of Lime *ten fluidounces.* Mix." W.

MAGNESIA.

Preparations of Magnesia.

MAGNESIA. *U. S.* Magnesia Levis. *Br. Magnesia.*

"Take of Carbonate of Magnesium *a convenient quantity.* Put it into an earthen vessel, and expose it to a red heat for two hours, or until the carbonic acid is entirely expelled." *U. S.*

In the British Pharmacopœia directions are given for preparing two forms of magnesia, one called *Magnesia Levis*, or *Light Magnesia*, from the *Light Carbonate*, and the other simply *Magnesia* from the heavy carbonate, which it designates as *Carbonate of Magnesia.* It is the former which corresponds with our ordinary magnesia.

"Take of Light Carbonate of Magnesia *four ounces.* Put it into a Cornish or Hessian crucible closed loosely by a lid, and expose it to a low red heat until a small quantity, taken from the centre of the crucible, when it has been cooled, and dropped into diluted sulphuric acid, causes no effervescence." *Br.*

Magnesia. *Br.* This is directed, in the British Pharmacopœia, to be prepared precisely in the same manner as light magnesia, using, however, the heavy carbonate, named by it Carbonate of Magnesia. The two varieties differ, according to the Br. Pharmacopœia, only in their weight in the same bulk; the volumes corresponding to the same weight being to each other in the ratio of three and one-half to one.

By exposure to a red heat, the water and carbonic acid of the carbonate of magnesium are expelled, and the earth is obtained pure. According to Dr. Black, the carbonate loses seven-twelfths of its weight by calcination. Brande says that the loss varies from 50 to 60 per cent., of which from 15 to 20 per cent. is water. About the close of the process the earth exhibits a luminous or phosphorescent appearance, which is said to be a good criterion of its freedom from carbonic acid. (*Duncan.*) A more certain indication, however, is the absence of effervescence when muriatic acid is added to a little of the magnesia, previously mixed with water. It is an error to suppose that a very intense heat is requisite in the calcination. The temperature of ignition is sufficient for the expulsion of the water and carbonic acid, and any increase serves only to render the magnesia harder, denser, less readily soluble in acids, and consequently less useful as a medicine. In order to ensure a pure product, care should be taken that the carbonate employed be free from lime. It should be rubbed to powder before being introduced into the pot or crucible; and, as in consequence of its levity it occupies a very large space, the plan has been proposed of moistening and compressing it in order to reduce its bulk; but the French pharmaceutical writers direct that the vessels employed should be sufficiently large to contain a considerable quantity of the carbonate, without the necessity of resorting to compression.* The officinal direction, to keep the magnesia, after it has been prepared, in well-stopped glass vessels, is founded on the fact that it absorbs carbonic acid and water from the air; but, as the absorption of the acid goes on very slowly, and that of water does not injure the preparation, the caution is often neglected in the shops. The great bulk of the earth renders its introduction into small bottles inconvenient. A four-ounce bottle holds only about an ounce of the purest and finest magnesia. But its specific gravity is greatly increased by trituration; and four times the quantity may be thus got into the same space. The density of *Henry's Magnesia*, which is at least four times that of the earth prepared in the ordinary way, has been ascribed to this cause. It has also been attributed to the influence of intense heat employed in the calcination. The conjecture has even been advanced, that this magnesia, which has enjoyed so great a popularity in England and this country, is prepared by precipitating a solution of sulphate of magnesium by caustic potassa; as the earth afforded by this plan is comparatively dense. It is asserted that the magnesia, prepared from the carbonate procured by precipitating the sulphate of magnesium with carbonate of sodium, is softer to the touch, and bears a closer resemblance to Henry's than that prepared from the ordinary carbonate. The fact is explained by the presence in common magnesia of a little sulphate of potassium, from which it is difficult entirely to free it in consequence of the sparing solubility of this salt, and of a portion of silica, which originally existed in the carbonate of potassium employed to decompose the sulphate of magnesium, and of which the carbonate of sodium is destitute. According to Mr. Richard Phillips, jun., if equivalent quantities of crystallized sulphate of magnesium and crystallized carbonate of sodium be boiled together in water, the mixture evaporated to dryness, the residual salts calcined, and the sulphate of sodium dissolved out by water, the magnesia obtained will be dense. (See *Am. Journ. of Pharm.*, xvi. 118.) By packing the carbonate closely in the crucible, or by moistening and then compressing it strongly in a cloth, before calcination, a heavy magnesia is obtained. The advantages of Henry's magnesia, independently of the convenience of its less bulk, are its greater softness, and more ready miscibility with water. Preparations similar to Henry's are made by T. J. Husband and by Charles Ellis, of

* In a paper by M. A. Vée (*Journ. de Pharm.*, Avril, 1860, p. 84), it is stated that the magnesia of commerce, in consequence of imperfect preparation, is often found dense, granular, harsh, and of difficult solubility in the acids. To remedy this inconvenience the only method heretofore known was to prepare it in small quantities, and to stir the magnesia during calcination with an iron spoon. The difficulty in preparing it properly on the large scale depends upon the unequal action of the heat on large masses, so that the outer part becomes heated in excess before the inner is sufficiently so. To remedy this inconvenience M. Vée uses a furnace and crucible of a peculiar shape, so arranged that the magnesia may not be in layers thicker than seven centimetres (2·7 inches), may be exposed equably to heat, and not longer exposed than may be necessary for its decomposition. For an account of the apparatus, and of the proper method of managing the process, the reader is referred to the *Am. Journ. of Pharm.*, Nov. 1862, p. 522. (*Note to the twelfth edition.*)

Philadelphia, and sold under the names respectively of *Husband's* and of *Ellis's Magnesia.**

Properties, &c. Magnesia is a very light, white, inodorous powder, of a feeble alkaline taste. Its sp. gr. is commonly stated at 2·3. It was deemed infusible till melted by means of the compound blowpipe of Dr. Hare. Water sprinkled upon it is absorbed to the extent of about 18 per cent., but with scarcely any increase of temperature. It is almost insoluble, requiring, according to Dr. Fyfe, 5142 parts of water at 60°, and 36,000 parts of boiling water for solution. Water thus impregnated has no effect on vegetable colours; but magnesia itself produces a brown stain by contact with moistened turmeric paper. Magnesia is a metallic oxide, consisting of one equivalent of magnesium 12, and one of oxygen 8 = 20. *Magnesium* is a white, very brilliant metal, resembling silver, malleable, fusible at a low temperature, and convertible into magnesia by the combined action of air and moisture. It burns with great facility, and yields by its combustion a light which is said to be more intense than that from any other earthly source. (*Journ. de Pharm.*, 4e sér., ii. 320.)† There is a hydrate of magnesia consisting of one equiv. of the earth and one of water. Magnesia forms with nitric and muriatic acids, salts which are soluble in alcohol, and very deliquescent. It is precipitated from its saline solutions by the pure alkalies in the state of a hydrate, and by the carbonates of potassium and sodium as a carbonate; but it is not precipitated by the alkaline bicarbonates, nor by common carbonate of ammonium.

Magnesia is liable to contain, as impurities, carbonate of magnesium, lime, alumina, silica, and small quantities of the soluble salts employed or produced in the prepara-

* The three kinds of heavy magnesia sold in our market have been examined by Prof. Procter, with the following results. All are heavier than common magnesia, more readily miscible with water, smoother upon the tongue, and of a less quickly developed taste; but they differ in these respects, Henry's standing first, Husband's second, and Ellis's last. But the two latter are much more readily acted on by acids than Henry's, differing in this respect little from each other. Both, moreover, though less readily miscible with water than Henry's, are longer retained in suspension, and Ellis's exceeds Husband's in this quality. In reference, therefore, to mere facility of administration and to taste, it appears that the imported magnesia has the advantage; but for forming liquid mixtures, and for rapidity of antacid action, the American are preferable. Husband's contained 7 per cent. of combined water; the two others lost at a red heat only seven-tenths of one per cent. (*Am. Journ. of Pharm.*, xxii. 383.)

Dr. Pereira found *light magnesia*, under the microscope, to exhibit the same forms observed in the light carbonate; namely, one portion was amorphous and of a flocculent or granular consistence, and another was composed of fragments of prismatic crystals; while the *heavy magnesia* was homogeneous, exhibiting no traces of crystals, and consisting of minute granules more or less cohering into small soft balls or masses. (*Pharm. Journ.*, viii. 235.)—*Note to the ninth edition.*

In reference to the preparation of heavy magnesia, Mr. T. H. Barr, after trying various methods, obtained the best results either by precipitating a hot concentrated solution of sulphate of magnesium with a like solution of carbonate of sodium, or by decomposing chloride of magnesium by heat. (*Am. Journ. of Pharm.*, xxvi. 193.)

Mr. Thomas Weaver proposes the following ready method of preparing a heavy magnesia, which, as we have been informed, yields a good product, having not only the recommendation of density, but that also of smoothness, which is a no less desirable quality. "Take of sulphate of magnesium ℥iv, ℥ij; *bi*carbonate of sodium ℥iij. Dissolve the sulphate in six ounces of water, add a few drops of nitric acid, and boil for 15 or 20 minutes; then add sufficient carbonate of sodium, dissolved in a little water, to produce a slight precipitate, and continue boiling for some time; filter, and set aside to cool. Triturate the *bi*carbonate of sodium with about eight ounces of cold water, and add it to the cold solution of sulphate of magnesium. After frequent agitation, filter, transfer to a porcelain capsule, and boil quickly till reduced to a small bulk. Collect the precipitate on a filter, wash thoroughly, and, when nearly dry, transfer to a crucible free from iron, and calcine, bearing in mind the suggestion of Mr. Barr, that a low heat just approaching redness, and long continued, will ensure a much finer product than a high heat for a short time." The object of the nitric acid is to peroxidize any iron present in the sulphate, and the subsequent addition of carbonate of sodium, followed by ebullition, is to precipitate the ferruginous oxide. Cold solutions of bicarbonate of sodium and sulphate of magnesium do not react on each other; but, when the excess of carbonic acid is driven off by boiling, a precipitation takes place of carbonate of magnesium, which affords a denser magnesia by calcination than can be obtained by the use of carbonate of sodium. (*Am. Journ. of Pharm.*, xxviii. 214.)—*Note to the eleventh edition.*

† M. Z. Roussin has made some valuable suggestions in relation to magnesium. This metal possesses a remarkable property, that, namely, of precipitating many metals from their solution in a metallic state; and may thus render great service to toxicology, both as an antidote and a test. Thus, in the case of a poisonous metallic salt in the stomach, it may if swallowed render the poison for a time innoxious by reducing the metal; and, after death from such a cause, or in life, through the vomited liquid, may detect the poison, if inserted into the complex liquid, by throwing down the metal. The magnesium itself is harmless. (See *Am. Journ. of Pharm.*, Sept. 1866, p. 455.)—*Note to the thirteenth edition.*

tion of the carbonate from which it is procured. The presence of carbonate of magnesium is indicated by effervescence when the earth is dissolved in muriatic acid. Lime, which is a very frequent impurity, and imparts to the magnesia a more strongly alkaline and more disagreeable taste, is detected by oxalate of ammonium or bicarbonate of potassium. Neither of these salts disturbs a neutral solution of pure magnesia in a dilute acid; but, if lime is present, both produce a precipitate, the former of oxalate, the latter of carbonate of calcium. But, according to Wittstein, oxalate of calcium is soluble in the neutral salts of magnesia, requiring 50 parts of chloride of magnesium, and 90 of the sulphate of magnesium; and consequently there might be no precipitate, or one redissolved by the liquid, should the proportion of lime be very small. (*Journ. de Pharm.*, 4e sér., iii. 216.) As magnesia is completely dissolved by muriatic acid, silica and other impurities insoluble in that acid would be left behind. Alumina is indicated by the production of a precipitate when ammonia is added in excess to a solution of fifty grains of magnesia in a fluidounce of muriatic acid. (*Christison's Dispensatory.*) If the magnesia contain a soluble sulphate or carbonate, chloride of barium will reveal it by producing a precipitate with water digested on the magnesia.* Rochelle salt has been found as an impurity in magnesia, but this probably was the result of some accident. (*Amer. Journ. of Pharm.*, Jan. 1873.)

Medical Properties and Uses. Magnesia is antacid and laxative; and is much used, under the name of *calcined magnesia*, in dyspepsia, sick headache, gout, and other complaints attended with sour stomach and constipation. It is also a favourite remedy in the complaints of children, in which acidity of the primæ viæ is often a prominent symptom. Its antacid properties render it useful in gravel attended with an excessive secretion of uric acid. Its advantages over carbonate of magnesium are that it may be given in a smaller dose, and does not occasion flatulence. The dose as a laxative is from thirty grains to a drachm; as an antacid merely, or antilithic, from ten to thirty grains twice a day. When it meets with no acid, it is apt to linger in the stomach or bowels, and may in that case be followed by lemonade. It should be administered in water or milk, and thoroughly triturated so as to render the mixture uniform. If mixed with less than 14 or 15 times its weight of water, and allowed to stand for a day or two, magnesia is apt to form a more or less concrete mass, owing to the production of a hydrate of the earth, and the solidification of a portion of the water. This change does not take place, or at least takes place much less readily, when magnesia already saturated with moisture is employed instead of that freshly calcined. It has been conjectured that anhydrous magnesia might prove injurious in the stomach by solidifying its liquid contents; and the earth which has become saturated with moisture by exposure to a damp air is preferably recommended. Freshly precipitated hydrate of magnesia will serve as an antidote to arsenious acid, though less efficient than hydrated sesquioxide of iron. It has been thought that the soluble *saccharate of magnesium* would be superior as an antidote to arsenic than the simple magnesia, but the experiments of M. Carles have shown the contrary to be the case. Dr. Ohleyer (*London Lancet*, July, 1873, p. 49) employs magnesia as a dressing in ulcers and abrasions.

Pharm. Uses. In preparing Veratria, *U. S.*

Off. Prep. Liquor Magnesiæ Citratis, *U. S.;* Pilulæ Copaibæ, *U. S.;* Pulvis Rhei Compositus; Trochisci Magnesiæ, *U. S.* W.

MELLITA.

Preparations of Honey.

Honey is used in pharmacy chiefly as the vehicle of more active medicines. It is said to have this advantage over syrup, that its preparations are less apt to become

† *Magnesite Dressings* have been used in surgery at Berlin in the same manner and for the same purpose as plaster of Paris dressings are employed in the United States. Kuester asserts that they are superior because lighter and more durable. To one part of magnesite he adds three parts of soluble glass. Protecting the parts with flannel, he surrounds them with linen thoroughly soaked in the paste. Magnesite is an impure carbonate of magnesium, said to be used largely in Europe as a source of carbonic acid. (*New York Med. Record*, 1873, p. 226.)—*Note to the fourteenth edition.*

candied; but, as it contains principles which disagree with the stomach in many persons, and as its variable consistence prevents the same exact precision in regard to proportion as is attainable with a solution of pure sugar, it is at present little employed. The preparations in which honey and vinegar are combined are called *Oxymels.* The *Oxymel of Squill*, of the former U. S. and London Pharmacopœias, has been omitted in the existing edition of our national code.

Medicated honeys are of a proper consistence, if, when a small quantity, allowed to cool upon a plate, is divided by the edge of a spoon, the portions do not readily coalesce. A more accurate criterion, however, is their specific gravity, which should be 1·319 (35° B.) at ordinary temperatures, and 1·261 (30° B.) at the boiling point of water. The specific gravity is most readily determined by means of the saccharometer. W.

MEL DESPUMATUM. *U. S.* Mel Depuratum. *Br. Clarified Honey.*

"Take of Honey *a convenient quantity.* Melt it by means of a water-bath, and then remove the scum." *U. S.*

"Take of Honey *five pounds.* Melt the honey in a water-bath, and strain, while hot, through flannel, previously moistened with warm water." *Br.*

Honey, by the heat of the water-bath, becomes so fluid that the wax and other lighter impurities which it contains rise to the surface, and may be skimmed off; while the heavier substances which may have been accidentally or fraudulently added, such as sand or other earth, sink to the bottom.

The following method of clarifying honey has been practised in France. Take of white honey 3000 parts; water 750 parts; carbonate of calcium, powdered and washed, 96 parts. Mix them in a suitable vessel, and boil for three minutes, stirring constantly. Then add 96 parts of animal charcoal, previously washed, heated to redness, powdered, and sifted, and boil for a few minutes. Lastly, add the whites of two eggs beat up with 500 parts of water, and bring the liquid to the boiling point. Withdraw the vessel from the fire, and, after the mixture has cooled for 15 minutes, strain it through flannel, and repeat the straining till the liquid passes perfectly clear. Should it not have a due consistence, it should be concentrated sufficiently by a quick boiling. The carbonate of calcium serves to saturate any acid in the honey, which might favour the formation of glucose, and thus increase the tendency to granulation.

The French Codex simply directs six pounds of white honey to be heated with two pounds of water, skimmed, concentrated to 30° B. while boiling hot, and then strained through flannel.

The following method of clarifying honey is recommended by André von Hirschberg. Boil 25 lbs. of honey, to which half the quantity of water has been added, with a pulp obtained by stirring three sheets of white blotting-paper with water, over a slow fire, till the paper is reduced to minute fibres. When the mixture cools, put it into a woollen filtering bag, previously moistened, and allow the honey to pass. It comes away quite clear. The paper pulp may then be washed, and the dark liquid which passes, evaporated by a water-bath to the proper consistence. (See *Pharm. Journ.*, ix. 543.)

Another process, recommended by A. Hofmann, is to dissolve 28 lbs. of honey in twice its weight of water, heat the solution to the boiling point, and then add a solution of three drachms of gelatin in three times its weight of water, and afterwards an aqueous solution of one drachm of tannin, or an infusion of two drachms of galls. The mixture is to be well stirred, and kept hot for an hour. Lastly, seven-eighths of the honey may be drawn off clear, the remainder filtered through flannel, and the whole evaporated. (*Ibid.*, xv. 121.) Heugel's method is to mix two pounds each of honey and water with a half ounce of carbonate of magnesium, frequently agitate for two or three hours, filter through doubled white filtering-paper, boil slowly, skim off the scum carefully, and finally evaporate upon a steam-bath to a syrupy consistence.

Honey clarified with carbonate of calcium and animal charcoal, as in the first process described, is as clear and colourless as syrup made with sugar, but still retains a peculiar flavour. It is less disposed to ferment than crude honey, and is said not to be so liable to produce griping pain when swallowed.

Off. Prep. Confectio Aromatica, *U. S.;* Confectio Opii, *U. S.;* Confectio Piperis, *Br.;* Confectio Rosæ, *U. S.;* Confectio Scammonii, *Br.;* Confectio Terebinthinæ *Br.;* Mel Boracis, *Br.;* Mel Rosæ, *U. S.;* Mel Sodii Boratis, *U. S.;* Oxymel, *Br.;* Oxymel Scillæ, *Br.;* Pilulæ Ferri Carbonatis, *U. S.;* Pilulæ Quiniæ Sulphatis, *U. S.;* Tinctura Cardamomi Composita, *U. S.;* Tinctura Opii Camphorata, *U. S.* W.

MEL ROSÆ. *U. S. Honey of Roses.*

"Take of Red Rose, in moderately fine powder, *two troyounces;* Clarified Honey *twenty-five troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with half a fluidounce of Diluted Alcohol, pack it firmly in a conical glass percolator, and gradually pour Diluted Alcohol upon it until six fluidrachms of filtered liquid have passed. Set this aside, and continue the percolation until half a pint more of liquid is obtained. Evaporate this, by means of a water-bath, to ten fluidrachms, add the reserved liquid, and mix the whole with the Clarified Honey." *U. S.*

Though one of the officinals in the late London and Edinburgh Pharmacopœias, the Honey of Roses has been dropped in the British. The U. S. formula is based on that of Prof. Grahame. (See *Am. Journ. of Pharm.*, Sept. 1859, p. 443.) The object in reserving a portion of the first tincture, in the process, is to avoid the evaporation of the volatile oil in the concentration of the liquid, and thus to preserve the flavour as well as the astringency of the roses.* Honey of roses forms a pleasant addition to the gargles employed in inflammation and ulceration of the mouth and throat. W.

MEL SODII BORATIS. *U. S.* Mel Boracis. *Br. Honey of Borate of Sodium. Honey of Borax.*

"Take of Borate of Sodium, in fine powder, *sixty grains;* Clarified Honey *a troyounce.* Mix them." *U. S.*

"Take of Borax, in fine powder, *sixty-four grains;* Clarified Honey *an ounce* [avoirdupois]. Mix." *Br.*

This preparation might well be left to extemporaneous prescription. It is used in the thrush of infants, and aphthous ulcerations of the mouth. W.

OXYMEL. *Br. Oxymel.*

"Take of Clarified Honey *forty ounces* [avoirdupois]; Acetic Acid *five fluidounces;* Distilled Water *five fluidounces.* Liquefy the Honey by heat, and mix with it the Acetic Acid and Water." *Br.*

This mixture of honey and vinegar forms a pleasant addition to gargles, and is sometimes used as a vehicle of expectorant medicines, and to impart flavour to drinks in febrile complaints. W.

OXYMEL SCILLÆ. *Br. Oxymel of Squill.*

"Take of Vinegar of Squill *a pint* [Imperial measure]; Clarified Honey *two pounds* [avoirdupois]. Mix, and evaporate by a water-bath, until the product, when cold, shall have a specific gravity of 1·32. *Br.*

After a long vogue, this preparation fell into such neglect that it was abandoned by the Pharmacopœias. Its reintroduction, however, into the Br. Pharmacopœia indicates that it is still prescribed. It has the virtues of squill, but is in no respect superior to the syrup. It is chiefly used as an expectorant in chronic catarrh, humoral asthma, hooping-cough, and generally in those states of the pulmonary organs in which the bronchial tubes are loaded with a viscid mucus of difficult expectoration.

*Mr. E. C. Trembly having found that mel rosæ after a time deposits saccharine matter and becomes unfit for use, has devised the following formula for making a fluid extract, whereby he claims honey of rose can be at any time made without delay. "Take of Red Rose, No. 60, two ounces; Stronger Alcohol five fluidounces: Glycerin four fluidounces and a half; diluted Alcohol q. s. Moisten the powder with q. s. of the Strong Alcohol, pack it moderately in a small glass funnel, and gradually pour upon it the remainder of the Stronger Alcohol. When it has disappeared pour on a mixture of five fluidounces and a half of diluted Alcohol and a half fluidounce of Glycerin, and continue the percolation with diluted Alcohol until twelve fluidounces have been obtained. To the first four fluidounces add half a fluidounce of Glycerin and set aside to evaporate spontaneously to two fluidounces. To the remainder add two fluidounces of Glycerin and evaporate at a temperature not exceeding 140° F. until it, with reserved portion and the remainder of the Glycerin, weighs seven troyounces. To make mel rosæ, mix one part of this with three of honey." (*Note to the fourteenth edition.*)

The dose is from one to two fluidrachms. In large doses it is emetic, and as such may sometimes be given with advantage in infantile croup and catarrh. W.

MISTURÆ.

Mixtures.

This term should be restricted, in the language of pharmacy, to those preparations in which insoluble substances, whether solid or liquid, are suspended in watery fluids, by the intervention of gum arabic, sugar, the yelk of eggs, or other viscid matter. When the suspended substance is of an oleaginous nature, the mixture is properly called an *emulsion*. The object of these preparations is usually to facilitate the administration, to conceal the taste, or to obviate the nauseating effects of unpleasant medicines; and their perfection depends upon the intimacy with which the ingredients are blended. Some skill and care are requisite for the production of a uniform and perfect mixture. As a general rule, the body to be suspended should be thoroughly mixed by trituration with the substance intended to act as the intermedium, before the watery vehicle is added.* In the case of the liquid balsams and oils, if gum arabic be employed as the intermedium, it should be previously brought to the state of mucilage of the consistence directed in the U. S. Pharmacopœia.† The white of eggs has been frequently ordered by physicians as the suspending substance; but it is inferior for this purpose to the yelk, or to gum arabic. When the white is used it should be well beaten, and incorporated with the oleaginous or balsamic substances before the water is added. Mixtures are generally the objects of extemporaneous prescription; but a few have been deemed of sufficient importance to merit a place in the Pharmacopœias. They should be prepared only when wanted for use. The mixtures, formerly officinal, which were discarded in the original preparation of the Br. Pharmacopœia, are *Mistura Acaciæ*, Ed., *Mistura Althææ*, Ed., *Mistura Camphoræ cum Magnesia*, Ed., *Mistura Ferri Aromatica*, Dub., *Mistura Gentianæ Composita*, Lond., and *Mistura Spiritus Vini Gallici*, Lond. Of these, however, the last three have been readmitted into the present edition. W.

MISTURA AMMONIACI. *U. S.*, *Br.* *Mixture of Ammoniac.*

"Take of Ammoniac *one hundred and twenty grains;* Water *half a pint.* Rub the Ammoniac with the Water, gradually added, until they are thoroughly mixed, and strain." *U. S.*

"Take of Ammoniacum, in coarse powder, *a quarter of an ounce* [avoirdupois]; Distilled Water *eight fluidounces.* Triturate the Ammoniacum with the Water, gradually added, until the mixture assumes a milky appearance, then strain through muslin." *Br.*

In this mixture the insoluble part of the ammoniac is suspended by means of the gum, imparting a milky appearance to the preparation, which, from this circumstance, was formerly called *lac ammoniaci* or *milk of ammoniac.* The greater portion of the resin subsides upon standing. The mixture is slightly curdled by acids. The dose is from one to two tablespoonfuls. W.

* The plan recommended by the late Prof. Procter is to add one part of gum to two or three of the oil in a mortar, triturate until the mixture is complete, and then add at once twice as much water as gum used, and triturate rapidly until the oil is completely emulsified, then gradually add the remainder of the vehicle with constant trituration. M. Nougaret substitutes agitation in a bottle for trituration. (*Am. Journ. of Pharm.*, xli.204.) Dr. E. Saunders makes the emulsion with mucilage. Having a broad flat pestle and a mortar perfectly free from grease, he puts in a little mucilage, rubs it around the mortar, adds about half as much oil, triturates from the centre so as to emulsify this, then more mucilage, then oil, and so on until the operation is completed. Care is required never to get the oil in excess of the mucilage. (*Pharm. Journ. and Trans.*, Feb. 1875, p. 663.) This plan seems to accord with the principle laid down by M. Rother (*Pharm. Journ. and Trans.*, May, 1872), that the most perfect and rapid emulsifier is a perfect emulsion. (*Note to the fourteenth edition.*)

† The proportion of gum and water necessary to make a good emulsion with the fixed oils varies with the oil. Thus, while castor oil requires only two drachms of the gum and three drachms of water to the ounce, most other fixed oils require half their weight of gum, and a weight of water equal to half that of the oil and gum united. These quantities being well rubbed together, any desirable amount of water may afterwards be gradually added, and will readily incorporate with the other ingredients. (Overbeck, *Pharm. Cent. Blatt.*, A. D. 1851, p. 95.)

MISTURA AMYGDALÆ. *U. S., Br. Mixture of Almond. Almond Mixture. Almond Emulsion.*

"Take of Sweet Almond *half a troyounce;* Gum Arabic, in fine powder, *thirty grains;* Sugar *one hundred and twenty grains;* Distilled Water *eight fluidounces.* Having blanched the Almond, beat it with the Gum Arabic and Sugar, in a mortar, until they are thoroughly mixed; then rub the mixture with the Distilled Water gradually added, and strain." *U. S.*

"Take of Compound Powder of Almonds *two ounces and a half* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Rub the powder with a little of the Water into a thin paste, then add the remainder of the Water, and strain through muslin." *Br.*

These preparations are essentially the same; the gum and sugar, which enter into the U. S. formula directly, being ingredients of the compound powder of almonds of the British. The processes are both preferable to that of the old London Pharmacopœia, in which a confection of almonds was employed; as this preparation was liable to spoil quickly when kept. The gum arabic in these formulas is introduced, not so much for its demulcent properties, as to assist in the suspension of the insoluble ingredients of the almonds. The same formula will answer for the preparation of an *emulsion of bitter almonds*, which may be preferred to the present when a slight influence of hydrocyanic acid is desired.

The oleaginous matter of the almonds is suspended in the water by means of their albumen, gum, and sugar, forming a milky emulsion. When the almonds themselves are employed, as in the U. S. process, care should be taken to reduce them to the consistence of a paste previously to the addition of the water; and with each successive portion of fluid a uniform mixture should be formed before another portion is added. Common water, when not very impure, may be properly substituted for the distilled. Great care should be taken to select the almonds perfectly free from rancidity. The mixture is not permanent.* Upon standing, the oil rises like thick cream to the surface, and the separation is effected more quickly by heat, alcohol, and the acids, which coagulate the albumen. The preparation is closely analogous to milk in chemical relations and appearance. In warm weather it soon becomes sour, and unfit for use.

The almond mixture has a bland taste, and may be used as an agreeable, nutritive demulcent in catarrhal and dysenteric affections, and irritation of the urinary passages. To be of service it must be freely employed. From two to eight fluidounces may be taken at once. It is occasionally employed as the vehicle of less agreeable medicines; but should not be used in connection with any considerable quantity of tinctures, acidulous salts, or other substances containing an excess of acid. W.

MISTURA ASSAFŒTIDÆ. *Assafetida Mixture.*

"Take of Assafetida *one hundred and twenty grains;* Water *half a pint.* Rub the Assafetida with the Water, gradually added, until they are thoroughly mixed." *U. S.*

This mixture, from its whiteness and opacity, is frequently called *lac assafœtidæ* or *milk of assafetida.* It is, as a general rule, the best form for the administration of this antispasmodic, being less stimulant than the tincture, and more prompt in its action than the pill. Its excessively disagreeable smell and taste are, however, objections, which induce a frequent preference of the last-mentioned preparation. It is very often employed as an enema. The dose is from one to two tablespoonfuls frequently repeated. From two to four fluidounces may be given by the rectum. Mr. D. Ackerman prepares a concentrated emulsion of assafetida, which will keep if excluded from the light, by using a mixture of three-fourths pure water and one-fourth of dilute acetic acid as the menstruum. (*Am. Journ. of Pharm.*, 1874, p. 268.†.) W.

* *Concentrated Emulsion of Almonds.* H. P. Reynolds prepares a permanent preparation which, when mixed with three times its bulk of water, makes an emulsion which cannot be distinguished from the officinal, by using the following formula. Take of Sweet Almonds [blanched], Sugar, Glycerin ("C. P."), each, one ounce; Powdered Gum Arabic one drachm; Water two ounces. Rub to a uniform paste, strain through muslin, evaporate by a heat not exceeding 150° F. to the consistency of a fresh solid extract, flavour to suit. (*Note to the fourteenth edition.*)

† *Syrup of Assafetida.* Such a preparation has been proposed by Mr. Richard Peltz. He has

MISTURA CHLOROFORMI. *U. S. Mixture of Chloroform.*

"Take of Purified Chloroform *half a troyounce;* Camphor *sixty grains;* the yolk of *one* Egg; Water *six fluidounces.* Rub the yolk in a mortar, first by itself, then with the Camphor, previously dissolved in the Chloroform, and lastly, with the Water, gradually added, so as to make a uniform mixture." *U. S.*

In consequence of the great facility with which camphor dissolves in chloroform, and the ready miscibility of the solution, by the intervention of the yelk of eggs, with water, this mixture affords an easy and agreeable method of administering these medicines jointly. Besides, in consequence of the preservative influence of the chloroform, it will keep long unchanged. The dose is one or two tablespoonfuls. W.

MISTURA CREASOTI. *Br. Creasote Mixture.*

"Take of Creasote, Glacial Acetic Acid, of each, *sixteen minims;* Spirit of Juniper *half a fluidrachm;* Syrup *one fluidounce;* Distilled Water *fifteen fluidounces.* Mix the Creasote with the Acetic Acid, gradually add the Water, and lastly the Syrup and Spirit of Juniper." *Br.*

The dose of this mixture is a fluidounce, containing a minim of creasote. W.

MISTURA CRETÆ. *U. S., Br. Chalk Mixture.*

"Take of Prepared Chalk *half a troyounce;* Glycerin *half a fluidounce;* Gum Arabic, in fine powder, *one hundred and twenty grains;* Cinnamon Water, Water each, *four fluidounces.* Rub them together until they are thoroughly mixed." *U. S.*

"Take of Prepared Chalk *a quarter of an ounce* [avoirdupois]; Gum Acacia, in powder, *a quarter of an ounce* [avoird.]; Syrup *half a fluidounce;* Cinnamon Water, *seven fluidounces and a half.* Triturate the Chalk and Gum Acacia with the Cinnamon Water, then add the Syrup and mix." *Br.*

This mixture is a convenient form for administering chalk, and is much employed in looseness of the bowels accompanied with acidity. As formerly prepared, it soon underwent fermentative changes, especially in warm weather; but the substitution of glycerin for sugar has made the U. S. preparation a permanent one. Laudanum and kino or catechu are very often added to increase its astringency. The dose is a tablespoonful frequently repeated. W.

MISTURA FERRI AROMATICA. *Br. Aromatic Mixture of Iron.*

"Take of Pale-Cinchona Bark, in powder, *one ounce;* Calumba Root, in coarse powder, *half an ounce;* Cloves, bruised, *a quarter of an ounce;* Fine Iron Wire *half an ounce;* Compound Tincture of Cardamoms *three fluidounces;* Tincture of Orange Peel *half a fluidounce;* Peppermint Water *a sufficiency.* Macerate the Cinchona Bark, Calumba Root, Cloves, and Iron with twelve fluidounces of the Peppermint Water, in a closed vessel, for three days, agitating occasionally; then filter the liquid, adding as much Peppermint Water to the filter as will make the product measure twelve and a half fluidounces; to this add the tinctures, and preserve the mixture in a well-stopped bottle." *Br.* The weights used in this process are the avoirdupois, and the measures the Imperial.

This is an old Dublin formula, which, we presume, bases its claim to an officinal position upon the favourable experience of physicians who have employed it; for it is certainly not one which, with the light of modern chemistry, would be apt to be formed. The following comment upon it is from the U. S. Dispensatory of 1862.

found the following formula to answer the purpose best. Take of assafetida ℥j, boiling water Oj, sugar lbsij. Rub the assafetida with a part of the water so as to make a uniform paste, then gradually add the remainder of the water, strain, and add the sugar, heating moderately till it is dissolved. This has a less disagreeable taste than the mixture, and keeps much better, remaining several months without change, while the latter is often altered in a short time. The dose is the same as that of the mixture. (*Am. Journ. of Pharm.*, xxiv. 313.)—*Note to the tenth edition.*

Wine of Assafetida. Mr. H. N. Rittenhouse proposes a concentrated wine of assafetida, as affording an easy method of preparing the mixture, which, when called for in haste, cannot always be furnished in due time, from the amount of trituration required. He rubs half an ounce of the gum-resin with ten fluidrachms of white wine until the former is suspended. Two ounces of the wine are thus obtained; and, as each drachm contains fifteen grains of assafetida, it is easy to prepare the mixture of the officinal strength, by simply mixing the wine in due proportion with water. (*Am. Journ. of Pharm.*, xxvii. 216.)—*Note to the eleventh edition.*

For cleaning mortars in which assafetida has been rubbed, Mr. D. Ackerman recommends liquor potassæ, followed by bitter almond water or paste, and soap and water. (*Note to the fourteenth edition.*)

This is an aromatic infusion of Peruvian bark and columbo, and has no claim to the title given it in the Pharmacopœia, as it contains but a minute proportion of iron, insufficient for remedial effect. In consequence of the action of the vegetable principles on the wire, enough of the metal is taken up to impart a greenish-black colour to the liquor; but the quantity is scarcely appreciable; as the iron appears to be hardly diminished by the process. The mixture may be given as a tonic in the dose of one or two fluidounces. W.

MISTURA FERRI COMPOSITA. *U. S., Br. Compound Mixture of Iron.*

"Take of Myrrh, Sugar [refined], each, *sixty grains;* Carbonate of Potassium *twenty-five grains;* Sulphate of Iron, in coarse powder, *twenty grains;* Spirit of Lavender *half a fluidounce;* Rose Water *seven fluidounces and a half.* Rub the Myrrh, Sugar, and Carbonate of Potassium with the Rose Water, gradually added, then with the Spirit of Lavender, and, lastly, with the Sulphate of Iron; and pour the mixture immediately into a bottle, which must be well stopped." *U. S.*

"Take of Sulphate of Iron *twenty-five grains;* Carbonate of Potash *thirty grains;* Myrrh, Refined Sugar, of each, *sixty grains;* Spirit of Nutmeg *four fluidrachms;* Rose Water *nine and a half fluidounces.* Reduce the Myrrh to powder, add the Carbonate of Potash and Sugar, and triturate them with a small quantity of the Rose Water, so as to form a thin paste; then gradually add more Rose Water and the Spirit of Nutmeg, continuing the trituration and further addition of Rose Water until about eight fluidounces of a milky liquid is formed; then add the Sulphate of Iron dissolved in the remainder of the Rose Water, mix them together thoroughly, and preserve the mixture as much as possible from contact with the air." *Br.*

This is very nearly the same with the celebrated tonic or antihectic myrrh mixture of Dr. Griffith. The sulphate of iron is decomposed by the carbonate of potassium, with the production of sulphate of potassium and carbonate of protoxide of iron; while the excess of the alkaline carbonate forms a saponaceous compound with the myrrh. The mixture is at first of a greenish colour, which it loses upon exposure to the air, in consequence of the conversion of the protoxide of iron of the carbonate into the red or sesquioxide.* It may, however, be kept for some time without change, if the vessel in which it is contained be well closed; but the best plan is to prepare it only when wanted for use. The sugar contained in it contributes somewhat to retard the further oxidation of the protoxide of iron, and, if considerably increased in amount, would act still more efficiently. The finest pieces of myrrh in lump should be selected, and rubbed down for the occasion with a little of the rose-water; as the powdered myrrh of the shops is often impure, and otherwise does not make a good mixture, owing mainly to its loss of volatile oil.

This mixture is a good tonic in debility of the digestive organs, especially when attended with derangement of the menstrual function. Hence it is used with advantage in chlorosis and hysterical affections. It has been also much employed in the hectic fever of phthisis and chronic catarrh. It is contraindicated by the existence of inflammation of the gastric mucous membrane. The dose is one or two fluidounces two or three times a day. W.

MISTURA GENTIANÆ. *Br. Infusum Gentianæ Compositum. Br.* 1864. *Gentian Mixture.*

"Take of Gentian Root, sliced, *a quarter of an ounce;* Bitter Orange Peel, cut small, Coriander Fruit, bruised, each, *thirty grains;* Proof Spirit *two fluidounces;* Distilled Water *eight fluidounces.* Macerate the Gentian, Orange Peel, and Coriander in the Proof Spirit, for two hours, then add the Water. Macerate again for two hours, and strain through calico." *Br.*

* *Permanent Mixture of Iron.* Mr. C. A. Staples remedies this tendency by making a concentrated myrrh emulsion of such strength that one fluidrachm of it contains the amount of myrrh and carbonate of potassium found in a fluidounce of the officinal mixture, and also a concentrated syrup of sulphate of iron, fifteen minims of which equals one fluidounce of Mistura Ferri Composita. When the latter is called for, the emulsion, properly diluted, is put in a bottle and the requisite quantity of the iron syrup added. (*Amer. Journ. of Pharm.,* Nov. 1, 1871.)—*Note to the fourteenth edition.*

According to the strict pharmaceutical meaning of mixtures, this preparation does not belong to that class, being in fact a compound infusion, as it was named in the first edition of the British Pharmacopœia; but as it was thought proper, in the present edition, to introduce the old London Compound Infusion of Gentian, it became necessary to find another name for the preparation here given, and it was consequently placed among the mixtures. The British Gentian Mixture is almost identical with the U. S. *Compound Infusion of Gentian*, to which the reader is referred for further remarks on the subject. The dose is a fluidounce. W.

MISTURA GLYCYRRHIZÆ COMPOSITA. *U. S. Compound Mixture of Liquorice. Brown Mixture.*

"Take of Liquorice [extract], in fine powder, Sugar, in coarse powder, Gum Arabic, in fine powder, each, *half a troyounce;* Camphorated Tincture of Opium *two fluidounces;* Wine of Antimony *a fluidounce;* Spirit of Nitrous Ether *half a fluidounce;* Water *twelve fluidounces.* Rub the Liquorice, Sugar, and Gum Arabic with the Water, gradually added; then add the other ingredients, and mix the whole together." *U. S.*

This is an exceedingly popular cough mixture, which was made officinal in the U. S. Pharmacopœia of 1850. The spirit of nitrous ether is probably useful by somewhat retarding decomposition. The preparation is applicable to the advanced stages of catarrhal affections, after expectoration has become established. The dose is a tablespoonful for an adult; a teaspoonful for a child two years old. It should be well shaken when administered. W.

MISTURA GUAIACI. *Br. Guaiac Mixture.*

"Take of Guaiacum Resin, in powder, Refined Sugar, of each, *half an ounce* [avoirdupois]; Gum Acacia, powdered, *a quarter of an ounce* [avoird.]; Cinnamon Water *one pint* [Imperial measure]. Triturate the Guaiacum with the Sugar and the Gum, adding gradually the Cinnamon Water." *Br.*

For the changes of colour which the Guaiac in this mixture undergoes, and produces in other substances, see *Guaiaci Resina*, p. 459. From one to four tablespoonfuls may be given for a dose, and repeated two or three times a day, or more frequently. W.

MISTURA POTASSII CITRATIS. *U.S.* LIQUOR POTASSÆ CITRATIS. *U. S.* 1850. *Mixture of Citrate of Potassium. Neutral Mixture.*

"Take of Lemon Juice, fresh, *half a pint;* Bicarbonate of Potassium *a sufficient quantity.* Add the Bicarbonate gradually to the Lemon Juice until the acid is completely saturated; then strain through muslin." *U. S.*

For remarks on this preparation, see *Liquor Potassii Citratis.* The dose is a tablespoonful or half a fluidounce, which, when taken, may be somewhat diluted with water. W.

MISTURA SCAMMONII. *Br. Scammony Mixture.*

"Take of Resin of Scammony *four grains;* Milk *two* [*fluid*]*ounces.* Triturate the Resin of Scammony with a little of the Milk, and continue the trituration, gradually adding the remainder of the Milk, until a uniform emulsion is obtained." *Br.*

This officinal is an imitation of a mixture recommended by Planche. The resin of scammony mixes admirably with the vehicle, and forms an emulsion scarcely distinguishable in appearance or taste from rich milk. Of course, it should be prepared only when wanted for immediate use. The whole is to be taken for a dose. W.

MISTURA SENNÆ COMPOSITA. *Br. Compound Mixture of Senna.*

"Take of Sulphate of Magnesia *four ounces* [avoirdupois]; Extract of Liquorice *half an ounce* [avoird.]; Tincture of Senna *two and a half fluidounces* [Imperial measure]; Compound Tincture of Cardamoms *ten fluidrachms;* Infusion of Senna *a sufficiency.* Dissolve the Sulphate of Magnesia and Extract of Liquorice in fourteen fluidounces [Imp. meas.] of the Infusion of Senna, with the aid of a gentle heat, then add the Tinctures, and sufficient Infusion of Senna to make one pint [Imp. meas.]." *Br.*

This is a new form of compound infusion of senna, called commonly the *black draught*. We prefer the form given under *Infusum Sennæ*, as being more easily prepared, and quite as efficient. The dose of this mixture is given in the Br. Pharmacopœia as from one fluidounce to one and a half. W.

MISTURA SPIRITUS VINI GALLICI. *Br.* *Mixture of Spirit of French Wine. Brandy Mixture.*

"Take of Spirit of French Wine [Brandy], Cinnamon Water, of each, *four fluidounces;* the Yolk of two eggs; Refined Sugar *half an ounce* [avoirdupois]. Rub the Yolk and Sugar together, then add the Cinnamon Water and Spirit." *Br.*

This is a formula of the London College, which was dropped on the preparation of the first British Pharmacopœia, to be taken up again in the present edition. It is a nutritious and stimulant draught, applicable to the sinking stage of low forms of fever; but scarcely entitled to a place in the Pharmacopœia. At least, if egg-nog is admitted, there would seem to be no good reason for excluding milk-punch. The dose of it is one or two fluidounces. W.

MORPHIA.

Preparations of Morphia.

MORPHIA. *U.S.* *Morphia.*

"Take of Opium, sliced, *twelve troyounces;* Water of Ammonia *six fluidounces;* Animal Charcoal, in fine powder, Alcohol, Distilled Water, each, *a sufficient quantity.* Macerate the Opium with four pints of Distilled Water for twenty-four hours, and, having worked it with the hand, again macerate for twenty-four hours, and strain. In like manner, macerate the residue twice successively with the same quantity of Distilled Water, and strain. Mix the infusions, evaporate to six pints, and filter; then add five pints of Alcohol, and afterwards three fluidounces of the Water of Ammonia, previously mixed with half a pint of Alcohol. After twenty-four hours, pour in the remainder of the Water of Ammonia, mixed, as before, with half a pint of Alcohol; and set the liquid aside for twenty-four hours that crystals may form. To purify these, boil them with two pints of Alcohol until they are dissolved, filter the solution, while hot, through Animal Charcoal, and set it aside to crystallize." *U. S.*

This process will be better understood by a previous acquaintance with the properties and chemical relations of the substance in question.

Morphia crystallizes from alcohol in the form of small, colourless, shining crystals. It is inodorous and bitter. Exposed to a moderate heat, it loses its water of crystallization and the crystalline form, becoming white and opaque. At a higher temperature it melts, forming a yellowish liquid, which becomes white and crystalline upon cooling. Heated in the open air, it burns with a bright flame, and at a red heat is wholly dissipated. In the products resulting from the combustion of opium or morphia, this alkaloid may be detected, proving that it is partly volatilized, when burned. (Descharmes, *Arch. Gén.*, Fév. 1855, p. 240.) According to Mr. Guy, morphia melts at 330°, and sublimes at 340°, leaving a carbonaceous residue. (*Pharm. Journ. and Trans.*, Feb. 1868, p. 375.) It is insoluble or nearly so in cold water, soluble in rather less than 100 parts of water at 212°, slightly soluble in cold alcohol, and freely so in boiling alcohol, which deposits it upon cooling. It is dissolved also by the fixed and volatile oils, but very slightly if at all by ether. Both morphia and its salts are insoluble in chloroform. (Lepage, *Journ. de Pharm.*, xxv. 258.) Morphia in solution is to a considerable extent absorbed by animal charcoal, which, though it will part with most of the alkaloid to alcohol, cannot be wholly deprived of it by repeated washings with that liquid, whether cold or hot. (Lefort, *Journ. de Pharm.*, Août, 1861, p. 98.) Its solution restores the blue colour of litmus paper reddened by acids, and turns the yellow of turmeric to brown. With the acids it forms salts, which are generally soluble, and are decomposed by the alkalies. The solutions of potassa and soda also dissolve morphia, which is precipitated slowly from them on exposure to the air, in consequence of the absorption of carbonic acid. Solution of ammonia has to a certain extent the same solvent power; and hence the

necessity, in precipitating morphia by this alkali, not to employ it in great excess. Solution of iodine with iodide of potassium precipitates the salts of morphia in aqueous solution. With chlorine water morphia and its salts assume an orange colour, and the same effect is produced on them by solution of chlorinated soda. (Fairthorne, *Am. Journ. of Pharm.*, xxviii. 9.) By the contact of nitric acid, they assume a blood-red colour, which ultimately changes to yellow; and this is one of the tests of morphia; but, as the same change of colour is produced with brucia and impure strychnia, it cannot be relied on in the absence of other evidence. Nitric acid also produces a red colour with oil of cloves, but in this case the red does not change to yellow. When added to a solution of iodic acid, or an acidulous iodate, morphia and its salts redden the liquid and set iodine free. (*Serullas.*) This is a very delicate test, but is not conclusive, as various other organic substances act in a similar manner. M. J. Lefort, however, has found that the colour produced by these substances is removed by ammonia, while the redness produced with morphia is greatly intensified by addition of that alkali. This test, thus modified by the addition of ammonia, is so delicate that, according to M. Lefort, it will detect one part of morphia in 10,000 parts of a liquid holding it in solution. (*Journ. de Pharm.*, Août, 1861, p. 113.)* Husemann's test consists in leaving morphia or its salt in contact with concentrated sulphuric acid for 12 or 15 hours, or in heating for half an hour with the acid to 212° F., and then adding either a little nitric acid, a nitrate or chlorate or chlorine water, or chlorinated soda, when a beautiful bluish or reddish-violet colour, passing into deep blood-red and gradually paling, is developed. The presence of small quantities of colouring matter do not prevent this reaction, if chlorinated reagents are selected. A. Husemann claims that this test will recognise the hundredth part of a milligramme of the alkaloid. (*Amer. Journ. of Pharm.*, xlvii. 210.) According to R. Schneider a very delicate test is performed by putting a drop of the suspected liquid on a plate, saturating with sugar and putting alongside of it a drop of sulphuric acid; if morphia be present a very intense purple will be developed at the point of contact, passing after half an hour into violet, then bluish-green, and finally dirty yellow. (*Journ. de Pharm.*, 4e sér., xviii. 221.) According to H. Weppen the delicacy of this test is much increased by the addition of a minute quantity of bromine water to the solution; codeia and aconitia are stated to give the same reaction. (*Ibid.*, 4e sér., xix. 246.)

Fröhde's solution (one milligramme of molybdic acid in one cubic centimetre of concentrated sulphuric acid) strikes with morphia and its salts a beautiful blue violet colour, passing into blue, then green, finally back to bluish-violet. This reaction is stated to be delicate but not characteristic. M. H. Kalbrunner claims that the most sensitive test is made with a solution (No. 1) of crystallized perchloride of iron (thirty grains to four fluidrachms of distilled water) and a fresh solution (No. 2) of

* When a mixture of a little morphia and *iodic acid* with a few drops of water is gently heated in a capsule, a series of explosions is produced, with the evolution of gas. The same thing happens with other vegetable alkaloids treated in the same manner; and Dr. Brett proposes this reaction of iodic acid, which takes place with no other organic substance that he has tried, as a test of the alkaloids. (*Pharm. Journ.*, xvi. 211.)

Unsized Paper in testing for Morphia. Most of the tests of morphia will act more satisfactorily if the alkaloid or its salts be fixed in unsized paper, which will then exhibit the characteristic changes of colour when exposed to the agents employed. Paper may be prepared for this purpose by dipping slips of perfectly white filtering paper several times in the liquid to be examined, and, after each immersion, drying the paper by a moderate heat. (Lefort, *Journ. de Pharm.*, Août, 1861, p. 106.)—*Note to the twelfth edition.*

Stas's method of extracting the Alkaloids from Mixtures. To separate the alkaloid from foreign matters, the mixture is treated alternately with water and alcohol in different degrees of concentration; the liquors thus obtained are filtered; tartaric or oxalic acid, but preferably the former, is added in excess; the mixture is heated to 160° or 170° F.; the whole is placed upon a filter; the deposited matter is washed with concentrated alcohol; the alcoholic solution is evaporated at a temperature not exceeding 95° F.; the residue is introduced into a small bottle; a solution of caustic potassa or soda is added, little by little, and afterwards four or five times the measure of ether; the mixture is shaken and then allowed to stand; and, finally, the ether is decanted, and yields the alkaloid by spontaneous evaporation. Stas included morphia among the alkaloids thus separable, though known to be nearly insoluble in ether; but Lefort has shown that the process is not applicable to that alkaloid. (*Journ. de Pharm.*, Août, 1861, p. 99.) M. Alfred Valser, however, has ascertained that, if acetic ether be substituted for ether, the process is equally applicable to morphia. (See *Am. Journ. of Pharm.*, Sept. 1864, p. 439.)—*Note to the twelfth edition.*

ferridcyanide of potassium (two grains to four drachms.) To the suspected liquor five or six drops of No. 1 are added, and afterwards three or four drops of No. 2. If morphia be present a colour varying from deep blue to pale blue and bluish-green, according to the proportion of the alkaloid, is developed. Neither gum, sugar, alcohol, glycerin, atropia, quinine, or strychnia interfere with this test. An excess of alkali does so by decomposing the perchloride of iron. This test depends upon the fact that the ferridcyanide of potassium solution is reduced by morphia to the ferrocyanide. It is stated that even $\frac{1}{60000}$ percentage of morphia can be detected. (*Ibid.*, p. 248.)

M. Siebold heats gently the suspected substance with some drops of concentrated sulphuric acid and a small quantity of chemically pure perchlorate of potassium; a deep brown colour is produced if morphia be present. (*Pharm. Journ. and Trans.*, Oct. 1873.) According to H. S. Wellcome one part of morphia in ten thousand of water can be recognised by chlorine water, provided care be exercised not to decolorize by an excess of the reagent; the colour varies from light orange-red to deep-red according to the proportion of morphia present. Brucia is the only other alkaloid giving the same reaction, but while the colour produced by morphia is discharged by excess of acid, that caused by brucia is not affected. (*Amer. Journ. of Pharm.*, 1874, p. 305.) To discover morphia in the presence of quinine see *Ibid.*, p. 361. Morphia and its salts assume a fine blue colour with the sesquichloride of iron, and the salts of the sesquioxide; at least this is true of the alkaloid, its sulphate, acetate, and oxalate; and the same effect will be produced by the other salts, if previously decomposed by an alkali; but that this test should be satisfactory, it is necessary to operate on morphia either in powder or concentrated solution. (*Lefort.*) Water, acids, and alkalies, added in large quantity to the blue compound formed, destroy its colour. According to Pelletier, moreover, there occasionally exists in opium a principle called by him pseudomorphia, which becomes red under the action of nitric acid, and changes the salts of sesquioxide of iron blue, and yet is destitute of poisonous properties; so that the occurrence of these phenomena, in any medico-legal case, cannot be considered as certain evidence of the presence of morphia. (See *Am. Journ. of Pharm.*, viii. 77.) The terchloride of gold precipitates morphia first yellow, then bluish, and lastly violet. (*Larocque* and *Thibierge.*) Peroxide of copper and oxide of silver are precipitated by morphia from their ammoniacal solutions. (*Chem. Gaz.*, No. 367, p. 54.) A solution of acetate or sulphate of morphia, containing only one part of the salt in 100, precipitates silver from a solution of the nitrate of that metal. (*Horsley.*) Morphia is precipitated from its solutions by potassa or soda, and redissolved by an excess of the alkali. Infusions of galls and other vegetable substances containing tannic acid precipitate morphia in the state of a tannate, which is soluble in acetic acid; but according to Dublanc, the alkaloid is not precipitated by pure gallic acid. If ammonia be added to a mixture of the solutions of chlorine and morphia, a dark-brown colour is produced, which is destroyed by a further addition of chlorine. The proportion of the constituents of morphia is somewhat differently given by different writers. According to the most recent authorities, anhydrous morphia consists of thirty-four eqs. of carbon 204, nineteen of hydrogen 19, one of nitrogen 14, and six of oxygen $48 = 285$, to which in the crystals are added two eqs. of water 18, or about 5·8 per cent. ($C_{34}H_{19}NO_6,2HO$).

Various processes for preparing morphia have been employed. In most of them the morphia is extracted from opium by maceration with water either pure or acidulated, is then precipitated by ammonia, and afterwards purified by the agency of alcohol, or by repeated solution in a dilute acid and precipitation.

Sertürner, the discoverer of morphia, made an infusion of opium in distilled water, precipitated the morphia by ammonia in excess, dissolved the precipitate in dilute sulphuric acid, precipitated anew by ammonia, and purified by solution in boiling alcohol, and crystallization.

The process of the French Codex is a modification of that of Sertürner. It is as follows. "Take of opium 1000 parts, solution of ammonia a sufficient quantity. Exhaust the opium, by means of cold water, of all its parts soluble in that menstruum. For that purpose, it is sufficient to treat the opium, four times consecutively, with ten parts of water to one of the drug, provided care be taken to macerate the opium for some hours, and to work it with the hands. Filter the liquors, and evaporate

them to a quarter of their volume. Then add sufficient ammonia to render the liquor very sensibly alkaline. Boil for some minutes, always maintaining a slight excess of ammonia. Upon cooling, the morphia, impure and much coloured, will be precipitated in granular crystals, which are to be washed with cold water. Reduce this coloured morphia to powder, macerate it for twelve hours in alcohol of 24° Cartier [sp. gr. about 0·900]; then decant the alcoholic liquid; dissolve the residuary morphia, already in great measure deprived of colour by the cold alcohol, in boiling alcohol of 33° Cartier [sp. gr. about 0·850]; add to the solution a little animal charcoal, and filter. Upon cooling, the morphia crystallizes in colourless needles. In this state the morphia always retains some narcotina, to free it from which, boil it with sulphuric ether in a matrass with a long neck surmounted by a refrigerator."

The process of the U. S. Pharmacopœia is an improvement upon the foregoing, and is essentially the same as that of Dr. Edward Staples, published in the *Journal of the Philadelphia College of Pharmacy* (i. 15). Without repeating a description of the process, we shall make such remarks upon its several steps, as appear to us likely to be of practical advantage. The employment of water as the solvent is justified by the almost universal practice. It is true that dilute acetic acid has sometimes been employed, and Vogel states that the product thus obtained is much greater than when water alone is used. But, when the opium is properly comminuted, either by being reduced to a coarse powder when dry, or by being finely sliced in its ordinary state, water alone will be found sufficiently to extract the morphia, by a protracted maceration or digestion in successive portions of water, assisted by kneading, as directed in the Pharmacopœia. The acids have this disadvantage, that they dissolve more of the narcotina than pure water, and thus render the ultimate product more impure; for the narcotina which is originally taken up continues associated with the morphia in all the subsequent steps of the process. It has been proposed to expose the opium to fermentation with water and yeast, in order to facilitate the extraction of the morphia. By this plan M. Blondeau succeeded in procuring more of the alkaline principle than he could obtain by the ordinary mode; and his results were confirmed by the experiments of MM. Robiquet and Guibourt. According to these latter chemists, no alcohol is produced during the fermentation, which appears to act merely by disengaging the morphia from the combinations in which it naturally exists, and which tend to counteract the solvent power of the menstruum. Alcohol was proposed as the solvent by M. Guillermond, but is liable to the objection that it dissolves also the resin, a portion of which is afterwards precipitated with the morphia, and embarrasses the process. Much of the resin, however, may be separated by distilling most of the alcohol from the tincture, and then adding water. The resin is precipitated, and the liquor may now be treated in the same manner as the aqueous infusion.* On the whole, however, the officinal mode of extraction will probably be found most satisfactory; and Mohr states that opium thus exhausted yields no more morphia even to muriatic acid; but he recommends that each maceration should be followed by strong expression. The infusion of opium having been prepared, the next object is to decompose the meconate or other salt of morphia contained in it. For this purpose solution of ammonia is added, which seizes the acid, and precipitates the organic alkali; but much colouring matter is thrown down along with the latter, occasioning some trouble to separate it, unless measures are taken to obviate this effect. The object is gained by mixing the infusion with alcohol, previously to the addition of the ammonia, and by employing the solution of ammonia itself in connection with alcohol, as directed in the Pharmacopœia. This is the peculiarity and chief merit of the process of Dr.

* By a modification of the process of Guillermond, MM. Desmedt have succeeded in extracting all the morphia from opium, perfectly free from narcotina. Of crude opium 60 parts were treated with 240 of alcohol at 71° centigrade (160° F.), and expressed when cold; the residue was then treated in the same manner with 160 parts of alcohol; the liquor was introduced into a bottle well stopped; next day a copious crystallization of narcotina appeared, without the least morphia; the liquid was decanted, and, on the addition of 4 parts of ammonia, furnished a considerable quantity of morphia, free from narcotina. To the mother-liquor a little distilled water was added, and the mixture was kept at the temperature of 24° C. In two days an additional quantity of the crystals of morphia was obtained equally free from narcotina. The opium was completely exhausted, and the 60 parts employed furnished 5 parts of morphia. (*Annuaire de Thérap.*, 1852, p. 31.)—*Note to the tenth edition.*

Staples. By the presence of the alcohol in all parts of the liquor, the colouring matter is dissolved as soon as it is separated by the ammonia, and the morphia is thus precipitated in a much purer state. The advantage of adding the ammonia in separate portions is, that the morphia, being thus more slowly disengaged, can be more completely deprived of its impurities by the alcohol of the mixture, than if the whole were liberated at once. It is necessary to be careful that the ammonia be not in great excess; as it has the property, under these circumstances, of dissolving the morphia in some degree, and will therefore lessen the product, while waste is incurred by its own unnecessary consumption. Very little more should be added than is sufficient to saturate the acid present. The solution of ammonia of the shops is often much below the officinal standard, and this should always be attended to in the process. Alcohol is mixed with the ammonia before it is added, in order that every particle of the separated morphia may come in contact with the particles of this fluid, and thus have the opportunity of being deprived of colouring matter. The crystals of morphia obtained by this first operation have a light-yellowish colour, and are much purer than when no alcohol is added to the infusion before the precipitation by ammonia. According to Dr. Staples, opium yields from 10 to 12·5 per cent. of the crystals. Their purification by solution in boiling alcohol is the concluding step of the operation. The liquid, on cooling, deposits the morphia crystallized, and nearly free from colour. As cold alcohol retains a portion of morphia, it should not be employed too largely. Alcohol somewhat reduced by water is preferable to highly rectified spirit; as it is less capable of holding the morphia in solution when cold. It is sufficiently strong at 25° Baumé (sp. gr. 0·9032). The impure morphia remaining in the alcohol may be obtained by distilling off the latter, and, when sufficiently accumulated, may be purified by a separate operation. The crystals of morphia may also be purified by solution in dilute sulphuric acid, digestion with purified animal charcoal, filtration, and precipitation by ammonia. If alcohol be added to the solution previously to the ammonia, the digestion with animal charcoal may be dispensed with, as the alcohol retains the colouring matter. Morphia procured in this way always contains narcotina, from which it may be freed by ether, or in some of the modes hereafter to be indicated.

Magnesia was employed by Robiquet instead of ammonia. But his process was soon abandoned; as it was found to occupy more time, to require a greater consumption of alcohol, and to be attended with a greater loss of morphia in consequence of the previous washing, than the processes in which ammonia was employed as the precipitant. For an account of it the reader is referred to former editions of this work.

A process for extracting morphia without the employment of alcohol was devised by MM. Henry, jun., and Plisson. The opium was exhausted by water acidulated with muriatic acid; the resulting solution was sufficiently concentrated, then filtered, and decomposed by ammonia; the precipitate was washed and treated with muriatic acid to saturation; and the muriatic solution was boiled with animal charcoal, filtered, and evaporated to the point of crystallization. The crystals of muriate of morphia thus obtained were pressed, purified by repeated solution and crystallization, and finally decomposed by ammonia. (*Journ. de Chim. Méd.*, Mars, 1828.)

Somewhat similar to this is the process of Gregory, of Edinburgh, by which muriate of morphia is obtained by double decomposition between chloride of calcium and the meconate of morphia of the opium, and the muriate thus obtained is decomposed by ammonia. This process was adopted by the Ed. College for the preparation of muriate of morphia; and is retained in the present Br. Pharmacopœia. It will be sufficiently explained under *Muriate of Morphia.*

Mohr has proposed a process founded on the solubility of morphia in water mixed with lime, which he recommends as the shortest and easiest method of procuring the alkaloid, without the use of alcohol, and without the possibility of contamination from narcotina. Opium is three or four times successively macerated with three parts of water, and each time strongly expressed. The liquors are then added to a boiling-hot milk of lime, containing a quantity of lime equal to about a sixth or a quarter of the opium used; and the mixture is boiled for a few minutes. It is then strained through linen, and the residue washed with boiling water and expressed. The whole of the narcotina is left behind, as not a trace of it can be discovered in the filtered

liquor. The liquor thus obtained is evaporated till reduced to double the weight of the opium, then quickly filtered through paper, and heated to ebullition. Chloride of ammonium is now added to it in the proportion of 1 part to 16 of the opium used; and the morphia is abundantly precipitated. The use of animal charcoal is unnecessary in the process, as the lime acts even more powerfully as a decolorizing agent. The crystallized morphia obtained is somewhat coloured, but may be rendered pure by solution in dilute muriatic acid, boiling with milk of lime, filtration, and precipitation by chloride of ammonium. (*Annal. der Pharm.*, xxxv. 119.)

Various other processes, or modifications of those above described, have been proposed; but, for the preparation of small quantities of morphia by the apothecary, none are probably better adapted than that of the U. S. Pharmacopœia.

It has been already stated that morphia, obtained in the ordinary manner, contains a considerable proportion of narcotina. It is highly probable that this ingredient exercises no influence, either beneficial or injurious, upon the operation of the morphia; but as the contrary has been supposed, various methods have been employed for separating it. The simplest and easiest is to submit the mixture to the action of ether, which dissolves the narcotina and leaves the morphia. The agency of acetic acid may also be resorted to. Distilled vinegar, or diluted acetic acid of the same strength, will dissolve the morphia and leave the narcotina, and the former may be recovered from the acetic solution by saturating the acid with ammonia. Another mode is to dissolve the mixed bases in strong acetic acid (of 7° Baumé, or sp. gr. 1·0511, for example), and expose the solution to heat. The narcotina is deposited, and the morphia, remaining in solution, may be precipitated by diluting the liquid and adding ammonia. (*Journ. de Pharm.*, xvii. 640.) Wittstock advises one of the following modes. Dissolve the impure morphia in dilute muriatic acid, evaporate to the point of crystallization, and strongly express the crystals, which consist solely of the muriate of morphia, the narcotina being retained in the mother-waters:—or saturate the muriatic solution with common salt, which will render the liquor milky, and cause the narcotina to separate after some days; then precipitate the morphia by ammonia:—or pour into the diluted muriatic solution a weak ley of caustic potassa, which, if in slight excess, will dissolve the morphia at the moment of its separation, while the narcotina is precipitated; then immediately filter the liquor, and separate the morphia by neutralizing the alkali. If the potassa is in great excess, a little of the narcotina is redissolved. (Berzelius, *Traité de Chim.*) Mohr recommends to dissolve the morphia in dilute muriatic acid, and to boil the solution with lime, which throws down the narcotina and holds the morphia dissolved. The liquid being filtered yields the morphia upon the addition of chloride of ammonium. (*Annal. der Pharm.*, xxv. 123.)

The proportion of pure morphia which Turkey opium is capable of affording varies from 9 per cent. or less to 14 per cent., according to the quality of the drug; but much less than the least quantity mentioned is often obtained, in consequence of the incomplete exhaustion of the opium, the loss in the process for preparing it, or inferiority in the quality of the drug.

Medical Properties. There can be no doubt that morphia is the chief narcotic principle of opium, from which, however, it differs somewhat in its mode of action. The difference probably arises in part from the peculiar state of combination in which morphia exists in opium, but chiefly from other narcotic principles being associated with it. That the former is in some degree the cause, would seem from the circumstance that, long before the discovery of this alkaloid, preparations of opium were habitually used, in which the properties of the medicine were somewhat similarly modified by the agency of vinegar, lemon-juice, or other vegetable acid. In consequence of its insolubility in water, morphia in its pure state is less certain in its effects than some of its saline compounds; as the mode and degree of its action must, in some measure, depend on the presence or absence of acid in the stomach, and perhaps on the peculiar character of the acid. Its salts are therefore always preferred. The acetate, sulphate, and muriate have been employed. Between these there is a great similarity of action, and what may be said of one, in regard to its therapeutical effects, will equally apply to the others. They have the anodyne, soporific, and diaphoretic

properties of opium, but are less stimulant, less disposed to constipate the bowels, and less apt to leave behind them headache, nausea, or other unpleasant effect. They are usually also more acceptable to an irritated stomach, and may be retained, when opium or its tincture would be rejected. That they operate by entering the circulation is proved by the detection of morphia in the urine, though it is said not to be eliminated by the skin. (*Lefort.*) They are applicable to all cases where the object is to relieve pain, quiet restlessness, promote sleep, or allay nervous irritation in any shape; but are less efficient than opium in the suppression of morbid discharges, and as stimulants in low forms of disease. A great advantage which they possess is the convenience of their external application to blistered surfaces, and the certainty of their effects when thus applied. In cases which do not admit of the internal use of opium or its preparations, the acetate or sulphate of morphia, sprinkled, in triple the ordinary dose, upon a blistered surface denuded of the cuticle, will be found to exercise upon the system all the influence it is capable of exerting when taken into the stomach. Applied in this manner, these salts are peculiarly useful in relieving violent neuralgic pains, and controlling obstinate sickness of the stomach. When intended to act on the system through the medium of the skin, they should be applied preferably to the epigastrium; when to act locally, as near the affected part as possible. Solutions of the salts of morphia also sometimes operate very favourably, both generally and locally, when injected, by means of a sharp-pointed syringe, adapted to the purpose, into the areolar tissue beneath the skin. Given in doses nearly but not quite sufficient to produce sleep, they sometimes occasion a very troublesome condition of the brain, amounting almost to delirium; but this always subsides spontaneously, or vanishes immediately upon the increase of the dose. An embrocation for external use may be made by dissolving muriate or acetate of morphia in glycerin, which takes up about 5 per cent. of these salts at common temperatures, and more with the aid of heat. (*Journ. de Pharm.*, xxvi. 90.) Oleic acid has also been proposed as a vehicle for morphia externally used, as it dissolves both the alkaloid and its salts perfectly in considerable proportion. A liniment has been proposed, consisting of 300 parts of oleic acid and 1 of morphia, scented with a little oil of bergamot. (*Ibid.*, xxvi. 302.)

In overdoses, morphia and its salts produce the effects of narcotic poisons, though not perhaps equally with a quantity of opium equivalent in anodyne operation. An instance of death from the injection of three grains of morphia into the rectum is recorded by Dr. Anstie, of England, but the age of the patient is not mentioned. (*Med. Times and Gaz.*, Dec. 1862, p. 317.) The toxicological treatment is precisely the same as in the case of laudanum. (See *Opium.*) Strong coffee has been employed with great apparent advantage as an antidote.

As the proportion of acid necessary to neutralize morphia is very small, the dose of the alkaloid is the same as that of its salts. One-sixth of a grain may be considered about equivalent to a grain of opium of the medium strength.*

Off. Prep. Morphiæ Acetas, *U. S.;* Morphiæ Murias, *U. S.;* Morphiæ Sulphas, *U. S.* W.

* *Apomorphia.* This alkaloid was discovered by Dr. Matthiesen and Mr. C. A. Wright. It is prepared by heating morphia in a closed tube with a great excess of hydrochloric acid for two or three hours to the temperature of 140° and 150° C. The contents of the tube are then dissolved in water, an excess of the bicarbonate of sodium added, and the precipitate exhausted with ether or chloroform. On the addition to the solution of a very small quantity of hydrochloric acid crystals of the chloride of apomorphia form. The process is one of dehydration; the morphia parting with one equivalent of water, and the formula of apomorphia being $C_{34}H_{17}NO_4$ ($C_{17}H_{17}NO_2$). Apomorphia may also be made by the action of hydrochloric acid upon codeia, and it is affirmed that the best method in practice is that of E. Mayer, in which morphia is treated with a solution of chloride of zinc, at 120° C. (*Berichte Deutsch. Chem. Gesell.*, Berlin, 1871, iv. 121.) According to Prof. Gubler (*Ann. de Thérap.*, 1874), it is very closely allied to the alkaloid of Sanguinaria Canadensis. It is very prone, when in solution or even when exposed to a moist atmosphere, to undergo a change, whereby it acquires an emerald-green colour. According to Max Quehl and H. Koehler, it is precipitated from its solutions greenish by tannic acid, lemon-yellow by nitropicric acid, bluish-white, and turning to sap-green on boiling, by sulphate of copper, purplish by chloride of gold, white, turning to violet-blackish on boiling, by ferridcyanide of potassium, blood-red by iodine in solution of iodide of potassium, the precipitate disappearing on boiling, white and curdy by sulphocyanide of potassium. (*Am. Journ. of Pharm.*, 1873, p. 166.) With bichromate of potassium and concentrated sulphuric acid it turns a dark-red; with the potassium salt alone a deep yellow-orange; with neutral chloride of iron an amethyst colour.

MORPHLÆ ACETAS. *U.S., Br. Acetate of Morphia.*

"Take of Morphia, in fine powder, *a troyounce;* Distilled Water *half a pint;* Acetic Acid *a sufficient quantity.* Mix the Morphia with the Distilled Water; then carefully drop Acetic Acid into the mixture, stirring it constantly until the Morphia is neutralized and dissolved. Evaporate the solution, by means of a water-bath, to the consistence of syrup, and set aside until it concretes. Lastly, dry the salt with a gentle heat, and rub it into powder." *U.S.*

"Take of Hydrochlorate of Morphia *two ounces* [avoirdupois]; Solution of Ammonia, Acetic Acid, Distilled Water, of each, *a sufficiency.* Dissolve the Hydrochlorate of Morphia in *one pint* [Imperial measure] of Distilled Water, and add Solution of Ammonia until the Morphia is precipitated and the liquid rendered slightly alkaline. Collect the precipitate on a filter, wash it with Distilled Water; then, having transferred it to a porcelain dish, add four [fluid]ounces of Distilled Water and a sufficient quantity of Acetic Acid to neutralise and dissolve it. Evaporate the solution by the heat of a water-bath until it concretes on cooling. Lastly, dry the salt with a gentle heat, and reduce it to powder." *Br.*

In the U. S. process, morphia is saturated with acetic acid, which is employed in preference to vinegar for saturating the alkaloid, because it can leave no impurity in the resulting salt. The solution of the morphia in the water is an indication that it is saturated. A small excess of acid is attended with no inconvenience, as it is subsequently driven off by the heat. Care is required not to employ too much heat in the evaporation; as the acetate is easily decomposed, a portion of the acetic acid escaping, and leaving an equivalent portion of uncombined morphia. With attention to arrest the evaporation at a certain point, the acetate may be obtained in the state of crystals; but the crystallization is attended with some difficulty, and evaporation to dryness is almost universally preferred. Some recommend to dissolve the morphia in boiling alcohol, instead of suspending it in water, previously to the addition of the acetic acid. A less heat is thus required in the evaporation, and impurities in the morphia may often be detected, as they are apt to be insoluble in alcohol. To ascertain, in this case, whether the morphia is saturated, it is necessary to employ litmus paper, the blue colour of which should not be restored, if previously reddened by an acid. If the morphia used in preparing the acetate contain narcotina, it will be best to employ as the solvent distilled vinegar, or diluted acetic acid of the same strength, and to favour its solvent power by heat. Under these circumstances it dissolves only the morphia, leaving the narcotina nearly or quite untouched. (Hodgson, *Journ. of the Philad. Col. of Pharm.*, v. 35.)

The British process differs from that of the U. S. Pharmacopœia only in obtaining uncombined morphia, as the first step, by precipitating it from a solution of the muriate; morphia itself not being among its officinal preparations.

Medical Properties and Uses. To Dr. Gee belongs the credit of bringing forward this substance as an emetic (*St. Bartholomew's Hosp. Rep.*, v. 215), and abundant testimony has since shown that it acts in a very short time when given hypodermically. In a few cases it has failed to vomit, and has produced a syncopal condition bordering upon collapse, but usually it acts most kindly and thoroughly. It is not irritant, and causes no pain when injected under the skin. The dose is from a twentieth to a tenth of a grain. Dr. Loeb found 0·002 grain to act very powerfully in an infant thirteen months old. A solution which has acquired a greenish tint should never be given. According to Mr. Constantine Paul, when glycerin is used as the sole menstruum, the solution will keep three or four days; and M. Carville states that glucose will preserve its watery solution. (*Note to the fourteenth edition.*)

Hydrocyanate of Morphia. Prof. J. M. Maisch has noticed that when a soluble salt of morphia is added to a solution of a soluble cyanide, crystals of hydrocyanate of morphia form. This salt, although sparingly soluble in water, is freely dissolved by that liquid when acidulated. It is evident that cyanide of potassium and morphia should not be prescribed together in solution, except in connection with free acid. (*Note to the fourteenth edition.*)

Bromide of Morphia. This salt has been brought forward by Dr. Richardson, of London, as especially efficacious in neuralgia, but it is very doubtful whether it has any advantages of the ordinary salts of the alkaloids. For a method of making the bromide, see *Am. Journ. of Pharm.*, xliv. 447. (*Note to the fourteenth edition.*)

A new alkaloidal derivative of Morphia. G. Nadler has obtained an alkaloid, which differs essentially from apomorphia in that its solution has no tendency to turn green, by the action of an ammoniacal solution of copper upon morphia. The sulphate, unlike that of morphia, is very sparingly soluble. For further particulars the reader is referred to *Pharm. Journ. and Trans.*, July 18, 1874, p. 47. (*Note to the fourteenth edition.*)

Acetate of morphia crystallizes in the form of slender needles united in fasciculi. It is readily dissolved by water, and less easily by alcohol. As ordinarily obtained, however, by evaporation to dryness, it is not entirely soluble in water, a portion of it being uncombined morphia. To render it soluble, all that is necessary is to add a little distilled vinegar. The U.S. Pharmacopœia gives the following tests of its character. "From its solution potassa throws down a precipitate which is dissolved by an excess of the alkali. It is affected by heat, nitric acid, and sesquichloride of iron, in the same manner as morphia. When sulphuric acid is added to the salt, acetous vapours are evolved." In addition to these tests, the *London College*, in its late Pharmacopœia, referred to the property possessed by this and other salts of morphia, when treated first with chlorine and then with ammonia, of presenting a brown colour, which disappears on the further addition of chlorine. The *Edinburgh College* gave the following mode of testing its purity: "One hundred measures of a solution of ten grains in half a fluidounce of water and five minims of acetic acid, heated nearly to 212°, and decomposed by a faint excess of ammonia, yield by agitation a precipitate which in 24 hours occupies 15·5 measures of the liquid."

From an eighth to a quarter of a grain may be given for a dose, and repeated, if necessary, in order to obtain the anodyne and soporific effects of the medicine. One-sixth of a grain is about equivalent to a grain of opium. It may be given in pill or solution. It is frequently employed externally, sprinkled on blistered surfaces, to obtain its effects upon the system. It is not unfrequently exhibited by subcutaneous injection; but great caution must be observed that it be not thrown into a superficial vein. A case of alarming prostration, coming on after the injection of a third of a grain dissolved in four minims of water into the arm of a woman suffering with neuralgia, is recorded in the *Med. Times and Gaz.* (Jan. 1868, p. 8). Respiration and circulation were apparently suspended; but the patient recovered under active local stimulation, aided by artificial respiration. When given hypodermically fifteen minutes before the anæsthetic it was found by Claude Bernard to prolong and intensify the anæsthesia in animals, and many surgeons have employed it in man in this way, with satisfactory results. In the subcutaneous injection of this, as of all other substances given to affect the system, it is important that the solution be perfectly clear. The solution should also be freshly prepared, as on keeping the acetic acid becomes decomposed, the solution acquiring a brown colour and morphia being deposited in crystals. (Prof. Maisch, *Am. Journ. of Pharm.*, xliii. 49.)

Off. Prep. Liquor Morphiæ Acetatis, *Br.* W.

MORPHIÆ MURIAS. *U.S.* MORPHIÆ HYDROCHLORAS. *Br. Muriate of Morphia. Hydrochlorate of Morphia.*

"Take of Morphia, in fine powder, *a troyounce;* Distilled Water *four fluidounces*, Muriatic Acid *a sufficient quantity*. Mix the Morphia with the Distilled Water then carefully drop in Muriatic Acid, constantly stirring, until the Morphia is neutralized and dissolved. Evaporate the solution, by means of a water-bath, so that on cooling it may crystallize. Lastly, drain the crystals, and dry them on bibulous paper." *U.S.*

"Take of Opium, sliced, *one pound* [avoirdupois]; Chloride of Calcium *three-quarters of an ounce* [avoird.]; Purified Animal Charcoal *a quarter of an ounce* [avoird.]; Diluted Hydrochloric Acid *two fluidounces*, or *a sufficiency;* Solution of Ammonia, Distilled Water, of each, *a sufficiency*. Macerate the Opium for twenty-four hours with two pints [Imperial measure] of the Water, and decant. Macerate the residue for twelve hours with two pints [Imp. meas.] of the Water, decant, and repeat the process with the same quantity of the Water, subjecting the insoluble residue to strong pressure. Unite the liquors, evaporate in a water-bath to the bulk of one pint [Imp. meas.], and strain through calico. Pour in now the Chloride of Calcium previously dissolved in four fluidounces of Distilled Water, and evaporate until the solution is so far concentrated that, upon cooling, it becomes solid. Envelope the mass in a double fold of strong calico, and subject it to powerful pressure, preserving the dark fluid which exudes. Triturate the squeezed cake with about half a pint [Imp. meas.] of boiling Distilled Water, and, the whole being thrown upon a paper filter, wash the residue well with boiling Distilled Water. The filtered fluids having been evaporated

as before, cooled, and solidified, again subject the mass to pressure; and, if it be still much coloured, repeat this process a third time, the expressed liquids being always preserved. Dissolve the pressed cake in six fluidounces of boiling Distilled Water; add the Animal Charcoal, and digest for twenty minutes; filter, wash the filter and charcoal with boiling Distilled Water, and to the solution thus obtained add the Solution of Ammonia in slight excess. Let the pure crystalline Morphia which separates as the liquid cools, be collected on a paper filter, and washed with cold Distilled Water until the washings cease to give a precipitate with a solution of nitrate of silver acidulated by nitric acid.

"From the dark liquids expressed in the above process an additional product may be obtained by diluting them with distilled water, precipitating with solution of potash added in considerable excess, filtering, and supersaturating the filtrate with hydrochloric acid. This acid liquid digested with a little animal charcoal, and again filtered, gives upon the addition of ammonia a small quantity of pure morphia.

"Diffuse the pure morphia obtained as above, through two fluidounces of boiling Distilled Water placed in a porcelain capsule kept hot, and add, constantly stirring, the Diluted Hydrochloric Acid, proceeding with caution, so that the morphia may be entirely dissolved, and a neutral solution obtained. Set aside to cool and crystallize. Drain the crystals, and dry them on filtering paper. By further evaporating the mother-liquor, and again cooling, additional crystals are obtained." *Br.*

In relation to the process of the U. S. Pharmacopœia, the remarks made upon the preparation of the sulphate of morphia are equally applicable here. (See *Morphiæ Sulphas.*) The troyounce of morphia, directed in the formula, is not soluble, even when converted into the muriate, in four fluidounces of cold water; and the process, if exactly followed, could not be carried out. By inadvertence, the direction was omitted to use the water of solution boiling hot, in which condition it will readily dissolve the whole of the muriate produced. The British process is based upon the plan, originally suggested by Wittstock, improved by Dr. Wm. Gregory, and adopted in the Edinburgh Pharmacopœia, of obtaining muriate of morphia immediately from opium without the use of alcohol. The meconate and a little sulphate of morphia extracted by water from opium are decomposed by chloride of calcium, yielding muriate of morphia in solution, and meconate and sulphate of calcium as precipitates. The next step consists in purifying the solution of the muriate by repeated evaporation, crystallization, expression, and re-solution, and finally the action of animal charcoal; the dark expressed liquors being set aside for future operation. The third step in the process is to obtain the morphia separate by precipitation by means of ammonia from the solution of the muriate. Lastly, the crystallized morphia is reconverted, by treatment with muriatic acid and hot water, into the muriate of morphia, which crystallizes from the solution as it cools. The reserved expressed liquors are united, and made to give up their morphia by the reagency of potassa in excess, which at once separates and dissolves the alkaloid. The solution yields it in a crystalline state on the addition of muriatic acid in excess, and afterwards of ammonia. The morphia thus obtained is added to that first procured, and with it again converted into the muriate. Dr. Christison says, in favour of Dr. Gregory's process, that the Edinburgh manufacturers, who follow it, produce a salt of unrivalled purity and cheapness. But it is much better calculated for the large laboratory of the manufacturing chemist, than for the smaller operations of the apothecary, who will probably find the U. S. process more convenient.

Muriate of morphia procured by the old Edinburgh process is free from narcotina; but always contains a portion of muriate of codeia, which, however, is scarcely sufficient to affect its operation upon the system. Dr. Christison found the proportion to vary between a 60th in the muriate prepared from good Turkey opium, a 30th in that from inferior samples of the same variety, and a 12th in that from the East Indian. This impurity may be separated by precipitating the morphia by means of ammonia; the codeia being left in solution; and this no doubt is the object of the last step of the present British process, previously to the final conversion of the morphia into the muriate.

The late Dr. A. T. Thomson published a process for procuring muriate of morphia,

which he found considerably more productive than that of the Edinburgh College. After macerating the opium in water, as directed by the College, for thirty hours, and expressing, he rubbed it in a mortar with an equal weight of pure white sand, and enough water to form the mixture into a paste, which he placed in a percolator, and subjected to the action of distilled water till the fluid passed without colour and taste. He then concentrated the liquor to the consistence of a thin syrup, added diacetate of lead, diluted the solution with twice its bulk of distilled water, allowed it to stand for twenty-four hours, decanted the supernatant liquid, washed the precipitate with warm water, added the washings to the decanted solution, and concentrated to one-half. To free the liquid from any remaining acetate of lead, he added diluted sulphuric acid in slight excess, decanted the liquid from the precipitate, washed the latter, added the washings to the solution, and boiled for some minutes to drive off acetic acid. To convert the sulphate of morphia now contained in the solution into muriate, he added a saturated solution of chloride of barium, washed the precipitate, evaporated the conjoined washings and solution to the point of crystallization, pressed the crystals, diluted and again evaporated the mother-liquor so long as it afforded crystals, which were purified by means of animal charcoal, and by repeated solution, evaporation, and crystallization. (*Pharm. Journ.*, i. 459.)

Muriate of morphia crystallizes in tufts of feathery acicular crystals. It is white, inodorous, bitter, soluble in 16 parts of water at 60°, and its own weight at 212°, and soluble also in alcohol. A saturated solution in boiling water forms a solid crystalline mass on cooling. The crystals are said to consist of one equivalent of morphia 285, one of muriatic acid 36·5, and six of water 54. Dr. Christison constantly found the crystals, when dried at 150°, to contain 12·7 per cent. of water; and the Edinburgh College stated that the loss of weight at 212° is not above 13 per cent. The salt may be known to be a muriate by yielding in solution, with nitrate of silver, a precipitate insoluble in nitric or muriatic acid, but dissolved by an excess of ammonia. Potassa throws down from its solution a precipitate which is redissolved by an excess of the alkali. The salt is affected by heat, nitric acid, iodic acid, sesquichloride of iron, and chlorine followed by ammonia, in the same manner as morphia. Sugar is said to have been used largely in the adulteration of this salt. It may be detected by the test of fermentation.

"Twenty grains of the salt dissolved in half a [fluid]ounce of warm water, with ammonia added in the slightest possible excess, give on cooling a crystalline precipitate, which, when washed with a little cold water, and dried by exposure to the air, weighs 15·18 grains." *Br.*

This preparation of morphia is much used in Great Britain, but, in this country, less than either the sulphate or acetate. The dose, equivalent to a grain of opium, is about one-sixth of a grain.

Off. Prep. Liquor Morphiæ Hydrochloratis, *Br.;* Suppositoria Morphiæ, *Br.;* Trochisci Morphiæ, *Br.;* Trochisci Morphiæ et Ipecacuanhæ, *Br.* W.

MORPHIÆ SULPHAS. *U.S.* *Sulphate of Morphia.*

"Take of Morphia, in fine powder, *a troyounce;* Distilled Water *half a pint;* Diluted Sulphuric Acid *a sufficient quantity.* Mix the Morphia with the Distilled Water, then carefully drop in Diluted Sulphuric Acid, constantly stirring until the Morphia is neutralized and dissolved. Evaporate the solution, by means of a water-bath, so that on cooling it may crystallize. Lastly, drain the crystals, and dry them on bibulous paper." *U.S.*

In this process the morphia is known to be saturated when it is wholly dissolved by the water. To ascertain whether the acid is added in excess, litmus paper may be resorted to. If the morphia employed contain narcotina, this will remain in the mother-liquor, and will not contaminate the product. The mother-liquor remaining after the first crystallization, may be evaporated so as to afford a fresh supply of the sulphate; but, if the morphia was not originally quite pure, the second product will contain the impurities, and should not be used till it has undergone further preparation. When impure morphia is employed, the mother-liquor should be mixed with alcohol, or boiled with purified animal charcoal and filtered, and then decomposed by

ammonia, which will precipitate the morphia. This may be converted into the sulphate in the manner directed by the Pharmacopœia.

Another mode of obtaining sulphate of morphia is to dissolve the alkaloid in boiling alcohol of 36° Baumé (sp. gr. 0·8428), saturate it while hot with sulphuric acid, add purified animal charcoal, boil for a few minutes, and filter the solution at the boiling temperature. Upon cooling, it deposits most of the sulphate; and the remainder may be obtained by evaporating the mother-liquor.

In the evaporation of the solution of this salt, care should be taken not to carry the heat too far; for, when pushed to incipient decomposition with an excess of acid, a new substance is formed containing no morphia.

Sulphate of morphia crystallizes in beautifully white, minute, feathery crystals, which are soluble in twice their weight of cold water, and still more soluble in boiling water. They contain, according to Liebig, in 100 parts, 10·33 of sulphuric acid, 75·38 of morphia, and 14·29 of water. By exposure to a heat of 248° F. they lose 9·66 parts of the water, but cannot be deprived of the remainder without decomposition. They are said to consist of one equivalent of morphia 285, one of sulphuric acid 40, and six of water 54, of which five are water of crystallization, and may be expelled by heat. The tests for it are those for sulphuric acid and for morphia. The dose is from an eighth to a quarter of a grain, which may be given in pill or solution. According to a writer in the *Druggists' Circular*, when ether is added to a strong alcoholic solution of sulphate of morphia, the salt crystallizes in the course of a few hours. (*Philad. Med. Times*, iv. 352.) The same effect apparently is produced to some extent with the watery solution.

Off. Prep. Liquor Morphiæ Sulphatis, *U. S.;* Suppositoria Morphiæ, *U. S.;* Trochisci Morphiæ et Ipecacuanhæ, *U. S.* W.

MUCILAGINES.

Mucilages.

Mucilage, in the ordinary acceptation of the term, and in the sense in which it is employed in the U. S. Pharmacopœia, is an aqueous solution of gum, or of substances closely allied to it. In the British Pharmacopœia it is applied also to the semi-liquid, jelly-like substance, resulting from the cooling of a hot solution of starch. W.

MUCILAGO ACACIÆ. *U. S., Br. Mucilage of Gum Arabic.*

"Take of Gum Arabic, in small fragments, *four troyounces;* Water *half a pint.* Add the Water to the Gum Arabic, agitate occasionally until it is dissolved, and strain." *U. S.*

"Take of Gum Acacia, in small pieces, *four ounces* [avoirdupois]; Distilled Water *six fluidounces.* Put the Gum and Water into a covered earthen jar, and stir them frequently until the Gum is dissolved. If necessary, strain the solution through muslin." *Br.*

The gum used for this purpose should be in small fragments, or coarse powder, as it is more readily dissolved in this state than when finely pulverized. Straining is necessary to separate the foreign substances which are often mixed with gum arabic. This mucilage is semi-transparent, almost colourless if prepared from good gum, viscid, tenacious, of a feeble peculiar odour, and nearly tasteless. If the solution of gum should be coloured, it may be rendered colourless by the addition of a concentrated solution of chlorine; and, by boiling for about half an hour so as to drive off the chlorine and muriatic acid, it may be rendered fit for use. (*Guérin.*) By keeping, mucilage becomes sour, in consequence of the spontaneous generation of acetic acid; and this happens even though it be enclosed in well-stopped bottles. But, according to Guérin, the solution of pure gum undergoes no change in vacuo. Heat in its preparation is said to favour the production of acid; and hence cold has been substituted for boiling water in the present formulas. According to R. Rothen (*Amer. Journ. of Pharm.*, xliv. 113), if glycerin be employed in proportion of one to eight of the mass, and the mixture of water and it be added to the gum in a bottle and solution secured by agitation at intervals over several hours, the resulting mucilage does not

spoil. Archer & Co. have found (*Ibid.*, xlvi. p. 469) that if "Tolu water" be substituted for water the mucilage will keep for months. The Tolu water is made by rubbing two drachms of the tincture with carbonate of magnesium and two pints of water, and filtering. Mucilage is employed chiefly in the formation of pills, and suspending insoluble substances in water. In prescribing it for mixtures, it should be recollected that it is a solution of definite strength, containing, according to the U. S. formula, half an ounce of the gum to each fluidounce of menstruum. The British mucilage is a little stronger. Half a fluidounce is usually sufficient for a six or eight ounce mixture. The adhesiveness of the mucilage is stated to be very much increased by the addition of one part of sulphate of aluminium to one hundred and twenty-five parts of the mucilage.

Off. Prep. Trochisci Acidi Tannici, *Br.;* Troch. Bismuthi, *Br.;* Troch. Catechu, *Br.;* Troch. Ferri Redacti, *Br.;* Troch. Ipecacuanhæ, *Br.;* Troch. Morphiæ, *Br.;* Troch. Morphiæ et Ipecacuanhæ, *Br.;* Troch. Potassæ Chloratis, *Br.;* Troch. Sodæ Bicarbonatis, *Br.* W.

MUCILAGO AMYLI. *Br. Mucilage of Starch.*

"Take of Starch *one hundred and twenty grains;* Distilled Water *ten fluidounces.* Triturate the Starch with the Water gradually added; then boil for a few minutes, constantly stirring." *Br.*

This mucilage has an opaline appearance, and gelatinous consistence, and is much used as a vehicle for laudanum and other active medicines given in the form of enema. In consequence of its demulcent properties, it may be usefully employed as an enema in irritation and inflammation of the mucous coat of the rectum and large intestines. Its unpleasant flavour, when it is prepared from ordinary starch, precludes its employment by the mouth.

Off. Prep. Enema Aloes, *Br.;* Enema Magnesiæ Sulphatis, *Br.;* Enema Opii, *Br.;* Enema Terebinthinæ, *Br.* W.

MUCILAGO SASSAFRAS MEDULLÆ. *U. S.* Mucilago Sassafras. *U. S.* 1860. *Mucilage of Sassafras Pith.*

"Take of Sassafras Pith *one hundred and twenty grains;* Water [cold] *a pint.* Macerate for three hours, and strain." *U. S.*

This infusion may be prepared in a much shorter time, if the pith be broken into small fragments, and the mixture often agitated. It is much used as an application to the eye in inflammation of the conjunctiva. It may be taken as a drink, *ad libitum*, in inflammatory and febrile diseases, particularly inflammations of the mucous passages. W.

MUCILAGO TRAGACANTHÆ. *U. S., Br. Mucilage of Tragacanth.*

"Take of Tragacanth *a troyounce;* Boiling Water *a pint.* Macerate the Tragacanth with the Water for twenty-four hours, occasionally stirring; then beat the mixture so as to render it of uniform consistence, and strain forcibly through muslin." *U. S.*

"Take of Tragacanth, in powder, *sixty grains;* Distilled Water *ten fluidounces.* To the Water contained in a pint bottle add the Tragacanth, agitate briskly for a few minutes, and again at short intervals, until the Tragacanth is perfectly diffused and finally has formed a mucilage." *Br.*

A part only of tragacanth is soluble in water. The remainder swells up and forms a soft tenacious mass, which may be mechanically mixed with water, but does not form a proper solution. Hence trituration is necessary to complete the incorporation of the ingredients. This mucilage is thick and very viscid, but not permanent, as the water separates from the insoluble portion of the tragacanth on standing. It is chiefly used in making pills and troches. From its great tenacity, it may be advantageously employed for the suspension of heavy insoluble substances, such as the metallic oxides, in water. When kept long it is apt to undergo decomposition, and to become offensive. Mr. Maisch has found a paste of tragacanth to keep perfectly well by the addition of enough creasote to impart its characteristic odour faintly. (*Am. Journ. of Pharm.*, March, 1864, p. 97.)

Off. Prep. Trochisci Ferri Subcarbonatis, *U. S.;* Trochisci Magnesiæ, *U. S.;* Tro-

chisci Menthæ Piperitæ, *U. S.;* Trochisci Morphiæ Ipecacuanhæ, *U. S.;* Trochisci Sodii Bicarbonatis, *U. S.* W.

MUCILAGO ULMI. *U. S.* INFUSUM ULMI. *U. S.* 1850. *Mucilage of Slippery Elm Bark. Infusion of Slippery Elm Bark.*

"Take of Slippery Elm Bark, sliced and bruised, *a troyounce;* Boiling Water *a pint.* Macerate for two hours in a covered vessel, and strain." *U. S.*

This may be used *ad libitum* as a demulcent and nutritious drink in catarrhal and nephritic diseases, and in inflammatory affections of the intestinal mucous membrane. It is much employed locally as a demulcent in inflammation of the skin, as in erysipelas, &c. W.

OLEA DESTILLATA.

Distilled Oils.

For an account of the general properties of the volatile or distilled oils, the reader is referred to the head of *Olea Volatilia* in the first part of this work. The following are the U. S. general directions for preparing them.

OLEA DESTILLATA. *U. S.*

"Most of the Distilled Oils are prepared by the following general formula. Put the substance from which the Oil is to be extracted into a retort, or other vessel suitable for distillation, and add enough water to cover it; then distil by a regulated heat into a large refrigeratory. Separate the Distilled Oil from the water which comes over with it."

In this manner are prepared OIL OF ANISE, from Anise, bruised; OIL OF CARAWAY, from Caraway, bruised; OIL OF CLOVES, from Cloves, bruised; OIL OF WORMSEED, from Wormseed; OIL OF CUBEB, from Cubeb, bruised; OIL OF CANADA FLEABANE, from Canada Fleabane; OIL OF FENNEL, from Fennel, bruised; OIL OF GAULTHERIA, from fresh Gaultheria [leaves]; OIL OF HEDEOMA, from Hedeoma; OIL OF JUNIPER, from Juniper [berries], bruised; OIL OF LAVENDER, from Lavender [flowers]; OIL OF PEPPERMINT, from fresh Peppermint; OIL OF SPEARMINT, from fresh Spearmint; OIL OF ORIGANUM, from fresh Origanum; OIL OF HORSEMINT, from fresh Horsemint; OIL OF PIMENTO, from Pimento, bruised; OIL OF ROSEMARY, from Rosemary [tops]; OIL OF RUE, from fresh Rue; OIL OF SAVINE, from Savine, bruised; OIL OF SASSAFRAS, from Bark of Sassafras Root, bruised; and OIL OF VALERIAN, from Valerian, bruised.

The *British Council* gives no directions for the preparation of the volatile oils, merely mentioning the names and sources of such as it recognises. The following general directions of the late Edinburgh Pharmacopœia, published in former editions of the Dispensatory, are retained in the present.

"Substances yielding volatile oils must be distilled with water, the proper proportion of which varies for each article, and for the several qualities of each. In all instances, the quantity must be such as to prevent any of the material from being empyreumatized before the whole oil is carried over. In operations where the material is of a pulpy consistence, other contrivances must be resorted to for the same purpose. These consist chiefly of particular modes of applying heat, so as to maintain a regulated temperature not much above 212°. On the small scale, heat may be thus conveniently applied by means of a bath of a strong solution of muriate of lime, or by means of an oil-bath, kept at a stationary temperature with the aid of a thermometer. On the large scale, heat is often applied by means of steam under regulated pressure. In other operations it is found sufficient to hang the material within the still in a cage or bag of fine net-work; and sometimes the material is not mingled with the water at all, but is subjected to a current of steam passing through it.

"The best mode of collecting the oil is by means of the refrigeratory described in the preface, from which the water and oil drop together into a tall narrow vessel, provided with a lateral tube or lip near the top, and another tube rising from the bottom to about a quarter of an inch below the level of the former. It is evident

that, with a receiver of this construction, the water will escape by the lower tube; while the volatile oil, as it accumulates, will be discharged by the upper one, except in the very few instances where the oil is heavier than the water."

Under the general observations on the *Aquæ* or *Waters* (*page* 1071) will be found remarks upon the use of steam in preparing the Distilled Waters, which are to a considerable extent applicable also to the volatile oils.

The substances from which the volatile oils are extracted may be employed either in the recent or dried state. Certain flowers, however, such as orange flowers and roses, must be used fresh, or preserved with salt, or by means of glycerin, as they afford little or no oil after exsiccation. Most of the aromatic herbs, also, as peppermint, spearmint, pennyroyal, and marjoram, are usually distilled while fresh; although it is thought by some that, when moderately dried, they yield a larger and more grateful product. Dried substances, before being submitted to distillation, require to be macerated in water till they are thoroughly penetrated by this fluid; and, to facilitate the action of the water, it is necessary that, when of a hard or tough consistence, they should be properly comminuted by slicing, shaving, rasping, bruising, or other similar mechanical operation.

The water which is put with the subject of distillation into the alembic, answers the double purpose of preventing the decomposition of the vegetable matter by regulating the temperature, and of facilitating the volatilization of the oil, which, though in most instances it readily rises with the vapour of boiling water, requires, when distilled alone, a considerably higher temperature, and is at the same time liable to be partially decomposed. Some oils, however, will not ascend readily with steam at 212°; and in the distillation of these it is customary to use water saturated with common salt, which does not boil under 230°. Recourse may also be had to a bath of strong solution of chloride of calcium, or to an oil-bath, the temperature of which is regulated by a thermometer, as suggested by the Edinburgh College in their general directions, given above. Other oils again may be volatilized with water at a temperature below the boiling point; and, as heat exercises an injurious influence over the oils, it is desirable that the distillation should be effected at as low a temperature as possible. To prevent injury from heat, it has been recommended to suspend the substance containing the oil in a basket, or to place it upon a perforated shelf, in the upper part of the alembic, so that it may be penetrated by the steam, without being in direct contact with the water. Another mode of effecting the same object, is to distil it *in vacuo*. Dr. Duncan stated that the most elegant volatile oils he had ever seen were prepared in this manner by Mr. Barry, the inventor of the process. The employment of steam heat also prevents injury; and the best volatile oils are now prepared in Philadelphia in this way. Steam can be very conveniently applied to this purpose by causing it to pass through a coil of leaden tube, of an inch or three-quarters of an inch bore, placed in the bottom of a common still. The end at which the steam is admitted enters the still at the upper part, and the other end, at which the steam and condensed water escape, passes out laterally below, being furnished with a stop-cock, by which the pressure of the steam may be regulated, and the water drawn off when necessary. In some instances, it is desirable to conduct the steam immediately into the still near the bottom, by which the contents are kept in a state of brisk ebullition. This method is used in the preparation of the oil of bitter almonds and the oil of mustard. The same method is applicable to the preparation of the distilled waters.

The quantity of water added is not a matter of indifference. An excess above what is necessary acts injuriously by holding the oil in solution, when the mixed vapours are condensed; and, if the proportion be very large, it is possible that no oil whatever may be obtained separate. On the contrary, if the quantity be too small, the whole of the oil will not be distilled; and there will be danger of the substance in the alembic adhering to the sides of the vessel, and thus becoming burnt. Enough water should always be added to cover the solid material, and prevent the latter accident. Dried plants require more water than the fresh and succulent. The whole amount of materials in the alembic should not exceed three-fourths of its capacity; as otherwise there would be danger of the liquor boiling over. The form of the alembic has an influence over the quantity of water distilled, which depends more upon the extent

of surface than the amount of liquid submitted to evaporation. By employing a high and narrow vessel, we may obviate the disadvantage of an excess of water. The broad shallow alembic, suitable for the distillation of alcohol and spirituous liquors, will not answer so well in this case. Sometimes the proportion of oil in the substance employed is so small that it is wholly dissolved in the water distilled, even though the proportion of the liquid in the alembic is not greater than is absolutely essential. In this case it is necessary to redistil the same water several times from fresh portions of the plant, till the quantity of oil which comes over exceeds its solvent power. This process is called *cohobation.*

The more volatile of the oils pass with facility along with the steam into the neck of the common still; but some which are less volatile are apt to condense in the head, and thus return into the alembic. For the distillation of the latter, a still should be employed with a large and very low head, having a rim or gutter around its internal circumference, into which the oils may be received as they condense, and thence pass into the neck. (See *page* 1071.) As, after the distillation of any one oil, it is necessary that the apparatus should be thoroughly cleansed before being used for the preparation of another, it is better that the condensing tube should be straight, than spiral as in the ordinary still. It should be recollected, moreover, that certain oils, such as those of anise and fennel, become solid by a comparatively slight reduction of temperature; and that, in the distillation of these, the water employed for refrigeration should not be below 42° F.

The mixed vapours are condensed into a milky liquid, which is collected in a receiver, and, after standing for some time, separates into the oil and a clear solution of it; the former floating on the surface, or sinking to the bottom, according as it is lighter or heavier than water. The distillation should be continued so long as the fluid which comes over has this milky appearance.

The last step in the process is to separate the oil from the water. For this purpose the *Florence receiver* may be used. This is a conical glass vessel, broad at the bottom and narrow towards the top, and very near its base furnished with a tubulure or opening, to which is adapted, by means of a pierced cork, a bent tube so shaped as to rise perpendicularly to seven-eighths of the height of the receiver, then to pass off from it at right angles, and near the end to bend downwards. The condensed liquid being admitted through the opening at the top of the receiver, the oil separates, and rising to the top occupies the upper narrow part of the vessel, while the water remains at the bottom, and enters the tube affixed to the receiver. When the surface of the liquid attains in the receiver a higher level than the top of the tube, the water will necessarily begin to flow out through the latter, and may be received in bottles. The oil thus accumulates so long as the process continues; but it is evident that the plan is applicable only to the oils lighter than water. For the heavier oils, cylindrical vessels may be employed, to be renewed as fast as they are filled. But, as all the water cannot be removed by these plans, it is necessary to resort to some other method of effecting a complete separation. An instrument called a *separatory* is usually employed for this purpose. It consists of a glass funnel, bulging at the top, where it is furnished with a stopper, and prolonged at the bottom into a very narrow tube. (See *figure, page* 961.) The lower opening being closed, the mixed liquids are introduced and allowed to stand till they separate. The orifice at the bottom is then opened, and, the stopper at the top being a little loosened so as to admit the air, the heavier liquid slowly flows out, and may be separated to the last drop from the lighter, which floats above it. If the oil is heavier than the water, it passes out of the separatory; if lighter, it remains within. Another mode of separating the oil is to introduce into the vessel containing the two liquids one end of a cord of cotton, the other end hanging out, and terminating in a suitable receptacle beneath the level of that immersed in the liquid. The oil at top passes through the cord, and may thus be wholly removed. The last drops may be collected by pressing the cord between the fingers. According to George Leuchs all oils obtained by distillation with water, even when perfectly clear, contain some water. (*Amer. Journ. of Pharm.*, 1873, p. 110.)

The water saturated with oil should be preserved for future distillations; as it can

dissolve no more of the oil. One or more volatile acids are frequently found in the distilled water, as the acetic, butyric, or valerianic; and Wunder has detected all three of these acids in the water distilled from chamomile flowers. (*Journ. für Prakt. Chem.*, lxiv. 499.)

According to Overbeck, all the volatile oils may be freed from colouring matter by distilling them from an equal weight of poppy-seed oil, and a saturated solution of common salt. (*Archiv. der Pharm.*, lxxxiv. 149.)

When first procured, the oils have a disagreeable empyreumatic odour, from which they may be freed by allowing them to stand for some days in vessels loosely covered with paper. They should then be introduced into small opaque bottles, which should be well stopped so as to exclude the air. When altered by exposure to air, they may sometimes be restored to their original appearance and quality, by agitation with a little recently heated animal charcoal; and the same method may be employed for freeing them from adhering water.

The volatile oils have the medical properties of the plants from which they are derived; and, as their remedial application has been mentioned under the heads of these plants respectively, it will be unnecessary to treat of it in this place. They may be administered upon a lump of sugar; or triturated with at least ten times their weight of sugar, forming an *oleo-saccharum*, and then dissolved in water; or made into an emulsion with water, sugar, and gum arabic. In making emulsions with volatile oils, it has been recommended first to dissolve them in one of the fixed oils, the oil of almonds for example, and then to emulsionize the oleaginous solution with syrup and gum arabic. For 100 parts of water, 15 of the almond oil in which the volatile oil is to be dissolved, 10 of powdered gum arabic, and 25 of syrup may be taken.* (*Journ. de Pharm.*, Juin, 1864, p. 461.) The volatile oils are often kept dissolved in alcohol under the name of *essences*.† W.

OLEUM ANISI. *U. S.*, *Br.* *Oil of Anise.*

The British Pharmacopœia refers the oil of anise not only to Pimpinella Anisum, but also to Illicium anisatum.

* Prof. Procter has kindly sent us the following suggestions on preparing emulsions of the volatile oils. Oil of turpentine and other volatile oils, to be emulsionized in quantity, are most successfully treated by rubbing them with the powdered gum, and when intimately mixed, adding, at once, with rapid trituration, one and a half times the weight of the gum used, of water. By this treatment the volatile oil gets thoroughly divided before contact with water, and, if the quantity of water indicated is added at once, the emulsion has the right preliminary consistence, and unites with and emulsionizes the volatile oil. If, however, but a little water is added, this seizes on the gum, forming a pilular mass, and throws the volatile oil out of union. Such an emulsion is more permanent when a little fixed oil is used, as noted in the text. (*Note to the thirteenth edition.*)

† It is often important to know how many drops a volatile oil will yield to the fluidrachm: in other words, the relation of a drop of the oil to a minim. This varies extremely according to the circumstances elsewhere noticed as influencing the size of the drop; so that any results obtained are only approximate and relative. At our request, Professor Procter tried the following oils, with the results stated in the table below. The columns of figures represent the number of drops in a fluidrachm of the oils respectively, the first column giving those obtained by dropping the oils from the bottles in which they are commonly kept, the second by dropping them from a minim measure.

Oleum Anisi	85– 86	Oleum Fœniculi	103–103	Oleum Rosmarini	104–105
" Carui	106–108	" Gaultheriæ	102–101	" Sabinæ	102–108
" Caryophylli	103–103	" Hedeomæ	91– 91	" Sassafras	102–100
" Chenopodii	97–100	" Menthæ Piperitæ	103–109	" Tanaceti	92–111
" Cinnamomii	100–102	" Menthæ Viridis	89– 94	" Valerianæ	116–110
" Cubebæ	86– 96			Creasotum	95– 91

For a table giving results as to the specific gravity, the refracting power, and influence on polarized light, of a large number of volatile oils, prepared by Mr. Gladstone, see the *Journ. de Pharm. et de Chim.* (4e sér., ii. 68, A.D. 1865); also *Am. Journ. of Pharm.* (Sept. 1865, p. 389).

Enfleurage. This term is applied by the French to the impregnation of fixed oils and fatty matters with the odour of certain sweet-scented plants, such as jasmine, tuberose, and mignonette, the oils of which are so delicate and fugitive that they cannot well be separated by distillation. The process consists in exposing the fatty matter, placed in layers, in suitable frames, to the exhalations from the flowers, which are absorbed, and give their characteristic odour to the fat. Another plan is to expose alternate layers of the flowers, and of cotton impregnated with bland fixed oil, to the sun, and afterwards to express the oil from the cotton. For remarks on this process, as conducted in the South of France, see a communication from Mr. Daniel Hanbury in the *London Pharm. Journ.*, copied into the *Am. Journ. of Pharm.* (**xxix.** 551).—*Note to the eleventh edition.*

The product of oil from anise is variously stated from 1·56 to 3·12 per cent. The oil employed in this country is imported. It is colourless or yellowish, with the peculiar odour and taste of the seed. At 50° it crystallizes in flat tables, and does not melt under 62°. Its sp. gr. increases with age, and is variously given from 0·9768 to 0·9903. It is soluble in all proportions in alcohol of 0·806; but alcohol of 0·840 dissolves at 77° only 42 per cent. Ether dissolves it in all proportions. (*Gmelin.*) It consists of two oils, one solid at ordinary temperatures and heavier than water (*stearoptene, anise camphor, solid anethol*), the other liquid and more volatile (*eleoptene, liquid anethol*), both of which are said to have the same atomic constitution, and to consist of carbon, hydrogen, and oxygen ($C_{20}H_{12}O_2$). *Anethol* is a name given to the solid and liquid oils, all having the composition above stated, but differing in properties, which mainly constitute the oils of *anise*, or *star aniseed*, and of *fennel*. (*Gmelin's Handbook*, xiv. 192.) By oxidization, by means of nitric or chromic acid, the different forms of anethol yield a peculiar acid denominated *anisic acid*. (*Ibid.*, xiii. 123.) Oil of anise absorbs oxygen from the air, and becomes less disposed to concrete. In consequence of its high price, it is frequently adulterated with spermaceti, wax, or camphor. The first two may be detected by their insolubility in cold alcohol, the last by its odour. In one instance, as much as 35 per cent. of spermaceti was found. Prof. Procter met with a parcel, of which not less than five-sixths were alcohol. (*Am. Journ. of Pharm.*, xxvii. 513.) The dose of the oil is from five to fifteen drops. Its comparative mildness adapts it to infantile cases. We are informed that the oil of anise has, in this country, been almost entirely superseded by the *oil of star aniseed* (*oleum badiani*), which closely resembles it in flavour, and which is recognised in the Br. Pharmacopœia under the same name.

Dr. Ruschenberger, of the U. S. Navy, has demonstrated that oil of anise has the extraordinary property of deodorizing sulphuret of potassium, without undergoing itself any perceptible change; a fluidrachm of anise-water being sufficient completely to change the odour of an ounce of the solution of the sulphuret, depriving it of all offensiveness; and a similar effect was produced by a drop of the oil rubbed up with a drachm of lard, and five grains of the sulphuret. (*Am. Journ. of Med. Sci.*, Oct. 1864, p. 418.)

Off. Prep. Essentia Anisi, *Br.;* Extractum Spigeliæ et Sennæ Fluidum, *U. S.;* Spiritus Anisi, *U. S.;* Syrupus Sarsaparillæ Compositus, *U. S.;* Tinctura Camphoræ Composita, *Br.;* Tinct. Opii Ammoniata, *Br.;* Tinct. Opii Camphorata, *U. S.;* Trochisci Glycyrrhizæ et Opii, *U. S.* W.

OLEUM CARI. *U. S.* Oleum Carui. *Br.* *Oil of Caraway.*

"The Oil distilled in Britain from caraway fruit." *Br.*

This oil is prepared to a considerable extent by our distillers. The fresh fruit yields on an average about 4·7 per cent. (*Recluz*); but the product is very variable. The oil of caraway is somewhat viscid, of a pale yellow colour, becoming brownish by age, with the odour of the fruit, and an aromatic acrid taste. Its sp. gr. is differently given at 0·946 (*Baumé*), 0·931 (*Brande*), and 0·916 (*Buignet*). It is dextrogyrate in its relation to polarized light. (Buignet, *Journ. de Pharm.*, Oct. 1861, p. 261.) It consists of two liquid oils, of different boiling points, and separable by distillation; one, a carbohydrogen called *carvene* ($C_{20}H_{16}$, *Völkel*), of the sp. gr. 0·861, and boiling point 343° F.; the other composed of carbon, hydrogen, and oxygen ($C_{20}H_{14}O_2$), and named *carvol*, of the sp. gr. 0·953, and boiling point 482° F. Oil of caraway is much used to impart flavour to medicines, and to correct their nauseating and griping effects. The dose is from one to ten drops.

When oil of caraway is distilled from hydrated phosphoric acid, the distilled liquor being poured back into the retort until it ceases to have the smell of caraway, an oily liquid is obtained, having a very disagreeable odour, and a strong taste. This product, to which the name of *carvacrol* has been applied, has been found to give immediate relief to toothache, when inserted on cotton into the cavity of a carious tooth. (See *Am. Journ. of Med. Sci.*, N. S., xv. 532.)

Off. Prep. Confectio Scammonii, *Br.;* Extractum Spigeliæ et Sennæ Fluidum, *U. S.;* Pilula Aloes Barbadensis, *Br.;* Spiritus Juniperi Compositus, *U. S.* W.

OLEUM CARYOPHYLLI. *U. S., Br. Oil of Cloves.*

"The Oil distilled in Britain from cloves." *Br.*

The oil is obtained by distilling cloves with water, to which it is customary to add common salt, in order to raise the temperature of ebullition; and the water should be repeatedly distilled from the same cloves, in order completely to exhaust them. Professor Scharling has found advantage from the application of super-heated steam to the distillation of this oil. (*Pharm. Journ.*, xi. 469.)* The product of good cloves is said to be about one-fifth or one-sixth of their weight. The oil was formerly brought from Holland or the East Indies; but, since the introduction of the Cayenne cloves into our markets, the reduced price and superior freshness of the drug have rendered the distillation of oil of cloves profitable in this country; and the best now sold is of domestic extraction. We have been informed that from seven to nine pounds of cloves yield to our distillers about one pound of the oil.

Properties. Oil of cloves, when recently distilled, is very fluid, clear, and colourless, but becomes yellowish by exposure, and ultimately reddish-brown. It has the odour of cloves, and a hot, acrid, aromatic taste. Its sp. gr. is variously stated at from 1·034 to 1·061; the latter being given by Bonastre as the sp. gr. of the rectified oil. It is one of the least volatile of the essential oils, and requires for congelation a temperature from zero of Fahrenheit to —4°. It is completely soluble in alcohol, ether, and strong acetic acid. Nitric acid changes its colour to a deep red, and converts it by the aid of heat into oxalic acid. The same change to red is produced by nitric acid on morphia, but in this case the red is followed by yellow, which does not happen with the oil of cloves. Besides, if to a solution of morphia with nitric acid a solution of chlorinated lime be added, and the mixture be exposed for some hours to the light, the solution of morphia will retain a straw colour, while if oil of cloves be treated in the same manner the colour disappears. (Haselden, *B. and F. Med.-chir. Rev.*, July, 1867, p. 265.) When long kept the oil deposits a crystalline *stearoptene*. It is frequently adulterated with fixed oils, and sometimes with oil of pimento and with copaiba. When pure it sinks in distilled water. According to Ed. Sherer, these adulterations may sometimes be detected by attention to the specific gravity and the boiling point, pure oil of cloves varying in specific gravity from 1·03 to 1·06, and boiling at from 464° F. to 491° F. According to Zeller, its character of congealing entirely into a crystalline mass with the alcoholic solution of potassa, losing at the same time its peculiar odour, affords a sufficient criterion of its purity. It appears to be indifferent in its effects on polarized light, as regards rotary power. (*Buignet.*)

According to Ettling, the oil of cloves consists of two distinct oils, one lighter, the other heavier than water. They may be obtained separate by distilling the oil from a solution of potassa. The lighter comes over, the heavier remains combined with the potassa, from which it may be separated by adding sulphuric acid, and again distilling. *Light oil of cloves* is colourless, has the sp. gr. 0·918, and consists exclusively of carbon and hydrogen, being isomeric with pure oil of turpentine. It is said not to possess active properties. (*Kane.*) *Heavy oil of cloves* is colourless at first, but darkens with age, has the odour and taste of cloves, is of the sp. gr. 1·079, boils at 470°, and forms soluble and crystallizable salts with the alkalies. Hence it has been called *eugenic* or *caryophyllic acid.*† It consists of carbon, hydrogen, and oxygen; the formula, according to Ettling, being $C_{24}H_{15}O_5$; according to Gerhardt, who is probably correct, $C_{20}H_{12}O_4$. (*Chem. Gaz.*, No. 373, p. 170.)

Medical Properties and Uses. The medical effects of the oil are similar to those of cloves, and it is used for the same purposes; but its most common employment is as a corrigent of other medicines. Like other powerful irritants, it is sometimes effectual in relieving toothache, when introduced into the cavity of a carious tooth. The dose is from two to six drops.

Off. Prep. Confectio Scammonii, *Br.;* Pilula Colocynthidis Composita. *Br.* W.

* For an account of the apparatus employed, and the method pursued by Messrs. Rogers and Crew, of Philadelphia, in the distillation of this oil, see *Am. Journ. of Pharm.*, Jan. 1862, p. 27.

† *Caryophyllic Acid.* This term has unfortunately also been applied to a substance obtained by the action of nitric acid upon caryophyllin. It crystallizes in white needles, readily soluble in alcohol, ether, and acetic acid, but nearly insoluble in water. For further particulars, see *Amer. Journ. of Pharm.*, xlvi. 65. (*Note to the fourteenth edition.*)

OLEUM CHENOPODII. *U. S.* *Oil of Wormseed.*

This oil is peculiar to the United States. The best is prepared in the vicinity of Baltimore. (See *page* 263.) It is of a light-yellow colour when recently distilled, but becomes deeper yellow and even brownish by age. It has in a high degree the peculiar flavour of the plant. When freshly prepared, it has the sp. gr. 0·908, which, according to Mr. S. S. Garrigues, is increased by time to 0·960. A portion examined by him, which was of a brownish-yellow colour, had the sp. gr. 0·959 at 61° F., boiled at 374°, and was freely soluble in alcohol and ether. He found it to be composed of two distinct oils, separable by distillation; one of these consists of carbon and hydrogen exclusively, and reacts with muriatic acid in a manner analogous to oil of turpentine; the other is heavier, and contains carbon, hydrogen, and oxygen. (*Am. Journ. of Pharm.*, xxvi. 405.) Wormseed oil is used as an anthelmintic, in the dose of from four to eight drops for a child, repeated morning and evening for three or four days, and then followed by a brisk cathartic. The case of a child, six years old, is recorded in the *Boston Med. and Surg. Journ.* (xlv. 373), in which death is supposed to have resulted from the use of overdoses. W.

OLEUM COPAIBÆ. *U. S.*, *Br.* *Oil of Copaiba.*

"The Oil distilled from copaiva." *Br.*

"Take of Copaiba *twelve troyounces;* Water *sixteen pints.* Add the Copaiba to the Water in a tinned still, and, having adapted a proper refrigeratory, distil twelve pints. Separate the Oil which comes over from the Water, return this latter to the still, and again distil twelve pints. Lastly, separate the Oil procured in the second distillation, add it to that first obtained, and keep the whole in a well-stopped bottle." *U. S.*

The oil constitutes from one-third to one-half or more of the copaiba. From one specimen of recent copaiba as much as 80 per cent. has been obtained. (*Am. Journ. of Pharm.*, xxii. 289.) It is prepared largely in Philadelphia by the application of steam heat. As it first comes over it is colourless, but the later product is of a fine greenish hue. By redistillation it may be rendered wholly colourless. It has the odour and taste of copaiba, boils at about 470° (*Christison*), solidifies, partly crystalline, at —15° F. (*Gmelin*), is soluble in ether and alcohol, absorbs muriatic acid gas, and forms with it crystals of artificial camphor, and when pure consists exclusively of carbon and hydrogen, being isomeric with pure oil of turpentine. From its want of oxygen, it answers even better than naphtha for preserving potassium, a fact first observed by Mr. Durand, of Philadelphia. It dissolves sulphur and phosphorus. (*Gmelin's Handbook*, xiv. 288.)

Its effects on the system are those of copaiba. From the experiments of C. Mitscherlich, it is one of the least injurious to the animal system of the volatile oils; six drachms of it having been introduced into the stomach of a rabbit without causing death. It has been used with success in ascites. (*London Lancet*, Dec. 1870, p. 852.) Externally it produces much less irritation than oil of turpentine. It may be used for the same purposes as copaiba in the dose of ten or fifteen drops, given in emulsion, or simply dropped on sugar. W.

OLEUM CORIANDRI. *Br.* *Oil of Coriander.*

"The Oil distilled in Britain from coriander fruit." *Br.*

This is obtained by distillation with water from the bruised seeds in the manner directed in the U. S. Pharmacopœia for the other volatile oils. Forty-two grains of it are stated by Zeller to be derived from a pound of the fruit. It is pale-yellow and colourless, and has the characteristic smell and taste of coriander. Its sp. gr. is from 0·859 to 0·871; and its boiling point 302° F. It is an oxygenated oil, with the formula $C_{20}H_{18}O_2$. Oil of coriander has the medical properties of the fruit, and, like the aromatic oils generally, may be used to cover the taste, or correct the nauseating or griping properties of other medicines.

Off. Prep. Syrupus Sennæ, *Br.* W.

OLEUM CUBEBÆ. *U. S.*, *Br.* *Oil of Cubeb.* *Oil of Cubebs.*

"The Oil distilled in Britain from cubebs." *Br.*

The oil is obtained from cubebs by grinding them, and then distilling with water.

From ten pounds Schönwald procured eleven ounces of oil; and this result very nearly coincides with the experiments of Christison, who obtained 7 per cent. When recently distilled from the fruit, the oil is somewhat greenish, becoming yellowish by age; but when carefully redistilled it is colourless. It has the smell of cubebs, and a warm, aromatic, camphorous taste; is of a consistence approaching that of almond oil; is lighter than water, having the sp. gr. 0·929; and, when exposed to the air, is said to thicken without losing its odour. Upon standing, it sometimes deposits rhomboidal prismatic crystals of a stearoptene oil. This camphor of cubebs is fusible at 67° to 68° C., and volatilizes without change at 148° to 150° C. According to Schmidt it does not pre-exist in the cubebs, but is formed by the prolonged action of the air. (*Journ. de Pharm.*, Juin, 1875.) It was thought to consist of carbon and hydrogen, with the formula $C_{15}H_{12}$, but more recent researches give the formula $C_{30}H_{26}O_2$.

The oil has the aromatic properties of cubebs; but it is probably not the sole active ingredient; as it is much less pungent than the fluid extract or oleo-resin. It may, however, often be advantageously substituted for the powder, in the commencing dose of ten or twelve drops, to be gradually increased until its effects are obtained, or until it proves offensive to the stomach. It may be given suspended in water by means of sugar, or in the form of emulsion, or enclosed in capsules of gelatin. W.

OLEUM ERIGERONTIS CANADENSIS. *U. S.* *Oil of Canada Fleabane.*

The oil of fleabane is limpid, of a light-straw colour, a peculiar aromatic persistent odour, and a mild characteristic taste. Its sp. gr., according to Prof. Procter, is 0·845. It probably consists of two distinct oils, as it begins to boil at 310° F.; and its temperature continues to rise to 365°. When distilled without water, it comes over colourless, and a little resinous matter is left behind, probably resulting from the oxidation of one or both of the constituent oils. It consists of carbon, hydrogen, and oxygen. It is slowly reddened by potassa, combines with iodine without explosion, is instantly decomposed by sulphuric acid, and is acted on by strong nitric acid, slowly at ordinary temperatures, but with heat explosively. (Procter, *Am. Journ. of Pharm.*, xxvi. 502.)

It was first brought into notice by the so-called eclectic physicians, who use it in diarrhœa, dysentery, and the hemorrhages. In a communication by Dr. E. Wilson, of Philadelphia, to the College of Physicians (Nov. 1, 1854), it is stated that the *oil of Philadelphia fleabane* had been employed with great advantage by Dr. Bournonville and himself in uterine hemorrhage. (*Trans. of Col. of Phys.*, N.S., ii. 330.) There can be little doubt, from the account of the oil at the same time given, that it was the oil of *E. Canadense*, or that now under consideration, which was really used; as *E. Philadelphicum* yields merely a trace of volatile oil when distilled; Mr. F. L. John having obtained only half a fluidrachm of it from 45 avoirdupois pounds of the herb. (*Am. Journ. of Pharm.*, xxvii. 105.) Dr. J. W. Moorman, of Hardinburg, Ky., considers, after much experience, the oil of Canada fleabane as a most valuable remedy in all forms of hemorrhage, in diarrhœa of debility, and in dysentery after sufficient evacuation of the stomach and bowels. He reports two cases of copious intestinal hemorrhage in the advanced stage of typhoid fever, in which the discharge was promptly arrested, and life apparently saved by large doses of the oil. In one case he gave two drachms in two doses at an interval of six hours; in the other a drachm and a half in two doses at four hours apart. (*Am. Journ. of Med. Sci.*, Oct. 1865, p. 396.) It probably acts very much like the oil of turpentine as a hæmostatic. For ordinary purposes the dose is from five to ten drops, which should be repeated every hour or two. W.

OLEUM FŒNICULI. *U. S.* *Oil of Fennel.*

Fennel seeds yield about 2·5 per cent., or, according to Zeller, from 3·4 to 3·8 per cent. of oil. That used in this country is imported. It is colourless or yellowish, with the odour and taste of the seeds. Its sp. gr. is 0·984 to 0·997. It congeals below 50° into a crystalline mass, separable by pressure into a solid and liquid oil (*stearoptene* and *elœoptene*); the former heavier than water, and less volatile than the

latter, which rises first when the oil is distilled. As found in the shops, therefore, the oil of fennel is not uniform; and a specimen examined by Dr. Montgomery did not congeal at 22°. It consists of carbon, hydrogen, and oxygen; its formula being, according to Blanchet and Sell, $C_{13}H_8O_2$. Its two component oils are now distinguished by the names of *liquid* and *solid anethol*, isomeric with the similar constituents of oil of anise. (See *Oleum Anisi.*) It is slightly dextrogyrate. The dose is from five to fifteen drops.

Off. Prep. Aqua Fœniculi, *U.S.;* Spiritus Juniperi Compositus, *U.S.* W.

OLEUM GAULTHERIÆ. *U.S.* *Oil of Gaultheria.*

This oil is a product of the United States, and is prepared chiefly in New Jersey. It is directed by the Pharmacopœia to be prepared from the leaves of *Gaultheria procumbens;* but the whole plant is usually employed. It has been obtained by Prof. Procter from the bark of *Betula lenta* or sweet birch, and has been supposed to exist also in the root of *Polygala paucifolia*, and the roots and stems of *Spiræa ulmaria*, *Spiræa lobata*, and *Gaultheria hispidula*, which have its peculiar flavour. Dr. T. E. De Vry found it in considerable proportion in the leaves of gaultheria leucocarpa and punctata, plants which are abundant in the volcanic regions of Java; associated with it was also quinic acid.

Oil of partridge-berry when freshly distilled is nearly colourless, but as found in the shops has a brownish-yellow or reddish colour. It is of a sweetish, slightly pungent, peculiar taste, and a very agreeable characteristic odour, by which it may be readily distinguished from all other officinal oils. It is the heaviest of the known essential oils, having the sp. gr. 1·173. Its boiling point is 412°. (*Am. Journ. of Pharm.*, iii. 199, and xiv. 213.) It is stated to have been largely adulterated with chloroform. This and other impurities are to be detected by a comparison of the specific gravities and boiling points or by fractional distillation. Another distinguishing property is that, in watery solution, it gives a purple colour with the salts of sesquioxide of iron. Oil of sassafras may be detected by the separation of a deep red resin or mass, on the treatment with nitric acid in the cold. Prof. Procter proved it to possess acid properties, and to be closely analogous to *salicylic acid*, one of the results of the decomposition of salicin by sulphuric acid and bichromate of potassium, and an ingredient in oil of *Spiræa ulmaria.* (See *Salix.*) M. Cahours has since corroborated this view, and shown that one-tenth of the oil consists of a peculiar carbohydrogen, which is called *gaultherilen*, and the remaining nine-tenths of *salicylate of oxide of methyl*, or *methylsalicylic acid;* and a product having the properties of the latter compound was obtained by distilling a mixture of pyroxylic spirit, salicylic acid, and sulphuric acid. (*Ibid.*, xiv. 211, and xv. 241.) Methylsalicylic acid forms with bases crystalline salts, which are resolved by heat into salicylic acid and wood spirit. Dr. T. J. Gallaher, of Pittsburg, Pa., records the case of a boy, nine years old, who took about half an ounce of this oil, with the effect of producing severe vomiting, purging, epigastric pain, hot skin, frequent pulse, slow and laboured respiration, dulness of hearing, and, notwithstanding excessive gastric irritability, an uncontrollable desire for food. After two or three days of great danger, he began to improve, and in two weeks was entirely restored to health. (*Med. Examiner*, N.S., viii. 347.) Oil of gaultheria is chiefly used, on account of its pleasant flavour, to cover the taste of other medicines.

Off. Prep. Syrupus Sarsaparillæ Compositus, *U.S.;* Trochisci Morphiæ et Ipecacuanhæ, *U.S.* W.

OLEUM HEDEOMÆ. *U.S.* *Oil of Hedeoma. Oil of American Pennyroyal.*

This, though analogous in properties to the oil of European pennyroyal, is derived from a distinct plant (*Hedeoma pulegioides*) peculiar to North America. It has a light-yellow colour, with the odour and taste of the herb. Its sp. gr. is 0·948. It may be used as a remedy in flatulent colic and sick stomach, to correct the operation of nauseating or griping medicines, and to impart flavour to mixtures. It is also much employed as a domestic remedy in amenorrhœa. The dose is from two to ten drops. W.

OLEUM JUNIPERI. *U.S., Br. Oil of Juniper.*

"The Oil distilled in Britain from the unripe fruit of Juniperus communis." *Br.*

The proportion of oil which juniper berries afford is stated very differently by different authors. Trommsdorff obtained one per cent. The highest quantity given in the table of Recluz is 2·34, the lowest 0·31 per cent. Zeller gives as the product of the fresh ripe fruit 1·3 per cent., of that a year old 0·86 per cent. (*Cent. Blatt*, März, 1855, p. 207.) The berries are most productive when bruised. The oil of juniper consumed in this country is brought from Europe, and is believed to be procured chiefly from the tops of the plant, being sold for a price which is altogether incompatible with the idea that it is prepared from the fruit alone. It is colourless, or of a light greenish-yellow, with terebinthinate odour, and hot acrid taste. Oil of juniper has a sp. gr. from 0·879 to 0·911, and is moderately lævogyrate. (*Buignet.*) It is not very soluble in alcohol. According to Blanchet, it contains two isomeric oils, of which one is colourless, and the other coloured and less volatile. It is, when pure, a carbohydrogen, and is said to have the same composition as oil of turpentine ($C_{10}H_8$); but it does not form a solid compound with muriatic acid. (*Journ. de Pharm.*, xxvi. 80.) Oil of turpentine is often fraudulently added, but may be detected by the specific gravity of the mixture, which is considerably less than that of the unadulterated oil of juniper.

The oil is stimulant, carminative, and diuretic; and may be employed advantageously in debilitated dropsical cases, in connection with other medicines, especially digitalis. It is this oil which imparts to Holland gin its peculiar flavour and diuretic power. Sir James Simpson, of Edinburgh, considers it an efficient diuretic when administered through the lungs. A teaspoonful of the oil is put into a vessel of hot water, and the patient directed to inhale the vapours. (*Bost. Med. and Surg. Journ.*, March 12, 1868, p. 96; from *Half-Yearly Compend. of Med. Sci.*) The dose is from five to fifteen drops two or three times a day, and may be considerably increased.

Off. Prep. Spiritus Juniperi, U. S., *Br.;* Spiritus Juniperi Compositus, *U.S.* W.

OLEUM LAVANDULÆ. *U.S., Br. Oil of Lavender.*

"The Oil distilled in Britain from the flowers of Lavandula vera." *Br.*

This oil is usually distilled from the flowers and flower-stems conjointly, though of finer quality when obtained from the former exclusively. Dried lavender flowers are said to yield from 1 to 1·5 per cent. of oil. According to Zeller, the fresh flowers yield 1·03, the dried 4·3, the whole fresh herb in flower 0·76 per cent. It is stated that the lavender produced by an acre of ground under cultivation will yield from 10 to 12 pounds of the oil. (*Pharm. Journ.*, Nov. 1864, p. 257.) The oil is very fluid, of a lemon-yellow colour, with the fragrance of the flowers, and an aromatic, burning taste. That met with in commerce has the sp. gr. 0·898 at 68° F., which is reduced to 0·877 by rectification (*Berzelius*), or 0·886 (*Buignet*). It is lævogyrate. According to Brande, the sp. gr. of the oil obtained from the whole herb is 0·9206. Alcohol of 0·830 dissolves oil of lavender in all proportions; that of 0·877, only 42 per cent. (*Berzelius.*) Proust states that, when allowed to stand in imperfectly stopped bottles, it lets fall a crystalline deposit, which often amounts to one-fourth of its weight. This has been found by M. Dumas to have the same point of volatilization and the same composition as the true camphor, but differs in the total want of rotatory power. (*Ibid.*, Juillet, 1863, p. 30.) It is said that the portion of oil first distilled is most fragrant, and is often kept separate, and sold at a higher price. According to M. Lallemand, oil of lavender consists chiefly of an oil isomeric with pure oil of turpentine, but contains acetic acid in combination, probably in the state of amylacetic ether. (*Journ. de Pharm.*, Avril, 1860, p. 290.) It is used chiefly as a perfume, though possessed of carminative and stimulant properties, and sometimes useful in cases of nervous languor and headache. The dose is from one to five drops.*

* ***Cologne Water.*** One of the Farinas, the noted manufacturers of Cologne water, the composition of which has been carefully kept secret by that family, is said recently to have published the following formula, as being that of the genuine perfume. "Take of Oil of Lavender 4 *ounces;* Purified Benzoin, Oil of Rosemary, each, 2 *ounces;* Stronger Alcohol 9 *gallons.* Dissolve the oils and benzoin in the alcohol; and to the solution add successively, of Oil of Neroli, Oil of the young orange denominated by the French Huile de Petits Grains, Oil of Lemons, each, 10·4 *ounces;* Oil of the Sweet Orange, Oil of the Lime, and Oil of Bergamot, each, 20·8 *ounces;* Tincture of the Flowers of the Rose Geranium *a sufficient quantity.* Macerate for some weeks, and introduce into flasks." (See *Am. Journ. of Pharm.*, July, 1864, p. 376.)—*Note to the twelfth edition.*

Oil of Spike is procured from the broad-leaved variety of lavender which grows wild in Europe, the *Lavandula Spica* of De Candolle. Its odour is less fragrant than that of common oil of lavender, and is somewhat analogous to that of oil of turpentine, with which it is said to be often adulterated. It is used by artists in the preparation of varnishes.

Off. Prep. Linimentum Camphoræ Compositum, *Br.;* Spiritus Ammoniæ Aromaticus, *U. S.;* Spiritus Lavandulæ; Spiritus Lavandulæ Compositus, *U. S.;* Tinctura Lavandulæ Composita, *Br.* W.

OLEUM MENTHÆ PIPERITÆ. *U. S., Br. Oil of Peppermint.*

"The Oil distilled in Britain from fresh flowering peppermint, Mentha piperita." *Br.*

Peppermint varies exceedingly in the quantity of oil which it affords. Four pounds of the fresh herb yield, according to Baumé, from a drachm and a half to three drachms of the oil. Zeller gives as the product of the fresh herb from 0·37 to 0·68 per cent., of the dried 1·14 per cent. The yield is generally less than 1 per cent. This oil is largely distilled in the United States. It is of a greenish-yellow colour or nearly colourless, but becomes reddish by age. Its odour is strong and aromatic, its taste warm, camphorous, and very pungent, but succeeded, when air is admitted into the mouth, by a sense of coolness. Its sp. gr. is stated differently from 0·902 to 0·920; its boiling point at 365°. It is considerably lævogyrate. (*Buignet.*) Upon long standing it deposits a *stearoptene*, which, according to Kane, has the same composition as the oil, viz., $C_{21}H_{20}O_2$. Berzelius states that at 8° below zero the oil deposits small capillary crystals. These, which are called *peppermint camphor* or *menthol*, melt at 95° F., volatilize unchanged, and, when distilled with anhydrous phosphoric acid, yield a peculiar aromatic product, denominated *menthene.* (*Gmelin's Handbook*, xiv. p. 445.) Professor Flückiger has discovered that 50 to 70 drops of peppermint oil, shaken with one drop of nitric acid sp. gr. 1·2, turn faintly yellowish-brownish, and after an hour or two a most beautiful blue-violet or greenish-blue, by transmitted light, or copper colour by reflected light. Either a greater amount of acid or heating hastens the reaction. The colour is very persistent. The presence of 5 per cent. of turpentine does not interfere with the reaction. (*Pharm. Journ. and Trans.*, Feb. 1871.) This oil is frequently adulterated with alcohol, and occasionally, there is reason to believe, with oil of turpentine, and even oil of copaiba. Oil of turpentine is detected by its odour, by its deficient solubility in cold alcohol, and by imparting the property of exploding with iodine. According to H. Martin, the copaiba is to be detected by the mass acquiring the consistency of butter, when heated to boiling with concentrated sulphuric acid. (*Neues Repertor. für Pharm.*, xvii. 635.) It is stated by the Messrs. Hotchkiss that, in much of the land under culture with peppermint in this country, other oil-producing plants are carelessly allowed to grow, which, being gathered and distilled with the peppermint, contaminate the product. (*Am. Journ. of Pharm.*, xxvii. 222.) Such impurities may be detected by the altered odour of the oil. Recently castor oil is said to have been used very largely in adulterating the oil. It is to be detected by the greasy stain left on evaporation on paper. When freshly prepared, oil of peppermint should volatilize completely from paper without leaving a mark, and when dropped into alcohol of 85 per cent., should completely dissolve without agitation. (Bullock, *Ibid.*, Nov. 1859, p. 553.)* To detect alcohol, Hager puts ten to fifteen drops of the oil in a test-tube

* *Action of Reagents.* Very curious differences have been noted in the action of chloral upon oil of peppermint, and further investigation is evidently needed. Jehu pointed out that when chloral hydrate is brought into contact with the oil, a red, passing from rose to cherry, is gradually produced; readily soluble in alcohol, ether, and chloroform, unaltered by boiling; it is intensified by sulphuric acid, and on the further addition of chloroform changed into a dark-violet. (*Amer. Journ. of Pharm.*, 1873, p. 447.) Prof. Flückiger, however, has found that chloral hydrate only develops a slightly brown or yellow colour, whilst anhydrous chloral changed some specimens of the oil to brown and others to green. He also found great differences in the action of bisulphate of sodium, the colouring varying from green to rose-red or violet. (*Ibid.*, 1874, p. 274.) M. A. Trebault has noticed Jehu's reaction, but is inclined to attribute it to the formic acid, which most specimens of chloral contain. (*Pharm. Journ. and Trans.*, June, 1874, p. 978.) According to M. A. Trebault, when picric acid is added in the cold no change occurs for half an hour, when a green colour instantly develops. The green produced has a showy red inflorescence. Sulphuric acid

with a piece of tannic acid, the size of a pea; if even one-half per cent. of alcohol be present, after two or three hours the tannin will be softened or dissolved. (*Amer. Journ. of Pharm.*, xliv. 104.) Much of the oil used in the United States is produced in Michigan. (*Ibid.*, xxix. 312.)*

Oil of peppermint is stimulating and carminative, and is much used in flatulence, nausea, spasmodic pains of the stomach and bowels, and as a corrigent or adjuvant of other medicines. The dose is from one to three drops, and is most conveniently given rubbed with sugar and then dissolved in water. The oil is frequently employed, dissolved in alcohol, in the form of *essence of peppermint*, which is an officinal preparation. (See *Spiritus Menthæ Piperitæ.*)

Off. Prep. Aqua Menthæ Piperitæ; Essentia Menthæ Piperitæ, *Br.;* Pilulæ Rhei Compositæ; Spiritus Menthæ Piperitæ; Trochisci Menthæ Piperitæ, *U. S.* W.

OLEUM MENTHÆ VIRIDIS. *U. S., Br. Oil of Spearmint.*

"The Oil distilled in Britain from fresh flowering spearmint, Mentha viridis." *Br.*

According to Lewis, ten pounds of spearmint yield an ounce of oil; by others the product is stated not to exceed one part from five hundred. The oil is largely distilled in this country. It is pale-yellow or greenish when recently prepared, but becomes red with age, and ultimately almost of a mahogany colour. Its flavour is analogous to that of the oil of peppermint, but less agreeable and less pungent. Its sp. gr. is stated differently from 0·914 to 0·975; its boiling point at 320°. Kane gives the formula $C_{35}H_{28}O$, as representing its composition. It is used for the same purposes as the oil of peppermint, in the dose of from two to five drops. An *essence of spearmint*, prepared by dissolving the oil in alcohol, is officinal. (See *Spiritus Menthæ Viridis.*)

Off. Prep. Aqua Menthæ Viridis; Spiritus Menthæ Viridis, *U. S.* W.

OLEUM MONARDÆ. *U. S. Oil of Horsemint.*

This is prepared by our distillers from the fresh herb of *Monarda punctata.* It has a reddish-amber colour, a fragrant odour, and a warm, very pungent taste. At 40° F., or lower, especially in the presence of moisture, it is gradually transformed by oxidation into a crystalline body, having the odour and taste of the oil. This appears to be analogous in constitution to camphor, being the oxide of a carbohydrogen radical ($C_{10}H_7$), three eqs. of which with one eq. of oxygen form the liquid oil. (C. T. Bonsall, *Am. Journ. of Pharm.*, xxv. 200.) It is now considered as identical with thymol, or camphor of the oil of thyme. (See *Oleum Thymi*, in *Part* I.) Applied to the skin, monarda oil is powerfully rubefacient, quickly producing heat, pain, redness, and even vesication. It has been employed externally in low forms of fever, cholera infantum, chronic rheumatism, and other affections in which rubefacients are indicated. In ordinary cases it should be diluted before being applied. It may be given internally as a stimulant and carminative, in the dose of two or three drops mixed with sugar and water. W.

OLEUM ORIGANI. *U. S.* 1850, *Ed. Oil of Origanum. Oil of Marjoram.*

This is obtained from the common marjoram, *Origanum vulgare*, and is frequently called *oil of marjoram.* Though it has been satisfactorily determined by Mr. Han-

develops a rose colour, passing through reddish-yellow to reddish-brown; hydrochloric acid a rose colour, rather slowly; nitric acid a rose colour, then red, soon becoming greenish. (For further particulars, see *Pharm. Journ. and Trans.*, June, 1874, p. 977.) Dr. C. Roucher states that when to acetic acid is added one-twentieth of its weight of oil of peppermint, with agitation, in an hour the liquid becomes deep-blue by transmitted and a cinnabar-red by reflected light. The colouration is not stable, but passes through green to yellow in the light. (*Note to the fourteenth edition.*)

* *Chinese Oil of Peppermint.* Although this substance has not found its way to any extent into commerce, it has recently attracted much attention. According to Mr. John Mackey, some of it has reached London in cylindrical tin canisters. Some specimens are said to resemble the ordinary oil, but to become solid in cool weather; others remain liquid and show no tendency to deposit a camphor; whilst others are solid crystalline masses at all temperatures. It seems probable that the original Chinese oil contains a great excess of the camphor, and constitutes the variety first spoken of, and that the solid and liquid oils are prepared by separating it into its two constituents. The solid oil Flückiger states not to differ from American menthol. (See *Pharm. Journ. and Trans.*, 3d ser., v. 366, 825.)—*Note to the fourteenth edition.*

bury that the oil circulating in commerce by the name of oil of origanum is really obtained from *Thymus vulgaris* growing in the south of France, and on this account the proper oil of marjoram has been expunged from our Pharmacopœia, and its place supplied by the oil of thyme (see *Oleum Thymi* in *Part* I.), yet, as Origanum vulgare is a common plant, possessed of valuable aromatic properties, and readily yields its oil by distillation in the ordinary mode, and as there is no reason to suppose that the descriptions given by authors from whom we have quoted are not those of the genuine oil, it is deemed expedient to retain the oil in its old position, and to continue the description given of it in former editions. The plant varies exceedingly in the proportion of oil which it affords. The mean product may be stated at from four to six parts from a thousand. The recent oil, when properly prepared, is yellow; but, if too much heat is used in the distillation, it is said to be reddish, and it acquires the same tint by age. It may be obtained colourless by rectification. It has the odour of the plant, and a hot acrid taste. Kane gives its sp. gr. 0·867, its boiling point 354°, and its composition $C_{50}H_{40}O$. According to Lewis, its sp. gr. is 0·940, according to Brande 0·909. It is sometimes used as an external irritant, and to allay the pain of toothache, by being introduced, on lint or cotton, into the cavity of a carious tooth. It is little employed internally.

The *oil of sweet marjoram* (*Origanum Majorana*) is obtained from the plant by distillation, in the quantity of from 2·5 to 6 parts from 1000. It is of a lemon-yellow colour, light and camphorous, and is said upon long standing to deposit a substance resembling camphor. It is not used in this country. W.

OLEUM PIMENTÆ. *U. S.*, *Br.* *Oil of Pimento.*

"The Oil distilled in Britain from pimento." *Br.*

The berries yield from 1 to more than 4 per cent. of oil, which, as found in the shops, is brownish-red, and has the odour and taste of pimento, though warmer and more pungent. It is said, when freshly distilled, to be colourless or yellowish. Nitric acid reddens it. Its sp. gr. is stated at 1·021, but varies. It consists, like oil of cloves, of two distinct oils, a lighter and heavier, the former of which comes over first in distillation. They may be separated by distilling the oil from caustic potassa. The light oil comes over, and the heavy remains combined with the potassa. The latter may be obtained by distilling the residue with sulphuric acid. The light oil is lighter than water, and is a pure carbohydrogen. The heavy has the acid property of forming crystalline compounds with the alkalies. They are analogous to the light and heavy oils of cloves. Indeed, the heavy has been found to be identical with the *eugenic acid* of that oil. (See *Oleum Caryophylli.*) The oil of pimento is given for the same purposes as the other stimulant aromatic oils. The dose is from three to six drops. W.

OLEUM ROSMARINI. *U. S.*, *Br.* *Oil of Rosemary.*

"The Oil distilled from the flowering tops of Rosmarinus officinalis." *Br.*

The fresh leaves of rosemary yield, according to Baumé, 0·26 per cent. of oil; but the product is stated much higher by others. According to Brande, a pound of the fresh herb yields about a drachm of the oil, which is about 1 per cent.; and Zeller gives very nearly the same product for the dried herb. This oil is colourless, with an odour similar to that of the plant, though less agreeable. Its sp. gr. is said to be 0·911, but reduced to 0·8886 by rectification. Buignet gives the sp. gr. of the rectified oil 0·896, and states that it is moderately dextrogyrate. It is soluble in all proportions in alcohol of 0·830; but requires for solution at 64° forty parts of alcohol of 0·887. (*Berzelius.*) Kane gives its sp. gr. 0·897, its boiling point 365°, and its composition $C_{45}H_{38}O_2$. Kept in bottles imperfectly stopped, it deposits a *stearoptene* analogous to camphor, sometimes amounting, according to Proust, to one-tenth of the oil. Bucholz states that it affords camphor when digested with from one-half its weight to an equal weight of potassa, and distilled. It is said to be sometimes adulterated with oil of turpentine, which may be detected by mixing the suspected liquid with an equal volume of pure alcohol. The oil of rosemary is dissolved, and that of turpentine left. This oil is stimulant, but is employed chiefly as an ingredient of rubefacient liniments. The dose is from three to six drops.

A case of death is recorded, in a child four or five years old, from a mixture of six measures of this oil, and two of oil of wormseed, given in repeated doses of a tablespoonful. (*Am. Journ. of Pharm.*, xxiii. 286.)

Off. Prep. Linimentum Saponis; Spiritus Lavandulæ Compositus, *U. S.;* Spiritus Rosmarini, *Br.;* Tinctura Lavandulæ Composita. *Br.* W.

OLEUM RUTÆ. *U. S., Br. Oil of Rue.*

"The Oil distilled from the fresh herb of Ruta graveolens." *Br.*

Rue yields a very small proportion of a yellow or greenish oil, which becomes brown with age. According to Zeller, the product of the fresh herb is 0·28 per cent., of the seeds about 1 per cent. The oil has the strong unpleasant odour of the plant, and an acrid taste. Kane gives its sp. gr. 0·837, its boiling point 446°, and its composition $C_{28}H_{28}O_3$. Gregory considers it as hydrated oxide of rutyl or rutylic aldehyd ($C_{20}H_{19}O,HO = C_{20}H_{20}O_2$), associated with a carbohydrogen. (*Handbook of Organic Chemistry*, 4th ed., pp. 275 and 342.) According to Williams, the composition of the pure oxygenated oil is $C_{22}H_{22}O_2$, which is confirmed by Harbordt, who, by oxidizing it by means of chromic acid, obtained caprinic acid, and concludes that its proper title is *methylo-caprinol*, and its rational formula $C_2H_3,C_{20}H_{19}O_2$. (See *Am. Journ. of Pharm.*, Jan. 1863, p. 34.) When treated with nitric acid, it yields, among other products, pelargonic acid, which is used in the preparation of a fruit essence, denominated *pelargonic ether*. (See *Fruit Essences*, in *Part* III.) It is stimulant and antispasmodic, and has been given in hysteria, convulsions, and amenorrhœa. The dose is from two to five drops. W.

OLEUM SABINÆ. *U. S., Br. Oil of Savine.*

"The Oil distilled in Britain from fresh savin, Juniperus Sabina." *Br.*

According to the more recent authorities, the proportion of volatile oil obtained from savine varies from less than 1 to 2·5 per cent. The oil is nearly colourless or yellow, limpid, strongly odorous, and of a bitterish, extremely acrid taste. Kane gives its sp. gr. 0·915, its boiling point 315°, and its composition $C_{10}H^8$, equivalent to that of oil of turpentine. According to Winckler, it is converted by sulphuric acid into an oil not distinguishable from that of thyme. (*Chem. Gaz.*, Jan. 1847, p. 11.) With iodine it becomes heated, detonates, and gives off yellow and violet-red vapours. (*Flaschoff.*) Distilled with 24 parts of water and 8 of chloride of calcium, it evolves carbonic acid with effervescence, and yields *chloroform*. (*Gmelin's Handbook*, xiv. 310.) The oil of savine is stimulant, emmenagogue, and actively rubefacient, and may be given for the same purposes as the plant in substance. It has been much employed empirically in amenorrhœa, and with a view to produce abortion, and in some instances with fatal effects. The dose is from two to five drops. Externally, Dr. Pincus has used it successfully in the proportion of five to thirty drops in an ounce of spirit for the cure of alopecia pityrodes. He has it rubbed into the head and also applied by means of compresses. W.

OLEUM SASSAFRAS. *U. S. Oil of Sassafras.*

The proportion of oil yielded by the root of sassafras is variously stated from less than 1 to somewhat more than 2 per cent. The bark of the root, directed by the U. S. Pharmacopœia, would afford a larger amount. Very large quantities of the oil are distilled in Maryland, and sent to Baltimore for sale. The usual yield is said by Mr. Sharp to be one pound from three bushels of the root. From fifteen to twenty thousand pounds were sent annually, before the war, to the Baltimore market. (A. P. Sharp, *Am. Journ. of Pharm.*, Jan. 1863, p. 53.) At Richmond, Va., in 1871, it was being manufactured at the rate of forty gallons of pure oil per week. The root, chopped fine by machinery, has steam forced through it in a closed tub, and the oil is then distilled in the ordinary way. 800 hundred pounds of unrectified oil are said to be obtained from 40,000 pounds of the root. (*Med. and Surg. Reporter*, Aug. 26, 1871.) The oil is of a yellow colour or colourless, becoming reddish by age. It has the fragrant odour of sassafras, with a warm, pungent, aromatic taste. It is among the heaviest of the volatile oils, having the sp. gr. 1·094, or 1·087 on the authority of Buignet, who states also that it is very slightly dextrogyrate. MM. Grimaux and Ruothe state that it is a mixture of dextrogyrate, hydrocarbon (saf-

frene, $C_{10}H_{16}$), and an inactive oxygenized principle (saffrol, $C_{10}H_{10}O_2$). They give its density as 1·0815 at zero, and believe it to contain in minute quantity a substance allied to phenol. (*Chemical News*, xxi. 21.) At 239° it evaporates freely and boils at 430°. (Procter, *Am. Journ. of Pharm.*, Nov. 1866, p. 491.) According to Bonastre it separates, by agitation with water, into two oils, one lighter, the other heavier than water. Berzelius states that the first is often nothing more than oil of turpentine existing as an adulteration in the oil of sassafras. It is readily soluble in alcohol, ether, and chloroform, and mixes with fixed oils and other volatile oils. (Procter, *Ibid.*) Nitric acid colours it red, and fuming nitric acid inflames it more readily than most other oils. It has the property of dissolving caoutchouc. When kept for a long time it deposits transparent crystals, having the same odour as the liquid oil. By treating the oil with chlorine, neutralizing with lime, and distilling, a product is obtained identical in properties and composition with common camphor. (See *Am. Journ. of Pharm.*, xxvi. 166.) Mr. E. S. Wayne, of Cincinnati, has shown that the oil forms an insoluble compound with lead; a property which renders leaden vessels, or those containing lead, unsuitable recipients for it. (*Am. Journ. of Pharm.*, xxviii. 521.) Its composition, according to St. Evre, is represented by the formula $C_{20}H_{10}O_4$. Oil of sassafras is stimulant, carminative, and supposed to be diaphoretic; and may be employed for the same purposes as the bark from which it is derived. It is much used in the arts for scenting soap, flavouring tobacco, &c. The dose is from two to ten drops.

Off. Prep. Syrupus Sarsaparillæ Comp., *U. S.;* Trochisci Cubebæ, *U. S.* W.

OLEUM SUCCINI RECTIFICATUM. *U. S. Rectified Oil of Amber.*

"Take of Oil of Amber *a pint;* Water *six pints.* Mix them in a glass retort, and distil until four pints of water have passed with the Oil into the receiver; then separate the Oil from the Water, and keep it in a well-stopped bottle." *U. S.*

For an account of the crude oil (*Oleum Succini*) the reader is referred to *Part* I. By successive distillations oil of amber becomes thinner and more limpid, till at length it is obtained colourless. The first portions which distil are less coloured than those which follow, and may be separated for keeping, while the remainder is submitted to another distillation. For practical purposes, however, the oil is sufficiently pure when once redistilled, as directed in the U. S. Pharmacopœia. As usually found in the shops, the rectified oil is of a light yellowish-brown or amber colour. As first distilled it has an amber colour, the sp. gr. 0·903 at 60°, and a boiling point from 339° to 367°. (*Ebert.*) When quite pure it is said to be colourless, as fluid as alcohol, of the sp. gr. 0·758 at 75°, and to boil at 186°. It has a strong, peculiar, unpleasant odour, and a hot, acrid taste. It imparts these properties in some degree to water, without being perceptibly dissolved. It is soluble in eight parts of alcohol of the sp. gr. 0·847 at 55°, in five parts of the sp. gr. 0·825, and in all proportions in absolute alcohol, ether, chloroform, bisulphuret of carbon, and the fixed oils. (*Ebert.*) On exposure to light and air, it slowly changes in colour and consistence, becoming ultimately black and solid. It appears, when quite pure, to be a carbohydrogen, consisting, according to Dr. Döpping, of 88·46 parts of carbon and 11·54 of hydrogen in 100. (*Chem. Gaz.*, Nov. 1845, p. 447.) It is said to be sometimes adulterated with oil of turpentine, which may be detected by passing muriatic acid gas through the suspected oil. If pure it will remain wholly liquid; while oil of turpentine, if present, will give rise to the formation of solid artificial camphor. (*Pharm. Journ.*, xiii. 292.)

From a communication, by Mr. A. E. Ebert, in the *Am. Journ. of Pharm.* (March, 1866, p. 146), it appears that there is very little genuine oil of amber now to be found in the shops; the substances sold as such, being either an oil strongly resembling kerosene, or oil of turpentine holding resin in solution. It would be advisable that the apothecary should either prepare it himself from amber, or obtain it from a chemical manufacturer in whom he could have entire confidence.

Medical Properties and Uses. Rectified oil of amber is stimulant and antispasmodic, and occasionally promotes the secretions, particularly that of urine. It has been employed with advantage in amenorrhœa, and in various spasmodic and convulsive affections, as tetanus, epilepsy, hysteria, hooping-cough, and infantile convulsions

from intestinal irritation, &c. The dose is from five to fifteen drops, diffused in some aromatic water by means of sugar and gum arabic. Externally applied the oil is rubefacient, and is considerably employed as a liniment in chronic rheumatism and palsy, and in certain spasmodic disorders, as hooping-cough and infantile convulsions. In the latter affection it should be rubbed along the spine, and was highly recommended by the late Dr. Joseph Parrish, mixed with an equal measure of laudanum, and diluted with three or four parts of olive oil and of brandy. W.

OLEUM TABACI. *U. S. Oil of Tobacco.*

"Take of Tobacco, in coarse powder, *twelve troyounces.* Put it into a retort of green glass, connected with a refrigeratory, to which a tube is attached for the escape of the incondensible products. Then, by means of a sand-bath, heat the retort gradually to dull redness, and maintain it at that temperature until empyreumatic oil ceases to come over. Lastly, separate the dark oily liquid in the receiver from the watery portion, and keep it in a well-stopped bottle." *U. S.*

This is a black, thickish liquid, of a strong characteristic odour, identical with that of old tobacco pipes, and in no degree resembling that of undecomposed tobacco. It may be obtained colourless by rectification, but soon becomes yellowish and ultimately brown. It probably contains a portion of nicotia volatilized unchanged, and is a powerful poison, unfit for internal use, and when employed externally requiring much caution. Mixed with simple ointment or lard, in the proportion of twenty drops to an ounce, it has been used as an application to indolent tumours, buboes, ulcers, and obstinate cutaneous eruptions; but, in all cases where the cuticle is wanting, it should be employed with reserve, and its effects carefully watched. Death has been produced by it in a child, in whom a portion of the oil from the bowl of a tobacco pipe was applied to an ulcer on the lip. (Dr. W. J. Tyrell, *Med. and Surg. Reporter*, May 2, 1868, p. 384.) W.

OLEUM VALERIANÆ. *U. S. Oil of Valerian.*

This was introduced for the first time as an officinal into the U. S. Pharmacopœia of 1850. It is obtained from the root of Valeriana officinalis by the usual process of distillation with water. According to Zeller, the dried root of the best quality yields 1·64 per cent. of the oil. Very good oil has been distilled from the root cultivated in this country. As first procured, it is of a pale-greenish colour, of the sp. gr. 0·934, with a pungent odour of valerian, and an aromatic taste. Upon exposure, it becomes yellow and viscid. It is a complex substance, containing 1. a carbohydrogen isomeric with pure oil of turpentine; 2. a small proportion of stearoptene, of an odour resembling that of camphor and pepper, and formed probably by the combination of water with the preceding constituent; 3. a peculiar oxygenated oil, called *valerol* ($C_{20}H_{12}O$, Kane's *Chemistry*), which, by the agency of the air, is converted into *valerianic* (*valeric*) *acid* and a resinous matter; and 4. valerianic acid, which always exists in the oil in small proportion, but is increased by exposure. The conversion of valerol into valerianic acid, through the agency of atmospheric oxygen, is very much promoted by the presence of caustic alkalies, which combine with the acid, when formed, to produce valerianates. Somewhat different views of the oil are given by M. Pierlot, who has investigated its nature. According to this chemist, the oil, whether fresh or old, always contains about five hundredths of valerianic acid, and, besides this, the two oils above referred to, namely, the carbohydrogen, which he names *valerene*, and the valerol, the formula of which he gives as $C_{21}H_{20}O_2$, and which becomes resinified by exposure to the air. He has concluded, moreover, that valerol cannot be changed into an acid by any known process. (See *Am. Journ. of Pharm.*, March, 1860, p. 142.) The oil of valerian exercises the same influence as the root on the nervous system, and is frequently administered as a substitute for it in the dose of four or five drops. W.

OLEORESINÆ.

Oleoresins.

The oleoresins, as a class of Preparations, were introduced into the U. S. Pharmacopœia at the revision of 1860, having been previously considered with the Fluid

Extracts. Their peculiarity is that they consist of principles, which, when extracted by means of ether, retain a liquid or semi-liquid state upon the evaporation of the menstruum, and at the same time have the property of self-preservation; differing in this respect from the fluid extracts, which require the presence of alcohol or sugar to prevent decomposition. They consist chiefly, as their name implies, of oil either fixed or volatile, holding resin and sometimes other active matter in solution. Their preparation is very simple, consisting in the exhaustion of the medicine employed with ether, by means of percolation, and the subsequent evaporation of the menstruum. In consequence of the great volatility of ether, it may in great measure be recovered by distillation, thus very materially diminishing the costliness of the process. It is proper not to continue the heat necessary for the distillation till the whole of the ether is driven over, lest, towards the close, a portion of the volatile matters also should pass, and the strength of the oleoresin be impaired. Hence, in every instance, the last portions of the menstruum are allowed to separate by spontaneous evaporation. Benzine has been proposed as a substitute for ether in these preparations, but should not be permitted to supersede it until officinally sanctioned. W.

OLEORESINA CAPSICI. *U.S.* *Oleoresin of Capsicum.*

"Take of Capsicum, in fine powder, *twelve troyounces;* Ether *a sufficient quantity.* Put the Capsicum into a cylindrical percolator, provided with a stop-cock, and arranged with a cover and receptacle suitable for volatile fluids, press it firmly, and gradually pour Ether upon it, until twenty-four fluidounces of liquid have slowly passed. Recover the greater part of the Ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining ether has evaporated. Lastly, remove, by straining, the fatty matter which separates on standing, and keep the Oleoresin in a well-stopped bottle." *U.S.*

The active principle of capsicum, called capsicin, is very soluble in ether, and is wholly extracted in the process. Its precise nature has not been determined; but, in the purest form in which it has been obtained, it is of a semi-liquid oleaginous consistence. After the concentration of the ethereal solution, a solid fatty matter separates on standing, but a portion of fixed oil probably still remains. The preparation is a very thick liquid, capable, however, of being dropped, of a dark reddish-brown colour, and, though opaque in mass, yet transparent in thin layers. It has not very decidedly the odour of capsicum, but to the taste is intensely pungent. It may be usefully employed to give locally stimulant properties to substances administered internally in a pilular form, in cases of gastric insensibility and excessive flatulence. Not more than a drop should be given at once, and that very much diluted, whether mixed with solids in the pill mass, or in liquid mixtures. It may be used also as a powerful rubefacient, diluted with olive oil or soap liniment. W.

OLEORESINA CUBEBÆ. *U.S.* Extractum Cubebæ Fluidum. *U.S.* 1850. *Oleoresin of Cubeb. Fluid Extract of Cubebs.*

"Take of Cubeb, in fine powder, *twelve troyounces;* Ether *a sufficient quantity.* Put the Cubeb into a cylindrical percolator, provided with a stop-cock, and arranged with a cover and receptacle suitable for volatile fluids, press it moderately, and gradually pour Ether upon it, until twenty-four fluidounces of liquid have passed. Recover the greater part of the Ether, by distillation on a water-bath, and expose the residue, in a capsule, until the remaining ether has evaporated. Lastly, keep the Oleoresin in a well-stopped bottle." *U.S.*

This *oleoresin* consists mainly of the volatile oil and resin, with a portion of the cubebin and waxy matter of the cubebs. The consistence differs with the character of the cubebs employed; its degree of fluidity being proportionate to the amount of volatile oil contained in the medicine. The colour is usually blackish-brown with more or less of a greenish hue, according to the quantity of chlorophyll present, which varies with the character of the cubebs, and with that of the menstruum; pure ether extracting the green colouring matter preferably, while ordinary alcoholic ether extracts also the brown. Cubebs yield from one-eighth to one-fifth of their weight of fluid extract. The preparation deposits waxy matter and crystals of cubebin on standing; but its efficacy is probably not impaired. It was first introduced into use by Prof. Procter. (*Am. Journ. of Pharm.*, xviii. 168.)

From carefully conducted experiments by Mr. F. V. Heydenreich, it would appear that, of the various constituents of cubebs contained in the officinal oleoresin, the cubebin has no perceptible effect in the dose of the medicine ordinarily given, that the volatile oil is simply stimulant and carminative, and finally, that the soft resin has all the diuretic properties of the cubebs. Of the last-mentioned ingredient, twenty grains given every two hours till five doses were taken, considerably increased the secretion of urine, producing at the same time a slight burning sensation in the passage, which ceased with the diuretic action. Pushed beyond this amount, it occasioned severe irritation of the urinary passages, with some fever. (*Ibid.*, Jan. 1868, p. 42.)

Prof. Procter has noticed that this oleoresin, as it occurs in the market, often has a decided ethereal odour, is of a thin consistence, and occasionally exhibits crystals of cubebin, either floating in the liquid, or adhering to the sides of the bottle. In one specimen three-eighths of its weight of ether were lost, in a short time, by spontaneous evaporation. He thinks that the quantity of ether employed in the process is unnecessarily large. As the cubebs are very nearly exhausted by the ether before the whole of it has passed, there is a considerable expenditure of that liquid for the sake of a scarcely appreciable portion of the active matter. In all cases of excess of ether in the oleoresin, the pharmaceutist should allow it to escape by spontaneous evaporation in a capsule. (*Ibid.*, May, 1860, p. 210.)

The dose of this oleoresin is from five to thirty minims, which may be given suspended in water, or mixed with powdered sugar.

Off. Prep. Troschisci Cubebæ, *U. S.* W.

OLEORESINA FILICIS. *U. S.* Extractum Filicis Liquidum. *Br* *Oleoresin of Male Fern. Liquid Extract of Fern Root.*

"Take of Male Fern, in fine powder, *twelve troyounces;* Ether *a sufficient quantity.* Put the Male Fern into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and a receptacle suitable for volatile liquids, press it firmly, and gradually pour Ether upon it, until twenty-four fluidounces of liquid have slowly passed. Recover the greater part of the Ether by distillation on a water-bath, and expose the residue, in a capsule, until the remaining Ether has evaporated. Lastly, keep the Oleoresin in a well-stopped bottle." *U. S.*

"Take of Male Fern, in coarse powder, *two pounds* [avoirdupois]; Ether *four pints* [Imperial measure], or *a sufficiency.* Pack the Male Fern closely in a percolator; and pass the Ether slowly through it, until it passes colourless. Let the ether evaporate on a water-bath, or recover it by distillation, and preserve the oily extract." *Br.*

This is an ethereal extract of the fern root, consisting mainly of oily and resinous matter, and, although introduced into the U. S. Pharmacopœia at the last revision, has been long known and much used on the Continent of Europe, under the name of *oil of fern*, in the treatment of the tape-worm. It is a thick, dark liquid, with the odour of fern, and a nauseous, bitterish, somewhat acrid taste. (See *Filix Mas*, in *Part* I.) According to Hayes, when an absolutely dry root and an anhydrous ether containing but little alcohol of a specific gravity below 0·728 are used, the oleoresin remains clear. It is believed to have all the anthelmintic powers of the male fern, and may be given in the dose of half a fluidrachm. W.

OLEORESINA LUPULINÆ. *U. S.* *Oleoresin of Lupulin.*

"Take of Lupulin *twelve troyounces;* Ether *a sufficient quantity.* Put the Lupulin into a narrow cylindrical percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour Ether upon it, until twenty fluidounces of liquid have slowly passed. Recover the greater part of the Ether, by distillation on a water-bath, and expose the residue, in a capsule, until the remaining ether has evaporated. Lastly, keep the Oleoresin in a wide-mouthed bottle, well-stopped." *U. S.*

Lupulin yields its volatile oil and resin, as well as any other active principle it may contain, to ether, and the resulting oleoresin constitutes about three-eighths, or somewhat less than one-half of the original drug. It is of a very thick semi-fluid con-

sistence, so thick indeed that it cannot be conveniently administered by drops. Its colour is almost black in mass, but a rich reddish-brown in thin layers. It has the odour and taste of lupulin, and possesses all its medical properties. The dose is from two to five grains, and may be most conveniently administered in the form of pill, made with powdered liquorice root, or other proper excipient. W.

OLEORESINA PIPERIS. *U.S.* EXTRACTUM PIPERIS FLUIDUM. *U.S.* 1850. *Oleoresin of Black Pepper. Fluid Extract of Black Pepper.*

"Take of Black Pepper, in fine powder, *twelve troyounces;* Ether *a sufficient quantity.* Put the Black Pepper into a cylindrical percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids, press it firmly, and gradually pour Ether upon it, until twenty fluidounces of liquid have slowly passed. Recover the greater part of the Ether, by distillation on a water-bath, and expose the residue, in a capsule, until the remaining ether has evaporated, and the deposition of piperin in crystals has ceased. Lastly, separate the Oleoresin from the piperin by expression through a muslin strainer, and keep it in a well-stopped bottle." *U.S.*

A substance has long been in use under the name of *oil of black pepper*, consisting mainly of the volatile oil, fixed oil, and resin of the pepper, and belonging, therefore, to the oleoresins. As usually found, it is almost black, and of a thickish consistence, and is a residue of the process for preparing piperin. The officinal oleoresin has the same general character, but is more fluid, and of more uniform strength, and should, therefore, be preferred. It contains almost all the volatile oil and acrid resin of black pepper, with little of the piperin; and, as the last-mentioned principle, when quite pure, is of doubtful efficacy, the extract may be considered as representing the virtues of the fruit. The colour is greener than that of the common oil of black pepper, and not so dark, owing to the fact that ether dissolves the green more readily than the brown colouring matter. A pound of black pepper yields about six drachms of the fluid extract, the dose of which, proportionate to the ordinary dose of pepper, would be one or two minims. It may be given in emulsion, or may be combined in small proportion with other substances in the form of pill. W.

OLEORESINA ZINGIBERIS. *U.S. Oleoresin of Ginger.*

"Take of Ginger, in fine powder, *twelve troyounces;* Stronger Ether *twelve fluidounces;* Alcohol *a sufficient quantity.* Put the Ginger into a cylindrical percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids, press it firmly, and pour upon it the Stronger Ether. When this has been absorbed by the powder, add Alcohol until twelve fluidounces of filtered liquid have passed. Recover from this the greater part of the Ether, by distillation on a water-bath, and expose the residue, in a capsule, until the volatile part has evaporated. Lastly, keep the Oleoresin in a well-stopped bottle." *U.S.*

In the preparation of this oleoresin alcohol is used in connection with ether, but solely on the score of economy; as it is added in order to displace the ether, and thus save an unnecessary expenditure of this more costly fluid. A little of the alcohol, no doubt, mixes with the ether at their surface of contact, but only a little; and the liquid which passes is mainly the ether loaded with the oleoresinous matter of the ginger. The whole of the virtues of the root are extracted in this preparation, as the residuary ginger is nearly or quite tasteless. The oleoresin constitutes about 5 per cent. of the dried root. It is the *piperoid of ginger* of M. Beral. (*Soubeiran's Trait. de Pharm.*, i. 371.) It is a clear, dark-brown liquid, of a thick consistence, though capable of being dropped, with the flavour of ginger, and intensely pungent. Its dose should not exceed a minim, and should be much diluted when administered. W.

PHOSPHORUS.

Preparation of Phosphorus.

The only officinal preparation of phosphorus requiring notice here is the oil, which was first introduced among the addenda to the British Pharmacopœia in 1874.

OLEUM PHOSPHORATUM. *Br. Phosphorated Oil.*

"Take of Phosphorus, Oil of Almonds, of each, *a sufficiency*. Heat the Oil in a porcelain dish to 300°, and keep it at this temperature for about fifteen minutes, then let it cool, and filter it through paper. Put four fluidounces of this Oil into a stoppered bottle, capable of holding four and a half fluidounces, and add to it twelve grains of Phosphorus. Immerse the bottle in hot water until the Oil has acquired the temperature of 180°, removing the stopper two or three times to allow the escape of expanded air, then shake the Oil and Phosphorus together until the latter is entirely dissolved." *Br.*

This new officinal of the British Pharmacopœia is a clear and colourless or but slightly coloured oil; phosphorescent in the dark. It affords a good way of exhibiting the drug. The dose is from five to ten minims. H. C. W.

PILULÆ.

Pills.

These are small globular masses of a size convenient for swallowing. They are well adapted for the administration of medicines which are unpleasant to the taste or smell, or insoluble in water, and do not require to be given in large doses. Deliquescent substances should not be made into pills; and those which are efflorescent should be previously deprived of their water of crystallization. Care should also be taken not to combine materials, the mutual reaction of which may result in a change of form.

Some substances have a consistence which enables them to be made immediately into pills. Such are the softer extracts and certain gum-resins; and the addition of a little water to the former, and a few drops of spirit to the latter, will give them the requisite softness and plasticity, if previously wanting. Substances which are very soft, or in the liquid state, are formed into the pilular mass by incorporation with dry and inert powders, such as wheat flour, starch, and powdered gum arabic, or with crumb of bread. Powders must be mixed with soft, solid bodies, as extracts, confections, soap, &c., or with tenacious liquids, as syrup, molasses, honey, mucilage, or glycerin; and the last-mentioned substance has been especially recommended in connection with a little alcohol. (*Tichborne.*) Heavy metallic powders are most conveniently made into pills with the former; light vegetable powders with the latter. Mucilage is very often used; but pills made with it are apt when kept to become hard, and of difficult solubility in the liquids of the stomach, and, if metallic substances are mixed with it, the mass does not work well. A mixture of syrup and powdered gum arabic is not subject to the same inconveniences, and is an excellent material for the formation of pills. Honey evaporated to about half its bulk has been highly recommended. Confection of roses and molasses are among the best excipients, when the pills are to be long kept. For the same purpose of keeping the pill soft, the addition of a small portion of some fixed oil or deliquescent salt has been recommended; but glycerin is still better. Glycerin incorporated with one twenty-fifth of its weight of finely dusted white tragacanth, is said to remain soluble for almost any length of time. Mr. Martindale prepares a mass by heating together with constant stirring to 240° F., five parts by weight of glycerin and one of flour, or when a very firm mass is required, equal parts of flour and glycerin. (*Pharm. Journ. and Trans.*, 3d ser., i. 412.) It has been objected that pills made with glycerin could not be handsomely gilt or silvered, the lustre of the metal disappearing. According to Hager this is only true of very recent pills, or of those in which an excess of glycerin has been used. For pills of sulphur, antimonial powder, bismuth, gallic and benzoic acid, Dover's powder, &c., Mr. Walter Searle uses a menstruum made by evaporating a solution of soluble cream of tartar to a thick consistence, rediluting with syrup and a little glycerin until the sp. gr. is about 1·420, then mixing half an ounce of this with half an ounce of a saturated solution of citrate of potassium in syrup and glycerin, and adding sufficient syrup to bring the sp. gr. to 1·400 and the consistency to that of a mucilage. Many powders require only water. Such are all those which contain ingredients capable of forming an adhesive or viscid solution with that liquid.

Care should always be taken that the matter added be not incompatible with the main constituents of the pill.

The materials should be accurately mixed together, and beat in a mortar till formed into a perfectly uniform and plastic mass. This should be of such a consistence that the pills may preserve their form, without being so hard as to resist the solvent power of the gastric liquors. As pills frequently become very hard by time, it is often convenient to keep the mass in a state fit to be divided when wanted for use. This may be done by wrapping it in bladders, putting it in covered pots, and occasionally moistening it as it becomes dry; or, more effectually, by keeping it in glass or well-glazed jars, accurately closed with varnished bladder.

The mass, having been duly prepared, is made into pills by rolling it with a spatula, or with a flat, smooth piece of hard wood, into a cylinder of precisely the same thickness throughout, and of a length corresponding to the number of pills required. It is then divided as equally as possible by the hand, or more accurately by a machine made for the purpose.* The pills receive a spherical form by being rolled between the fingers. M. Mialhe describes a little instrument for rolling pills, composed of two circular plates, one about 12, the other 6 inches in diameter; the former having a ledge at the border one-third of an inch high, the latter with a similar ledge, varying, according to the size of the pills, from less than a line to nearly two lines, and with a strap on the back by which it can be fitted to the hand. This is to be moved in a rotary manner upon the larger plate, holding the divided portions of the pill mass. (*Journ. de Pharm.*, 3e sér., xvii. 218.) In order to prevent the adhesion of pills to one another, or to the sides of the vessel in which they may be placed, it is customary to agitate them with some dry powder, which gives them an external coating, that serves also to conceal their taste. For this purpose carbonate of magnesium, powdered liquorice root, or starch may be used. Carbonate of magnesium is sometimes incompatible with one of the ingredients of the pills; and liquorice root is generally preferable, though it sometimes becomes mouldy with very damp pills. The powder of *lycopodium*, which has been long in use in Europe, is now considerably employed in this country, and is perhaps the best substance for the purpose; and it was formerly the custom to give the pill a coating of gold or silver leaf.†

It has been proposed by M. Garot to cover pills with gelatin, which answers the purpose of concealing their taste and odour, and counteracting deliquescence or chemical change from exposure to the air, without interfering with their solubility in the stomach. He dips each pill, sustained on the point of a pin, into melted gelatin, withdraws it with a rotary motion, then fixes the pin in a paste so as to allow the coating to dry in the air, and, having prepared about fifty pills in this way, proceeds to complete the operation by holding the pin in the flame of a taper so as to melt the gelatin near its point, and then withdrawing it from the pill so as to close up the orifice. The purest glue should be selected for this purpose, melted with the addition of two or three drachms of water to an ounce of the glue, and kept liquid by means of a salt-bath.

Another plan for attaining the same objects, less effectual, but more convenient than the above, is to introduce the pills into a spherical box, to drop on them enough syrup simply to moisten their surface, then to give a rotary movement to the box until the pills are uniformly covered, and finally to add by degrees a powder consisting of equal parts of gum, sugar, and starch, shaking the box with each addition, and continuing the process until nothing more will adhere to the pills. The investing material may be rendered agreeable to the taste and smell by aromatic additions, if

* The common pill-machine is too well known to require description. In the *Am. Journ. of Pharm.* (xxiv. 315) the reader will find the description of a rotary pill-machine, calculated to prepare large numbers of pills in a short time; and in the same journal (xxvi. 118) of another, which is considered an improvement on the first. Perhaps the machine which combines the greatest number of advantages is that known as *Busby's pill-machine*, which the reader will find described and figured in the *Am. Journ. of Pharm.* for Jan. 1869, and which is almost enthusiastically commended by the editor of the *Lond. Chem. and Druggist* in the number of that journal for Nov. 1868. (*Note to the thirteenth edition.*)

† This mode of protecting pills is still practised to some extent; and Messrs. Parrish and Bakes have published their method of proceeding. It consists in agitating the pills, prepared without dusting powder, and with their surface still damp, along with gold or silver leaf, in a hollow spherical wooden box, made by turning two hemispheres out of hard wood, fitting each other, and provided with a short handle. (*Am. Journ. of Pharm.*, Jan. 1861, p. 2.)

deemed advisable. (*Journ. de Pharm.*, x. 32.) M. Calloud has found that a better powder for the purpose, because less disposed to attract moisture, is made by boiling one part of flaxseed and three parts of white sugar with sufficient water till a thick mucilage is formed, evaporating this carefully to dryness, and then pulverizing. (*Ibid.*, xxiii. 301.) The same writer has since suggested, as still more effective, a powder made by forming a mucilage with one part of tragacanth and two of water, pressing this through linen, mixing it with twenty parts of sugar of milk, spreading the paste thus made in thin layers to dry, and then powdering. The pills may be simply moistened with water, and then shaken in the powder. M. Lhermite proposes first to agitate the pills in a mortar with a little concentrated solution of gum, and afterwards to put them into a box containing dry and very finely powdered sugar, to which a rotary motion is given. If the coating be not sufficiently thick, the process may be repeated. (*Ibid.*, xxv. 460.)* Still another method, proposed by Mr. E. K. Durden, is to cover the pills with collodion, which completely conceals the taste. The solution employed by Mr. Durden had the sp. gr. 0·810; and two dippings give a sufficient coating. (See *Am. Journ. of Pharm.*, xxi. 183.) It is, however, yet to be determined whether a coating of collodion would yield readily to the solvent powers of the gastric juice. M. Blancard covers pills with a solution of Tolu balsam in ether; but Mr. H. C. Baildon objects to this, that it takes too long to dry, and suggests as a substitute a solution of a drachm of the balsam in three drachms of chloroform, which dries sufficiently in twenty minutes. (*Am. Journ. of Pharm.*, xxix. 350.) If old and solid Tolu balsam be selected, it will be less liable to the objection of drying slowly. This balsam is officinally employed in coating the U. S. pills of iodide of iron. A solution of mastic in ether has also been used for coating pills; and the white of egg has been recommended for the same purpose. (*Ibid.*, March, 1862, p. 137.)

Pills which are to be long kept should be well dried, and put into bottles with accurately fitting stoppers. Though the U. S. Pharmacopœia, in almost every instance, orders the mass to be divided into pills; yet it should be understood rather as indicating the number of pills to be made from a certain quantity of the mass, when particular directions are not given by the physician, than as requiring the division to be made immediately after the materials have been mixed. It will be found convenient by the apothecary to retain a portion of the mass undivided, especially when it is desirable to keep the pills soft.†

* The sugar-coating of pills is now conducted upon a great scale by manufacturers, who send large quantities both of popular and officinal pills into the market thus protected. The process employed is similar to that of the confectioners in coating almonds. After having been thoroughly dried, the pills are put into a hemispherical tinned copper basin, which is suspended from the ceiling, and moved quickly backward and forward with an eccentric motion, so as to cause a constant attrition among the pills. First a little very thick syrup, or syrup of gum, is introduced in order to give a thin coating to their surface; and afterwards very finely powdered and very dry white sugar is sifted or thrown over them; the motion being constantly maintained. The sugar is fixed by the moist surface of the pills, and the coating made compact and smooth by the attrition. The process is aided by a gentle heat, arising from an open charcoal fire beneath; but the heat must be guarded, lest the pills be much softened, and thus lose their shape, and even discolour the coating. Dextrous manipulation is necessary in order that the process may succeed satisfactorily. For practical remarks on the sugar-coating of pills, see an essay by Mr. H. C. Archibald in the *Am. Journ. of Pharm.* for May, 1867, p. 199. (*Note to the twelfth and thirteenth editions.*)

Mr. Edward Parrish has published a proceeding, hitherto kept more or less secret, for the manufacturing of pills on a large scale, which we take from the *Am. Journ. of Pharm.* (Jan. 1867, p. 12), in a somewhat condensed form. Sugar, having been granulated, is separated into granules of different sizes, so as to have uniformity in this respect. A clean copper pan is now suspended by a cord two or three feet above a charcoal fire in a small furnace. Into this the granules are introduced, and, having been moistened with a thick mucilage or syrup, are then dusted over with the ingredients of the pills, reduced to fine powder and thoroughly mixed. By a rapid rotary and shaking motion of the pan, the powder is equally diffused over the moistened granules; and the process of moistening and application of the dry powder, with rotation, is repeated more or less frequently, till at length pills are formed nearly equal in size, and perfectly round. The smaller are now separated by a sieve from those of the desired size; and the former are returned to the pan to undergo a further treatment of the same kind. Those which may be too large are dried and powdered, and undergo the same treatment. The chief art in making the pills by this method consists in a proper regulation of the heat and dextrous manipulation. The pan should not be allowed to become hot, and should be held by the left hand which moves it, while the right hand is used to prevent the pills from adhering, and in aiding the rotary movement. This plan is adapted to preparing pills on the large scale, and is not equally applicable to all. (*Am. Journ. of Pharm.*, Jan. 1867, p. 12.)—*Note to the thirteenth edition.*

† *Granules.* Minute pills, scarcely larger than a pin's head, have for some years been popular

The Pills formerly officinal, which have been omitted in the present U. S. and Br. Pharmacopœias, are the *Compound Pills of Aloes*, Lond., Dub.; the *Pills of Calomel and Opium*, Ed.; the *Pills of Sulphate of Iron*, Ed.; those of *Mild Chloride of Mercury*, U. S.; the *Opiate Pills of Lead*, Ed.; *Pills of Rhubarb and Iron*, Ed., and the *Compound Pills of Storax*, Lond., Ed. W.

PILULÆ ALOËS. *U.S.* PILULA ALOES BARBADENSIS. *Br.* PILULA ALOES SOCOTRINÆ. *Br.* *Pills of Aloes.* *Pill of Barbadoes Aloes.* *Pill of Socotrine Aloes.*

"Take of Socotrine Aloes, in fine powder, Soap, in fine powder, each, *forty-eight grains.* Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills." *U. S.*

"Take of Barbadoes Aloes, in powder, *two ounces* [avoirdupois]; Hard Soap, in powder, *one ounce* [avoird.]; Oil of Caraway *one fluidrachm;* Confection of Roses, *one ounce* [avoird.]. Beat all together until thoroughly mixed." *Br.*

The British process for pill of Socotrine Aloes is the same, except that Socotrine is substituted for Barbadoes Aloes, and the volatile Oil of Nutmeg for that of Caraway.

The soap, in this formula, not only serves to impart a proper consistence to the aloes, but is thought to qualify its operation, and diminish its liability to irritate the rectum. Five of the U. S. pills, containing ten grains of aloes, may be given with a view to their purgative effect; but the preparation is usually employed as a laxative in habitual costiveness, in the quantity of one, two, or three pills, taken before breakfast or dinner, or at bedtime. The British pill is of very nearly the same strength. W.

PILULÆ ALOËS ET ASSAFŒTIDÆ. *U.S., Br.* *Pills of Aloes and Assafetida.*

"Take of Socotrine Aloes, in fine powder, Assafetida, Soap, in fine powder, each, *thirty-two grains.* Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills." *U. S.*

"Take of Socotrine Aloes, in powder, Assafetida, Hard Soap, in powder, Confection of Roses, of each, *an ounce.* Beat all together until thoroughly mixed." *Br.*

These pills are peculiarly adapted, by the stimulant and carminative properties of the assafetida, to cases of costiveness attended with flatulence and debility of the digestive organs. Each pill contains about four grains of the mass. From two to five may be given for a dose. W.

PILULA ALOËS ET FERRI. *Br.* *Pill of Aloes and Iron.*

"Take of Sulphate of Iron *one ounce and a half;* Barbadoes Aloes, in powder, *two ounces;* Compound Powder of Cinnamon *three ounces;* Confection of Roses *four ounces.* Reduce the Sulphate of Iron to powder, rub it with the Aloes and Compound Powder of Cinnamon, and adding the Confection make the whole into a uniform mass." *Br.*

This is essentially an old preparation of the Edinburgh Pharmacopœia, which, having been omitted in the original British, has been resumed in the present edition.

in France, under the name of granules: and their use has been introduced into the United States, where they are now largely consumed. They are generally used for the administration of very powerful medicines, such as digitaline, which is given in the dose of one-fiftieth of a grain. An objection to them is the great difficulty of securing an exactly equal amount of the medicine in each granule; and great care, therefore, is necessary, in their preparation, to guard against this danger. M. Ernest Agnew has given (*Amer. Journ. of Pharm.*, xlii. 271) an account of the way in which the granules are prepared; but as the details are somewhat extensive, and as the process can only be practised profitably by the large manufacturers, we content ourselves with the reference to his paper. A peculiar modification of the granules is "*granules perles*" of M. Sarmant. They are prepared by squeezing through a fine tube, in drops, a thick fluid impregnated with the medicinal principle. The pressure and size of orifice being uniform, the drops, which harden as they fall, are also uniform. (*Journ. de Pharm.*, 4e sér., xviii. 481.)—*Note to the twelfth and fourteenth editions.*

Compressed Pills. These are pills made directly from the medicinal substance without the aid of an excipient. The drug, if not already in powder, is reduced to such, and then forced into pill shape by means of a powerful hydraulic press. For certain substances which naturally exist in powder, such as quinine and bismuth, and which have little cohesiveness, the result is a good one; with the extracts it is probably otherwise. The expensiveness of the process, which is patented, will probably always prevent its coming into general use. (*Note to the fourteenth edition.*)

It is said that the laxative power of aloes is increased, and its tendency to irritate the rectum diminished by combination with sulphate of iron. This pill is especially adapted to amenorrhœa with debility of the stomach and constipation. The dose is from five to ten grains. W.

PILULÆ ALOËS ET MASTICHES. *U. S.* *Pills of Aloes and Mastic.*

"Take of Socotrine Aloes, in fine powder, *forty-eight grains;* Mastic, in fine powder, Red Rose, in fine powder, each, *twelve grains.* Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills." *U. S.*

Each of these pills contains about four grains of the mass, including the water employed, and nearly two grains of aloes. They are in imitation of Lady Webster's dinner pills, and one of them may be given as a laxative at bedtime, or before a meal. The mastic has probably little other effect than to impair the solubility of the aloes, and thus give it a still greater tendency to act on the lower bowels.* W.

PILULÆ ALOËS ET MYRRHÆ. *U. S.*, *Br.* *Pills of Aloes and Myrrh.*

"Take of Socotrine Aloes, in fine powder, *forty-eight grains;* Myrrh, in fine powder, *twenty-four grains;* Aromatic Powder *twelve grains;* Syrup *a sufficient quantity.* Beat the whole together so as to form a pilular mass, to be divided into twenty-four pills." *U. S.*

"Take of Socotrine Aloes *two ounces;* Myrrh *one ounce;* Saffron, dried, *half an ounce;* Confection of Roses *two ounces and a half.* Triturate the Aloes, Myrrh, and Saffron together, and sift; then add the Confection of Roses, and beat them together into a uniform mass." *Br.*

This composition has been long in use, under the name of *Rufus's Pills.* It is employed, as a warm stimulant cathartic, in general debility attended with constipation, and retention or suppression of the menses. From three to six pills, or from ten to twenty grains of the mass may be given for a dose. W.

PILULÆ ANTIMONII COMPOSITÆ. *U. S.* PILULA HYDRARGYRI SUBCHLORIDI COMPOSITA. *Br.* PILULA CALOMELANOS COMPOSITA. *Br.* 1864. *Compound Pills of Antimony. Compound Pill of Subchloride of Mercury. Compound Calomel Pill. Plummer's Pills.*

"Take of Sulphurated Antimony, Mild Chloride of Mercury, each, *twelve grains;* Guaiac, in fine powder, Molasses, each, *twenty-four grains.* Rub the Sulphurated Antimony first with the Mild Chloride of Mercury, and afterwards with the Guaiac and Molasses, so as to form a pilular mass, to be divided into twenty-four pills." *U. S.*

"Take of Subchloride of Mercury, Sulphurated Antimony, of each, *one ounce* [avoirdupois]; Guaiacum Resin, in powder, *two ounces* [avoird.]; Castor Oil *one fluidounce*, or *a sufficiency.* Triturate the Subchloride of Mercury with the Antimony, then add the Guaiacum Resin and Castor Oil, and beat the whole into a uniform mass." *Br.*

We prefer the title "compound calomel pill," of the former British Pharmacopœia; as, though not scientific, it is not liable to any mistake, and is most expressive of the quality of the medicine. The antimonial employed, though under a different name,

* The following is the formula for the aloetic pills, usually called *dinner pills* or *Lady Webster's pills.* They are the *pilulæ stomachicæ* of the fifth edition of the Paris Codex, A. D. 1758. Take of the best aloes six drachms; mastic and red roses, each, two drachms; syrup of wormwood sufficient to form a mass, to be divided into pills of three grains each. Common syrup may be substituted for syrup of wormwood. One or two of these pills, taken shortly before a meal, will usually produce one free evacuation.

The Philadelphia College of Pharmacy has adopted the following formulas for the compound aloetic preparations commonly called *Hooper's* and *Anderson's pills.*

"*Hooper's female pills.* ℞. Aloës Barbadensis ℥viij, Ferri Sulphatis Exsiccati ℥ij, ℥iss, *vel* Ferri Sulphatis Crystal. ℥iv, Extracti Hellebori ℥ij, Myrrhæ ℥ij, Saponis ℥ij, Canellæ in pulv. tritæ ℥j, Zingiberis in pulv. trit. ℥j.—Beat them well together into a mass with water, and divide into pills, each containing two and a half grains." (*Journ. of the Phil. Col. of Pharm.*, v. 25.)

"*Anderson's Scots' pills.* ℞. Aloës Barbadensis ℥xxiv, Saponis ℥iv, Colocynthidis ℥j, Gambogiæ ℥j, Olei Anisi f℥ss. Let the aloes, colocynth, and gamboge be reduced to a very fine powder: then beat them and the soap with water into a mass, of a proper consistence to divide into pills, each containing three grains." (*Ibid.*)

is identical with the old U. S. precipitated sulphuret. According to Vogel, a reaction takes place between the calomel and sulphuret of antimony, resulting in the production of chloride of antimony and sulphuret of mercury. (*Annal. der Pharm.*, xxviii. 236.) The preparation was originally introduced to the notice of the profession by Dr. Plummer, who found it useful as an alterative, and upon whose authority it was at one time much employed under the name of *Plummer's Pills.* The combination is well adapted to the treatment of chronic rheumatism, and of scaly and other eruptive diseases of the skin, especially when accompanied with a syphilitic taint. Six grains of the U. S. preparation, and five of the British contain about one grain of calomel, and each U. S. pill about half a grain. One to two pills or more may be given morning and evening. W.

PILULÆ ASSAFŒTIDÆ. *U. S. Pills of Assafetida.*

"Take of Assafetida *seventy-two grains;* Soap, in fine powder, *twenty-four grains.* Beat them together with water so as to form a pilular mass, to be divided into twenty-four pills." *U. S.*

Each of these pills contains three grains of the gum-resin. They are a convenient form for administering assafetida, the unpleasant odour and taste of which render it very offensive in the liquid state. W.

PILULA CAMBOGIÆ COMPOSITA. *Br. Compound Pill of Gamboge.*

"Take of Gamboge, in powder, Barbadoes Aloes, in powder, Compound Powder of Cinnamon, of each, *one ounce;* Hard Soap, in powder, *two ounces;* Syrup *a sufficiency.* Mix the Powders together, add the Syrup, and beat the whole into a uniform mass." *Br.*

This is an active purgative pill, and may be given in the dose of from five to fifteen grains. The formula is that of Dr. George Fordyce simplified. W.

PILULÆ CATHARTICÆ COMPOSITÆ. *U. S. Compound Cathartic Pills.*

"Take of Compound Extract of Colocynth *thirty-two grains;* Extract of Jalap, in fine powder, Mild Chloride of Mercury [calomel], each, *twenty-four grains;* Gamboge, in fine powder, *six grains.* Mix the powders together; then with water form a pilular mass, to be divided into twenty-four pills." *U. S.*

This cathartic compound was first made officinal in the second edition of the U. S. Pharmacopœia. It was intended to combine smallness of bulk with efficiency and comparative mildness of purgative action, and a peculiar tendency to the biliary organs. Such an officinal preparation was much wanted in this country, in which bilious fevers, and other complaints attended with congestion of the liver and portal circle generally, so much abound. The object of smallness of bulk is accomplished by employing extracts and the more energetic cathartics; that of a peculiar tendency to the liver, by the use of calomel; and that of efficiency with mildness of operation, by the union of several powerful purgatives. It is a fact, abundantly proved by experience, that drastic cathartics become milder by combination, without losing any of their purgative power. Nor is it difficult, in this case, to reconcile the result of observation with physiological principles. Cathartic medicines act on different parts of the alimentary canal and organs secreting into it. In small doses, both the irritation which they occasion and their purgative effect are proportionably lessened. If several are administered at the same time, each in a diminished dose, it is obvious that the combined purgative effect of all will be experienced; while the irritation, being feeble in each part affected, and diffused over a large space, will be less sensible to the patient, and will more readily subside. In the compound cathartic pills, most of the active purgatives in common use are associated together in proportions corresponding with their respective doses, so that an excess of any one ingredient is guarded against, and violent irritation from this cause prevented. The name of the preparation may at first sight seem objectionable, as it might be applied to any compound pills possessing cathartic properties; but, when it is considered that the ingredients cannot all be expressed in the title, that no one is sufficiently prominent to give a designation to the whole, and that the preparation is intended as the represen-

tative of numerous cathartics, and calculated for a wide range of application, the name will not be considered an inexcusable deviation from ordinary medical nomenclature. It is highly important, for the efficiency of these pills, that they be prepared in exact compliance with the directions, and that the *compound extract of colocynth* and the *extract of jalap* used be of good quality. When they fail, the result is generally ascribable to the substitution of jalap for the extract, or to the use of a compound extract of colocynth made with nearly inert scammony, inferior aloes, and insufficient colocynth, and altogether badly prepared.

Three of the pills, containing $10\frac{2}{3}$ grains of the mass, are a medium dose for an adult. In this quantity are four grains of compound extract of colocynth, three of extract of jalap, three of calomel, and two-thirds of a grain of gamboge. A single pill will generally be found to operate as a mild laxative. In a full dose, the preparation acts vigorously on the bowels, producing bilious stools, generally without much pain or disorder of the stomach. It may be employed in most instances where a brisk cathartic is required; but is particularly applicable to the early stages of bilious fevers, to hepatitis, jaundice, and all those derangements of the alimentary canal, or of the general health, which depend on congestion of the portal circle. W.

PILULA COLOCYNTHIDIS COMPOSITA. *Br. Compound Pill of Colocynth.*

"Take of Colocynth Pulp, in powder, *one ounce;* Barbadoes Aloes, in powder, Scammony, in powder, of each, *two ounces;* Sulphate of Potash, in powder, *a quarter of an ounce;* Oil of Cloves *two fluidrachms;* Distilled Water *a sufficiency.* Mix the Powders, add the Oil of Cloves, and beat into a mass with the aid of the Water." *Br.* The ounce employed is the avoirdupois ounce.

This is not, like the late London pills of the same name, merely another form of the compound extract of colocynth, though containing essentially the same materials; one great difference being that colocynth and aloes are used in substance in the pill, instead of in the state of extract. The present British preparation is that of the late Edinburgh Pharmacopœia slightly altered. Sulphate of potassium is used to promote the more complete division of the aloes and scammony. The preparation is actively cathartic in the dose of from five to twenty grains. W.

PILULA COLOCYNTHIDIS ET HYOSCYAMI. *Br. Pill of Colocynth and Hyoscyamus.*

"Take of Compound Pill of Colocynth *two ounces;* Extract of Hyoscyamus *one ounce.* Beat them into a uniform mass." *Br.*

This is an old officinal of the Edinburgh College. It is asserted that the compound pill and compound extract of colocynth are almost entirely deprived of their griping tendency by combination, as above, with extract of hyoscyamus, without losing any of their purgative power. The dose is from five to twenty grains. W.

PILULA CONII COMPOSITA. *Br. Compound Pill of Hemlock.*

"Take of Extract of Hemlock *two ounces and a half;* Ipecacuanha, in powder, *half an ounce;* Treacle *a sufficiency.* Mix the Extract of Hemlock and Ipecacuanha, and add sufficient Treacle to form a pill-mass." *Br.*

This is an old formula of the London College, discarded in the formation of the original British Pharmacopœia, but admitted into the present edition. The pill is an anodyne and expectorant combination, useful in chronic bronchial disease. The dose is from five to ten grains. W.

PILULÆ COPAIBÆ. *U. S. Pills of Copaiba.*

"Take of Copaiba *two troyounces;* Magnesia, recently prepared, *sixty grains.* Mix them together, and set the mixture aside until it concretes into a pilular mass, to be divided into two hundred pills."

"Should the mixture not concrete in eight or ten hours, a deficiency of water in the copaiba may be inferred; and this difficulty may be obviated, in subsequent operations, by shaking the copaiba with one-twentieth of its weight of water, allowing it to stand for some days, or until all the uncombined water has subsided, and then decanting, and keeping it in closed bottles for use." *U. S.*

When copaiba is mixed with pure magnesia, it gradually loses its fluidity, forming

at first a soft tenacious mass, and ultimately becoming dry, hard, and brittle. The quantity of magnesia, and the length of time requisite for this change, vary with the condition of the copaiba; being greater in proportion to the fluidity of this substance, or, in other words, to its amount of volatile oil. The quantity of magnesia directed by the Pharmacopœia, one-sixteenth of the weight of the copaiba, is sufficient to solidify the latter, as it is often found in the shops, in the course of six or eight hours; but, when the copaiba is fresh, or has been kept in closely-stopped bottles, and retains, therefore, nearly the whole of its oil, it is necessary either to augment the proportion of magnesia, or to expose the mixture for a much longer time, or to diminish the volatile oil of the copaiba by evaporation. The magnesia combines chemically with the *copaivic acid* or hard resin, but, in relation to the volatile oil, acts merely as an absorbent; for, when the solidified mass is submitted to the action of boiling alcohol, a part is dissolved, abandoning the magnesia with which it was mixed, while the resin, combined with another portion of the earth, remains undissolved. Varieties of copaiba, therefore, are solidifiable by magnesia, directly in proportion to the hard resin they contain, and inversely in proportion to the volatile oil; the soft resin being indifferent. According to Guibourt, copaiba, not solidifiable by magnesia, may be made so by adding one-sixth of Bordeaux or common European turpentine. In the preparation of the pills of copaiba, care should be taken to divide the mass before it has become too hard. The advantage of this preparation is, that the copaiba is brought to the state of pill with little increase of bulk. Each pill contains nearly five grains of copaiba, and from two to six may be taken for a dose twice or three times a day.

Hydrate of lime produces the same effect as magnesia, and as stated by M. Thierry in a shorter time, if employed according to his formula. He takes 15 parts of copaiba and 1 part of slaked lime, mixes them in a marble mortar, transfers the mixture to an open vessel, places this upon a sand-bath, and sustains the heat for four hours, occasionally stirring. The hydrate of lime must have been freshly prepared from recently-burnt lime. The mixture loses only a twenty-fourth of its weight, which is chiefly the water of the hydrate. (*Journ. de Pharm.*, 3e sér., i. 310.)

Notwithstanding the accuracy of the above statements, it sometimes happens that copaiba of undoubted genuineness, and with a due proportion of volatile oil, will not solidify with magnesia or with lime; and the cause of this uncertainty of action remained long undetermined. At length it has been ascertained by M. Z. Roussin, through a series of well-devised experiments, that the occasional want of solidifying power is owing to the absence of water, the presence of a certain quantity of which, whether in the copaiba or the earth employed, is essential to the combination of the magnesia or lime with the copaivic acid. In instances of deficiency in the solidifying property, M. Roussin recommends that the copaiba be shaken for some time with about one-twentieth of its weight of water, and then allowed to stand for some days in a warm place so as to allow all the water in excess to subside. The copaiba may now be decanted and preserved. Thus prepared it will solidify with one-sixteenth of calcined anhydrous magnesia, in the course of a few days, and often in twenty-four hours. (*Journ. de Pharm.*, 4e sér., i. 321–328.)

M. Rabot proposes a process by which the copaiba can in a few minutes be solidified to a consistence fit for preparing pills. He mixes pure copaiba with one-sixteenth of its weight of magnesia, previously slightly hydrated by sprinkling on it some drops of water, equal to about one-tenth of its weight, then introduces the capsule containing the mixture into boiling water, and keeps it thus by means of a water-bath for several minutes. The immediate consolidation is explained by the fact that the earth combines most readily with the resin of copaiba at a temperature of about 122° F., a heat which in no degree impairs the virtue of the medicine. (*Ibid.*, ii. 445.)

Pills may also be made by incorporating vegetable powders with copaiba so as to bring it to the proper consistence; but this method has the inconvenience of greatly increasing the bulk. Spermaceti and wax have been proposed as excipients; and the latter, which was originally suggested by J. F. Simon, is recommended by Mr. Maisch as retaining all the volatile oil, and, with some vegetable powder, forming a mass that will retain its plasticity for years. One part, each, of wax, copaiba, and vegetable

powder will answer the purpose, when the copaiba does not contain more than 50 per cent. of volatile oil; but if richer than this, it will require more of the excipient. To prepare the pills, melt the wax at the lowest possible heat, then gradually add the copaiba, and lastly incorporate some vegetable powder, as pulverized liquorice root, for example, with the other ingredients. (See *Am. Journ. of Pharm.*, Jan. 1863, p. 17.) W.

PILULA FERRI CARBONATIS. *U. S., Br. Pill of Carbonate of Iron. Vallet's Ferruginous Pills.*

"Take of Sulphate of Iron *eight troyounces;* Carbonate of Sodium *nine troyounces;* Clarified Honey *three troyounces;* Sugar, in coarse powder, *two troyounces;* Boiling Water *two pints;* Syrup *a sufficient quantity.* Dissolve the salts separately, each in a pint of the Water, and, having added two fluidounces of syrup to the ferruginous solution, filter both solutions. Mix the two solutions, when cold, in a bottle just large enough to hold them, close it accurately with a stopper, and set it by that the carbonate of iron may subside. Pour off the supernatant liquid, and, having mixed water, recently boiled, with Syrup in the proportion of a pint to the fluidounce, wash the precipitate with the mixture until the washings no longer have a saline taste. Drain the precipitate on a flannel cloth, and express as much of the water as possible. Lastly, mix the precipitate immediately with the Clarified Honey and Sugar, and, by means of a water-bath, evaporate the mixture, constantly stirring, until it is brought to the weight of eight troyounces." *U. S.**

"Take of the Saccharated Carbonate of Iron *one ounce;* Confection of Roses *a quarter of an ounce.* Beat them into a uniform mass." *Br.*

The effect of saccharine matter in protecting iron from oxidation has been explained under the heads of *Ferri Carbonas Saccharata* and *Syrupus Ferri Iodidi.* The U. S. pill of carbonate of iron is another example of a ferruginous preparation, in which the iron is protected from further oxidation by the same means. The salts employed are the same as those used for obtaining the officinal subcarbonate of iron; but, in forming that preparation, the carbonate which is at first precipitated absorbs oxygen, and loses nearly all its carbonic acid in the processes of washing and drying. When, however, as in the U. S. formula above given, the reacting salts are dissolved in weak syrup instead of water, and the washing is performed with weak syrup also, the absorption of oxygen and loss of carbonic acid, during the separation of the precipitate, are almost completely prevented. It only remains, therefore, to preserve it unaltered, and to bring it to the pilular consistence, and this is effected by admixture with honey and sugar, and evaporation by means of a water-bath. It is essential to the success of this process, that the sulphate of iron should be pure; otherwise some sesquioxide will be present in the product. The process is that of M. Vallet, of Paris, after whom the preparation is popularly called. The present U. S. process differs from that of 1850, in boiling the water for washing so as to expel the air, and in evaporating to a definite weight at the close, instead of to a proper consistence as before directed; both of which changes are improvements suggested by Dr. Squibb. (*Proceed. of Am. Pharm. Assoc.*, 1858, p. 426.) The British pill of carbonate of iron is made from the saccharine carbonate, which is brought to the pilular consistence by being mixed with conserve of roses. This mode of making it is inferior to that of Vallet; for, in the first place, the saccharine carbonate is admitted to contain sesquioxide of iron, and secondly, conserve of roses, while it is a less efficient preservative of the pilular mass than honey and sugar, will, through its tannic acid, form

* Wm. Silver Thompson claims that the pill is more stable when made by the following formula than when prepared in the officinal manner. Take of Protosulphate of Iron eight ounces; Bicarbonate of Sodium six ounces; Sugar, in fine powder, four and a half ounces; Clarified Honey half an ounce; Syrup, Water, each, a sufficient quantity. Dissolve each salt separately in water, add the sodium solution to the iron solution gradually, constantly stirring until the effervescence ceases, when add about a fluidounce of syrup, and again stir. After the carbonate of iron has subsided draw off the supernatant liquid, and repeat the washing with cold water slightly sweetened with syrup, until the washings are free from a saline taste; when, having again drawn off the supernatant liquid, transfer the precipitate to a muslin cloth, and express as much of the water as possible. To the precipitate, in a porcelain dish placed over a water-bath, add the honey and sugar, and with frequent stirring evaporate to the pilular consistence. (*Amer. Journ. of Pharm.*, 1870, p. 30.)—*Note to the fourteenth edition.*

an inky compound with the ferruginous sesquioxide. (See *Ferri Carbonas Saccharata.*)

Properties. The U. S. preparation is in the form of a soft pilular mass, of a dark greenish-gray colour, becoming black on exposure, and with a strong ferruginous taste. When carefully prepared, it is wholly and readily soluble in acids. It contains nearly half its weight of carbonate of protoxide of iron. The corresponding pill, obtained from the saccharine carbonate, may be supposed to contain one-third of ferruginous matter.

Medical Properties. The U. S. pill of carbonate of iron, or Vallet's ferruginous mass, is admirably adapted to cases in which chalybeate preparations are indicated. It is considered particularly useful in chlorosis, amenorrhœa, and other female complaints, and appears to act favourably by increasing the colouring matter of the blood, causing the capillary system to become more fully injected, and the lips to assume a redder colour. It may be given in divided doses to the extent of from ten to thirty grains in the course of the day, and continued for a month or six weeks, if improvement take place. As the mass is not divided in the U. S. formula, it is necessary in prescription to indicate the weight of each pill, which may vary from three to five grains, according to the views of the prescriber. There is little doubt that, when the alterative effects of iron are indicated, Vallet's preparation is one of the best that can be employed. Its chief merits are its unchangeableness and ready solubility in acids. For further information respecting it, see the favourable report made on Vallet's pills to the French Royal Academy of Medicine, in 1837, by M. Soubeiran, republished in the *Am. Journ. of Pharm.* (x. 244), and the paper on carbonate of iron by Professor Procter, in the same journal (x. 272).

Blaud's ferruginous pills, celebrated in France as a remedy in chlorosis, are prepared from equal weights of sulphate of iron and carbonate of potassium, made into a pilular mass with mucilage of tragacanth and powdered liquorice root. The pills contain, as the result of double decomposition, carbonate of protoxide of iron and sulphate of potassium. MM. Van de Velde and Van Melckebeke prefer the bicarbonate of sodium to the potassium salt. (*Journ. de Pharm.*, 4e sér., xvi.) B.

PILULÆ FERRI COMPOSITÆ. *U. S.* *Compound Pills of Iron.*

"Take of Myrrh, in fine powder, *thirty-six grains;* Carbonate of Sodium, Sulphate of Iron, each, *eighteen grains;* Syrup *a sufficient quantity.* Rub the Myrrh, first with the Carbonate of Sodium, and afterwards with the Sulphate of Iron, until they are thoroughly mixed; then beat them with Syrup so as to form a pilular mass, to be divided into twenty-four pills." *U. S.*

This preparation is closely analogous to the Mistura Ferri Composita in properties and composition. It is a good emmenagogue and antihectic tonic. As its peculiar advantages depend upon the presence of carbonate of protoxide of iron, which speedily changes into the sesquioxide on exposure, it is proper that only so much of the mass should be prepared as may be wanted for immediate use. It is said that the iron will be better preserved in the state of protoxide, if, instead of mixing the ingredients as directed in the Pharmacopœia, the operator should first dissolve the sulphate of iron, finely powdered, in the syrup, with a moderate heat, then add the carbonate of sodium, stirring till they are thoroughly mixed, and lastly incorporate the myrrh. From two to six pills may be given at a dose three times a day. W.

PILULÆ FERRI IODIDI. *U. S.* Pilula Ferri Iodidi. *Br.* *Pills of Iodide of Iron.*

"Take of Iodine *three hundred grains;* Iron, in the form of wire and cut in pieces, *one hundred and twenty grains;* Sugar, in fine powder, Liquorice Root, in fine powder, each, *one hundred and ninety-two grains;* Liquorice, in fine powder, Gum Arabic, in fine powder, each, *forty-eight grains;* Reduced Iron *ninety-six grains;* Water *a fluidounce and a half.* Mix the Iodine with ten fluidrachms of the Water in a glass flask, and gradually add the Iron, agitating until the solution has become of a light pea-green colour; then filter into a porcelain capsule containing the Reduced Iron, and add the remainder of the Water in order to wash the filter. Evaporate the solution until a pellicle forms, and, adding the remaining powders

previously mixed together, continue the evaporation, by means of a water-bath, with constant stirring, until the mixture is reduced to a pilular consistence; lastly, divide into three hundred and eighty-four pills. Dissolve sixty grains of Balsam of Tolu in a fluidrachm of Ether, shake the pills with the solution until they are uniformly coated, and put them on a plate to dry, occasionally stirring them until the drying is completed. Keep the pills in a well-stopped bottle.

"These pills are devoid of the smell of iodine; and distilled water, rubbed with them and filtered, does not colour solution of starch, or gives it only a slight blue tint." *U. S.*

"Take of Fine Iron Wire *forty grains;* Iodine *eighty grains;* Refined Sugar, in powder, *seventy grains;* Liquorice Root, in powder, *one hundred and forty grains;* Distilled Water *fifty minims.* Agitate the Iron with the Iodine and Water in a strong stoppered ounce phial, until the froth becomes white. Pour the fluid upon the Sugar in a mortar, triturate briskly, and gradually add the Liquorice." *Br.*

The pills of iodide of iron were introduced, as a new officinal, into the U. S. Pharmacopœia at the revision of 1850. The U. S. pills are formed on the plan proposed by Prof. Procter, in imitation of *Blancard's pills* (*Am. Journ. of Pharm.*, May, 1860), and are much superior to those made by the U. S. process of 1850, or by that of the British Pharmacopœia.* The iodine and iron unite directly to form the iodide of iron in solution, which is protected against the oxidizing influence of the air by the sugar and reduced iron into which the solution is dropped, while the liquorice and gum serve to give due consistence and plasticity to the pilular mass. The pills are still further protected from the air by the impervious coating of balsam of Tolu, which readily yields to the softening and solvent properties of the gastric liquids. The great disadvantage of the pill of iodide of iron, as ordinarily prepared, is that it will not keep; crumbling by time and exposure, and evolving iodine in consequence of the oxidation of the iron. The preparation, made according to the U. S. formula, has stood the test of time; and we have seen pills which, four years after their preparation, exhibited no signs of change. Each pill contains about a grain of iodide of iron and one-fifth of a grain of reduced iron. The therapeutic uses of this preparation are the same as those of iodide of iron. (See *Ferri Iodidum.*) B.

PILULÆ GALBANI COMPOSITÆ. *U. S.* PILULA ASSAFŒTIDÆ COMPOSITA. *Br.* *Compound Pills of Galbanum. Compound Pill of Assafetida.*

"Take of Galbanum, Myrrh, each, *thirty-six grains;* Assafetida *twelve grains;* Syrup *a sufficient quantity.* Beat them together so as to form a pilular mass, to be divided into twenty-four pills." *U. S.*

"Take of Assafetida, Galbanum, Myrrh, of each, *two ounces;* Treacle, by weight, *one ounce.* Heat all together by means of a water-bath, and stir the mass until it assumes a uniform consistence." *Br.*

This compound is given as an antispasmodic and emmenagogue in chlorosis and hysteria. The dose is from five to twenty grains. W.

PILULÆ HYDRARGYRI. *U. S.* PILULA HYDRARGYRI. *Br.* *Pills of Mercury. Mercurial Pill. Blue Pill.*

"Take of Mercury *three hundred and eighty-four grains;* Confection of Rose *five hundred and seventy-six grains;* Liquorice Root, in fine powder, *one hundred and ninety-two grains.* Rub the Mercury with the Confection until the globules cease to be visible; then add the Liquorice Root, and beat the whole into a pilular mass, to be divided into three hundred and eighty-four pills." *U. S.*

* M. Magnes-Lahens especially recommends the following formula. "Take of Pure Iodine 1·10 grammes; Powdered Iron 1·90 grammes; Powdered Sugar 2·50 grammes; Powdered Gum Arabic 2·50 grammes; Distilled Water, 2·50 grammes. Put in an iron dish the Water and the Powdered Iron, add the Iodine gradually, and facilitate the reaction by stirring with a spatula of iron and by warming a little; when the reaction is complete, add the Gum and the Sugar, then heat to about 50° C., stirring continually until the mass ceases to drop when a little is taken up on the spatula. If necessary, five grammes of powdered liquorice root may be incorporated into the mass, which is then to be rolled into one hundred pills. (*Am. Journ. of Pharm.*, 1873, 498.)—*Note to the fourteenth edition.*

The *British* process is the same with the above, only that about double the quantity of materials are used, and no division of the mass into pills is directed.

This preparation is generally known by the name of *blue pill* or *blue mass*. The mercury constitutes one-third of the mass; and consequently the pill of our Pharmacopœia, weighing three grains, contains one grain of the metal.

The precise condition of the mercury in this preparation is somewhat uncertain. By far the greater proportion is in a state of minute mechanical division, and not chemically altered. Some maintain that the whole of the metal is in this state, others, that a small portion is converted during the trituration into the protoxide, and that this is the ingredient upon which the activity of the pill depends. The supposed oxidation is attributed partly to the influence of the air upon the surface of the metal, greatly extended by the separation of its particles, partly to the action of the substance used in the trituration. If the mercury be not oxidized during the trituration, there can be little doubt that it becomes so to a slight extent by subsequent exposure. The obvious changes which the mass undergoes by time can be explained in no other way; and protoxide of mercury is asserted to have been actually extracted from old mercurial pill. Nevertheless, it scarcely admits of dispute that the metal, quite independently of oxidation out of the body, is capable of producing the peculiar mercurial effects when introduced into the stomach, probably undergoing chemical changes there. According to M. Mialhe, mercury is slowly converted into corrosive sublimate in the stomach, under the combined agency of air and chloride of sodium. All agree that the efficacy of the preparation is proportionate to the extinction of the mercury, in other words, to the degree in which the metallic globules disappear. This extinction may be effected by trituration with various substances; and manna, syrup, honey, liquorice, mucilage, soap, guaiac, and extract of dandelion have been recommended, among others, for this purpose; but the confection of roses has been adopted in all the Pharmacopœias, as less liable to objection than any other. The mercury is known to be completely extinguished, when, upon rubbing a small portion of the mass with the end of the finger upon a piece of paper or glass, no globules appear. Powdered liquorice root is added in order to give due consistence to the mass. Some prefer for the purpose powdered marshmallow root. Mr. W. W. Stoddart has found that the extinguishment of the mercury, in the officinal process, is very much hastened by rubbing it first with the *powdered liquorice root*, moistened with a little distilled water or rose-water, and afterwards incorporating the confection. (*Am. Journ. of Pharm.*, xxviii. 162.) As the trituration requires to be long continued, and renders the process very laborious, it is customary to prepare the mass by machinery. At Apothecaries' Hall, in London, the trituration is effected by the agency of steam. The machine there employed consists of "a circular iron trough for the reception of the materials, in which revolve four wooden cylinders, having also a motion on their axis." A machine for preparing blue mass, capable of being worked by the hand or by steam-power, has been invented by Mr. J. W. W. Gordon, of Baltimore, and, having been found to answer well, is in extensive use. It is described and figured in the *American Journal of Pharmacy* (xxi. 6). We have already referred, under *Hydrargyrum cum Cretâ*, to another ingenious apparatus invented by Dr. Squibb, by which the extinguishment of mercury is very satisfactorily effected.* Formerly much of the blue mass used in this country was imported; but at present the market is chiefly supplied by our own druggists. The preparation slowly changes colour upon being kept, assuming an olive and sometimes even a reddish tint, in consequence, probably, of the further oxidation of the mercury.†

* Mr. James Beatson, apothecary of the U. S. Naval Hospital at New York, found great advantage in the following mode of preparing the mercurial pill, which, while much easier than the officinal method, yields the same results. Instead of mixing the mercury with the confection, he first rubs it with the honey directed in the preparation of the confection, until the globules disappear, then adds the heated rose-water and sugar, and lastly the powdered red rose and liquorice root in succession, all in the officinal proportions. For the quantity of the material directed in the U. S. process for confection of roses, he employs 32 ounces of mercury. (*Am. Journ. of Pharm.*, xxiv. 204.)

† The mercurial pill is very apt to contain less than the due proportion of the metal. This was frequently the case with the mass as formerly imported. The fraud may be detected by the following plan of estimating the proportion of mercury, suggested by Prof. Reid, of New York, and

In consideration of the incomplete extinguishment of the mercury in many specimens of the blue pill, arising from the tedious process employed, Mr. F. B. Benger proposes to obtain the metal in a state of minute division. For this purpose he adds to a solution of an ounce of protochloride of tin, in a mixture of two drachms of hydrochloric acid and two ounces of cold water, a boiling hot solution of 136 grains of corrosive sublimate in four ounces of distilled water, and stirs the mixture for a few seconds. The mercury of the corrosive chloride is thrown down in the form of a black powder, to which, after the liquid has been drawn off by means of a pipette, 30 grains of sugar, 100 grains of powdered liquorice, and about a drachm of glycerin are added. The mass being transferred to a porcelain slab, is allowed to become sufficiently dry, and then mixed with enough glycerin and liquorice to make it weigh 300 grains. (*Pharm. Journ. and Trans.*, 2d ser., ii. 165.) Theoretically, this appears to be a good process; but only a long experience of its practical advantages would justify its substitution for a plan which has been followed, for so many years, with results upon the whole so satisfactory. An obvious objection to the process is the possibility, with carelessness of manipulation, of having in the preparation a minute proportion of corrosive sublimate or bichloride of tin.

Medical Properties and Uses. These pills are among the mildest of the mercurials, being less liable than most others to act upon the bowels, and exercising the peculiar influence of the remedy upon the system with less irritation. They are much employed for producing the sialagogue and alterative action of mercury. For the former purpose, one pill may be given two or three times a day; and in urgent cases the dose may be increased. Even this preparation sometimes disturbs the bowels. It should then be given combined with a little opium, or in very minute doses, as half a grain or a grain of the mass, repeated every hour or two through the day, so as to allow of its absorption before a sufficient quantity has been administered to act as an irritant. With a view to the alterative effect upon the digestive organs, one pill may be given every night, or every other night, at bedtime, and followed in the morning, if the bowels should not be opened, by a small dose of laxative medicine. From five to fifteen grains of the mass are occasionally given as a cathartic, in cases requiring a peculiar impression upon the liver; but, when used for this purpose, it should always either be combined with or speedily followed by a more certain purgative. The *blue mass* may often be administered with advantage, suspended in water by the intervention of thick mucilage; and it forms an excellent addition to the chalk mixture in diarrhœa, particularly that of children, when the biliary secretion is deficient or otherwise deranged.* W.

PILULA IPECACUANHÆ CUM SCILLA. *Br. Pill of Ipecacuanha with Squill.*

"Take of Compound Powder of Ipecacuanha *three ounces;* Squill, in powder. Ammoniacum, in powder, of each, *one ounce;* Treacle *a sufficiency.* Mix the Powders and beat into a mass with the Treacle." *Br.*

modified by a committee of the Philadelphia College of Pharmacy. A certain weight of the mercurial pill, say fifty grains, is mixed with about one-fourth of its weight of iron filings, and introduced into a small green glass bulb, at the end of a somewhat curved tube, the open extremity of which is inserted, through a cork, into alcohol, contained in a broad-mouthed glass vial; another tube, open at both ends, passing through the cork in order to permit the escape of uncondensed gases. Heat is then applied to the bulb by means of a spirit-lamp, is gradually increased until the glass becomes red hot, and continued for an hour. The alcohol in the vial dissolves the empyreumatic products, and, by being allowed to rise in the tube, and then expelled, serves to wash out any mercury that may be condensed upon its sides. The alcohol is poured off from the condensed mercury, which is then washed with fresh alcohol, dried, and weighed. (See *Am. Journ. of Pharm.*, xvii. 151 and 309.)

* The blue pill is sometimes wanted in the state of powder: but, from its peculiar constitution, is not eligible for reduction to this form; as the mercury is disposed to aggregate during pulverization, and, from the honey it contains, it is apt, when pulverized, to attract moisture from the air. Mr. Ch. Bullock, therefore, recommends the following method of preparing a powder, which shall, as nearly as possible, represent the blue pill, in reference to its therapeutic effects. Take of finely powdered Elm-bark, finely powdered Sugar, and Mercury, equal parts, and of Alcohol a sufficiency. Rub the mercury with the powdered bark, adding from time to time enough alcohol to maintain a pasty consistence, till the mercury is completely extinguished; then spread the mass on paper to dry. When dry, powder it, add the sugar, and rub the mixture thoroughly until the powder will pass through a sieve of fine bolting cloth. (*Am. Journ. of Pharm.*, May, 1859, p. 271.) —*Note to the twelfth edition.*

This is a preparation of the late London Pharmacopœia, which, abandoned in the original preparation of the British Code, is recognised in the present. It is a good combination of expectorants, along with a little opium to allay irritation and restlessness, well adapted to chronic catarrh, with either deficient or greatly excessive expectoration, and to the advanced stages of the acute disease offering similar indications. The dose is from five to ten grains. W.

PILULÆ OPII. *U.S.* *Pills of Opium.*

"Take of Opium, in fine powder, *twenty-four grains;* Soap, in fine powder, *six grains.* Beat them together with water, so as to form a pilular mass, to be divided into twenty-four pills." *U.S.*

This process is designed merely to furnish a convenient formula for putting opium into the pilular form, preferable to the mode sometimes practised of making the pills directly from the unpowdered mass of opium as found in commerce. The soap answers no other purpose than to give a due consistence, and is therefore in small proportion. Each pill contains a grain of opium.

As hard old opium pills are sometimes preferred, in cases of irritable stomach, in consequence of their slow solution, it is proper for the apothecary to keep some in this state to meet the prescription of the physician.

Of the pills above directed, one is a medium dose in reference to the full effects of opium. W.

PILULA PHOSPHORI. *Br.* *Phosphorus Pill.*

"Take of Phosphorus *two grains;* Balsam of Tolu *one hundred and twenty grains;* Yellow Wax *sixty grains.* Put the Phosphorus and Balsam of Tolu into a Wedgwood mortar about half-full of hot water, and when the Phosphorus has melted and the Balsam has become sufficiently soft, rub them together beneath the surface of the water until no particles of phosphorus are visible, the temperature of the water being maintained at or near to 140°. Add now the Wax, and as it softens mix it thoroughly with the other ingredients. Allow the mass to cool without being exposed to the air, and keep it in a bottle immersed in cold water. It may be softened with a few drops of rectified spirit when made into pills." *Br.*

Of this mass, three drachms contain two grains of the drug, and the dose is therefore from 2 to 5 grains, equivalent to from $\frac{1}{45}$th to $\frac{1}{16}$th of a grain of phosphorus. H. C. W.

PILULA PLUMBI CUM OPIO. *Br.* *Pill of Lead and Opium.*

"Take of Acetate of Lead, in fine powder, *thirty-six grains;* Opium, in powder, *six grains;* Confection of Roses *six grains.* Beat them into a uniform mass." *Br.*

This pill would be better left to extemporaneous prescription; the requisite proportion of opium to the acetate varying in different cases. The tannic acid of the confection of roses decomposes a portion of the acetate; but the resulting tannate of lead is not inert. The mass contains six parts of the acetate of lead in eight, and may be given in the dose of two or three grains to begin with. W.

PILULA SCAMMONII COMPOSITA. *Br.* *Compound Scammony Pill.*

"Take of Resin of Scammony, Resin of Jalap, Curd Soap, in powder, of each, *one ounce;* Strong Tincture of Ginger *one fluidounce;* Rectified Spirit *two fluidounces.* Add the spirit and tincture to the soap and resins, and dissolve with the aid of a gentle heat; then evaporate the spirit by the heat of a water-bath until the mass has acquired a suitable consistence for forming pills." *Br.*

These pills are actively purgative in doses of from five to fifteen grains. H. C. W.

PILULÆ QUINIÆ SULPHATIS. *U.S.* PILULA QUINIÆ. *Br.* *Pills of Sulphate of Quinia.* *Pill of Quinia.*

"Take of Sulphate of Quinia *twenty-four grains;* Clarified Honey sufficiently inspissated *fourteen grains.* Add the Honey to the Sulphate of Quinia, beat them together so as to form a pilular mass, and divide into twenty-four pills." *U.S.*

"Take of Sulphate of Quinia *sixty grains;* Confection of Hips *twenty grains.* Mix them to a uniform mass." *Br.*

The pills made according to the old U. S. directions were apt to become hard and of difficult solubility when long kept; in order to obviate this disadvantage, honey was substituted, at the last revision, for the gum and sugar formerly employed. Glycerin and a mixture of glycerin and honey have also been proposed; and according to Wm. Decker one drop of glycerin to three grains of the sulphate is the right proportion. The late Mr. Edward Parrish was in the habit of preparing pills of sulphate of quinia, by taking 20 grains of the salt, adding 15 drops of aromatic sulphuric acid, and triturating until the mixture assumes a pilular consistence. Though at first liquid, the mixture soon thickens, and finally becomes quite solid. The officinal sulphate is thus rendered more soluble by combining with an additional eq. of sulphuric acid. The advantages of this process are the solubility of the resulting pill, and the smallness of its bulk. A five-grain pill thus made is not inconveniently large. (*Am. Journ. of Pharm.*, xxv. 292.)*

Each of the U. S. pills contains a grain of the sulphate of quinia, and twelve are equivalent to an ounce of good Peruvian Bark. The dose of the Br. pill is only one-fourth less than that of the sulphate of quinia itself. W.

PILULÆ RHEI. *U.S.* *Pills of Rhubarb.*

"Take of Rhubarb, in fine powder, *three hundred and sixty grains;* Soap, in fine powder, *one hundred and twenty grains.* Beat them together with water, so as to form a pilular mass, to be divided into one hundred and twenty pills." *U. S.*

Rhubarb is so often given in the pilular form, that it is convenient both for the physician and apothecary to have an officinal formula, indicating the mode of preparing the pills, as well as the quantity of rhubarb to be contained in each. Soap, as directed by the U. S. Pharmacopœia, has stood the test of long experience as a good excipient for rhubarb. We have found rhubarb pills, made with compound tincture of cardamom, without other ingredient, to answer an excellent purpose. Each officinal pill contains three grains of rhubarb. W.

PILULÆ RHEI COMPOSITÆ. *U.S.* PILULA RHEI COMPOSITA. *Br.* *Compound Pills of Rhubarb.* *Compound Rhubarb Pill.*

"Take of Rhubarb, in fine powder, *forty-eight grains;* Socotrine Aloes, in fine powder, *thirty-six grains;* Myrrh, in fine powder, *twenty-four grains;* Oil of Peppermint *three minims.* Beat them together with water so as to form a pilular mass, and divide into twenty-four pills." *U. S.*

"Take of Rhubarb Root, in powder, *three ounces;* Socotrine Aloes, in powder, *two ounces and a quarter;* Myrrh, in powder, Hard Soap, in powder, of each, *one ounce and a half;* Oil of Peppermint *one fluidrachm and a half;* Treacle, by weight, *four ounces.* Mix the Powders with the Oil, then add the Treacle, and beat the whole into a uniform mass." *Br.*

This is a warm tonic laxative, useful in costiveness with debility of stomach. From two to four pills, or from ten to twenty grains of the mass, may be taken twice a day. W.

PILULA SAPONIS COMPOSITA. *U.S.* PILULA SAPONIS COMPOSITA. *Br.* PILULA OPII. *Br.* 1864. *Compound Pill of Soap.*

"Take of Opium, in fine powder, *sixty grains;* Soap, in fine powder, *half a troy-ounce.* Beat them together with water so as to form a pilular mass." *U. S.*

"Take of Opium, in powder, *half an ounce;* Hard Soap, in powder, *two ounces;* Distilled Water *a sufficiency.* Mix the Opium and Soap, and beat into a mass with the Water." *Br.*

This preparation is useful by affording the opportunity of conveniently administering opium, in a pilular and readily soluble form, in small fractions of a grain. The name now used in both Pharmacopœias was probably intended to conceal the nature of the preparation from the patient. One grain of opium is contained in five of the mass. W.

* Mr. H. P. Reynolds claims very excellent results from the following formula: the pills certainly ought to be very soluble. Take of Sulphate of Quinia six hundred grains; Tartaric Acid one hundred grains; Glycerin, pure, (exactly) seventy-five minims. Rub the quinia and acid together in a mortar to a fine powder, add the glycerin and continue the trituration until the powder becomes adherent; beat into proper form for handling and divide; to whiten pills, roll in starch powder. (*Amer. Journ. of Pharm.*, Sept. 1874.)—*Note to the fourteenth edition.*

PILULÆ SCILLÆ COMPOSITÆ. *U.S.* PILULA SCILLÆ COMPOSITA. *Br. Compound Pills of Squill. Compound Squill Pill.*

"Take of Squill, in fine powder, *twelve grains;* Ginger, in fine powder, Ammoniac, in fine powder, each, *twenty-four grains;* Soap, in fine powder, *thirty-six grains;* Syrup *a sufficient quantity.* Mix the powders together; then beat them with Syrup so as to form a pilular mass, to be divided into twenty-four pills." *U.S.*

"Take of Squill, in powder, *one ounce and a quarter;* Ginger, in powder, Ammoniacum, in powder, Hard Soap, in powder, of each, *one ounce;* Treacle, by weight, *two ounces,* or *a sufficiency.* Mix the Powders, add the Treacle, and beat into a uniform mass." *Br.*

This is a stimulating expectorant compound, depending for its virtues chiefly on the squill, and applicable to the treatment of chronic affections of the bronchial mucous membrane. From five to ten grains may be given three or four times a day. The preparation should be made when wanted for immediate use, as the squill which it contains is liable to be injured by keeping. W.

PLUMBUM.

Preparations of Lead.

Of the Preparations formerly considered under this head, *Solution of Subacetate of Lead* and *Diluted Solution of Subacetate of Lead* have been transferred to the LIQUORES or *Solutions;* and *Iodide of Lead* is the only one remaining.

PLUMBI IODIDUM. *U. S., Br. Iodide of Lead.*

"Take of Nitrate of Lead, Iodide of Potassium, each, *four troyounces;* Distilled Water *a sufficient quantity.* With the aid of heat, dissolve the Nitrate of Lead in a pint and a half, and the Iodide of Potassium in half a pint of Distilled Water, and mix the solutions. Allow the precipitate formed to subside, and, having poured off the supernatant liquid, wash it with Distilled Water, and dry it with a gentle heat." *U.S.*

The process of the British Pharmacopœia is the same as the above, and almost in the identical words.

In this process the nitrate of lead gives up its metal to the iodine, from which it receives the potassium; the operation taking place between single equivalents of the several ingredients. The nitrate of potassium thus formed remains in solution, while the iodide of lead is precipitated. The saturating proportions of nitrate of lead and iodide of potassium are 165·6 of the former and 165·5 of the latter, or almost precisely equal quantities. The proportions should be as nearly as possible those of exact saturation. An excess of the iodide of potassium, independently of the waste, has the disadvantage of holding a portion of the iodide of lead in solution; while, according to Christison, an excess of lead over the iodine disposes to the formation of the lemon-yellow insoluble oxyiodide of lead. By the use of equal quantities of the two salts, these disadvantages are avoided. As iodide of lead is slightly soluble in cold water, it is desirable to use as little of the menstruum as will answer; and hence the comparatively small proportion of water employed.

Iodide of lead, though all the three Colleges gave processes for it, was omitted in the first British Pharmacopœia. It has, however, been admitted into the present edition. In the London process acetate of lead was employed instead of the nitrate; but M. Depaire, of Brussels, ascertained that, in this process, a considerable amount of iodine remains in solution after the precipitation of the iodide of lead; and M. F. Boudet states that the quantity of the iodide resulting from the process is 10 per cent. less than theory would indicate. By the addition of nitric acid to the solution, after precipitation, an additional quantity of iodide of lead is obtained. M. Boudet ascribes this result to the formation of a portion of soluble iodide of potassium and lead, whenever iodide of lead and acetate of potassium are in contact. By substituting nitrate for acetate of lead, he found that a quantity of iodide of lead was obtained, as near that required by theory as the solubility of the iodide of lead permits. (*Journ. de Pharm.*, 3e sér., xi. 274.)

From the above remarks it would appear that the present officinal process is on the whole to be preferred to that in which the acetate of lead is used, and especially as the nitrate is more easily obtained pure. Some interesting experiments have been made by M. T. Huraut, of Paris, on the different methods of preparing iodide of lead. It may be obtained by the reaction between any of the soluble iodides and the soluble salts of lead. It resulted from his observations that of the two salts of lead employed, the nitrate was to be preferred, and of the various iodides, though iodide of potassium yielded a very handsome product, yet iodide of calcium afforded one not inferior in quality, and somewhat greater in quantity. Upon a small scale, as the process is performed by the apothecary, the difference would be of little or no consequence; but it might be important to the manufacturer. (See *Am. Journ. of Pharm.*, xxi. 228.)

As obtained by the above process, iodide of lead is in the form of a bright yellow, heavy, tasteless, inodorous powder. It is soluble in 1235 parts of cold water (Soubeiran, *Trait. de Pharm.*), and 194 of boiling water, which, on cooling, deposits it in minute, shining, golden-yellow, crystalline scales. It is freely soluble in a concentrated solution of acetate of sodium (Donato Tommasi, *Pharm. Journ. and Trans.*, 3d series, ii. 805). It melts by heat, and is dissipated in vapours, which are at first yellow, and ultimately violet in consequence of the disengagement of the iodine. It consists of one equivalent of iodine 126·3, and one of lead 103·6 = 229·9. As a test of its purity, the Edinburgh College stated that five grains are entirely dissolved, with the aid of heat, by a fluidrachm of pyroligneous acid, diluted with a fluidounce and a half of distilled water; and golden crystals are copiously deposited when the solution cools. According to the late London Pharmacopœia, 100 grains of it, dissolved at a boiling heat in nitric acid diluted with two parts of water, will, after the expulsion of the iodine, yield with sulphate of sodium, a precipitate of sulphate of lead weighing 66 grains. It should be kept excluded from the light. It is stated by Engelhardt that iodine is separated from iodide of lead by the perchlorides of iron and copper; while the other metallic chlorides, whether bichlorides, sesquichlorides, or protochlorides, have no such effect, producing compounds of iodides of the metal employed with chlorides of lead. (*Chem. Gaz.*, Jan. 15, 1856, p. 24.)

Medical Properties and Uses. This compound is supposed to have the resolvent properties of iodine, combined with those which are peculiar to lead, and was at one time recommended in tuberculous diseases, in which, however, it has proved wholly inefficient. It is said to have been usefully employed in the discussion of scrofulous tumours and other indolent swellings, and in the cure of obstinate ulcers; and for these purposes has been used both internally and locally in the form of an ointment. According to Dr. Cogswell, if given for some time in small doses, it produces the effects of lead, but not those of iodine, upon the system. (*Christison's Dispensatory.*) The dose is from half a grain to three or four grains. Dr. O'Shaughnessy states that ten grains are borne without inconvenience.

Off. Prep. Emplastrum Plumbi Iodidi, *Br.*; Unguentum Plumbi Iodidi, *Br.*

W.

POTASSA.

Preparations of Potassa.

Of the preparations formerly embraced in this category, the *Solution of Potassa*, the *Solution of Citrate of Potassium*, and the *Compound Solution of Iodide of Potassium*, Lond., Dub., under the altered name of *Liquor Iodi*, Br., have been transferred to the Liquores or *Solutions*; *Pure Nitrate of Potassa*, Dub., has been treated of in *Part* I. of this work; and the following preparations, at one time officinal, have been omitted in the existing Pharmacopœias; namely, *Solution of Carbonate of Potassa*, U. S., Lond., Dub., *Sulphate of Potassa with Sulphur*, Ed., and *Bisulphate of Potassa*, Ed., Dub.

POTASSA. *U. S.* Potassa Caustica. *Br.* Kali Purum. *Potassa. Caustic Potassa. Hydrate of Potassa.*

"Take of Solution of Potassa *eight pints*. Evaporate the Solution rapidly in an

iron vessel, over the fire, until ebullition ceases, and the potassa melts. Pour this into suitable moulds, and keep it, when cold, in a well-stopped bottle." *U. S.*

"Take of Solution of Potash *two pints* [Imperial measure]. Boil down the Solution of Potash rapidly in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which when removed on a warm glass rod solidifies on cooling. Pour this into proper moulds, and when it has solidified, and while it is still warm, put it into stoppered bottles." *Br.*

The concrete alkali, obtained from these processes, is the hydrate of potassa, sufficiently pure for medicinal purposes. The solution of the alkali freed from carbonic acid having been obtained by another formula (see *Liquor Potassæ*), the formation of the present preparation requires merely the evaporation of this solution until the whole of its uncombined water is driven off. The evaporation must be performed in metallic vessels, as those of glass or earthenware are acted on by the alkali; and it should be completed as quickly as possible, in order to abridge the period during which the solution would be liable to absorb carbonic acid from the atmosphere. When poured out on a metallic plate or dish, the cake, just as it concretes, may be marked with a knife in the directions in which it is to be divided, and when cold it readily breaks in those directions. A better plan, however, is to run the fused alkali into suitable moulds, as directed in the U. S. and British formulas. These should be made of iron and have a cylindrical shape, which is the most convenient form of the alkali for surgical use. Green glass bottles with ground stoppers are best adapted for preserving this preparation, as white flint glass is slightly acted on.

Properties, &c. In its officinal form, potassa is in sticks having a fibrous fracture, and, when properly prepared from pure materials, white and somewhat translucent; but, as often found in the shops, they have a dingy gray or greenish colour, with occasionally a bluish tint, and the peculiar odour of slaking lime. It is extremely caustic and very deliquescent, and dissolves in less than its weight of water, leaving but a slight residue. Its aqueous solution agrees in properties with Liquor Potassæ. It is also readily soluble in alcohol. When exposed to a low red heat it melts, and at bright redness is volatilized. On account of its deliquescent property, and its strong attraction for carbonic acid, it requires to be kept in very accurately stopped bottles. In the state here described, the alkali is united with water, forming hydrate of potassa. As formerly obtained by the U. S., London, and Edinburgh formulas, from solution of potassa derived from an impure carbonate, it contained various impurities, which, however, did not interfere with its medicinal value; such as chloride and teroxide of potassium, sesquioxide of iron, lime, silica, alumina, sulphate of potassium, and a portion of the alkali still in a carbonated state. As our officinal solution of potassa, from which the alkali is now prepared, is made from the bicarbonate, the resulting potassa is purer than as formerly obtained. According to the U. S. Pharmacopœia, it is dissolved by water and alcohol, with the exception of a slight residue, which probably consists chiefly of undecomposed carbonate, as this is insoluble in alcohol. Officinal potassa may be rendered nearly pure by digestion in alcohol, which takes up only the hydrated alkali, evaporating the solution to dryness, and fusing the dry mass obtained. *Hydrate of Potassa*, when thus procured, is called *alcoholic potassa*. It is generally in flat white pieces, which are dry, hard, brittle, and extremely caustic. Its other properties are similar to those of the impure hydrate above described. According to Mr. H. Wurtz, of New York, alcoholic potassa usually contains a trace of silicate of potassium, which appears to be taken up by the alcohol. The source of this is the carbonate of potassium employed, which may be freed from this impurity by evaporating its aqueous solution, in a sheet-iron dish, to dryness, and adding, from time to time, lumps of carbonate of ammonium. The silicate is thus converted into the carbonate; and, on dissolving the residue, the silica appears in flakes, which may be separated by filtration. (*N. Y. Journ. of Pharm.*, Feb. 1852.) Potassa may be discriminated from the other fixed alkalies (soda and lithia) by affording, when in solution, a crystalline precipitate (cream of tartar) with an excess of tartaric acid, and a yellow one with bichloride of platinum.* Potassa imparts to the flame of burning alcohol in

* For a method of analyzing commercial potash so as to determine per cent. and character of impurities, see *Amer. Journ. of Pharm.*, xlvii. 464. (*Note to the fourteenth edition.*)

which it is dissolved a reddish tint; soda colours it yellow even in the presence of potassa; and thus a method is afforded of detecting an admixture of the latter with the former alkali. According to Bunsen, when the flame is regarded through a glass of a cobalt blue colour, only the colour imparted by potassa is seen, that peculiar to soda not being able to penetrate through blue glass. (*Journ. de Pharm.*, Oct. 1860, p. 319.) The officinal potassa, apart from impurities, consists of one eq. of dry potassa 47·2, and one of water 9 = 56·2. Dry potassa is composed of one eq. of potassium 39·2, and one of oxygen 8 = 47·2. B.

Medical Properties and Uses. This is the old *causticum commune acerrimum* or *strongest common caustic.* It is a powerful escharotic, quickly destroying the life of the part with which it comes in contact, and extending its action to a considerable depth beneath the surface. In this latter respect, it differs from nitrate of silver or lunar caustic, to which it is, therefore, preferred in forming issues and opening abscesses. It has been used for removing stricture of the urethra; but in consequence of its tendency to spread, it may, unless carefully applied, produce such a destruction of the lining membrane, as to open a passage for the urine into the cellular tissue. The most convenient mode of employing the caustic for the formation of an issue, is to apply to the skin a piece of linen spread with adhesive plaster, having a circular opening in its centre corresponding with the intended size of the issue, and then to rub upon the skin, within the opening, a piece of the caustic previously moistened at one end. The application is to be continued till the life of the part is destroyed, when the caustic should be carefully washed off with a wet sponge or wet tow, or neutralized by vinegar. The preparation is also employed for forming solutions of potassa of definite strength, whether for medicinal or pharmaceutic use. A solution of one drachm and a half of caustic potassa in two fluidounces of distilled water was highly recommended by the late Dr. Hartshorne, of Philadelphia, as an application to the spine in tetanus. It may be applied by means of a sponge attached to the end of a stick, which should be drawn quickly along the back from the nape of the neck to the sacrum. It produces a powerful rubefacient effect.*

Pharm. Uses. In the preparation of Ether. *U. S.*

Off. Prep. Liquor Potassæ, *U. S.;* Potassa cum Calce, *U. S.;* Potassæ Permanganas, *Br.;* Potassii Iodidum, *U. S.* W.

POTASSA CUM CALCE. *U. S.* *Potassa with Lime.*

"Take of Potassa, Lime, each, *a troyounce.* Rub them together so as to form a powder, and keep it in a well-stopped bottle." *U. S.*

This preparation is a grayish-white powder, sometimes called *Vienna caustic.* It should not effervesce on the addition of an acid. It is prepared for use by being made up into a paste with a little alcohol. The paste is applied to the part to be cauterized for ten or fifteen minutes, and is conveniently limited in its operation by a piece of adhesive plaster, in the manner explained under potassa. The former Edinburgh preparation, made by evaporating the solution of potassa to one-third, and adding lime enough to bring it to the state of a firm paste, was often called *causticum commune mitius* or *milder common caustic.* Potassa with lime is a more manageable caustic than the officinal potassa, on account of the presence of the lime, which renders it milder, slower in its operation, and less deliquescent, and causes it to spread less beyond the part intended to be affected. Dr. Filhos has improved this caustic by forming it in sticks. To prepare it thus, the potassa is perfectly fused in an iron spoon, and one-third of its weight of quicklime is added in divided portions; the whole being stirred with an iron rod. The fused mass is then run into lead tubes, closed at one end, about three inches long, and from a quarter to half an inch in diameter in the clear. The sticks are kept, still enclosed in the lead tubes with the

* At the suggestion of Dr. Maunoury, of Chartres, M. E. Robiquet has prepared a paste consisting of gutta-percha and caustic potassa, which offers many advantages of manipulation, in the application of the latter substance. It is prepared by simply melting together equal weights of the two substances. The resulting paste can be moulded into any form that may be thought desirable, either of cylinders, plates, or lozenges, and retains its form indefinitely, even when introduced into cavities. All that is necessary, before applying it, is to dip it into alcohol for a few seconds. The resulting eschars are very precise in their form. (*Journ. de Pharm.*, xxx. 275.) —*Note to the eleventh edition.*

open end downwards, in thick glass tubes, containing some powdered quicklime, and closed with a cork, between which and the stick some cotton is put to steady the caustic. When employed, as much of the caustic is uncovered at the end, by scraping off the lead, as it is proposed to use. This form of caustic is particularly recommended for cauterizing the neck of the uterus. M. E. Robiquet has modified the caustic, by fusing the potassa and lime at a higher heat, running the fused mass into iron moulds, and quickly coating the sticks, when cold, with melted gutta-percha. The higher heat employed renders the caustic harder and more homogeneous.* B.

POTASSII ACETAS. *U. S., Br. Acetate of Potassium.*

"Take of Acetic Acid *a pint;* Bicarbonate of Potassium *a sufficient quantity.* Add the Bicarbonate gradually to the Acid until it is neutralized; then filter the solution, and evaporate cautiously, by means of a sand-bath, until a dry salt remains. Lastly, keep this in a well-stopped bottle." *U. S.*

"Take of Carbonate of Potash *twenty ounces* [avoirdupois]; Acetic Acid [sp. gr. 1·044] *two pints* [Imperial measure], or *a sufficiency.* To the Acetic Acid, placed in a thin porcelain basin, add gradually the Carbonate of Potash, filter, acidulate, if necessary, with a few additional drops of the Acid, and, having evaporated to dryness, raise the heat cautiously so as to liquefy the product. Allow the basin to cool, and, when the salt has solidified, and while it is still warm, break it in fragments, and put it into stoppered bottles." *Br.*

The process for forming this acetate is a case of single elective affinity. The substitution in the present Pharmacopœia, of the bicarbonate of potassium for the carbonate used in the formula of 1850, is an improvement, as it ensures a purer product. The form of acid for generating the salt directed in both Pharmacopœias is officinal acetic acid. Distilled vinegar should never be employed, on account of organic impurity, which gives the solution, when concentrated, a reddish or brownish colour. When acetic acid is used, a colourless solution is obtained. This is evaporated to dryness, according to the U. S. and British Pharmacopœias; but the latter, following the late Dublin Pharmacopœia, directs the dry salt to be melted, so that it may be obtained as a solid mass on cooling. When fusion is resorted to, great care must be taken not to use too high a heat; as otherwise part of the acetic acid will be decomposed, and the resulting salt will be discoloured. For drying the acetate of potassium, Dr. Christison considers the heat of a vapour-bath too low, and that of a sand-bath apt to become too high. He, therefore, recommends the use of a bath of chloride of calcium when operating on a small scale. In conducting the evaporation, it is best to have the solution always slightly acid; for if the alkali predominate, it will react upon the acetic acid when the solution is concentrated, and give rise to discoloration.

Acetate of potassium may also be obtained by double decomposition between acetate of lead and sulphate of potassium. When thus procured it is very white and pure, but liable to the objection, for medical use, that it may possibly contain a little lead. Another method by double decomposition is between acetate of calcium and sulphate of potassium.

Properties, &c. Acetate of potassium when pure is a white salt, perfectly neutral to test paper, unctuous to the touch, and of a warm, pungent, saline taste. When unskilfully prepared it is apt to be more or less coloured. Its state of aggregation differs with the manner in which it is prepared. As obtained by evaporating the solution to dryness, agreeably to the directions of the U. S. Pharmacopœia, it is in the form of soft fibrous masses. As usually prepared and found in the shops, it has a foliated texture, which is given to it by fusion and cooling. On account of this appearance it was formerly called *foliated earth of tartar.* This salt is extremely deliquescent, and, if exposed to the air, becomes converted into a liquid of an oleaginous appearance. It is on account of this property that it must always be preserved in well-stopped bottles. It dissolves in about half its weight of water, and twice its weight

* M. Piedagnel has found that by mixing the Vienna powder with muriate of morphia, in the proportion of three parts of the former to one of the latter, a caustic is obtained which will produce an eschar without causing pain. He first mixes them intimately in the dry state, and then with alcohol, chloroform, or water, makes a paste, which may be applied by means of adhesive plaster. (*Journ. de Pharm.*, 3e sér., xxxiii. 469.)—*Note to the twelfth edition.*

of alcohol. Anything remaining undissolved by these menstrua is impurity. Heated above its point of fusion, it is decomposed into acetone and carbonate of potassium; the acetic acid being resolved into that volatile liquid and carbonic acid. When treated with sulphuric acid, acetous vapours are copiously evolved, and sulphate of potassium is formed; and a blood-red colour is produced by a solution of sesquichloride of iron. One hundred grains of the salt, decomposed by sulphuric acid, furnish a salt (sulphate of potassium), which, after exposure to a strong heat, weighs 88·8 grains. (*Lond. Pharm.*) The most usual impurities contained in it are sulphate, tartrate, and chloride of potassium, and the salts of lead and copper. A soluble sulphate may be detected by chloride of barium; and chloride of potassium, or other soluble chloride, by nitrate of silver added to a *dilute* solution. If the nitrate be added to a concentrated solution, crystals of acetate of silver will be precipitated, soluble in water or dilute nitric acid. With bichloride of platinum it yields a yellow, and with tartaric acid a crystalline precipitate, showing it to be a salt of potassa. If tartrate of potassium be present, it will remain undissolved when the salt is acted on by alcohol. Lead and copper may be detected by sulphuretted hydrogen and ferrocyanide of potassium; the former test producing with the lead a blackish, and the latter with the copper a brown precipitate. Since the introduction of the cheap method of obtaining pure acetic acid from wood, this salt has scarcely been subjected to adulteration. Acetate of potassium is incompatible with the mineral acids, which expel the acetic acid; with the sulphates of sodium and magnesium; with corrosive sublimate and nitrate of silver; and with several other earthy and metallic salts. This salt exists in the juices of many plants, and especially in the sap of trees, and is the principal source of the carbonate of potassium existing in the ashes of wood. It consists of one eq. of acetic acid 51, one of potassa 47·2, and two of water 18 = 116·2.

Medical Properties and Uses. Acetate of potassium acts as a diuretic in doses of from a scruple to a drachm, and as a mild cathartic when given to the extent of two or three drachms. It is employed in dropsies, and often with good effect. The late Dr. Duncan, of Edinburgh, considered it to be a medicine of great efficacy, and one of our best saline deobstruents. Dr. J. A. Easton, of Glasgow, has found it useful in several skin diseases, such as psoriasis, eczema, and lepra. Cases which had resisted the ordinary remedies were cured, after a treatment occupying from three weeks to two months. The dose given by Dr. Easton was half a drachm, three times a day, dissolved in water. The remedy seemed to act through the kidneys, the urine being remarkably increased, both in its aqueous and solid contents. The late Dr. Golding Bird treated a large number of cases of acute rheumatism with remarkable success with this salt. The pain of the disease declined as soon as the urine became alkaline and rose in specific gravity. The quantity given, in twenty-four hours, was half an ounce in divided doses, largely diluted with water. (*Braithwaite's Retrospect*, Am. ed., July, 1854, p. 43.) It has been highly recommended by Ambrosoli, in large doses, as a remedy in acute and subacute urethritis with mucous or puruloid discharge, and in similar affections of the vagina and uterus. (*Ann. de Thérap.*, 1863, p. 115.) Acetate of potassium may be made extemporaneously in the liquid form by saturating distilled vinegar with carbonate of potassium. Two drachms of the carbonate, saturated with vinegar, will sometimes produce in hydropic cases ten or twelve stools, and a copious discharge of urine. (*Duncan.*) Acetate of potassium, like the other alkaline salts containing a vegetable acid, may be given in the uric acid diathesis, to render the urine alkaline; for the experiments of Wöhler have shown that the acid of these salts undergoes decomposition in the digestive and assimilating processes, while the alkali enters the current of the circulation. From the decided property which this salt possesses of increasing the secretion of the kidneys, it was formerly called *sal diureticus* or *diuretic salt.*

Off. Prep. Tinctura Ferri Acetatis, *Br.* B.

POTASSII BROMIDUM. *U.S., Br.* *Bromide of Potassium.*

"Take of Bromine *two troyounces;* Iron, in the form of Filings, *a troyounce;* Pure Carbonate of Potassium *two troyounces and sixty grains;* Distilled Water *four pints.* Add the Iron, and afterwards the Bromine, to a pint and a half of the Distilled Water, stirring the mixture frequently with a glass rod for half an hour. Apply

a gentle heat, and, when the liquid assumes a greenish colour, add gradually the Pure Carbonate of Potassium, previously dissolved in a pint and a half of the Distilled Water, until it ceases to produce a precipitate. Continue the heat for half an hour, and then filter. Wash the precipitate with the remainder of the Distilled Water, boiling hot, and again filter. Mix the filtered liquids, and evaporate that crystals may form. Lastly, pour off the mother-water, and, having dried the crystals on bibulous paper, keep them in a well-stopped bottle." *U. S.*

"Take of Solution of Potash *two pints* [Imperial measure]; Bromine *four fluid-ounces* [Imp. meas.], or *a sufficiency;* Wood Charcoal, in fine powder, *two ounces* [avoirdupois]; Boiling Distilled Water *one pint and a half* [Imp. meas.]. Put the Solution of Potash into a glass or porcelain vessel, and add the Bromine in successive portions, with constant agitation, until the mixture has acquired a permanent brown tint. Evaporate to dryness; reduce the residue to a fine powder, and mix this intimately with the Charcoal. Throw the mixture in small quantities at a time into a red-hot iron crucible, and, when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled dissolve it in the Water, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and dry them with a gentle heat. More crystals may be obtained by evaporating the mother-liquor and cooling. The salt should be kept in a stoppered bottle." *Br.*

In the first step of the U. S. process, a solution of bromide of iron is formed; and this, by the addition of the solution of carbonate of potassium, is decomposed so as to generate carbonate of the protoxide of iron which precipitates, and bromide of potassium in solution. By straining, the precipitated carbonate is separated, and from the strained liquor crystals of bromide of potassium are obtained by due evaporation. In the Br. process, by reaction between potassa and bromine, the bromide and bromate of potassium are produced in solution, and, having been obtained dry by evaporation, are exposed with the powder of charcoal to a red heat, whereby the bromate of potassium is converted into bromide of potassium by the separation of its oxygen. The remainder of the process consists in obtaining the bromide in crystals by solution in boiling water, which deposits it on cooling.

Properties, &c. Bromide of potassium is a permanent, colourless, anhydrous salt, crystallizing in cubes or quadrangular prisms, and having a pungent, saline taste, similar to that of common salt, but more acrid. It is very soluble in cold water, more so in hot, and but slightly soluble in alcohol. When heated it decrepitates, and, at a red heat, fuses without decomposition. If its aqueous solution be mixed with a little chlorine water, and then shaken with ether, the bromine, separated by the chlorine, will be dissolved by the ether, which will rise to the surface of a red colour. The salt may thus be known to be a bromide. That the base is potassium may be known by the white crystalline precipitate produced by tartaric acid added to its solution. The following characters are given of the salt in the U. S. Pharmacopœia. "Its aqueous solution does not affect the colour of litmus or turmeric, and is not precipitated by chloride of barium. When mixed with starch and treated with sulphuric acid, it becomes yellow. The salt, when subjected to heat, does not lose weight. Ten grains of it require, for complete precipitation, 14·30 grains of nitrate of silver [840 grain-measures of the *volumetric solution of nitrate of silver, Br.*]; and the precipitate formed has a yellowish colour." The object of adding sulphuric acid with the starch, is to set the bromine free. If iodine be set free at the same time, the starch will assume a violet or feeble blue colour. To test for iodine in this salt, Lassaigne recommends to add to its solution a few drops of chlorine water, and then to introduce a piece of starched white paper. If iodine be present, the starch will become violet, or faintly blue; and iodide of potassium, which is not an unfrequent impurity, may thus be detected. The absence of iodine is to be inferred from the non-production of a blue colour, upon the addition of a drop of an aqueous solution of bromine or chlorine to a solution of the salt mixed with mucilage of starch. *Br.* According to Mr. Chas. D. Chase, the commercial salt often is decidedly alkaline, and will precipitate the alkaloids from the solution of their salts; a serious mishap from such cause is very conceivable. If the salt decomposes more nitrate of silver than is

above stated, its saturating power is greater than it should be, and the presence of a chloride, probably of potassium or sodium, may be suspected. Chlorides may be more certainly detected by precipitating the salt with nitrate of silver, and treating the precipitate with a slight excess of ammonia. If there be a chloride, the chloride of silver will be thrown down, to be dissolved by the ammonia; and the solution thus obtained, if treated with nitric acid in excess, will throw down a white precipitate of chloride of silver. (*Journ. de Pharm.*, Dec. 1863, p. 514.) To determine the per cent. of chloride in an impure bromide the process of M. Baudrimont, as improved by M. Faliéres, may be used. It is founded upon the fact that chlorides precipitate more silver than the bromides; for an explanation of the rationale of the steps of the process the reader is referred to the *Pharm. Journ. and Trans.*, Jan. 1872, p. 542. Prepare a triturated solution of ·852 grammes of nitrate of silver in 100 cubic centimetres of distilled water. It is necessary, by means of perchloride of iron, salts of barium, and strong sulphuric acid in excess, to ensure that there are present no other salts, such as iodide, carbonate or sulphate of potassium, or nitrate of sodium, which shall interfere with the results. Then dissolve one grain of the bromide in thirty or forty grammes of water in a stoppered bottle, and add 1·427 grammes of nitrate of silver in solution. When the precipitate has subsided, add, drop by drop, from a Gay-Lussac burette the titrated solution. If the bromide be pure no precipitate forms, otherwise the number of cubic centimetres required to completely precipitate it equals the per cent. of the chloride. An iodide of an alkaline metal will be detected by adding to the solution of the bromide the chloride of palladium, which will precipitate all the iodine in the form of iodide of palladium, while the bromide of that metal will remain in solution. (*Ibid.*) According to MM. Bobienre and Herbelin, bromide of potassium containing iodide may be purified by boiling with bromine water and evaporating, the liberated iodine and the excess of bromine being driven off during the evaporation. (*Journ. de Pharm.*, 4e sér., x. 166.) Bromide of potassium consists of one eq. of bromine 78·4, and one of potassium 39·2 = 117·6.

Medical Properties. Bromide of potassium is alterative and resolvent, and is thought to be sedative to the nervous system and powerfully antaphrodisiac.* In 1828, Pourché used it with benefit, both internally and in the form of ointment, in the treatment of bronchocele and scrofula. Favourable results were obtained by the late Dr. T. Williams, of London, from its use as an internal remedy in enlarged spleen, and it has been given advantageously in goitre. According to Ricord, it produces effects in secondary syphilis similar to those of iodide of potassium, but acts more slowly. The same view is taken of its slow action in syphilis by Dr. John Egan. This surgeon, after experimenting with bromide of potassium for four years in the Westmoreland Lock Hospital, found its effects, in secondary and tertiary syphilis, slow and unsatisfactory, when compared with those of the iodide. While the latter generally increased the appetite and improved digestion, the bromide not unfrequently produced nausea and derangement of the digestive organs. M. Huette, from extensive trials of the remedy in the same stages of syphilis, found it inefficacious; exhibiting, in its effects, a marked contrast to iodide of potassium, which rapidly relieved the cases in which the bromide had failed. (*Ann. de Thérap.*, 1851, p. 216.) Given in large doses (from two to five drachms daily), it produces headache, followed by a peculiar intoxication, with torpor and drowsiness, slowness of the pulse, temporary dulness of sight and hearing, and weakness of the intellectual faculties. In one case, observed by M. Rames, the insensibility was so complete that the puncture of the skin with a suture needle was not felt, and the titillation of the conjunctiva and fauces with a feather produced neither winking nor desire to vomit. (*Journ. de Pharm.*, Dec. 1849.) Anæsthesia of the fauces, produced by the bromide, was subsequently observed by M. Huette, who also noticed in it the property of inducing more or less torpidity of the genital organs. Its powers as an antaphrodisiac have been confirmed

* For an account of experiments in reference to the physiological effects of bromide of potassium, for which we have not space here, the reader is referred to the Treatise by Dr. Wood on Therapeutics and Pharmacology (3d ed., ii. 398, A.D. 1868); and, since the publication of that work, for researches by Eulenburg and Guttmann, to the *Annuaire de Thérapeutique* (1868, p. 191), and for similar experimental researches by Dr. J. H. Bill, U. S. Army, to the *Am. Journ. of Med. Sci.* (July, 1868, p. 17).—*Note to the thirteenth edition.*

by Dr. Thielmann, of St. Petersburg, M. Trousseau, of Paris, and subsequently by many others. Sir Charles Locock has used it advantageously in hysterical epilepsy, and other nervous affections connected with uterine disorder; and others have found it useful generally in cases of that disease not dependent upon incurable lesions. It has also proved advantageous in chorea. Dr. Garrod has found it powerfully sedative to the sexual function, and recommends it strongly in nymphomania, priapism, certain forms of menorrhagia, and even in ovarian tumours. (*Med. Times and Gaz.*, March, 1864, p. 276.) Dr. Bedford Brown, of Washington, D. C., has experienced great advantage from it, taken internally, in the resolution of enlarged testicles. (*Am. Journ. of Med. Sci.*, July, 1867, p. 97.) It is said to be efficacious in the painful erections occurring in gonorrhœa; and has been much used, with supposed benefit, in spermatorrhœa; but Dr. W. F. Munroe, of Boston, has failed with it in chordee, unless when associated with general nervous disorder. (*N. Y. Med. Journ.*, July, 1868, p. 327.) It is thought to have proved useful in hooping-cough. Dr. J. Jones, of London, has found it very effectual in certain infantile convulsions, given in the dose of two or three grains every four or six hours (*Ibid.*, p. 254); and a case of obstinate asthma, in the care of Dr. J. D. Palmer, of Monticello, Florida, was greatly benefited by its use. (*Bost. Med. and Surg. Journ.*, March 26, 1868, p. 127.) Dr. A. J. Stone, of Boston, speaks strongly of its efficacy in checking the nausea so apt to follow the use of ether as an anæsthetic (*Med. Record*, May 15, 1868, p. 137); and Dr. J. H. Packard, of Philadelphia, has employed it successfully in the nausea and vomiting of pregnancy, when owing to reflex irritation of the stomach. (*Am. Journ. of Med. Sci.*, July, 1868, p. 133.) By M. Ozanam, of Paris, it has been successfully used in fourteen cases of pseudomembranous affections, two of which were croup. It has been given with good effect by Mr. Spencer Wells, of London, in cancerous tumours, in the dose of from five to ten grains, with one, two, or three drachms of cod-liver oil, three times a day. (*Med. T. and Gaz.*, July, 1857, p. 31.) In reference to its anæsthetic action on the fauces, it has been usefully employed in examination of these parts, and in operations upon them. Besides the nervous affections mentioned above, it has been employed with more or less asserted advantage in neuralgia, palpitation of the heart, delirium, and other forms of mental disorder, and especially want of sleep. Perhaps in no morbid condition has it proved so efficacious, or been so much used, as in sleeplessness dependent on functional disorder.

[When given to either cold or warm-blooded animals in repeated doses of sufficient amount, bromide of potassium produces a condition of universal depression, with failure of the circulation, progressively increasing paralysis, lowering of temperature, and finally death from asphyxia or exhaustion. In man the remedy causes similar results—the series of phenomena being known as *bromism*. The symptoms are muscular weakness, general mental and bodily sluggishness, loss of memory, often marked sleepiness, depression of spirits deepening into complete apathy, lowering of temperature, and finally a universal depression of function, the patient lying in bed scarcely more than a feeble automaton. Fetor of breath is usually well marked, and an eruption of acne may be the first indication of the constitutional action of the drug. In some cases the effects of the drug upon the skin are most marked, and the pustules, under its continuous exhibition, become furuncular or go on to ulceration. The detailed consideration of the physiological action of remedies is so foreign to the purpose of the present volume that I can give only the results arrived at, referring the reader to my treatise on Therapeutics for the proof. It seems to me proven that the bromide affects the whole nervous system, but that the portions most susceptible to its influence are those tissues of the spinal cord whose function it is to receive the impulse from without and the peripheral ends of the afferent or sensitive nerves. Its action upon the circulation has not been clearly determined, but it is somewhat probable that in small doses it contracts, in large ones relaxes, the capillaries; in sufficient amount it lessens the force of the heart's beats. It is probably eliminated with all the secretions, having been found in the sweat, saliva, urine, and intestinal mucus. When taken largely for some time it accumulates in the system, and has been found in the urine a month after the ingestion of the last dose. It has been employed in almost all diseases to which human flesh is heir. But experience has shown that it

is chiefly valuable as a means of quieting non-inflammatory excitement, of the reflex centres of the cord, of the peripheral afferent nerves, of the genital function, and of the cerebrum. It is especially valuable in epilepsy, very often affording relief and in a few cases bringing about a cure. It is necessary to maintain its decided action for years. In various forms of convulsions, such as infantile and puerperal, it is often of great service In tetanus and strychnia poisoning, if given with sufficient boldness, it seems to be an excellent remedy. In general nervous excitement—or unrest—in delirium tremens, in genital irritation without inflammation, in the semi-impotence from over-irritability of the sexual organs, it is of great service. Given with opium it will often avert the secondary nausea which that narcotic produces in some persons. In reflex vomiting, as that of pregnancy, it is often of service. According to Dr. J. T. Rothrock, it is of service in preventing the so-called urethral fever produced in some very susceptible males by the passage of a catheter or bougie. H. C. W.]

Bromide of potassium may be given, dissolved in water, in doses of twenty grains to a drachm three times a day. In some cases much larger amounts are required. In severe strychnia poisoning a half ounce, properly diluted, may be exhibited at once; and in tetanus there is little use giving less than the same amount in the twenty-four hours. The *ointment* may be made by mixing from a scruple to two drachms of the bromide with an ounce of lard. Of this from half a drachm to a drachm may be rubbed on a scrofulous tumour, or other part where its local action is desired, once in twenty-four hours. Sometimes bromine is added to this ointment in the proportion of thirty minims to the ounce of lard. B.

POTASSII CARBONAS. *U. S.* POTASSÆ CARBONAS. *Br.* *Carbonate of Potassium. Carbonate of Potassa from Pearlash.*

"Take of Impure Carbonate of Potassium [pearlash] *thirty-six troyounces;* Water *two pints and a half.* Dissolve the Impure Carbonate in the Water, and filter the solution; then pour it into an iron vessel, and evaporate over a gentle fire until it thickens. Lastly, remove it from the fire, and stir constantly with an iron spatula so as to form a granular salt." *U. S.*

The British Pharmacopœia defines this salt as "KO,CO_2, with about 16 per cent. of water of crystallisation;" and states that it is "obtained from common commercial pearl-ash, by treating it with its own weight of distilled water and evaporating the solution to dryness, while kept briskly agitated."

The object of the above process is to purify the impure carbonate of potassium, or pearlash. This generally contains certain insoluble impurities, as well as small portions of sulphate, silicate, and chloride of potassium, as explained under another head. (See *Potassii Carbonas Impura.*) By dissolving it in a due proportion of water, and filtering the solution, the insoluble impurities are got rid of, as well as the greater part of the foreign salts, which, being much less soluble than the carbonate of potassium, are excluded by the superior affinity of this salt for the water. The proper way of conducting the purification is to mix the impure carbonate with an equal weight of *cold water*, and to allow the mixture to stand for a day or two, stirring it frequently to promote the action of the water. The clear liquor obtained by decantation or filtration is then evaporated to dryness. The officinal process is conducted very much in this way; cold water being employed, and about equal weights of alkali and water being used. The prolonged contact of the water with the salt, and the occasional stirring of the mixture, formerly ordered by the Dublin College, were useful directions. In no case should the undissolved residue be washed with a fresh portion of water; as, by such a proceeding, the foreign salts, which it is the object of the process to separate, would be dissolved. Iron vessels are directed, because this metal is not acted on by the alkali, while glass is attacked by it. In granulating the salt by stirring, it is better, when the solution is brought nearly to dryness, to keep it on the fire at a reduced heat until the process is finished, then to remove it the moment it thickens.

According to Berzelius, a more productive process for purifying pearlash, though the resulting salt is not so pure as when obtained in the way just described, is to dissolve the pearlash in more than its weight of water, to evaporate the solution till it has the sp. gr. 1·52, and then to put it in a cool place, that the foreign salts, prin-

cipally sulphate and chloride of potassium, may crystallize. The solution is then decanted, and evaporated to dryness.

To get rid of the silica, Rieckher proposes to evaporate the solution, exempt from sulphate, to dryness, to moisten the residue with solution of carbonate of ammonium, and again evaporate. The silica separates, and passes into the insoluble state at the temperature necessary for evaporation. By again dissolving and evaporating, the carbonate is obtained free from this impurity. (*Chem. Central Blatt*, 1863, p. 158.)

Properties, &c. Carbonate of potassium, as found in the shops, is in the form of a coarse, granular, white powder, having a nauseous, alkaline taste, and acting as an alkali on vegetable colours. It is very soluble in water, dissolving in its weight of that liquid, but is insoluble in alcohol. It is extremely deliquescent; and hence a portion of it, exposed to the air for some time, attracts so much water as completely to dissolve into an oily liquid, called by the older chemists, *oleum tartari per deliquium*. On account of this property, carbonate of potassium should be kept in bottles with accurately-ground stoppers. If exposed in its usual state to a red heat, it retains its carbonic acid, but loses 16 per cent. of water; and when decomposed by dilute sulphuric acid, evolves 26·3 per cent. of carbonic acid. (*London Pharm.*) It should be completely soluble in water; but, generally, a small insoluble portion is left of earthy matter. The usual impurities are earthy matters, sulphate and chloride of potassium, and silica in the state of silicate of potassium. When dissolved in water and treated with nitric acid in excess, it affords a faint cloudiness with chloride of barium, and a slight precipitate with nitrate of silver; effects showing the presence of minute portions of a sulphate and of a chloride. The nitric solution is also precipitated by carbonate of sodium, if earthy matter be present. If the indications of these tests are decided, the salt is below the officinal standard of purity. Its aqueous solution, saturated by an acid, slowly deposits a slight flocculent precipitate of hydrated silica. It is incompatible with acids and acidulous salts, chloride and acetate of ammonium, lime-water, chloride of calcium, sulphate of magnesium, alum, tartar emetic, nitrate of silver, ammoniated copper and ammoniated iron, sulphate of iron, tincture of chloride of iron, calomel and corrosive sublimate, acetate and subacetate of lead, and sulphate of zinc. It is not decomposed by tartrate of iron and potassium. According to the Br. Pharmacopœia, "83 grains require for neutralisation at least 980 grain-measures of the *volumetric solution of oxalic acid;*" and "20 grains neutralise 17 grains of citric acid, or 18 grains of tartaric acid."

Composition. Carbonate of potassium, after exposure to a red heat, is anhydrous, consisting of one eq. of carbonic acid 22, and one of potassa 47·2 = 69·2. Obtained by the officinal formulas, it is, according to Mr. Phillips, a sesquihydrate, containing two equivalents of carbonate and three of water. When exposed to the air, carbonate of potassium absorbs sufficient water, before losing its solid form, to give it three equivalents; with more it begins to deliquesce. (Dr. Pohl. See *Am. Journ. of Pharm.*, Nov. 1861, p. 532.) B.

Medical Properties and Uses. Purified pearlash is the form of carbonate of potassium usually employed in this country, where it is frequently, though incorrectly, called *salt of tartar;* the latter name being strictly applicable to the purer carbonate obtained by decomposing cream of tartar. It is occasionally used as an antacid in dyspepsia, a diuretic in dropsy, and antilithic in gravel attended with red deposits in the urine; but the purpose to which it is most commonly applied is the formation of the *neutral mixture* and *effervescing draught.* (See *Mistura Potassii Citratis.*) It is also used with advantage in some cases of jaundice, in which it probably operates by entering the circulation, and directly exciting the hepatic function. It has enjoyed considerable popular reputation mixed with cochineal in hooping-cough, and is supposed by some, in common with other alkaline remedies, to operate favourably in pseudomembranous inflammations of the mucous tissues. It is considered among the most effectual remedies in obstinate cutaneous eruptions, in which it is employed both internally and externally. The dose is from ten to thirty grains, given in some aromatic water sweetened with sugar. In large quantities it acts as a corrosive poison, and is capable of producing death in a few hours. A case is recorded in which an adult female swallowed about three ounces in very concentrated solution, with the

most alarming effects, though the patient ultimately recovered, after a long and very painful convalescence. (Dr. Espagne, *Arch. Gén.*, Fév. 1867, p. 233.) The antidotes are the fixed oils and vegetable acids.

As a local remedy in cutaneous affections, carbonate of potassium is used in the form of bath, of lotion, and of ointment. From eight to sixteen ounces may be used for a single bath, the quantity being gradually increased. Lotions may be made by dissolving two or three drachms in a pint of water; and ointments, by rubbing from ten grains to a drachm with an ounce of lard.

A solution of the salt, on exposure to the air, or on the addition of an acid, deposits flocculi consisting of hydrate of silica, resulting from the decomposition of silicated potassa, which is always present as an impurity. The spontaneous deposition of silica is owing to the absorption of carbonic acid.

Pharm. Uses. In preparing Atropia, *Br.;* Chloroformum Purificatum, *U. S.*, Spiritus Ætheris Nitrosi, *U. S.*

Off. Prep. Decoctum Aloes Compositum, *Br.;* Enema Aloes, *Br.;* Extractum Spigeliæ et Sennæ Fluidum, *U. S.;* Liquor Arsenicalis, *Br.;* Liquor Potassæ, *Br.;* Mistura Ferri Composita; Potassa Sulphurata, *Br.;* Potassæ Acetas, *Br.;* Potassii Bicarbonas, *U. S.;* Potassæ Bicarbonas, *Br.;* Potassæ Chloras, *Br.;* Potassæ Citras, *Br.;* Potassæ Tartras, *Br.;* Potassii Sulphuretum, *U. S.* W.

POTASSII CARBONAS PURA. *U. S. Pure Carbonate of Potassium. Salt of Tartar.*

"Take of Bicarbonate of Potassium, in coarse powder, *twelve troyounces.* Put it into a capacious iron crucible, heat gradually until the water of crystallization is driven off; then raise the heat to redness, and maintain that temperature for half an hour. Having taken the crucible from the fire, and allowed it to cool, dissolve its contents in Distilled Water, and filter the solution. Then pour it into an iron vessel, and evaporate over a gentle fire until it thickens. Lastly, move it from the fire, and stir constantly with an iron spatula, so as to form a granular salt." *U. S.*

In this process the bicarbonate of potassium is ignited, whereby it loses its water of crystallization and second equivalent of carbonic acid, and is reduced to the state of carbonate. As the bicarbonate is a very pure salt, so the carbonate obtained from it is also very pure.

The pure carbonate was formerly obtained from bitartrate of potassium, by first purifying it by solution and crystallization, and then incinerating it; and this was one of the processes of the late Edinburgh Pharmacopœia. The tartaric acid, which consists of carbon, hydrogen, and oxygen, is decomposed, and gives rise, among other products, to carbonic acid, which combines with the potassa. The matter, after ignition, contains, besides carbonate of potassium, certain impurities derived from the bitartrate. These are carbonate of calcium arising from the decomposition of tartrate of calcium, alumina, and minute portions of the oxides of iron and manganese; but, being all insoluble in water, they are left behind when the mass is acted on by that liquid, the alkaline carbonate being taken up. Some silicate of potassium is sometimes dissolved, derived from silica, either originally in the bitartrate, or derived from the earthenware or porcelain crucible in which the ignition is performed.

Pure carbonate of potassium may also be obtained by deflagrating a mixture of two parts of bitartrate of potassium, and one of nitrate of potassium. This process has been objected to on the ground that it gives a carbonate, apt to contain a little of the poisonous cyanide of potassium. But this objection is unfounded. It is true, as Engelhardt and Wicke have proved, that the deflagrated mass contains cyanate of potassium; but this is entirely decomposed into ammonia and carbonate of potassium by the subsequent operations of solution and evaporation to dryness, to which the mass is subjected. Mr. J. Lawrence Smith prepares a "pure potassa," which, however, often contains a trace of nitre, by heating 50 parts of pure nitre and 100 parts of oxalic acid in a platinum crucible with a little water (adding once, when nearly dry, more water) to a red heat, breaking up the lumps with an iron rod, allowing to cool, dissolving, and filtering. (*Pharm. Journ. and Trans.*, Jan. 1875, p. 523.)

It was this origin from bitartrate of potassium, called in its impure state *tartar*, that gave rise to the name of *salt of tartar*, still frequently applied to the purer forms

of the carbonate. It may, indeed, be very much doubted whether the real salt of tartar is often kept in our shops; the ordinary carbonate, as purified from pearlash, being generally substituted for it, and answering, in most cases, every medicinal purpose that could be expected from the use of the purer salt.

M. Lunge prepares what he considers the pure carbonate by carrying still further the officinal process for carbonate of potassium described in the preceding article. After procuring the carbonate as there directed, he dissolves it again in water, and, having permitted the solution to stand, decants and evaporates to dryness on a furnace. Dissolving the product anew, he evaporates the solution until, upon cooling, it deposits all the sulphate of potassium in crystals. He then separates the mother-water, and again evaporates until, on cooling, the liquid sets in a solid mass, which is the pure carbonate. (*Journ. de Pharm. et de Chim.*, Avril, 1868, p. 275.)

Properties, &c. Pure carbonate of potassium, obtained from the bicarbonate or cream of tartar, differs from the same salt procured from pearlash, in containing no impurities. With the tests mentioned under the carbonate it gives negative indications, showing the entire absence of foreign substances. The U. S. Pharmacopœia gives the following characters of the salt. It is white, deliquescent, and wholly soluble in water; effervesces with acids, and has an alkaline reaction; yields, in solution, a yellow precipitate with bichloride of platinum, and a white one effervescing with acids, with sulphate of magnesium; when saturated with an acid deposits nothing upon standing, and, when treated with pure nitric acid in excess, is not precipitated by carbonate of sodium, chloride of barium, or nitrate of silver. It loses 16 per cent. of its weight at a red heat.

Medical Properties and Uses. These are the same with those of the carbonate of potassium described in the preceding article. The pure carbonate, on account of its freedom from silica, furnishes the best material for forming the solution of citrate of potassium, or neutral mixture.

Off. Prep. Potassii Bromidum, *U. S.;* Potassii Cyanidum, *U. S.* B.

POTASSII BICARBONAS. *U. S.* Potassæ Bicarbonas. *Br.* *Bicarbonate of Potassium.*

"Take of Carbonate of Potassium *forty-eight troyounces;* Distilled Water *ten pints.* Dissolve the Carbonate of Potassium in the Distilled Water, and pass Carbonic Acid through the solution till it is fully saturated. Then filter the liquid, and evaporate that crystals may form, taking care that the heat does not exceed 160°. Lastly, pour off the supernatant liquid, and dry the crystals upon bibulous paper. Carbonic acid may be obtained from marble by the addition of dilute sulphuric acid." *U. S.*

"Take of Carbonate of Potash *one pound* [avoirdupois]; Distilled Water *two pints* [Imperial measure]; Hydrochloric Acid *one pint and a half* [Imp. meas.]; Water *three pints* [Imp. meas.]; White Marble, in fragments, *one pound* [avoird.], or *a sufficiency.* Dissolve the Carbonate of Potash in the Distilled Water, and filter the solution into a three-pint bottle, capable of being tightly closed by a cork traversed by a glass tube sufficiently long to pass to the bottom of the fluid. Introduce the Marble into another bottle, in the bottom of which a few small holes have been drilled, and the mouth of which is closed by a cork, also traversed by a glass tube, and place the bottle in a jar, of the same height as itself, but of rather larger diameter. Connect the two glass tubes, air-tight, by a caoutchouc tube. The cork of the bottle containing the Carbonate of Potash having been placed loosely, and that of the bottle containing the Marble tightly, in its mouth, pour into the jar surrounding the latter bottle the Hydrochloric Acid, previously diluted with the Water. When carbonic acid gas has passed through the potash solution for two minutes so as to expel the whole of the air of the apparatus, fix the cork tightly in the neck of the bottle, and let the process go on for a week. At the end of this time numerous crystals of Bicarbonate of Potash will have formed, which are to be removed, shaken with twice their bulk of cold Distilled Water, and, after decantation of the water, drained, and dried on filtering paper by exposure to the air. The mother-liquor, filtered, if necessary, and concentrated to one-half, at a temperature not exceeding 110°, will yield more crystals. The tube immersed in the solution of Carbonate of Potash, which

should have as large a diameter as possible, may require the occasional removal of the crystals formed within it, in order that the process may not be interrupted." *Br.*

In these processes, the carbonate of potassium, consisting of one eq. of acid and one of base, is combined with an additional equivalent of carbonic acid. The combination is effected by passing a stream of this acid through a solution of the carbonate, so long as it is absorbed. In the U. S. formula the distilled water taken is about three times the weight of the carbonate. As the bicarbonate of potassium requires four times its weight of water to dissolve it, the quantity of water ordered in the U. S. formula would seem not to be sufficient to dissolve the new salt; unless it be assumed that the solution becomes heated in consequence of the reaction. The solution of the whole of the new salt is not intended in the British process, which proceeds on the plan of forming crystals of bicarbonate at once in the original solution, without concentration by heat. The filtration directed in the U. S. formula is ordered on the presumption that the whole of the bicarbonate formed is dissolved; and is intended to separate silica, which is always deposited during the progress of the saturation, when carbonate of potassium from pearlash is employed. On a small scale the saturation of the carbonate is best conducted in a Wolfe's apparatus of three bottles; the first containing water to wash the carbonic acid gas, the two others, solutions of the carbonate. The bottles should be connected by means of wide tubes, to prevent their being obstructed by the crystals formed. On a large scale the saturation is performed in strong vessels, into which the carbonic acid is driven under pressure. Sulphuric acid is always used by the manufacturing chemist for generating the carbonic acid; but in small operations, muriatic acid, diluted with twice its bulk of water, is more convenient; inasmuch as it generates with the marble or chalk a soluble salt (chloride of calcium), which does not interfere with the extrication of the carbonic acid, as the insoluble sulphate of calcium does. In the British process dilute muriatic acid is used for the extrication of the carbonic acid, which is effected in a self-regulating generator of that gas.

In the process of the late Ed. Pharmacopœia, carbonate of ammonium was incorporated with carbonate of potassium, by the assistance of a little water, so as to form a uniform pulp, which was dried by a gentle heat. By the combined influence of the volatility of the ammonia, and the affinity of the carbonate of potassium for carbonic acid, the carbonate of ammonium was totally decomposed; its carbonic acid generating the bicarbonate by uniting with the carbonate, and its ammonia being evolved during the drying of the pulp, which was then reduced to a fine powder. This process is alleged by Dr. Christison to be superior to the other "in point of economy, dispatch, and certainty in small operations."

Mr. Brande gives the following proportions for the preparation of bicarbonate of potassium on the large scale: "100 lbs. of purified carbonate of potassium are dissolved in 17 gallons of water, which, when saturated with carbonic acid, yield from 35 to 40 lbs. of crystallised bicarbonate; 50 pounds of carbonate of potassium are then added to the mother liquor, with a sufficient quantity of water to make up 17 gallons, and the operation repeated."

Wöhler states that charcoal, when mixed with the carbonate, facilitates by its porosity, in a remarkable degree, the formation of the bicarbonate. Thus he found that, when crude tartar was charred in a covered crucible, and the carbonaceous mass, after having been slightly moistened with water, was subjected to a stream of carbonic acid, the gas was absorbed with great rapidity, and heated the mass so considerably, as to render it necessary to surround the vessel with cold water, to prevent the decomposition of the bicarbonate formed. When the temperature diminished, the saturation was known to be completed. The mass was lixiviated in the smallest quantity of water at the temperature of from 85° to 100°, and the solution, after filtration and cooling, deposited the greater part of the bicarbonate in fine crystals. (See *Am. Journ. of Pharm.*, x. 82.)

M. Behrens has proposed to obtain bicarbonate of potassium by partially saturating the carbonate, dissolved in an equal weight of water, with acetic acid gradually added. Up to a certain point, no carbonic acid is extricated, and a precipitate takes place of pure bicarbonate of potassium, equal to half the weight of the carbonate

employed. After the bicarbonate is separated, the saturation may be completed, and acetate of potassium obtained. (*Journ. de Pharm.*, 3e sér., iv. 464.) The bisalt is also produced when the carbonate is treated with weak lemon-juice in forming the citrate. (See *page* 1309.)

According to Berzelius, the cheapest method of obtaining the bicarbonate of potassium is to suspend a concentrated solution of the purified carbonate, contained in a stoneware dish, within a cask, over a liquid undergoing the vinous fermentation. The alkali is thus surrounded by an atmosphere of carbonic acid, and, by absorbing it, crystallizes into bicarbonate in the course of five or six weeks. Distillers and brewers may prepare this salt with great facility by suspending the alkaline solution in the fermenting tun. The salt in powder called *sal aëratus*, made principally in New England, is, we believe, prepared in this way. In composition it is between a carbonate and bicarbonate.

Properties, &c. Bicarbonate of potassium is in transparent, colourless crystals, slightly alkaline to the taste and to test paper, permanent in the air, and having the shape of irregular eight-sided prisms with two-sided summits. It dissolves in four times its weight of cold water, and in five-sixths of its weight of boiling water, by which it is partially decomposed, and converted into *sesquicarbonate*. It is insoluble in alcohol. Exposed to a red heat, it loses 30·7 per cent., comprising half its carbonic acid and the whole of its water of crystallization, and returns to the state of carbonate, which, when thus obtained, is free from silica, and otherwise very pure. This method is now adopted in the U. S. Pharmacopœia for obtaining the pure carbonate. Treated with nitric acid in excess, it should give a clear solution, the transparency of which is not disturbed by chloride of barium, and but slightly by nitrate of silver. When a perfect bicarbonate, its solution, unless heated, does not precipitate a solution of sulphate of magnesium. This negative indication, however, cannot be depended upon as showing the absence of carbonate; for, according to Dr. Christison, no precipitate will be occasioned even when 50 per cent. of this impurity is present. Bicarbonate of potassium does not decompose calomel. When dissolved in 40 parts of water, it produces a white haze merely with a solution of corrosive sublimate; but if it contain so much as a hundredth part of carbonate, a brick-red precipitate is immediately produced. (*Christison.*) Another way of detecting the presence of carbonate is to add starch sugar to a heated solution of the suspected bicarbonate. If any carbonate be present, the mixture turns yellow or brown. (*Chevallier.*) Bicarbonate of potassium consists of two eqs. of carbonic acid 44, one of potassa 47·2, and one of water 9 = 100·2. "Fifty grains exposed to a low red heat, leave 34·5 grains of a white residue, which requires for exact saturation 500 grain-measures of the *volumetric solution of oxalic acid;*" and "20 grains neutralise 14 grains of citric acid, or 15 grains of tartaric acid." *Br.*

Medical Properties. The medical properties of this salt are similar to those of the carbonate, to which it is preferable from its milder taste, and greater acceptability to the stomach. The dose is from twenty grains to a drachm. Dr. Garrod, of London, has had great success in the treatment of acute rheumatism by the use of two-scruple doses of this salt, given in weak solution, every two hours, day and night, and continued for a few days after the articular affection and febrile disturbance have subsided. The salt probably acts by rendering the secretions alkaline, and by increasing the alkalinity of the blood. For this purpose it is much better than the carbonate, which is not well borne by the stomach when continued for any length of time.

Off. Prep. Liquor Magnesii Citratis, *U. S.;* Liquor Potassæ, *U. S.;* Liquor Potassii Arsenitis, *U. S.;* Liquor Potassii Citratis, *U. S.;* Liquor Potassæ Effervescens, *Br.;* Mistura Potassii Citratis, *U. S.;* Potassii Acetas, *U. S.;* Potassii Carbonas Pura, *U. S.;* Potassii Citras, *U. S.* B.

POTASSII CITRAS. *U. S.* POTASSÆ CITRAS. *Br.* *Citrate of Potassium.*

"Take of Citric Acid *ten troyounces;* Bicarbonate of Potassium *fourteen troyounces;* Water *a sufficient quantity*. Dissolve the Citric Acid in a pint of Water, add the Bicarbonate of Potassium gradually, and, when effervescence has ceased, filter the solution and evaporate to dryness, stirring constantly, after a pellicle

has begun to form, until the salt granulates. Keep it in a well-stopped bottle." *U. S.*

"Take of Carbonate of Potash *eight ounces* [avoirdupois], or *a sufficiency;* Citric Acid, in crystals, *six ounces* [avoird.], or *a sufficiency;* Distilled Water *two pints* [Imperial measure]. Dissolve the Citric Acid in the Water, add the Carbonate of Potash gradually, and, if the solution be not neutral, make it so by the cautious addition of the Acid or the Carbonate of Potash. Then filter, and evaporate to dryness, stirring constantly, after a pellicle has begun to form, till the salt granulates. Triturate in a dry, warm mortar, and preserve the powder in stoppered bottles." *Br.*

Citrate of potassium was first recognised as officinal in the U. S. Pharmacopœia of 1850. It was known formerly by the name of *salt of Riverius.* In the above U. S. formula, mutually saturating proportions of the acid and bicarbonate were intended to be employed; the latter ingredient being preferred to the carbonate on account of its greater purity. The potassium of the bicarbonate unites with the citric acid, to form the citrate of potassium, and the carbonic acid escapes, producing effervescence. The resulting solution is directed to be evaporated to dryness, as affording the most convenient form for use. The granulation ordered has a tendency to retard the deliquescence of the citrate. The British process differs only in the use of the carbonate instead of bicarbonate, and by providing more carefully for an exact neutralization.

Citrate of potassium is crystallizable, but, as procured by the above process, is in the form of a white granular powder. It is inodorous, of a saline, slightly bitterish, not unpleasant taste, deliquescent, very soluble in water without residue, and insoluble in alcohol. It is stated in the U. S. Pharmacopœia that its solution does not change the colour of litmus; but we have found a carefully prepared specimen slightly to redden the paper; and the acid used in the process is theoretically in slight excess. By a red heat, with exposure to the air, the salt is decomposed, leaving a residue of pure carbonate of potassium. The presence of tartaric acid would be indicated by a precipitate of bitartrate of potassium on the addition of muriatic acid.

The British Pharmacopœia gives the following tests of its character. Heated with sulphuric acid it forms a brown fluid, and gives off inflammable vapours with the odour of acetic acid. Its solution, mixed with a solution of chloride of calcium, remains clear till it is boiled, when a white precipitate is formed readily soluble in acetic acid. This is a character of citric acid, which, in saline combination, unites with lime to form the insoluble citrate only when heated. Acidulated with hydrochloric acid, the solution gives a yellow precipitate with perchloride of platinum; showing that the base of the salt is potassa. "One hundred and two grains, heated to redness till gases cease to be evolved, leave an alkaline residue [carbonate of potassium], which requires for exact neutralisation 1000 grain-measures of the *volumetric solution of oxalic acid.*" *Br.*

As citric acid is tribasic, this salt consists of three eqs. of potassa and one of acid; its formula being $3KO,C_{12}H_5O_{11}$.

Medical Properties. Citrate of potassium is a grateful refrigerant diaphoretic, and has long been used in the fevers of this country, in the extemporaneous forms of neutral mixture and effervescing draught. As these require time and a somewhat careful manipulation in their preparation, it has been found more convenient to keep the citrate of potassium ready made, and dissolve it in water when wanted for use. This solution will no doubt produce the essential diaphoretic and refrigerant effects of the neutral mixture or effervescing draught; but is less agreeable to the stomach and palate, because destitute of the carbonic acid contained in these preparations. The dose of the citrate is from twenty to twenty-five grains. (See *Liquor Potassii Citratis*, p. 1310.) W.

POTASSII CYANIDUM. *U.S.* Potassii Cyanuretum. *U.S.* 1850. *Cyanide of Potassium. Cyanuret of Potassium.*

"Take of Ferrocyanide of Potassium, dried, *eight troyounces;* Pure Carbonate of Potassium, dried, *three troyounces.* Mix the salts intimately, and throw the mix-

ture into a deep iron crucible previously heated to redness. Maintain the temperature until effervescence ceases, and the fused mass concretes, of a pure white colour, upon a warm glass rod dipped into it. Then pour out the liquid carefully into a shallow dish to solidify, ceasing to pour before the salt becomes contaminated with the precipitated iron. Break up the mass while yet warm, and keep the pieces in a well-stopped bottle." *U. S.*

The above process for obtaining this cyanide, which is that of F. & E. Rodgers, though generally known under the name of Liebig, was substituted, in the U. S. Pharmacopœia of 1850, for the process in which the ferrocyanide is ignited without addition. It furnishes a large product, but a considerable part of it is the impurity, cyanate of potassium. The reaction takes place between two eqs. of ferrocyanide of potassium and two of carbonate of potassium. The iron is set free, the carbonic acid evolved, and a compound of five eqs. of cyanide of potassium and one of cyanate of potassium is formed. The iron occupies the lower part of the fused liquid; and, if the latter be carefully poured out to solidify, the portion contaminated with the iron may be left behind. The reaction is explained by the following equation: 2(2KCy, FeCy) and $2(KO,CO_2)=5KCy$ and KO,CyO and 2Fe and $2CO_2$. Dr. Wittstein gives the reaction differently, to explain the larger proportion of cyanate of potassium formed than the above equation calls for. He conceives that the product consists of seven eqs. of cyanide of potassium, and three of cyanate of potassium. MM. Fordos and Gélis, in an able paper contained in the *Journ. de Pharmacie* for Aug. 1857, have pointed out numerous causes which concur in rendering the salt, as obtained by the use of carbonate of potassium, impure. The commercial cyanide, which is obtained by this process, was found by these writers to be very impure, only containing from 36 to 55 per cent. of the pure salt. The cyanate of potassium may be readily detected by saturating the product with an acid, which will cause an effervescence of carbonic acid, and the generation of a salt of ammonium. According to Dr. Schwarz, it may be freed from cyanate and carbonate of potassium, by treating the impure cyanide with bisulphuret of carbon, which dissolves it, and may be recovered in great measure by distillation. (*Chem. News*, No. 190, p. 41.)

In the process in which the ferrocyanide of potassium is ignited alone (former U. S. process), the salt is first deprived of its water of crystallization by exposure to a moderate heat, and then calcined at a red heat for two hours, in order to decompose the cyanide of iron. The product of the calcination is a black, porous mass, consisting of cyanide of potassium, mixed with carburet of iron and charcoal. As the cyanide is very prone to absorb oxygen, especially when hot, whereby it is decomposed, atmospheric air is excluded from the retort while it is cooling, by luting its orifice. When the whole is cold, the black mass is reduced to coarse powder, and exhausted by cold distilled water, which dissolves the cyanide of potassium, and leaves the carburet of iron and charcoal behind. The filtered liquor, therefore, is an aqueous solution of cyanide of potassium, which is obtained in a solid state by a rapid evaporation to dryness. During the evaporation, a small portion of the cyanide is decomposed, attended with the evolution of ammonia, and the production of formiate of potassium. A portion of this salt, therefore, contaminates the cyanide, as obtained by this process; but the quantity is too small to interfere with its medicinal action. The decomposition here referred to takes place between one eq. of cyanide of potassium and four of water, and is represented by the following equation, in which the cyanogen is expressed by its full symbol NC_2, and formic acid by C_2HO_3: K, NC_2 and $4HO=NH_3$ and KO,C_2HO_3. This decomposition is avoided by exhausting the black mass with boiling alcohol of 60 per cent. (sp. gr. 0·896) instead of with water. The alcoholic solution, by evaporation to a pellicle, lets fall the salt upon cooling, as a crystalline precipitate, perfectly white and pure.

According to the process of the French Codex, which is that of Robiquet, this cyanide is obtained in the dry way, without the use of any solvent. The calcination is performed in a coated stoneware retort, half-filled with the ferrocyanide, to which a tube is attached for collecting the gaseous products. When these cease to be disengaged, the heat is gradually raised to a very high temperature, at which it is kept for a quarter of an hour; after which the tube is closed with luting, and the whole

left undisturbed until quite cold. When the calcination is thus conducted, the retort, upon being broken, will be found to contain a black matter, covered with a fused layer of pure cyanide of potassium, resembling white enamel. This is detached by means of a knife, and immediately transferred to a bottle, with an accurately fitting stopper. The black matter, under the name of *black cyanide of potassium*, is also kept for medicinal use; but the dose of this cannot be accurately fixed, on account of its containing, at different times, more or less impurity.

According to MM. Fordos and Gélis, the French Codex process should supersede the carbonate of potassium process; as it gives a product far purer, and in larger proportion to the materials employed, estimated by the pure product. The same process is preferred by Mr. Donovan, who has modified it by substituting, for the stoneware retort, an iron mercury bottle, which, when cold, must be cut in two by a chisel and hammer to get out the product. The same recommendation of iron in preference to stoneware vessels, is made by Fordos and Gélis, who found that the latter, at the high heat employed, were acted on.

The process of Wiggers consists in disengaging hydrocyanic acid from a mixture of ferrocyanide of potassium and sulphuric acid, and passing it into a cooled receiver, containing an alcoholic solution of hydrate of potassa. The contents of the receiver ultimately form a solid magma of the cyanide, which is drained, washed several times with strong alcohol, pressed between folds of bibulous paper, and dried as quickly as possible.

Cyanide of potassium may be formed by passing a current of strongly heated nitrogen over charcoal, impregnated with carbonate of potassium, and heated to white redness. (See *page* 734.)

Properties. Cyanide of potassium, as prepared by the U. S. formula, is in white, opaque, amorphous masses, having a sharp, somewhat alkaline, and bitter-almond taste, and an alkaline reaction. If yellow it contains iron. It is deliquescent in moist air, readily soluble in water when reduced to powder, and sparingly soluble in strong alcohol. Its solution effervesces with acids. The salt and its solution, when exposed to the air, exhale the odour of hydrocyanic acid, and become weaker; but the change takes place slowly. Orfila found that the salt, after fourteen days' exposure, by which it was almost entirely liquefied, still possessed energetic poisonous properties. He thinks, therefore, that the bad effects of opening the containing bottle, in dispensing the medicine, have been exaggerated. Unfortunately, the salt varies in quality, independently of the effects of time and exposure. Dr. David Stewart, of Baltimore, examined six samples of this cyanide, on sale, and found them to vary considerably in purity. Besides water, the usual impurities are hydrate, carbonate, cyanate, and formiate of potassium. They sometimes amount to half the weight of the cyanide, consisting principally of the carbonate. From the extensive use at present made of cyanide of potassium in electro-metallurgy and photography, it is of importance to have a reliable test of its purity. Such a test has been discovered by MM. Fordos and Gélis, founded on the fact that two eqs. of iodine rapidly react with one of the cyanide, so as to form a colourless compound, consisting of one eq. of iodide of potassium, and one of iodide of cyanogen: KCy and $2I = KI$ and CyI. Accordingly, a tincture of iodine of known strength is gradually added to an aqueous solution of a given weight of the cyanide to be tested, until it assumes a permanent yellowish tinge; and the amount of iodine expended indicates the proportion of cyanide in the specimen. A necessary preliminary step, before using the tincture, is to add sufficient carbonic acid water to the solution of the cyanide, to convert any hydrate or carbonate of potassium present into bicarbonate, in which state neither has any action on the iodine. (*Chem. Gaz.*, Oct. 15, 1852, p. 387.) This test is applicable to other cyanogen compounds. (See *page* 1002.) Mr. Thornton J. Herapath's test for commercial cyanide of potassium is a standard solution of ammonio-sulphate of copper, the blue colour of which is destroyed by a solution of the cyanide. The copper solution is added to one of the cyanide of known strength, until a faint blue coloration is produced; and the richness of the sample in pure cyanide is in proportion to the quantity of the copper solution required. (*Chemist*, April, 1856, and Feb. 1857.) Applying this test to five samples, Mr. Herapath found the pro-

portion of pure cyanide to vary from 41 to 65 per cent. Cyanide of potassium yields with nitrate of silver a precipitate of cyanide of silver, wholly soluble in ammonia and boiling nitric acid. It consists of one eq. of cyanogen 26, and one of potassium 39·2 = 65·2.

Medical Properties. Cyanide of potassium is pre-eminently poisonous, acting precisely like hydrocyanic acid as a poison and as a medicine. (See *Acidum Hydrocyanicum Dilutum.*) Since the tenth edition of this work was published, three fatal cases of poisoning by this salt have occurred in the United States. The first case, reported by Dr. C. E. Ware, of Boston, was that of a woman who took, by mistake, a teaspoonful of a solution, containing about seven grains of the salt. The second and third cases occurred in Baltimore, and arose from the mistake of an apothecary in putting up cyanide of potassium for chlorate of potassium in a mixture. A dose of the mixture destroyed a child, and, likewise, the apothecary, who, to show his confidence in the correctness with which it had been compounded, swallowed a portion of it himself. Hydrocyanic acid has been detected in the blood of a person who had been fatally poisoned by the cyanide. (Venghauss, *Arch. der Pharm.*, clii. 138.) The grounds on which this cyanide was proposed as a substitute for hydrocyanic acid by Robiquet and Villermé, were its uniformity as a chemical product, and its less liability to undergo decomposition. The dose is the eighth of a grain, dissolved in half a fluidounce of distilled water, to which may be added half a fluidrachm of syrup of lemons, if the prescriber wish to set the hydrocyanic acid free. The spurious cyanide, formed by calcining dried muscular flesh with potash, consists principally of carbonate of potassium, and is but slightly poisonous. (*Orfila.*) A solution of cyanide of potassium, made with from one to four grains to the fluidounce of water, has been recommended in neuralgic and other local pains, applied by means of pieces of linen. Mr. Guthrie found that a solution of from three to six grains to the fluidounce of distilled water, answered admirably, applied by drops every other day, for removing the olive-coloured stains of the conjunctiva caused by nitrate of silver. B.

POTASSII ET SODII TARTRAS. *U. S.* Soda Tartarata. *Br.* Sodæ et Potassæ Tartras. *Br.* 1864, *U. S.* 1850. Sodæ Potassio-tartras. *Lond. Tartrate of Potassium and Sodium. Tartrate of Soda and Potassa. Tartarated Soda. Rochelle Salt.*

"Take of Carbonate of Sodium *twelve troyounces;* Bitartrate of Potassium, in fine powder, *sixteen troyounces;* Boiling Water *five pints.* Dissolve the Carbonate of Sodium in the Water, and gradually add the Bitartrate of Potassium. Filter the solution, and evaporate until a pellicle begins to form; then set it aside to crystallize. Pour off the mother-water, and dry the crystals on bibulous paper. Lastly, evaporate the mother-water, that it may furnish more crystals." *U. S.*

"Take of Acid Tartrate of Potash, in powder, *sixteen ounces* [avoirdupois], or *a sufficiency;* Carbonate of Soda *twelve ounces* [avoird.], or *a sufficiency;* Boiling Distilled Water *four pints* [Imperial measure]. Dissolve the Carbonate of Soda in the Water, add gradually the Acid Tartrate of Potash, and, if after being boiled for a few minutes the liquid has an acid or alkaline reaction, add a little Carbonate of Soda or Acid Tartrate of Potash till a neutral solution is obtained. Boil and filter; concentrate the liquor till a pellicle forms on the surface, and set it aside to crystallise. More crystals may be obtained by again evaporating as before." *Br.*

This is a double salt, consisting of tartrate of potassium combined with tartrate of sodium; or if the bibasic view of tartaric acid is accepted, a tartrate of potassium and sodium, as its name imports, consisting of one eq. of tartaric acid with one of each of the alkalies. The theory of its formation is very simple, being merely the saturation of the excess of acid in the bitartrate of potassium by the sodium of the carbonate of sodium, the carbonic acid of which escapes with effervescence. The quantities of the materials for mutual saturation are 143·3 parts of carbonate and 188·2 of bitartrate, or one eq. of each. This gives the ratio of 3 to 3·95. The proportion adopted in the U. S. and Br. Pharmacopœias is as 3 to 4, which is very near the theoretical quantities. As the salts employed are apt to vary in composition and purity, the carbonate from the presence of more or less water of crystallization,

and the bitartrate from containing tartrate of calcium, it is, perhaps, best in all cases, after indicating the nearest average proportion as a general guide, to present to the operator the alternative of using the cream of tartar to the point of exact saturation.

Properties. Tartrate of potassium and sodium is in the form of colourless, transparent, slightly efflorescent crystals, often very large, and having the shape, when carefully prepared, of right prisms, with ten or twelve unequal sides. As ordinarily crystallized, they are generally in half prisms, as if split in the direction of their axis. The salt has a saline and slightly bitter taste. It dissolves in 2·5 parts of cold water, and in much less boiling water. Any undissolved residue is impurity, probably tartrate of calcium or bitartrate of potassium, or both. Its solution is neutral to test paper, and yields no precipitate with chloride of barium, or a dilute solution of nitrate of silver. The non-action of these tests shows the absence of sulphates and chlorides. As it is sometimes largely adulterated with sulphate of sodium (F. Mahla, *Am. Journ. of Pharm.*, Nov. 1868, p. 548), the former test may be important. When the salt is exposed to a strong heat, it blackens, and gives out inflammable gases with the odour of burnt sugar; the tartaric acid being destroyed, and a mixture of the carbonates of potassium and sodium left. It sometimes contains tartrate of calcium, which may be removed by solution and crystallization; but when the crystals are large and well defined, it may be assumed to be pure. It is incompatible with most acids, and with all acidulous salts except bitartrate of potassium. It is also decomposed by the acetate and subacetate of lead, by the soluble salts of calcium, and by those of barium, unless the solution of the tartrate be considerably diluted. The way in which acids act in decomposing it, is by combining with the sodium, and throwing down bitartrate of potassium as a crystalline precipitate. This double salt was discovered by Seignette, an apothecary of Rochelle, and hence is frequently called *Seignette's salt*, or *Rochelle salt.*

Composition. Tartrate of potassium and sodium consists of two eqs. of tartaric acid 132, one of potassa 47·2, one of soda 31·3, and eight of water 72 = 282·5; or, considered as a double salt, of one eq. of tartrate of potassium 113·2, and one of tartrate of sodium 97·3, with the same quantity of water. If tartaric acid is bibasic, it must be considered as consisting, the eight eqs. of water being left out of the question, of one eq. of each of its other three constituents, the equivalent of the acid being doubled. "One hundred and forty-one grains of it, heated to redness till gases cease to be evolved, leave an alkaline residue which requires for neutralisation 1000 grain-measures of the *volumetric solution of oxalic acid.*" *Br.*

Medical Properties and Uses. This salt is a mild, cooling purgative, well suited to delicate and irritable stomachs, being among the least unpalatable of the neutral salts. As it is not incompatible with tartar emetic, it may be associated with that salt in solution. It is an ingredient in the effervescing aperient called Seidlitz powders. (See *Pulveres Effervescentes Aperientes.*) The dose as a purge is from half an ounce to an ounce. Given in small and repeated doses it does not purge, but is absorbed and renders the urine alkaline. (Millon and Laveran, *Journ. de Pharm.*, 3e sér., vi. 222.)

Tartrate of potassium and magnesium, formed by saturating cream of tartar with carbonate of magnesium, has been proposed by M. Maillier as a safe and pleasant purgative. (*Journ. de Pharm.*, xiii. 252.)

Off. Prep. Pulveres Effervescentes Aperientes, *U. S.* B.

POTASSII IODIDUM. *U. S., Br. Iodide of Potassium.*

"Take of Potassa *six troyounces;* Iodine, in fine powder, *sixteen troyounces*, or *a sufficient quantity;* Charcoal, in fine powder, *two troyounces;* Distilled Water *a sufficient quantity.* To the Potassa, dissolved in three pints of Distilled Water, boiling hot, gradually add the Iodine, stirring after each addition until the solution becomes colourless, and continue the additions until the liquid remains slightly coloured from excess of Iodine. Evaporate the solution to dryness, stirring in the charcoal towards the close of the operation, so that it may be intimately mixed with the dried salt. Rub this to powder, and heat it to dull redness in an iron crucible, maintaining that temperature for fifteen minutes; then, after it has cooled, dissolve the saline matter with Distilled Water, filter the solution, evaporate, and set it aside to crystallize. An

additional quantity of crystals may be obtained from the mother-water by evaporating and crystallizing as before." *U. S.*

"Take of Solution of Potash *one gallon* [Imperial measure];* Iodine *twenty-nine ounces* [avoirdupois], or *a sufficiency;* Wood Charcoal, in fine powder, *three ounces* [avoird.]. Put the Solution of Potash into a glass or porcelain vessel, and add the Iodine in small quantities at a time with constant agitation, until the solution acquires a permanent brown tint. Evaporate the whole to dryness in a porcelain dish, pulverise the residue, and mix this intimately with the Charcoal. Throw the mixture, in small quantities at a time, into a red-hot iron crucible, and, when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled, dissolve it in two pints [Imp. meas.] of boiling distilled water, filter through paper, wash the filter with a little boiling distilled water, unite the liquids, and evaporate the whole till a film forms on the surface. Set it aside to cool and crystallise. Drain the crystals, and dry them quickly with a gentle heat. More crystals may be obtained by evaporating the mother-liquor and cooling. The salt should be kept in a stoppered bottle." *Br.*

In these processes, which are essentially the same, an aqueous solution of potassa is treated with iodine in slight excess. The result of thus saturating potassa with iodine is the formation of two salts, iodide and iodate of potassium. Six eqs. of iodine react with six of potassa, and there are formed five eqs. of iodide of potassium, and one of iodate of potassium ($6KO$ and $6I = 5KI$ and KO,IO_5). By evaporating the solution to dryness the mixed salts are obtained; and, if the dry mass be exposed to a red heat, the iodate will be converted into iodide of potassium, thus removing this impurity from the iodide. In the formula the mixed salts, towards the close of their evaporation to dryness, are directed to be mixed with powdered charcoal, according to the plan of Mr. Scanlan, which facilitates the deoxidation of the iodate. This being accomplished by a dull red heat, the iodide of potassium is dissolved out of the mass, and the solution is set aside to crystallize.

In the late Ed. and Dub. processes the first step was to form iodide of iron in solution, precisely as is done in the formula for that compound; and the second to decompose it by carbonate of potassium, which gave rise to iodide of potassium in solution, and a precipitate of carbonate of protoxide of iron. The solution of iodide of potassium was separated by filtration and washing from the precipitated carbonate, and evaporated to dryness. The dry salt was then freed from iron and other impurities by solution in boiling water or alcohol, filtration, and crystallization. Messrs. T. and H. Smith, of Edinburgh, instead of washing the precipitate, prefer the plan of pressing it strongly in a cloth, in order to extract the remains of the solution. The mass left is broken up in a portion of distilled water equal to about two-thirds of the weight of the iodine employed, and pressed a second time. Proceeding thus, less water is used, and less evaporation is necessary. The solution obtained by them is evaporated to dryness, and the dry salt is carefully fused in an iron pot, in order to free it from colour. It is then dissolved, and the solution, by filtration, concentration, and cooling, furnishes a perfectly pure iodide nearly to the last.†

* For formulas by Prof. Meyer, of New York, for the preparation of the iodides and bromides, based on the reaction between iodine or bromine on the one hand, and iron and bicarbonate of potassium or the carbonate of sodium, lithium, or calcium, according to the particular iodide wanted, on the other, see the *Am. Journ. of Pharm.* (July, 1862, p. 292). Another process of Liebig, as detailed by Mr. Squire, will be found in the same journal for Sept. 1862 (p. 437). To 1 part of phosphorus covered with 40 parts of water, 20 parts of iodine are gradually added; the solution of phosphoric and hydriodic acids thus obtained is poured off, and milk of lime added in slight excess; the whole is placed upon a filter, and the precipitate, consisting of phosphate of calcium, is pressed and washed; the filtrate, containing only iodide of calcium, is boiled down, with 12 parts of powdered sulphate of potassium, to about one-half; the whole, after standing six hours, is filtered, and the precipitate pressed as before; a little pure carbonate of potassium is added to the filtrate to remove every trace of lime; and the filtered solution, containing only iodide of potassium, yields that salt in crystals by concentration. By slight modifications of the process, the iodides of sodium, lithium, and various other metals may be obtained. (*Note to the twelfth edition.*)

† According to the method of E. Sonstadt, iodide of potassium is prepared directly from the mother-liquors of kelp by converting the alkaline iodides into iodates by means of chlorine or permanganate of potassium, precipitating the iodic acid by a soluble barium salt, heating the precipitate with solution of sulphate of potassium; drying up and melting the resulting iodate of

Properties, &c. Iodide of potassium, sometimes incorrectly called *hydriodate of potassa*, is in opaque, white or transparent crystals, permanent in a dry air, slightly deliquescent in a moist one, and having a sharp saline taste. It does not change the colour of litmus, and has little or no effect on turmeric.* According to the Messrs Smith, of Edinburgh, it is not at all deliquescent when perfectly pure. It generally crystallizes in cubes. It is soluble in about two-thirds of its weight of cold water, and in from six to eight parts of rectified spirit. If solution of iodide of potassium be mixed with solution of starch, and a minute quantity of solution of chlorine be added, a blue colour will be produced; the chlorine combining with the potassium and thus liberating the iodine which forms a blue compound with starch. Its solution is decomposed by the addition of a few drops of sulphuric acid, hydriodic acid being generated, which speedily undergoes decomposition, with evolution of iodine; and, if starch be added after the lapse of a few minutes, a blue colour is produced. The starch test will not give the characteristic blue colour immediately, if added simultaneously with the acid, unless the iodide of potassium contains iodate of potassium, which impurity causes an immediate liberation of iodine. The blue colour being produced by the starch and acid, if simultaneously added, is, therefore, a sign of impurity. A very delicate test for iodide of potassium, and other soluble iodides, is that of M. Grange. It consists in pouring a little of the liquid to be examined into a test tube, adding a few drops of solution of starch, and passing through the mixture a few bubbles of fuming nitrous acid. The liquid immediately assumes a pale-rose colour, inclining to violet, if containing 1-200,000th of its weight of the iodide, and a bright-blue colour, if 1-100,000th is present. (See *page* 502.) "When tartaric acid is freely added to a strong solution of the iodide, it occasions a white crystalline precipitate; and the supernatant liquid, if mixed with starch, becomes first purple, and finally blue. Bichloride of platinum colours its solution reddish-brown, without causing a precipitate; chloride of barium but slightly affects it; and sulphate of iron occasions no change." (*U. S.*) The non-action of the last test shows the absence of carbonate of potassium. The aqueous solution is capable of taking up a large quantity of iodine, forming a liquid of a deep-brown colour.

M. Payen has noticed a curious effect produced by iodide of potassium. In saturated solution, this salt causes in starch added to it an enlargement of its granules to twenty-five or thirty times their original volume, dissolving the interior substance of the granules, and enormously distending the exterior layer. The bromide of potassium produces the same effect; but the alkaline chlorides neither cause the enlargement referred to, nor a solution of the amylaceous substance; and if the saturated solution of the iodide be diluted with three and a half volumes of water or more, it is inert in reference to starch in the cold. (*Journ. de Pharm.*, 4e sér., ii. 373.) M. Feriéres found that ether added to a solution of iodide of potassium decomposes it, but it has been shown by the researches of M. de Vry and of M. Magnes-Lahens, that this does not happen with pure ether, but is due to the acetic acid which is developed by sunlight in ether. (*Journ. de Pharm.*, 4e sér., xvi. 107, 468; xvii. 116.)

Exposed to a dull red heat iodide of potassium fuses, and on cooling concretes into a crystalline pearly mass, without loss of weight; but at a full red heat it is slowly volatilized without decomposition. The most usual impurities contained in this salt are the chlorides of potassium and sodium, bromide of potassium, and carbonate and iodate of potassa. According to M. Payen, the iodide of potassium of commerce generally contains carbonate of potassa and iodine in excess. (*Journ. de Pharm.*, 4e sér., ii. 373.) He states, however, that it may be easily purified by saturating the potassa with hydriodic acid, and then eliminating the excess of iodine by sulphuretted hydrogen, boiling, rest, and filtration. (*Ibid.*, p. 368.) The presence of a chloride may be determined by nitrate of silver. This test will throw down nothing from the pure

potassium solution, and crystallizing its solution from the iodide of potassium thus obtained. (*Chem. News*, xxvi. 182.)—*Note to the fourteenth edition.*

* It is stated, however, that commercial iodide usually has an alkaline reaction. When neutral iodide is wanted, Mr. T. B. Groves prepares it by neutralizing the solution with dilute sulphuric acid, adding some spirit to aid in the precipitation of the sulphate, pouring off and evaporating the clear liquid. The crystals, it is said, rapidly turn yellow if not excluded from the air. (*Pharm Journ. and Trans.*, Feb. 1874, p. 669.)—*Note to the fourteenth edition.*

salt but iodide of silver, which is scarcely soluble in ammonia; while chloride of silver is readily soluble in it. If then a solution of the iodide be precipitated by an excess of nitrate of silver, and agitated with ammonia, the latter will dissolve any chloride which may have been thrown down, and will yield it again as a white precipitate on being saturated with nitric acid. If, on the other hand, the iodide of potassium be pure, the ammonia will take up only a minute quantity of iodide of silver, and the addition of nitric acid will scarcely disturb the transparency of the solution. The iodide of silver precipitated from 10 grains of iodide of potassium weighs, when washed and dried, 14·1 grains. When acetate of lead is added to a solution of iodide of potassium, a yellow precipitate of iodide of lead is thrown down, soluble in boiling water. The low price of bromide of potassium, compared with that of the iodide, has caused the former to be used to adulterate the latter. When bromide of potassium is sold for the iodide, the fraud may be detected by the fact that the addition of sulphuric acid produces copious reddish fumes, instead of the purple ones, arising from the iodide. Mr. Edm. Van Melckebeke proposes taking advantage of the fact that a saturated solution of one salt will still dissolve another salt. He prepares a saturated solution of the bromide in boiling water, allows it to cool and crystallize, and then filters. To 10 cubic centimetres of this 10 drops of distilled water are added in a test tube, and then one grain of the suspected iodide in coarse powder. If the iodide be pure it dissolves almost instantly, but any bromide which may be present remains unaffected. (*Am. Journ. of Pharm.*, xliv. 248.) Alfred E. Tanner affirms that he has found this test useless. (*Pharm. Journ. and Trans.*, June, 1873, p. 1033.) M. Lepage determines the amount of the bromide as follows. Dissolve one gramme of the corrosive sublimate in twenty cubic centimetres of water; also one gramme of the suspected iodide in thirty grammes of pure water. Add by means of a burette the former fluid to the latter until it just ceases to cause a turbidity. If the iodide is pure, at least 16 c.c. of the mercurial solution are required; if impure, the remaining solution will exceed the volume of 4 c.c. in proportion as the iodide has been replaced by bromide of potassium. For this test it is necessary that the iodide be free from chloride, carbonate, and iodate. (*Am. Journ. of Pharm.*, xliv. 167.) In order to detect bromine, M. Personne first precipitates from an aqueous solution of the suspected iodide, the whole of the iodine as protiodide of copper, by successively adding, in excess, a solution of sulphate of copper, and aqueous sulphurous acid; and then treats the filtered liquid with ether and chlorine water, the whole being shaken together and left at rest. If bromine be present, the ether which rises to the surface will be tinged of a reddish-yellow colour. Fresenius's test of chloride of gold is, according to Dr. J. H. Bill, of the U. S. Army, very delicate. The iodine having been separated by palladium, and the excess of palladium by sulphuretted hydrogen, the solution supposed to contain bromine, if treated first with a drop of muriatic acid, and then with a drop of solution of chloride of gold, will, if bromine be present, exhibit a decided yellowness, which will appear more obviously if the solution be compared with pure water or a weak solution of a chloride. (See *Am. Journ. of Pharm.*, May, 1868, p. 272.). Carbonate of potassium may be discovered by lime-water, which causes a milkiness (carbonate of calcium), and by tincture of iodine, the colour of which is destroyed. The Br. Pharmacopœia admits a slight degree of this impurity, directing that saccharated solution of lime should only faintly precipitate the solution. The iodate may be detected by adding a solution of tartaric acid to a solution of the suspected iodide. Bitartrate of potassium will be precipitated, and, if the iodide be pure, a yellow colour is *soon* developed by the action of the air on the liberated hydriodic acid; but, if any iodate be present, the test will give rise to both iodic and hydriodic acids, which, by their mutual action, will *instantly* develop iodine.

Mr. William Copney has pointed out an excellent test for detecting carbonate and iodate of potassium, in the use of protiodide of iron, in the form of syrup of iodide of iron, recently prepared. (See *Syrupus Ferri Iodidi.*) A drop of the syrup is added to a solution of the suspected iodide of potassium. A bluish precipitate indicates the carbonate; a red one, the iodate; and a blue precipitate, followed by a red one, both impurities. Carbonate of potassium is generally present in the proportion of

from 1 to 10 per cent. Dr. Christison has detected 74½ per cent., and Dr. Pereira as high as 77 per cent. An adulteration by the carbonate under 10 per cent. does not alter the crystalline appearance of the iodide, but gives it an increased tendency to deliquesce. When it is greater it renders the salt granular and highly deliquescent. As iodide of potassium is soluble in rectified spirit, anything left undissolved by that menstruum is impurity. The amount of impurity in this salt, without ascertaining its nature, may be determined by the method of Marozeau, which consists in adding a solution of corrosive sublimate to one of the iodide to be examined, the salts being taken in the proportion of four eqs. of the iodide to one of the bichloride. If the iodide be pure, its excess will be just competent to redissolve all the red iodide of mercury formed by the addition of the corrosive sublimate solution. If impure, a reddish colour from undissolved red iodide will appear before the whole of the latter solution is added. Accordingly, if a solution of one eq. of corrosive sublimate be gradually added to a solution of four eqs. of the iodide, until the reddish colour ceases to disappear upon stirring, the proportion expended will represent the pure iodide, and that unexpended, the impurity in the specimen examined. (See a paper of Mr. J. M. Maisch, in the *Am. Journ. of Pharm.*, xxvi. 293.) A seemingly better method is that of M. Personne, founded upon the fact that when bichloride of mercury is added to a solution of the iodide in just sufficient amount to form the iodo-hydrargyrate the solution remains clear; but on the further addition of the minutest quantity of the bichloride a persistent reddish or rose-coloured precipitate is formed. He prepares the titrating solution by dissolving 13·55 grammes of the bichloride and 8 to 10 grammes of common salt in 200 to 250 grammes of distilled water, and then adding sufficient distilled water to make the whole measure one litre; 10 cubic centimetres of this equal 0·1355 of the bichloride. Of the iodide to be tested 3·32 grammes are dissolved in sufficient water to make exactly 100 cubic centimetres. The titration is performed by putting 10 cubic centimetres of this in a beaker glass, and adding from a burette, drop by drop, the mercurial liquid, keeping the beaker in a constant agitation by means of the gyratory movement with the hand. When the red colour appears the trituration is complete. If the iodide be pure 10 cubic centimetres of the mercurial solution will have been used; if only 8 c.c. have been used, it is known that the iodide only contains 80 per cent. of the pure salt; 9 c.c. indicate 90 per cent.; 7 c.c., 70 per cent., and so on. The presence of bromide, chloride, or carbonate of potassium is said not to interfere with this test. (*Journ. de Pharm.*, Janv. 1875, p. 5.) Iodide of potassium consists of one eq. of iodine 126·3, and one of potassium 39·2 = 165·5. It contains no water of crystallization.

According to M. Payen, a saturated solution of iodide of potassium, which will evince signs of decomposition by becoming orange-yellow, in the presence of atmospheric air, on the addition of small quantities of acetic, nitric, oxalic, and probably many other acids, remains unaffected by these additions if atmospheric air be excluded. The air oxidizes a portion of the potassium, which then unites with the acid, and the iodine liberated gives colour to the solution. (*Journ. de Pharm.*, 4e sér., iii. 200.) As first pointed out by M. Loew (*Am. Journ. of Pharm.*, xlii. 80), and confirmed by M. Vidau in an elaborate series of experiments, iodine is liberated from a solution of iodide of potassium by direct sunlight; the more concentrated the solution the more energetic is the action. (*Journ. de Pharm.*, 4e sér., xx. 351.)

Prof. Procter has given a paper on the incompatibles of iodide of potassium in relation to the mercurial preparations. He finds it incompatible with calomel, the black and red oxides of mercury, turpeth mineral, white precipitate, blue mass, and metallic mercury. These experiments serve to confirm the observation of M. Melsens, that iodide of potassium, given in connection with the insoluble preparations of mercury, renders them soluble and much more active. (See *Am. Journ. of Pharm.*, xxvi. 222.) With nitrous ether iodide of potassium reacts, yielding, among other products, hydriodic ether and a little ordinary ether. (Juncadella, *Comptes Rendus*, Fév. 1859, p. 345.) At ordinary temperatures iodide of potassium is slowly decomposed, with evolution of iodine, by nitrate of ammonium and boracic acid; and at high temperatures, in a glass test tube, with escape of violet vapours, not only by

the two substances just named, but also by sulphate, oxalate, carbonate, and muriate of ammonium, sulphate, phosphate, nitrate, and borate of sodium, sulphates of potassium and magnesium, nitrate of calcium, chlorides of sodium, potassium, and calcium, and silicic acid. (Ubaldini, *Journ. de Pharm.*, Oct. 1859, p. 292.) To M. Melsens we are indebted for another important fact in relation to the operation of iodide of potassium. When this salt and chlorate of potassium are mixed in solution, no change takes place at ordinary temperatures; but if a certain amount of a mineral acid be added to the solution of the mixed salts, a reaction occurs, attended with the escape of iodine; and evidences are presented of the existence of iodic acid in the solution. Now, M. Melsens has ascertained by experiments on dogs that neither of these salts, if given separately and at different times, produces any evil effect; while, if given together, so as to be in the system at the same time, they act as a poison, and may cause death in a few days. Seven grammes (108 grains) of a mixture of iodide of potassium and chlorate of potassium in equivalent proportions, given daily to a dog of medium size, uniformly proved fatal in less than a month, and often as early as the fifth day. M. Melsens ascribed the result to the production of iodate of potassium, which he has shown to be a poisonous salt. (*Am. Journ. of Pharm.*, Nov. 1866, p. 521; from *Bullet. de la Soc. Chem. de Paris.*) With the alkaloids iodide of potassium is incompatible, and fatal results have been caused by the iodide of strychnia crystallizing out of a prescription, so that the whole of it was taken at a single dose. (See *Am. Journ. of Pharm.*, xliii. p. 51.)

Medical Properties, &c. The general therapeutic properties of the preparations of iodine, of which iodide of potassium is the most important, have been given under the head of iodine. By most practitioners the preparation under notice is preferred for producing the constitutional effects of iodine. It certainly produces very marked effects on the secretions, which it uniformly increases, and into which it readily passes. It has a tendency to irritate the mucous membrane of the air-passages, as shown by its sometimes occasioning an affection like cold in the head. When long continued in large doses, it occasionally produces a tender, enlarged, lobulated, and fissured tongue, constituting a true chronic glossitis. Mr. Langston Parker, of England, has reported several cases of this kind, in which the iodide had been taken for years. Its obvious effects on the system are very variable, arising probably either from peculiarities of constitution, or from the unequal quality of the medicine itself. Thus it produces nausea, pain in the stomach, and diarrhœa, in moderate doses, in some cases; and is borne in large doses without inconvenience in others. It generally increases the appetite and flesh. The general character of its action is to remove abnormal tissue, eliminating the material for the most part by the channel of the kidneys. There are few diseases in which it has not been tried. Its use in scrofulous affections, combined with iodine, has been explained under the head of iodine. It has been recommended by M. Oke in chorea, after the preparations of iron have failed; by M. Gendrin, Dr. Clendenning, and Mr. Spencer Wells in gout; by M. Arrigan in albuminuria; by Mr. Sankey in ague, given in large doses; and by MM. Demarquay and Gustin in stomatitis. The later writers think it more efficacious in this disease than chlorate of potassium. In subacute and chronic rheumatism it is one of our best remedies.

Dr. Williams, of London, considers it applicable to the treatment of various forms of secondary syphilis. He used it with success, in a majority of cases, in removing hard periosteal nodes, and found it beneficial in the treatment of tubercular forms of venereal eruptions. It is also considered as one of the best alterative remedies in mercurio-syphilitic sorethroat. Ricord bears testimony to its valuable powers in the treatment of secondary syphilis. Dr. Hanfield Jones found it particularly efficacious in that form of rheumatism characterized by wandering pains in the bones, and numerous other observers bear testimony to its being the remedy in most cases of advanced syphilis. It is of very great service in all forms of specific nervous disorders, but must be given in very large doses. Indeed, in all forms of advanced syphilis the tolerance of the drug is extraordinary, patients often taking half a drachm three times a day without the indication of any constitutional symptoms. According to the clinical observations of Dr. W. R. Basham, iodide of potassium is well suited to

the treatment of chronic periosteal rheumatism in subjects who have previously taken mercury to salivation; while it is not applicable to the disease when occurring in patients who have not undergone a mercurial course, but have suffered from syphilis, which has been neglected, or treated only locally. In the latter cases he conceives that corrosive sublimate and sarsaparilla are the proper remedies. It is probably useful in the former cases on the principle of eliminating mercury from the system, agreeably to the views of M. Melsens given below. In 1843 MM. Guillot and Melsens gave iodide of potassium with advantage, in doses of from a drachm to a drachm and a half daily, in mercurial tremors and lead poisoning. In a memoir published in 1849, M. Melsens gives a full account of his experiments with it as a remedy for the affections caused by mercury and lead. He effected a number of cures of mercurial tremors and lead palsy; and, during the progress of the cure, these metals were found in the urine. The manner in which the remedy acts, according to M. Melsens, is by rendering the poisonous metal, which has become fixed in the tissues, soluble, first converting it into an iodide, and then dissolving the iodide formed. This view is supported by the fact that all the compounds of mercury and lead are soluble in iodide of potassium.*

The views and results of M. Melsens have been confirmed by therapeutic trials in lead poisoning by M. Malherbe, of Nantes, and by Drs. Parke and Sieveking, of London. An important fact observed by M. Melsens was that iodide of potassium, given at the same time with certain compounds of mercury, rendered them more active; and, when given after them, developed an activity not previously manifested, and sometimes to such an extent as to occasion serious accidents. This fact he explained by referring it to the power of the iodide to render the mercurial compounds soluble, in which state only are they capable of being eliminated with the urine. During the use of iodide of potassium, ptyalism sometimes occurs. This has been usually considered as a primary effect of the remedy; but the light shed on the subject by M. Melsens leads to the belief, that it may be a secondary effect, resulting from the liberation from the tissues of mercury previously taken, which is thereby enabled, by becoming soluble, to produce its constitutional effects. Dr. Budd relates several cases, in which mercurial ptyalism came on, during the use of iodide of potassium, in persons who had not taken mercury for weeks or months before. It is probable that, in these cases, the mercury had been long lying fixed in the system, and was rendered soluble and active by the iodide. Mr. John Day thinks that the action of the iodide is much intensified by exhibiting, half an hour after the ingestion of each dose, half a drachm to a drachm of ethereal solution of peroxide of hydrogen. He believes that this leads to the liberation of the iodine in the blood. (*Med. Times and Gaz.*, May, 1871, p. 569.) Sir James Paget believes that the association of the carbonate of ammonium with the iodide increases its efficiency. (*Med. and Surg. Reporter*, Aug. 22, 1874.)

Dr. G. W. Balfour, of Edinburgh, has published several cases of aneurism of the aorta, in which iodide of potassium was given in the dose of thirty grains twice or thrice daily, with apparently great advantage; the symptoms of the disease having not only been greatly relieved, but in some instances having entirely disappeared. (*Edin. Med. Journ.*, July, 1868, p. 33; also April, 1871, p. 935.)

The late Dr. Isaac Parrish, of this city, employed iodide of potassium successfully in strumous inflammation of the eye, given in the compound syrup of sarsaparilla. It appeared promptly to relieve the severe neuralgic, circumorbital pain. Dr. Griscom, also of this city, cured a case of supposed membranous croup in a child by the use of this remedy, after leeches, sinapisms, warm baths, and emetics had failed. (*Trans. of the Coll. of Phys. of Philad.*, N. S., ii. 164.) Dr. De Renzy, of Carnew, Ireland, found it efficacious in hæmoptysis. Dr. G. L. Upshur, of Virginia, recommends its use in the suppurative stage of pneumonia.

Iodide of potassium has been used internally by Dr. A. Beaufort, with much supposed advantage in reference to its local effects. Being largely secreted with the

* See the Memoir of M. Melsens, translated by Dr. Budd, of Bristol, England, in the *Brit. and For. Medico-chir. Review*, Am. ed., for Jan. 1853, p. 157; also a paper by Dr. J. W. Corson, in the *N. Y. Journ. of Med.* for Sept. 1853.

tears, and to a certain extent with the uterine fluids, he gives it with a view to its effects on the passages with which it thus comes in contact. In this way he explains the very good effects he has experienced from it in chronic inflammation of the lachrymal passages, and in chronic metritis with copious leucorrhœa. (*B. & F. Med.-chir. Rev.*, Oct. 1868, p. 517; from *Bullet. Gén. de Thérap.*, Jan. 3, 1868.)

The dose of iodide of potassium is from two to ten grains or more, three times a day, given in dilute solution. Ricord rarely exceeded three scruples a day. Some practitioners have employed enormous doses, such as two, four, and even six drachms daily, without inconvenience. Dr. Buchanan, of Glasgow, assures us that he has given the pure salt in doses of half an ounce, without any precaution being observed by the patient, except to drink freely of diluents. Notwithstanding this testimony, Dr. Lawrie, of the same city, reports several cases of dryness and irritation of the throat, ending in severe spasmodic croup, and one case of death following the sudden occurrence of dyspnœa, caused by the use of this iodide, when given in small doses. According to Dr. Gull, of London, the efficiency of the remedy is much increased by uniting it with carbonate of ammonium, in the proportion of two or three grains of the iodide to four or five of the carbonate.

Iodide of potassium passes quickly into the urine, in which it may be detected by first adding to the cold secretion a portion of starch, and then a few drops of nitric acid, when a blue colour will be produced. It has been detected in six minutes after having been swallowed. According to Schottin it passes slowly into the sweat. Taken in half-drachm doses daily, it did not appear in that secretion until five days had elapsed.

According to Ricord, this salt produces in some constitutions peculiar effects; such as eruptions of the skin, excessive diuresis, vascular injection of the conjunctiva and tumefaction of the eyelids, cerebral excitement like that produced by alcoholic drinks, and discharges from the urethra and vagina, resembling blennorrhœa. Eruptions of the skin were also observed by Dr. A. Van Buren, as a very common effect of large and long-continued doses of iodide of potassium, given to patients in the Bellevue Hospital, N. Y. Dr. John O'Rielly, of New York, reports several cases, in which, after the use of this iodide, spots like purpura were produced, invading first the face, and then the trunk and extremities. These became bullæ, sometimes an inch in diameter, filled with a purple liquid, and finally sphacelated spots ending in ulcers. Great constitutional disturbance coexisted, with swollen tongue, fetor, and salivation. The remedies found successful were nutritious diet, tonics, and stimulants. From the facts above mentioned, showing the power of iodide of potassium to render active mercury that is latent in the system, it is not improbable that the cases of Dr. O'Rielly were mercurial salivation, modified by a cachectic condition of the system, which caused the coincident eruption. Dr. Bumstead has reported similar cases. (*Amer. Journ. Med. Sci.*, lxii. 101.)

Iodide of potassium is employed as an external application in the form of ointment, either alone or mixed with iodine. (See *Unguentum Potassii Iodidi* and *Unguentum Iodinii Compositum*.)

Off. Prep. Ammonii Iodidum, *U. S.*; Hydrargyri Iodidum Rubrum; Linimentum Iodi, *Br.*; Linimentum Potassii Iodidi cum Sapone, *Br.*; Liquor Iodi, *Br.*; Liquor Iodinii Compositus, *U. S.*; Plumbi Iodidum, *U. S.*; Tinctura Iodi, *Br.*; Tinctura Iodinii Composita, *U. S.*; Unguentum Iodi, *Br.*; Unguent. Iodinii, *U. S.*; Unguent. Iodinii Compositum, *U. S.*; Unguent. Potassii Iodidi. B.

POTASSII SULPHURETUM. *U. S.* POTASSA SULPHURATA. *Br.* HEPAR SULPHURIS. *Dub.* *Sulphuret of Potassium. Sulphurated Potash. Liver of Sulphur.*

"Take of Sublimed Sulphur *a troyounce;* Carbonate of Potassium *two troyounces.* Rub the Carbonate, previously dried, with the Sulphur, and heat the mixture gradually in a covered crucible until it ceases to swell, and is completely melted. Then pour out the liquid on a marble slab, and when the mass is cold, break it into pieces, and keep these in a well-stopped bottle of green glass." *U. S.*

"Take of Carbonate of Potash, in powder, *ten ounces;* Sublimed Sulphur *five ounces.* Mix the Carbonate of Potash and the Sulphur in a warm mortar, and, hav-

ing introduced them into a Cornish or Hessian crucible, let this be heated, first gradually, until effervescence has ceased, and finally to dull redness, so as to produce perfect fusion. Let the liquid contents of the crucible be then poured out on a clean flagstone, and covered quickly with an inverted porcelain basin, so as to exclude the air as completely as possible while solidification is taking place. The solid product thus obtained should, when cold, be broken into fragments, and immediately enclosed in a green-glass bottle, furnished with an air-tight stopper." *Br.*

These processes are essentially the same, except that a greater heat is used in the Br. process, which somewhat modifies the result. When carbonate of potassium is melted with half its weight of sulphur, as in the U. S. process, the carbonic acid is expelled. The explanation heretofore given is as follows. Four eqs. of potassa and ten of sulphur may be supposed to react on each other. Three eqs. of potassa are decomposed into three eqs. of potassium and three of oxygen. The three eqs. of potassium unite with nine eqs. of sulphur to form three eqs. of tersulphuret of potassium. The three eqs. of oxygen, by uniting with the remaining eq. of sulphur, form one eq. of sulphuric acid, which combines with the undecomposed eq. of potassa to form sulphate of potassium. Thus the preparation may be considered to be a mixture of tersulphuret of potassium with sulphate of potassium; and the French Codex sulphuret, made from the same proportion of carbonate and sulphur, is stated in that work to have the same composition. The fact is, however, that the composition varies with the heat employed. If the heat do not exceed 365° F., the resulting preparation will contain hyposulphite of potassium; if above 572° F., sulphate of potassium. (*Fordos and Gélis.*) The U. S. preparation, therefore, which is made at the temperature of fusion, probably contains hyposulphite of potassium, and may be represented by the formula $2KS_3+KO,S_2O_2$; three eqs. of CO_2 escaping: while the British, being prepared at a red heat, contains sulphate of potassium, with the formula $3KS_3+KO,SO_3$; four eqs. of CO_2 escaping.

The Pharmacopœias use the carbonate of potassium from pearlash; but in the process of M. Henry, which is stated to be the best yet devised, the pure carbonate of potassium is employed. His formula is as follows. Mix two parts of real salt of tartar with one of roll sulphur reduced to powder, and put the mixture into flat-bottomed matrasses, which should be only two-thirds filled. These are placed on a sand-bath, and the fire is applied so as, at first, to produce only a gentle heat, which is afterwards increased. Care must be taken that the necks of the matrasses do not become obstructed. The heat is continued, until the matter is brought to the state of tranquil fusion, when it is allowed to cool. The mass obtained, which is compact, smooth, and of a fine yellow colour, is broken into pieces, and preserved in well-stopped bottles.

Properties, &c. Sulphuret of potassium, when properly prepared, is a hard, brittle substance, having a nauseous, alkaline, and bitter taste. Its colour is liver-brown, and hence its name of *hepar sulphuris* or *liver of sulphur*. The colour of the surface of a fresh fracture is brownish-yellow. It is inodorous when dry, but emits a slightly fetid smell when moist, owing to the extrication of a little sulphuretted hydrogen gas. It is soluble in water, forming an orange-yellow liquid, and exhaling the smell of sulphuretted hydrogen. By exposure to the air it attracts oxygen, and the sulphuret of potassium is gradually changed into sulphate of potassium, when the preparation becomes inodorous, and white on the surface. The solution is decomposed by the mineral acids, which extricate sulphuretted hydrogen, and precipitate the excess of sulphur. It is also incompatible with solutions of most of the metals, which are precipitated as sulphurets. When boiled with an excess of muriatic acid and filtered, it gives a yellow precipitate with bichloride of platinum, and a white one with chloride of barium. The preparation of the Br. Pharmacopœia yields about three-fourths of its weight to alcohol; the portion dissolved being sulphuret of potassium, and the undissolved portion sulphate of potassium. B.

Medical Properties and Uses. Sulphuret of potassium is a local irritant, and, in small and repeated doses, is said to increase the frequency of the pulse, heat of the skin, and different secretions, especially the mucous. Occasionally it vomits and purges. It acts, moreover, as an antacid, and produces the alterative effects of sul-

phur. By some it is maintained to be sedative, and directly to reduce the action of the heart. It probably does so, when taken in considerable quantities, by the development of sulphuretted hydrogen. In overdoses it acts, according to Orfila, as a violent poison, corroding the stomach, and depressing the powers of the nervous system. Acetate of lead or acetate of zinc may be used as an antidote; but the latter is preferable, as less likely to act injuriously in an overdose, and having besides emetic properties. The complaints in which it has been most advantageously employed are chronic rheumatism and gout, and various cutaneous affections. It has been given also in painters' colic, asthma, and chronic catarrh, and acquired a short-lived reputation as a remedy in croup, after the publication of the essay to which the prize offered by Napoleon for the best dissertation on that disease was awarded. It is said, in some cases of cancer, to have assisted the palliative operation of hemlock. In consequence of forming insoluble sulphurets with the metallic salts, it has been proposed as an antidote for some mineral poisons; but Orfila has shown that it does not prevent their effects. Dissolved in water, it has proved efficacious as an external application in cutaneous diseases, and in scabies is an almost certain remedy. It may be used for this purpose in the form of lotion, bath, or ointment. For a lotion it may be dissolved in water in the proportion of from fifteen to thirty grains to the fluidounce, and for a bath the same quantity or rather more may be added to a gallon of water. A very small proportion of muriatic or sulphuric acid may in either case be added to the solution. The ointment is made by mixing half a drachm of the sulphuret with an ounce of lard. The odour is very favourably modified, whether in solution or the state of ointment, by incorporating with it a little oil of anise. (See *Anisum*, p. 130.) The dose of sulphuret of potassium is from two to ten grains, repeated several times a day, and given in pill with liquorice, or in solution with syrup. In infantile cases of croup, from one to four grains were given every three or four hours.

Off. Prep. Unguentum Potassæ Sulphuratæ, *Br.* W.

POTASSII TARTRAS. *U.S.* POTASSÆ TARTRAS. *Br.* *Tartrate of Potassium. Soluble Tartar.*

"Take of Carbonate of Potassium *sixteen troyounces;* Bitartrate of Potassium [cream of tartar], in fine powder, *thirty-six troyounces*, or *a sufficient quantity;* Boiling Water *eight pints.* Dissolve the Carbonate of Potassium in the Water; then gradually add Bitartrate of Potassium to the solution until it is completely saturated, and boil. Filter the liquid, evaporate it until a pellicle forms, and set it aside to crystallize. Lastly, pour off the mother-water, and, having dried the crystals on bibulous paper, keep them in a well-stopped bottle." *U.S.*

"Take of Acid Tartrate of Potash *twenty ounces* [avoirdupois], or *a sufficiency;* Carbonate of Potash *nine ounces* [avoird.], or *a sufficiency;* Boiling Distilled Water *two pints and a half* [Imperial measure]. Dissolve the Carbonate of Potash in the Water; add by degrees the Acid Tartrate of Potash, and if, after a few minutes' boiling, the liquid is not neutral to test paper, make it so by the careful addition of more of the Carbonate or of the Acid Tartrate. Then filter, concentrate till a pellicle forms on the surface, and set it aside to cool and crystallise. More crystals may be obtained by evaporating and cooling the mother-liquor. Drain the crystals, dry them by exposure to the air in a warm place, and preserve them in a stoppered bottle." *Br.*

In these processes, the excess of acid in the bitartrate is saturated by the potassa of the carbonate, the carbonic acid is extricated with effervescence, and the neutral tartrate of potassium is formed. On account of the greater solubility of the carbonate than of the bitartrate, the former is first dissolved, and the latter added to the solution to full saturation. As the bitartrate is gradually added, the mutual action of the salts should be promoted by constant stirring, and the addition continued so long as effervescence takes place, which is a better mode of proceeding than to add any specified quantity of the bisalt; since, from its variable quality, it is impossible to adjust precisely the proportions applicable to all cases. It is necessary that the solution should be exactly neutral, or a little alkaline; and hence, if inadvertently too much bitartrate has been used, the proper state may be restored by adding a little of the

alkaline carbonate. When the saturation has been completed, the solution is filtered in order to separate tartrate of calcium, which appears in white flocks, and which is always present in cream of tartar as an impurity. The evaporated liquor should then be placed in *warm* earthenware vessels, to ensure a slow refrigeration; and, after remaining at rest for several days, the crystals begin to form. In order that the crystallization should proceed favourably, it is necessary, according to Baumé, that the solution should be somewhat alkaline. Iron vessels should not be used in any part of the process; as this metal is apt to discolour the salt.

Tartrate of potassium is sometimes made in the process for preparing tartaric acid. When thus obtained, the excess of acid of the bitartrate is neutralized by means of carbonate of calcium. This generates an insoluble tartrate of calcium, and leaves the neutral tartrate in solution, from which it may be obtained by evaporation and crystallization. (See *Acidum Tartaricum.*)

Properties, &c. Tartrate of potassium, prepared according to the officinal processes, is in white crystals, which are neutral to test paper, slightly deliquescent, and usually in the form of irregular six-sided prisms with dihedral summits. Its taste is saline and bitter. It dissolves in its own weight of cold, and in half its weight of boiling water (*Wittstein*), and is nearly insoluble in alcohol. Exposed to heat it undergoes fusion, swells up, blackens, and is decomposed; being converted into carbonate of potassium. For medical use it should be crystallized; but, as it ordinarily occurs in the shops, it is a white granular powder, obtained by evaporating the solution to dryness, while it is constantly stirred. In this state it is said to require four times its weight of water for solution. It is not known to be purposely adulterated; but, if obtained by evaporation to dryness, it is liable to contain an excess of carbonate or bitartrate of potassium, when it will have either an alkaline or acid reaction. It is decomposed by all the strong acids, and by many acidulous salts, which cause the precipitation of minute crystals of bitartrate of potassium, by abstracting one eq. of alkali from two of the salt. Chloride of barium or acetate of lead occasions a white precipitate of tartrate of barium or lead, distinguishable from the sulphate of those bases by being wholly soluble in dilute nitric acid. Tartrate of potassium is composed of one eq. of potassa 47·2, and one of tartaric acid 66 = 113·2, or, if tartaric acid be considered as bibasic, of two eqs. of base 94·4 and one of acid 132 = 226·4. According to Berzelius, the crystals contain no water of crystallization. "One hundred and thirteen grains, heated to redness till gases cease to be evolved, leave an alkaline residue, which requires for exact neutralisation 1000 grain-measures of the *volumetric solution of oxalic acid.*" *Br.*

Medical Properties. Tartrate of potassium is a mild cooling purgative, operating, like most of the neutral salts, without much pain, and producing watery stools. It is applicable to febrile diseases, and is occasionally combined with senna, the griping effects of which it has a tendency to obviate. The dose is from a drachm to an ounce, according to the degree of effect desired. B.

PULVERES.

Powders.

The form of powder is convenient for the exhibition of substances which are not given in very large doses, are not very disagreeable to the taste, have no corrosive property, and do not deliquesce rapidly on exposure. As the effect of pulverization is to expose a more extended surface to the action of the air, care should be taken to keep substances which are liable to be injured by such exposure in closely-stopped bottles. In many instances it is also important to exclude the light, which exercises a deleterious influence over numerous medicines when minutely divided. This may be done by coating the bottles with black varnish. In relation to substances most liable to injury from these causes, the best plan is to powder them in small quantities as wanted for use.*

* In contradiction to what has been stated in the text in relation to keeping powders in well-stopped bottles, it is asserted by M. Hérouard, a French pharmaceutist, that this plan, instead of preserving powders, tends in fact to their more speedy and certain change. Whatever pains may

Powders may be divided into the *simple*, consisting of a single substance, and the *compound*, of two or more mixed together. The latter only are embraced under the present head. In the preparation of the compound powders, the ingredients, if of different degrees of cohesion or solidity, should be pulverized separately and then mixed. An exception, however, is when one substance is employed to facilitate by its hardness the minute division of another, as in the *compound powder of ipecacuanha*. Deliquescent substances, and those containing fixed oil in large proportion, should not enter into the composition of powders intended to be kept; the former because they render the preparation damp and liable to spoil; the latter, because they are apt to become rancid, and impart an unpleasant odour and taste. When deliquescent substances are extemporaneously prescribed, the apothecary should enclose them before delivery in tin foil or other impervious covering; and the same remark is applicable to volatile powders, as carbonate of ammonium and camphor.

The lighter powders may in general be administered in water or other thin liquid; the heavier, such as those of metallic substances, require a more consistent vehicle, as syrup, molasses, honey, or one of the confections. Resinous powders, if given in water, require the intervention of mucilage or sugar. For many powders the *cachet de pain* affords the best method of administration.*

In the act of powdering, the whole substance in the mortar should not be beaten till completely pulverized; as the portion already powdered interferes with the action of the pestle upon the remainder, while the finer matter is apt to be dissipated; so that there is a loss both of time and material. The proper plan is to sift off the fine powder after a short continuance of the process, then to return the coarser parts to the mortar, and to repeat several times this alternate pulverization and sifting, until the process is completed. Care should be taken to mix thoroughly the several portions of fine powder thus obtained.†

be taken in drying medicines previously to powdering them, most of them during the process attract moisture, so as to put themselves in this respect in equilibrium with the surrounding air; and, if enclosed in this state in air-tight vessels, they are exposed to injurious influence from their own absorbed water, which, vaporized in hot weather, is in the colder seasons condensed on the inner surface of the vessel, and determines a movement of fermentation; and even cryptogamic growths appear. The best method of preservation, the author thinks, is to enclose the powders in strong paper bags of a blue or gray colour, so as to exclude the light, while the air has exit or entrance through the porous walls. Whatever may be our theoretical opinions on the point, M. Hérouard asserts the fact, as the result of observation, that powders keep best in this way. They may be more likely to cake or harden into aggregate masses; but this disadvantage is easily counteracted by a new pulverization when required. (*Journ. de Pharm.*, Août, 1862, p. 98.) There is probably some truth in these statements; and the inference may be drawn, that, where powders are kept in air-tight bottles, they should be thoroughly dried, after pulverization, before being enclosed. (*Note to the twelfth edition.*)

* *Cachet de Pain.* These very useful articles are wafers made of unleavened bread in such a manner that they offer a concavity, so that when two are placed face to face there is a space in which a powder may be contained. They are of different sizes and capacities, the largest readily holding as much as ten grains of quinine. In filling them one wafer is placed upon a board, the requisite amount of the medicine put in it; then a second wafer, whose interior margin has been wetted, is laid upon the first and pressed down upon it. When taken they should be dipped in water, placed immediately upon the back of the tongue, and swallowed with a gulp of fluid. For most powders of disagreeable taste, the cachet de pain affords the best method of administration.

† *Granulated Powders.* A new method of preparing powders for use has lately been introduced, consisting in converting them into minute granules, such as those of which salt of tartar consists, and of which there have long been a few examples, in which the object was to obviate change from atmospheric influence by diminishing the surface of exposure. In the new *granulated powders*, not only is the advantage arising from mere aggregation of particles gained, but the granules are further protected against change by receiving a distinct coating, which, being generally saccharine, has the additional advantage that it covers the taste of the powders, and much facilitates their administration. Placed on the tongue in quantities, less or more, they may be swallowed without difficulty, by simply washing them down with a little water; or they may be stirred up with water in a wineglass, and then swallowed.

Dr. Thos. Skinner, in a paper contained in the *Pharmaceutical Journal* (May, 1862, p. 572), gives the following plan of preparing these granulated powders, suggested by Mr. S. Banner, of Liverpool. The powder to be granulated should be freshly prepared. In general it is not at all necessary that it should be so fine as to be impalpable. The powder is first mixed in a mortar with enough mucilage of gum arabic to make a mass that will easily crumble; or it may be made into a plastic mass, which is to be rolled into thin cakes, and dried. The material is then to be broken up in a mortar, and sifted. For this purpose three sieves are required, with 12, 16, and 20 meshes, respectively, to the inch; which are to be fitted together, one over the other, the coarsest at top and the finest at bottom. The broken up mass is put in the upper sieve, and rubbed through by the open hand; the conjoined sieves are then shaken as in sifting; and, this part of the process

The preparations of this class, which have been dismissed at the recent revision of the Pharmacopœias, are the *Compound Powder of Aloes*, Lond.; the *Compound Powder of Alum*, Ed.; and the *Citrated Effervescing Powders*, Ed. W.

PULVERES EFFERVESCENTES. *U. S.* *Effervescing Powders. Soda Powders.*

"Take of Bicarbonate of Sodium, in fine powder, *three hundred and sixty grains;* Tartaric Acid, in fine powder, *three hundred grains.* Divide each of the powders into twelve equal parts, and keep the parts, severally, of the Bicarbonate and of the Acid in separate papers of different colours." *U. S.*

This is a formula, introduced into the previous edition of our national Pharmacopœia, for a preparation which has been long in use under the name of *soda powders.* The powders consist, severally, of twenty-five grains of the acid in one paper, and thirty of the bicarbonate in the other. They are administered in solution. An acid and an alkaline powder may be dissolved in separate portions of water and then mixed; or they may be thrown together, or successively into the same portion of water. The whole draught should be half a pint or somewhat less. It may be rendered more agreeable by adding two or three fluidrachms of syrup of ginger or orange peel to the water, before dissolving the powders. The rationale is simple. The tartaric acid seizes the alkali of the bicarbonate, forming a tartrate of sodium, while the carbonic acid escapes with effervescence. The effervescing powders are refrigerant and slightly laxative; and afford an agreeable and refreshing drink, suitable to febrile complaints, and generally very acceptable to the stomach. W.

PULVERES EFFERVESCENTES APERIENTES. *U. S.* *Aperient Effervescing Powders. Seidlitz Powders.*

"Take of Bicarbonate of Sodium, in fine powder, *a troyounce;* Tartrate of Potassium and Sodium, in fine powder, *three troyounces;* Tartaric Acid, in fine powder, *four hundred and twenty grains.* Mix intimately the Bicarbonate of Sodium with the Tartrate of Potassium and Sodium, and divide this mixture into twelve equal parts. Then divide the Tartaric Acid into the same number of equal parts. Lastly, keep the parts, severally, of the mixture and of the Acid in separate papers of different colours." *U. S.*

These powders, so long and so usefully employed under the name of *Seidlitz powders*, were put among the officinal preparations in the 1860 revision of the U. S. Pharmacopœia. Though named from the saline springs of Seidlitz, in Bohemia, they do not correspond in composition with those famous waters. Of each pair of powders, one, much the smaller of the two, contains thirty-five grains of tartaric acid, the other forty grains of bicarbonate of sodium mixed with two drachms of Rochelle salt. The acid powder is usually put into a white, the alkaline into a blue paper; and a number of them are enclosed in a paper or tin box. They should not be kept in a damp place, as the tartaric acid is liable to be dissolved by the moisture, and absorbed into the substance of the paper; thus altering the due proportion of the ingredients. We have known the whole of the contents of the white paper thus to disappear in the course of two or three years. In such a case, however, the paper itself may be torn up and put into the water, to which it soon imparts the acid. The Rochelle salt is the ingredient upon which the aperient property mainly depends. In their administration, each powder is dissolved separately, the smaller in a fluidounce or more of water, the larger in twice or three times the quantity; and the two solutions are mixed gradually. A reaction takes place between the tartaric acid and the bicarbonate of sodium, by which tartrate of sodium is produced, adding somewhat

being completed, they are separated. The larger granules are found in the middle sieve, the smaller in the lowermost, and the waste powder on a leather or parchment drum beneath. This waste is to be worked over again. The two sizes of granules are kept apart. If not already dry, as they always are when the material is first made into cakes, they are to be carefully dried; and are next put into a mortar, and, a strong tincture of tolu (℥iij to f℥i), aromatized, if desired, having been added, are stirred constantly till their surface appears glossy; after which they are again dried, and thus prepared for use. The proportion of gum used is about one-sixteenth of the weight of the granules, that of tolu balsam too small to be worth estimating.

In France the granular powders are usually made with the addition of sugar, which if in fixed proportion, as one to one, or one to two, can be of no inconvenience in relation to the estimation of the dose. (*Note to the twelfth edition.*)

to the laxative property of the draught, and carbonic acid escapes, causing a brisk effervescence. The acid is in slight excess, and thus causes an agreeable acidity in the solution. These powders are refrigerant and aperient, and generally very acceptable to the stomach in consequence of the carbonic acid eliminated. They are especially adapted to febrile cases with a somewhat irritable stomach. One pair of them will generally operate slightly; but, if required, two may be given at once; or the dose may be repeated every three or four hours till the desired effect is produced. The flavour may sometimes be advantageously improved by adding syrup of ginger, orange peel, or lemon to one of the solutions before admixture. W.

PULVIS ALOËS ET CANELLÆ. *U. S.* *Powder of Aloes and Canella.* *Hiera Picra.*

"Take of Socotrine Aloes, in fine powder, *twelve troyounces;* Canella, in fine powder, *three troyounces.* Rub them together until they are thoroughly mixed." *U. S.*

This preparation has long been known under the name of *hiera picra.* The canella serves to correct the griping property, and imperfectly to cover the taste of the aloes; but the bitterness of the latter is still very obvious in the mixture, which would be better given in the form of pill. It is a popular remedy in amenorrhœa, and may be used for all the purposes to which aloes is applied. It is sometimes administered in domestic practice, infused in wine or spirit. The dose is from ten to twenty grains. W.

PULVIS AMYGDALÆ COMPOSITUS. *Br.* CONFECTIO AMYGDALÆ. *Lond.* CONSERVA AMYGDALARUM. *Ed.* *Compound Powder of Almonds.*

"Take of Sweet Almonds *eight ounces;* Refined Sugar, in powder, *four ounces;* Gum Arabic, in powder, *one ounce.* Steep the Almonds in warm water until their skins can be easily removed; and, when blanched, dry them thoroughly with a soft cloth, and rub them lightly in a mortar to a smooth consistence. Mix the Gum and the Sugar; and, adding them to the pulp gradually, rub the whole to a coarse powder. Keep it in a lightly covered jar." *Br.*

This is nothing more than the old *Almond Confection* under a new name. It is intended to afford a speedy method of preparing the almond mixture, which, when made immediately from the almonds, requires much time, and which cannot be kept ready made in the shops. But, from its liability to be injured by keeping, it was omitted from our Pharmacopœia, which directs the almond mixture to be made immediately from the ingredients.

Off. Prep. Mistura Amygdalæ, *Br.* W.

PULVIS ANTIMONIALIS. *Br.* *Antimonial Powder.*

"Take of Oxide of Antimony *one ounce;* Phosphate of Lime *two ounces.* Mix them thoroughly." *Br.*

This preparation has been introduced into the British Pharmacopœia as a substitute for the different forms of antimonial powder formerly officinal with the British Colleges. In order that the subject may be properly understood, it will be necessary to introduce a notice of the powder as formerly directed to be prepared by the London and Dublin Colleges; the process of the Edinburgh College having been so similar to the London, that it does not require special consideration.

Antimonial Powder of the London College. The following was the London process. "Take of Tersulphate of Antimony, powdered, *a pound;* Horn shavings *two pounds.* Mix, and throw them into a red-hot crucible, and stir constantly until vapour ceases to arise. Rub the residue to powder, and put it into a crucible. Then apply heat, and raise it gradually to redness, and keep it so for two hours. Rub the remaining powder until it is as fine as possible." *Lond.*

This preparation consists mainly of bone-phosphate of calcium, or calcined bone, mixed with antimonious acid, and is intended to furnish a substitute for the celebrated nostrum of Dr. James, an English physician who died in 1776, and after whom the original preparation was called *James's powder.* Dr. Pearson, of London, found the genuine powder, on analysis, to consist of phosphate of calcium and oxidized antimony, and, guided by his results, devised the formula adopted by the London College. By burning the materials directed by the College, the sulphur is expelled in the form

of sulphurous acid, and the antimony oxidized; while the horn, which is of the nature of bone, has its animal matter converted into charcoal. By the subsequent calcination the charcoal is dissipated, leaving only the phosphate of calcium of the horn mixed with the oxidized antimony.

The antimonial powder made by this formula is a tasteless, inodorous, gritty powder, of a dull-white colour. As often prepared it is insoluble in water; but usually a small portion, consisting of antimonite and superphosphate of calcium, dissolves in boiling distilled water. Its composition varies exceedingly, a circumstance which forms a strong objection to it as a medicine. When entirely insoluble in boiling water, it probably contains nothing but antimonious acid and phosphate of calcium; for, when its soluble constituents are absent, the teroxide is absent also. The best samples consist of "a mixture chiefly of antimonious acid and phosphate of lime, with some sesquioxide [teroxide] of antimony, and a little antimonite of lime." (*Ed.*) To these ingredients may be added superphosphate of calcium, which was found in small quantity by Dr. D. Maclagan, of Edinburgh. This writer obtained in his experiments about 50 per cent. of antimonious acid, 45 of phosphate of calcium, nearly 4 of teroxide, and not quite one of antimonite and superphosphate of calcium. The antimonial powder, sold by the representatives of Dr. James, is more active, and more uniform in its effects, than the imitation powder of the Pharmacopœias; its greater activity being explained by the presence of a greater proportion of teroxide, which Dr. Maclagan found to vary from 4 to 10 per cent. In analyzing the London antimonial powder, the first step is to act on it with boiling distilled water. If any antimonite should be dissolved, the solution will form with sulphuretted hydrogen an orange-coloured precipitate of quadrisulphuret of antimony; if superphosphate be present, nitrate of silver will throw down phosphate of silver. What remains of the powder, unacted on by the distilled water, is next digested with muriatic acid, which dissolves the phosphate of calcium, and also teroxide of antimony if present, and leaves a residue which is the antimonious acid. If teroxide be present in the muriatic solution, it will be precipitated by sulphuretted hydrogen, as an orange-coloured tersulphuret, and from the filtered solution, water of ammonia will throw down the phosphate of calcium. In this way all the ingredients of antimonial powder may be detected and separated. It might be supposed that the muriatic solution would be more readily tested for teroxide by means of water, which causes a white precipitate of oxychloride in this solution; but there seems to be some ambiguity in relation to the action of water. The Edinburgh College, in its formula of tests, stated that the muriatic solution of the residue, left after the exhaustion by water, does not become turbid by dilution; but, according to Dr. Barker and Dr. Pereira, this effect sometimes takes place. These different results may be explained by the different qualities of the preparation. A small quantity of teroxide may be in the muriatic solution, and yet not be precipitated by water as oxychloride; while a larger quantity will be so precipitated. On the other hand, a precipitate may be produced with water, without proving the presence of teroxide; for, unless the antimonial powder be most carefully exhausted by the distilled water before being subjected to the acid, the muriatic solution may contain antimonite of calcium, which, like the teroxide, gives it the property of becoming turbid with water.

The Dublin Antimonial Powder. Influenced, apparently, by considerations such as above presented, the Dublin College contrived the following process, with the object of having a preparation of definite constitution, and of an activity to be relied on. "Take of Tartarized Antimony, Phosphate of Soda, each, *four ounces* [avoirdupois]; Chloride of Calcium *two ounces* [avoird.]; Solution of Ammonia *four fluid-ounces* [Imperial measure]; Distilled Water *one gallon and a half* [Imp. meas.], or *a sufficient quantity*. Dissolve the Tartarized Antimony in half a gallon, and the Phosphate of Soda and Chloride of Calcium, each, in a quart of the Water. Mix the solutions of the Tartarized Antimony and Phosphate of Soda when cold, and then pour in the solution of Chloride of Calcium, having first added to the latter the Water of Ammonia. Boil now for twenty minutes, and, having collected the precipitate, which will have then formed, on a calico filter, wash it with hot distilled water until the liquid which passes through ceases to give a precipitate with a dilute solution of

nitrate of silver. Finally, dry the product by a steam or water heat, and reduce it to a fine powder." *Dub.*

This formula was a new one of the Dublin Pharmacopœia of 1850, and was an improvement on the process of Mr. Chenevix, proposed in 1801, for obtaining antimonial powder in the humid way. By this formula the liquid, resulting from mixing aqueous solutions of tartar emetic and phosphate of sodium, is precipitated by a solution of chloride of calcium, previously mixed with water of ammonia. The water of ammonia throws down teroxide of antimony from the tartar emetic; and the chloride of calcium, phosphate of calcium from the phosphate of sodium; and the mixed precipitate, washed, dried, and reduced to fine powder, constitutes what was the Dublin antimonial powder. It is quite a different preparation from that previously described; inasmuch as all the antimony present is in a state of teroxide. It should not have been called antimonial powder, but designated by a distinct name. The process by which it is obtained is certainly a great improvement on that usually followed. It is doubtful whether the phosphate of calcium adds anything to its efficacy; and, if not, the preparation is equivalent to teroxide of antimony, used in a smaller dose.

British Antimonial Powder. The formula for this is the one given at the head of the present article. It is the preparation now officinal in Great Britain to the exclusion of the others. The only essential difference between it and the Dublin powder is that its ingredients are taken already prepared and mixed in fixed proportion, while those of the latter result simultaneously from one operation. It is of course much more easily prepared, and less liable to uncertainty from any error in the process.*

Medical Properties and Uses. This preparation is stated to be alterative, diaphoretic, purgative, or emetic, according to the dose in which it is given. Until within a few years it was often prescribed in febrile diseases, with a view to its diaphoretic effect. According to Dr. A. T. Thomson, it is advantageously given in acute rheumatism, conjoined with camphor, calomel, and opium, and with calomel and guaiac in several cutaneous affections. The estimation in which this preparation is held is very various. The late Dr. Duncan, referring to the preparation of the Lond. and Ed. Colleges, characterized it as one of the best antimonials we possess; yet he acknowledged that its effects are very unequal, either from idiosyncrasy in the patient, or variations in its composition. Dr. Thomson found it sometimes to answer his expectations, but as often to disappoint them. Mr. Brande admits its activity sometimes, and entire inertness at others, which he attributes to the presence or absence of *teroxide* of antimony. Of course these observations had reference to the former antimonial powder of the British Colleges; and it was this uncertainty of its action that led to its omission from the U. S. Pharmacopœia, upon the revision of 1830.

The antimonial powder at present officinal in Great Britain is exempt from the objection of irregularity of composition. Nevertheless, as it depends for its greater or less energy on the presence or absence in the alimentary canal of an acid which may form a salt with the antimonial oxide, it cannot always be relied on for a definite effect, being sometimes mild, and sometimes more active than might be desirable. The dose, as a diaphoretic, is from three to eight grains every third or fourth hour, given in the form of pill. In larger doses it is purgative and emetic. It is impossible to give precise directions as to the dose of the former London powder; as it sometimes proved violently emetic in moderate doses, and at other times produced no obvious effect even in doses of one hundred grains.

The late *Dublin* antimonial powder, which may be considered as essentially identical with the British, was tried therapeutically in twenty cases of disease, chiefly rheumatism, pneumonia, and bronchitis, by Dr. Jonathan Osborne, of Dublin. In five-grain doses, given evening and night, it produced, variously, nausea, vomiting, and perspiration. In half the cases it acted gently on the bowels. The teroxide, given separately in three-grain doses, evening and night, produced similar effects. (*Pharm. Journ.*, Jan. 1855, p. 331.) Practitioners who may wish to prescribe the antimonial

* Mr. Michael Donovan believes that none of the officinal formula fairly represent James's powder, and gives an elaborate history of this celebrated proprietary medicine, and a method of its preparations, in the *Lond. Pharm. Journ.*, Sept. 1869. (*Note to the fourteenth edition.*)

powder, in its present more certain form, should add (*Br.*) or (*Dub.*) to its name; so as to be secured against the old *Lond.* and *Ed.* preparation. B.

PULVIS AROMATICUS. *U. S.*, *Ed.* PULVIS CINNAMOMI COMPOSITUS, *Br.* *Aromatic Powder.* *Compound Powder of Cinnamon.*

"Take of Cinnamon, in fine powder, Ginger, in fine powder, each, *two troyounces;* Cardamom, deprived of the capsules and in fine powder, Nutmeg, in fine powder, each, *a troyounce.* Rub them together until they are thoroughly mixed." *U. S.*

"Take of Cinnamon Bark, in powder, Cardamom Seeds, in powder, Ginger, in powder, of each, *one ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

These powders now closely resemble each other; the only material difference being that, instead of the cardamom and nutmeg of the U. S. Pharmacopœia, together equal in quantity to each of the other ingredients, the British takes only the cardamom in double the proportion, or equal to each of the others. The present British formula differs from that of 1864, in the substitution of ginger for nutmeg, cloves, and saffron, and especially in the absence of sugar, which in the latter constituted two-thirds of the whole, having probably been added in order that, by the addition of a little water to the powder, an aromatic confection might be readily prepared, without the necessity of keeping it. It is obvious that this end may be as effectually attained by the addition of a little syrup to the present powder.

The cardamom seeds should always be separated from their capsules before being weighed; and the powder, when prepared, should be kept in well-stopped bottles. The aromatic powder is stimulant and carminative, and the U. S. preparation may be given in the dose of from ten to thirty grains, in cases of enfeebled digestion with flatulence; but it is chiefly used as a corrigent and adjuvant of other medicines. A mixture of aromatic powders in the form of a cataplasm is much used as a mild rubefacient, especially in nausea and vomiting, being applied over the epigastrium. Such mixtures are commonly called *spiced plasters.* The following is a good formula. Take of ginger, cloves, cinnamon, and black pepper, each, in powder, an ounce; tincture of ginger half a fluidounce; honey a sufficient quantity. Mix the powders, and then add the tincture and honey, so as to form a stiff cataplasm.*

Off. Prep. Confectio Aromatica, *U. S.;* Confectio Opii, *U. S.;* Pilula Aloes et Ferri, *Br.;* Pilula Aloës et Myrrhæ, *U. S.;* Pilula Cambogiæ Composita, *Br.* W.

PULVIS CATECHU COMPOSITUS. *Br.* *Compound Powder of Catechu.*

"Take of Pale Catechu, in powder, *four ounces;* Kino, in powder, Rhatany Root, in powder, of each, *two ounces;* Cinnamon Bark, in powder, Nutmeg, in powder, of each, *one ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

This is an agreeable form for the administration of kino or catechu; but we do not see the propriety of mixing two substances so similar in their properties, at least in relation to taste and medicinal effect, that they may be considered identical. The dose is from fifteen to thirty grains. W.

PULVIS CRETÆ AROMATICUS. *Br.* CONFECTIO AROMATICA. *Lond.* *Aromatic Powder of Chalk.*

"Take of Cinnamon Bark, in powder, *four ounces;* Nutmeg, in powder, Saffron, in powder, of each, *three ounces;* Cloves, in powder, *one ounce and a half;* Cardamom Seeds, in powder, *one ounce;* Refined Sugar, in powder, *twenty-five ounces;* Prepared Chalk *eleven ounces.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

This is the former "Aromatic Powder" of the Br. Pharmacopœia, with the addi-

* *Aromatic Sugar.* Mr. Wm. L. Turner proposes an ingenious mode of obtaining the effects of the aromatic powder, in certain cases where the use of the powder itself would be inconvenient. He prepares an aromatic sugar by submitting eight ounces of the freshly prepared powder to percolation with stronger alcohol to exhaustion, pouring the percolate over eight ounces of sugar and evaporating at a low heat. The sugar thus prepared may be added to mixtures, solutions, &c., requiring aromatic addition. (*Am. Journ. of Pharm.*, March, 1869, p. 118.)—*Note to the thirteenth edition.*

tion of chalk, and differs from the former "Aromatic Powder of Chalk" only in having the ingredients severally directed instead of being mixed in the form of the "Aromatic Powder." The colour of the genuine powder, according to Mr. Archibald Paterson, varies from a bright yellow ochre to a dark brown, almost resembling that of Dover's powder. (*Pharm. Journ. and Trans.*, June, 1873, p. 992.) It is a warm stimulant and astringent, as well as antacid; and is well calculated for diarrhœa connected with acidity, and without inflammation. In such a combination, however, the due proportion, and even the choice of the ingredients, vary so much with the symptoms, that they might with propriety be left to extemporaneous prescription. The dose is from thirty to sixty grains, given in mucilage or sweetened water, and frequently repeated.

Off. Prep. Pulvis Cretæ Aromaticus cum Opio, *Br.* W.

PULVIS CRETÆ AROMATICUS CUM OPIO. *Br.* *Aromatic Powder of Chalk and Opium.*

"Take of Aromatic Powder of Chalk *nine ounces and three-quarters;* Opium, in powder, *a quarter of an ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

The addition of the opium greatly increases the efficacy of the compound powder of chalk in diarrhœa; and its equal diffusion through the powder presents this advantage, that it may be conveniently given in minute doses applicable to infantile cases. Two scruples of the powder contain a grain of opium. In the diarrhœa of adults from ten to twenty grains may be given for a dose, and repeated several times a day, or after each evacuation. W.

PULVIS ELATERII COMPOSITUS. *Br.* *Compound Powder of Elaterium.*

"Take of Elaterium *ten grains;* Sugar of Milk *ninety grains.* Rub them together in a mortar until they are reduced to fine powder and intimately mixed." *Br.*

Ten grains of this powder contain one grain of elaterium. If the elaterium be of good quality, not more than three grains of the powder should be given at once, and a single grain would represent the ordinary dose. H. C. W.

PULVIS GLYCYRRHIZÆ COMPOSITUS. *Br.* *Compound Powder of Liquorice.*

"Take of Senna, in fine powder, Liquorice Root, in fine powder, of each, *two ounces;* Refined Sugar, in powder, *six ounces.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar." *Br.*

The dose of this powder is from thirty to sixty grains. H. C. W.

PULVIS IPECACUANHÆ COMPOSITUS. *U. S.*, *Br.* PULVIS IPECACUANHÆ CUM OPIO. *Br.* 1864. PULVIS IPECACUANHÆ ET OPII. *U. S.* 1850. *Compound Powder of Ipecacuanha. Powder of Ipecacuanha and Opium. Dover's Powder.*

"Take of Ipecacuanha, in fine powder, Opium, dried and in fine powder, each, *sixty grains;* Sulphate of Potassium *a troyounce.* Rub them together into a very fine powder." *U. S.*

The British Pharmacopœia directs the same ingredients in the same proportions, though in a larger quantity, and orders them to be well rubbed together, the powder to be passed through a fine sieve, rubbed lightly in a mortar, and kept in a stoppered bottle.

It is a subject for congratulation that, at last, the name of this important compound is identical in the two Pharmacopœias.

The sulphate of potassium in this preparation serves, by the hardness of its particles, to promote that minute division and consequent thorough intermixture of the opium and ipecacuanha upon which the peculiar virtues of the compound depend. It also serves to dilute the active ingredients, and thus allow of their division into minute doses adapted to the complaints of children. This composition, though called Dover's powder, does not precisely correspond with that originally recommended by Dr. Dover, which was prepared as follows. Four ounces of nitrate of potassium and the

same quantity of sulphate of potassium were mixed in a red-hot crucible, and afterwards very finely powdered; one ounce of opium, sliced, was then added, and ground to powder with the saline mixture; lastly, an ounce of ipecacuanha and an ounce of liquorice root, in powder, were mixed with the other ingredients. This process was adopted in a former French Codex, and has been retained with little change in the present.

This powder is an admirable anodyne diaphoretic, not surpassed, perhaps, by any other combination in the power of promoting perspiration. Opium itself has a strong tendency to the skin, evinced both by the occasional diaphoresis, and by the itching and tingling sensation which it excites. While the vessels of the skin are stimulated by this ingredient, the secreting pores are relaxed by the ipecacuanha, and the combined effect is much greater than that which results from either separately. At the same time, the general stimulating influence of the opium, and its tendency to operate injuriously on the brain, are counteracted so that the mixture may be given with safety in cases which might not admit of the use of opium alone. The preparation is applicable to all cases, not attended with much fever, cerebral disease, or sick stomach, in which there is an indication for profuse diaphoresis, especially in painful affections, or those connected with unhealthy discharges. It is admirably adapted to the phlegmasiæ, particularly rheumatism and pneumonia, when complicated with a typhoid tendency, or after sufficient depletion. Under similar circumstances, it is useful in dysentery, diarrhœa, and the various hemorrhages, especially that from the uterus. It is sometimes also given in dropsy. In bowel affections, and whenever the hepatic secretion is deranged, it is frequently combined with small doses of calomel.

Ten grains of the powder contain one grain of opium. The dose is from five to fifteen grains, given diffused in water, or mixed with syrup, or in the form of bolus, and repeated at intervals of four, six, or eight hours, when it is desirable to maintain a continued diaphoresis. Its action may be promoted by warm drinks, such as lemonade or balm tea, which, however, should not be given immediately after the powder, as they might provoke vomiting. W.

PULVIS JALAPÆ COMPOSITUS. *U.S., Br.* *Compound Powder of Jalap.*

"Take of Jalap, in very fine powder, *a troyounce;* Bitartrate of Potassium, in very fine powder, *two troyounces.* Rub them together until they are thoroughly mixed." *U. S.*

"Take of Jalap, in powder, *five ounces;* Acid Tartrate of Potash *nine ounces;* Ginger, in powder, *one ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar." *Br.*

The bitartrate, by being rubbed with the jalap, is thought to favour its more minute division, while it increases its hydragogue effect. A combination of these two ingredients, though with a larger proportion of cream of tartar (see *Jalapa*), forms a good cathartic in dropsy, and scrofulous diseases of the joints and glands. The dose of the powder is from thirty grains to a drachm. W.

PULVIS KINO COMPOSITUS. *Br., Lond.* PULVIS KINO CUM OPIO. *Br.* 1864. *Compound Powder of Kino. Powder of Kino and Opium.*

"Take of Kino, in powder, *three ounces and three-quarters;* Opium, in powder, *a quarter of an ounce;* Cinnamon Bark, in powder, *one ounce.* Mix them thoroughly, pass the Powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

This is an anodyne astringent powder, useful in some forms of diarrhœa, but of which the composition would be better left to extemporaneous prescription; as the proportion of the ingredients should vary with the circumstances of the case. Twenty grains contain one grain of opium. The dose is from five grains to a scruple. W.

PULVIS OPII COMPOSITUS. *Br.* *Compound Powder of Opium.*

"Take of Opium, in powder, *one ounce and a half;* Black Pepper, in powder, *two ounces;* Ginger, in powder, *five ounces;* Caraway Fruit, in powder, *six ounces;* Tragacanth, in powder, *half an ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle." *Br.*

This seems to have been introduced in order to have at hand all the dry ingredients of the Confection of Opium. (See *Confectio Opii*, p. 1130.)

Ten grains of the powder contain one grain of opium.

Off. Prep. Confectio Opii, *Br.* W.

PULVIS RHEI COMPOSITUS. *U. S.*, *Br.* *Compound Powder of Rhubarb.*

"Take of Rhubarb, in very fine powder, *four troyounces;* Magnesia *twelve troyounces;* Ginger, in very fine powder, *two troyounces.* Rub them together until they are thoroughly mixed." *U. S.*

"Take of Rhubarb Root, in powder, *two ounces;* Light Magnesia, *six ounces;* Ginger, in powder, *one ounce.* Mix them thoroughly, and pass the powder through a fine sieve." *Br.*

This is a good laxative antacid, well adapted to bowel complaints, especially in children. The dose for an adult is from half a drachm to a drachm; for a child two or three years old, from five to ten grains. W.

PULVIS SCAMMONII COMPOSITUS. *Br.* *Compound Powder of Scammony.*

"Take of Scammony, in powder, *four ounces;* Jalap, in powder, *three ounces;* Ginger, in powder, *one ounce.* Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar." *Br.*

This does not appear to us a very eligible preparation. Though the ginger may tend to correct the griping property of the purgative ingredients, the jalap too closely resembles the scammony in its operation to exert any important modifying influence upon it. The dose is from ten to twenty grains. W.

PULVIS TRAGACANTHÆ COMPOSITUS. *Br.* *Compound Powder of Tragacanth.*

"Take of Tragacanth, in powder, Gum Acacia, in powder, Starch, of each, *one ounce;* Refined Sugar, in powder, *three ounces.* Rub them well together." *Br.*

This is applicable to the general purposes of the demulcents; but is chiefly employed in Great Britain as a vehicle for heavy insoluble powders. The dose is from thirty grains to a drachm. W.

PYROXYLON.

PYROXYLON. *U. S.* PYROXYLIN. *Br.* *Soluble Gun Cotton.*

"Take of Cotton, freed from impurities, *half a troyounce;* Nitric Acid, *three troyounces and a half;* Sulphuric Acid, *four troyounces.* Mix the Acids gradually, in a porcelain or glass vessel, and, when the temperature of the mixture has fallen to 90°, add the Cotton; by means of a glass rod, imbue it thoroughly with the acid, and allow it to macerate for fifteen hours; then transfer it to a larger vessel, and wash it first with cold water until the washings cease to have an acid taste, and then with boiling water. Drain the Cotton on filtering paper, and dry it by means of a water-bath.

"If acids of the proper strength cannot be easily obtained, use for the above quantity of cotton, of Nitric Acid, having a specific gravity from 1·382 to 1·390, *four troyounces*, and of Sulphuric Acid, having the specific gravity 1·833, *two troyounces*, and proceed as directed." *U. S.*

"Take of Cotton *one ounce* [avoirdupois]; Sulphuric Acid, Nitric Acid, of each, *five fluidounces* [Imperial measure]. Mix the Acids in a porcelain mortar, immerse the Cotton in the mixture, and stir it for three minutes with a glass rod, until it is thoroughly wetted by the Acids. Transfer the Cotton to a vessel containing water, stir it well with a glass rod, decant the liquid, pour more water upon the mass, agitate again, and repeat the affusion, agitation, and decantation, until the washings cease to give a precipitate with chloride of barium. Drain the product on filtering paper, and dry in a water-bath." *Br.*

The adoption, by the U. S. and Br. Pharmacopœias, of gun cotton as an officinal preparation, renders necessary, in accordance with the plan of the U. S. Dispensatory, the

transferrence of the subject to this part of the work from the third part, where it has heretofore been treated. The following article, prepared by the late Dr. Bache, is accordingly brought hither from the position which it occupied in the twelfth edition. It will be perceived that the British process is essentially the same as that given below, the proportion of cotton to the acid employed being somewhat larger in the former.

Gun cotton, discovered by Schönbein of Bâle, in Switzerland, is conveniently prepared by the following process, given by Mr. Thomas Taylor, of London. Mix, in a glass vessel, 1½ fluidounces of nitric acid (sp. gr. 1·45) with an equal bulk of sulphuric acid, and, when the mixture has cooled, pour it upon 100 grains of fine cotton contained in a Wedgwood mortar, and, with a glass rod, imbue the cotton as quickly as possible with the acids. As soon as the cotton is completely saturated, pour off the superabundant liquid, and, with the aid of the pestle, quickly press out as much of it from the cotton as possible. Then throw the cotton into a basin of water, wash it until it has not the slightest acid taste, and dry it with a gentle heat. Gun cotton may be made with strong nitric acid alone; but, as this acid is not always of full strength, it is better to mix with it sulphuric acid, which acts by strengthening the nitric acid, from its affinity for water. It may also be formed by immersing the cotton in a mixture of nitre and sulphuric acid, and this was the mode formerly adopted in the U. S. Pharmacopœia.

Properties, &c. Gun cotton has the appearance of ordinary cotton, but is harsh to the touch. There are several varieties of it, and that which is the most serviceable for explosive use is not the most suitable for medical purposes. When intended for solution it is best made by the joint action of sulphuric and nitric acid, or, as originally proposed by Dr. Ellet, of South Carolina College, of nitre and sulphuric acid. Experience is said to have shown that the use of the acids as practised in the present officinal formula gives better results than the employment of nitre and sulphuric acid, which was directed in the U. S. Pharmacopœia of 1860. Care should be exercised not to let the mixture attain a temperature much above 110° F. It is perfectly insoluble in water, and nearly so in strong alcohol; but dissolves in large quantity in acetic ether. As ordinarily made for the purpose of explosion, it is insoluble in ether; but, when carefully and *freshly* prepared, with proper precautions, it dissolves in that menstruum, forming a powerfully adhesive liquid. M. Guichard proposes the use of chemically pure filtering paper as yielding a superior product to cotton. He takes 1400 parts of sulphuric acid, sp. gr. 1·82; 700 parts of nitric acid, sp. gr. 1·37; 70 parts of the paper. Puts the mixed acid in a vessel surrounded by cold water to keep down the temperature, drops the paper in leaf by leaf, allows to stand three hours, and then washes freely with water. (*Journ. de Pharm.*, 4e sér., xii. 290.) According to Dr. J. H. Gladstone, of England, gun cotton is subject to spontaneous decomposition, if kept for some time. The same fact has been observed by Mr. James Beatson, of New York, and Prof. Procter, of Philadelphia. The specimen, observed by Prof. Procter to undergo decomposition, had not been well washed. The change is shown by the bottle, in which the gun cotton is kept, becoming full of nitrous acid vapour; and the substance is so far altered that it is no longer explosive or soluble in ether. M. Bouet states that the decomposition from exposure to light takes place sooner in that which has been prepared with nitre and sulphuric acid, than where the mixed acids have been used. He says that, with both, the sides and bottom of the bottle are nearly covered with crystals of oxalic acid. (See *Am. Journ. of Pharm.*, March, 1862, p. 187.) According to M. Béchamp, of Strasburg, the product is soluble in ether, if the cotton be immersed in a mixture of nitric and sulphuric acid, while still hot from their reaction; but not soluble, if the cotton be added to the mixture when cold. By treating gun cotton with protochloride of iron, M. Béchamp caused the disengagement of nitrous oxide gas, and gave the filaments a coating of oxide of iron, which was readily dissolved by muriatic acid. After this treatment the gun cotton was restored to its original state of cotton. (*Chem. Gaz.*, Jan. 1, 1854, p. 11.) When kindled, gun cotton flashes off like gunpowder, burning without residue. Yet, according to M. Bleekrode, when wet with ether, or similar fluid, and touched with a light, the liquid will burn out of it without firing it. (*Journ. de Pharm.*, 4e sér., xviii.) Its inflaming

point is at 370° F. Dr. Marx makes it lower. It has been tried as a substitute for gunpowder in fire-arms; but from its strong bursting power, it has not been found to answer for this purpose. It appears, however, to be well adapted to rock blasting. Its composition has been variously given. Mr. Walter Crum, of Glasgow, makes its composition correspond with that of cellulose (cotton) $C_{12}H_{10}O_{10}$, in which three eqs. of water are replaced with three of nitric acid. On this supposition its formula is $C_{12}H_7O_7 + 3NO_5$. Porret and Teschemacher are of opinion that the cotton loses two eqs. of water, and gains four of nitric acid; so as to make its formula $C_{12}H_8O_8 + 4NO_5$. Another view is that three eqs. of the hydrogen are replaced by three eqs. of hyponitric acid, the oxygen which forms water with the hydrogen being derived from the nitric acid; so that the formula will be $C_{12}H_7 3NO_4 O_{10} + 3HO$. But the researches of Mr. Hadow, in 1864, seem to be more satisfactory. According to this chemist, who employs the new notation, the action of nitric acid on cotton is an example of substitution. Three eqs. of cotton, which represents cellulose $C_6H_{10}O_5$, enter together into action, giving up hydrogen, and receiving peroxide of nitrogen; the number of eqs. of hydrogen, replaced in the triple atom of cellulose, varying from nine to six according to the strength of the acid used. The highest of these substitution products is that in which nine eqs. of hydrogen are replaced by nine eqs. of peroxide of nitrogen. This is trinitrocellulose, the pyroxylon or gun cotton of Schönbein, previously discovered by Pelouze, as early as 1836, in an impure state. The triple atom of cellulose $C_{18}H_{30}O_{15}$ gives up nine eqs. of its hydrogen, receiving in their place nine eqs. of peroxide of nitrogen, thus becoming $C_{18}\left\{\begin{matrix}H_{21}\\9NO_2\end{matrix}\right\}O_{15}$, equalling $3C_6\left\{\begin{matrix}H_7\\3NO_2\end{matrix}\right\}O_5$. (Prof. Abel, *Pharm. Journ. and Trans.*, 2d ser., vi. 71.) The above, however, though the formula for the gun cotton used for xplosive purposes, which is insoluble in ether, is not that of the soluble pyroxylon used in preparing collodium, in which the substitution of the peroxide of nitrogen is eight for the same number of hydrogen eqs., instead of nine for nine. For some interesting observations by MM. Pelouze and Maurey on the subject of gun cotton, and particularly in reference to the modifications in the mode of preparing it, introduced by General Lenk, of Austria, the reader is referred to an article contained in the *American Journal of Pharmacy* (Jan. 1865, p. 36). One of these modifications consists in giving to each fibre a coating of soluble glass, by dipping the gun cotton into a solution of silicate of sodium. On exposure to the air, sufficient soda combines with carbonic acid to bring the silicate to the insoluble state, so that each fibre is enclosed in an impermeable covering, which is supposed to protect it from change. But MM. Pelouze and Maurey consider this coating less beneficial than supposed by General Lenk.

Off. Prep. Collodium; Collodium cum Cantharide, *U. S.;* Collodium flexile, *Br.*

B.

QUINIA.

Preparations of Quinia.

QUINIÆ SULPHAS. *U. S., Br. Sulphate of Quinia.*

"Take of Yellow Cinchona, in coarse powder, *forty-eight troyounces;* Muriatic Acid *three troyounces and a half;* Lime, in fine powder, *five troyounces;* Animal Charcoal, in fine powder, Sulphuric Acid, Alcohol, Water, Distilled Water, each, *a sufficient quantity.* Boil the Cinchona in thirteen pints of water mixed with one-third of the Muriatic Acid, and strain through muslin. Boil the residue twice successively with the same quantity of Water and Acid as before, and strain. Mix the decoctions, and, while the liquid is hot, gradually add the Lime, previously mixed with two pints of Water, stirring constantly, until the quinia is completely precipitated. Wash the precipitate with Distilled Water, and, having pressed, dried, and powdered it, digest it in boiling Alcohol. Pour off the liquid, and repeat the digestion several times, until the Alcohol is no longer rendered bitter. Mix the liquids, and distil off the Alcohol until a brown viscid mass remains. Upon this, transferred

to a suitable vessel, pour four pints of Distilled Water, and, having heated the mixture to the boiling point, add as much Sulphuric Acid as may be necessary to dissolve the quinia. Then add a troyounce and a half of Animal Charcoal, boil the liquid for two minutes, filter while hot, and set it aside to crystallize. Should the liquid, before filtration, be entirely neutral, acidulate it very slightly with Sulphuric Acid; should it, on the contrary, change the colour of litmus paper to a bright red, add more Animal Charcoal. Separate the crystals from the liquid, dissolve them in boiling Distilled Water slightly acidulated with Sulphuric Acid, add a little Animal Charcoal, filter the solution, and set it aside to crystallize. Lastly, dry the crystals on bibulous paper with a gentle heat, and keep them in a well-stopped bottle. The mother-water may be made to yield an additional quantity of Sulphate of Quinia by precipitating the quinia with Water of Ammonia, and treating the precipitated alkaloid with Distilled Water, Sulphuric Acid, and Animal Charcoal, as before." *U. S.*

"Take of Yellow Cinchona Bark, in coarse powder, *one pound* [avoirdupois]; Hydrochloric Acid *three fluidounces* [Imperial measure]; Distilled Water *a sufficiency;* Solution of Soda *four pints* [Imp. meas.]; Diluted Sulphuric Acid *a sufficiency.* Dilute the Hydrochloric Acid with ten pints [Imp. meas.] of the Water. Place the Cinchona Bark in a porcelain basin, and add to it as much of the Diluted Hydrochloric Acid as will render it thoroughly moist. After maceration, with occasional stirring for twenty-four hours, place the bark in a displacement apparatus, and percolate with the Diluted Hydrochloric Acid, until the solution which drops through is nearly destitute of bitter taste. Into this liquid pour the Solution of Soda, agitate well, let the precipitate completely subside, decant the supernatant fluid, collect the precipitate on a filter, and wash it with cold Distilled Water, until the washings cease to have colour. Transfer the precipitate to a porcelain dish containing a pint [Imp. meas.] of Distilled Water, and, applying to this the heat of a water-bath, gradually add Diluted Sulphuric Acid until very nearly the whole of the precipitate has been dissolved, and a neutral liquid has been obtained. Filter the solution while hot through paper, wash the filter with boiling Distilled Water, concentrate till a film forms on the surface of the solution, and set aside to crystallize. The crystals should be dried on filtering paper without the application of heat." *Br.*

The present U. S. process, which is essentially that of the French Codex, is the same as that of the Pharmacopœia of 1850, but differs from the one originally adopted in the edition of 1830, in the use of muriatic instead of sulphuric acid for acidulating the water first employed, and in the greater minuteness of the details. Both this and the French Codex process are modifications of the plan originally proposed by M. Henry, jun., of Paris, which has been almost universally employed where alcohol is not too expensive. Henry's process, with all its details, may be found in former editions of this work. An explanation of the several directions given in the U. S. Pharmacopœia will be useful to the student, by enabling him to comprehend each step of the process.

The yellow bark (Calisaya, or royal yellow) is the variety selected, because this contains quinia in the largest proportion, and most free from admixture with cinchonia. The alkaloid exists in the bark combined with kinic acid, and probably also with one or more of the colouring principles, as suggested by M. Henry. As in this latter state it is difficult of solubility, if it be not insoluble in water, the whole of the quinia cannot be extracted from the bark by means of that liquid alone. Berzelius, however, attributes the difficulty of exhausting the bark to the circumstance that water converts the native neutral kinates into soluble superkinates which are dissolved, and insoluble subkinates which remain. By adding muriatic or sulphuric acid to the water in such quantities as to be in excess in relation to the quinia, the whole of the alkaloid combines with the acid to form a very soluble muriate or sulphate, in which state it exists, together with various impurities, in the decoctions procured by the first steps of the process. By the addition of lime to the filtered and mixed decoctions, the salt of quinia is decomposed, giving up its acid to the lime, while the quinia is liberated, and, being insoluble in water, is precipitated; the water retaining most of the impurities. If sulphuric acid was employed in the commencement of the process, sulphate of calcium is deposited along with the quinia;

but if muriatic acid was employed, the resulting chloride of calcium is retained in solution; and a reason is thus afforded for the preference of the latter acid. But, in either case, the excess of lime, and a compound formed of the lime and colouring matter, which is insoluble both in water and alcohol, are thrown down with the alkaloid. The precipitate having been washed in order to remove from it everything soluble in water, then pressed, dried and powdered; the next step is to separate the quinia from the insoluble impurities. This is accomplished by the repeated action of alcohol, which dissolves the former, and leaves most of the latter behind. The whole of the alkaloid having been abstracted, the alcoholic solution of quinia is then concentrated so as to afford a brown viscid mass, which is impure quinia. Portions of this may be reserved, if thought advisable, for the preparation of other salts of quinia. The mass is treated with boiling distilled water acidulated with sulphuric acid, which forms the officinal sulphate (disulphate of many chemists) with the quinia, and, being somewhat in excess, enables the salt to be readily dissolved. The animal charcoal now added should be the *unpurified* bone-black, the carbonate of calcium contained in which neutralizes a portion of the sulphuric acid, and thus facilitates the crystallization of the sulphate of quinia when the solution cools. Should the quantity of the bone-black added be sufficient to render the solution quite neutral, so as in no degree to affect litmus paper, as much sulphuric acid should be added as will give the paper a slightly vinous tint; for otherwise the crystallization may commence before the liquor is completely filtered. If, on the contrary, the bone-black has been deficient, and the solution colours litmus paper cherry-red, more of that substance is to be added. This, however, is merely an incidental advantage of the animal charcoal; its chief use being to decolorize the liquid. The second crystallization is necessary to obtain the salt of quinia free from colour; and sometimes it cannot be rendered perfectly white without a third. It is essential that the heat employed in drying the crystals should be gentle, in order to prevent their efflorescence. The small quantity of cinchonia contained in Calisaya bark is extracted along with the quinia; but, as the sulphate of the former is more soluble than that of the latter, it remains in the mother-liquors.*

According to M. Calvert, the proportion of sulphate of quinia obtained from bark is never certain when muriatic acid is employed as the solvent, and lime as the precipitant; for quinia is dissolved by a solution of chloride of calcium, and by lime-water; and a portion, therefore, remains in the liquid unprecipitated, which is greater when the lime employed is in excess. Having ascertained by trial that quinia is not dissolved by a solution of soda, and in scarcely appreciable proportion by chloride of sodium, he proposes to substitute this alkali for lime; first neutralizing the excess of acid by the carbonate, and then precipitating the quinia by caustic soda. (*Journ. de Pharm.*, 3e sér., ii. 388.)

The British process seems to be based on that of M. Rabourdin, of Orleans, published in the *Journal de Pharmacie* (Juin, 1861, p. 408), for which the advantages are claimed, that it does not require the use of alcohol, escapes the loss incurred in the ordinary process by the solvent property of lime, and is enabled, by the use of soda as the precipitant, to dispense with animal charcoal, and thereby avoid the waste incurred through its absorbent property. The soda in this process is employed not only as a precipitant, for which purpose a much smaller quantity would suffice, but in order to hold in solution the tannin, cinchonic red, and colouring and resinous matters, which it does without in the least dissolving the quinia. The precipitated quinia is thus obtained so far exempt from foreign matters that it may be immediately converted into the sulphate without the necessity of using animal charcoal.

* Mr. Weightman, of the firm of Powers & Weightman, manufacturing chemists of this city, informs us that the following modification of the above process has been found practically advantageous in their laboratory. The tincture, obtained by acting with alcohol on the impure precipitated quinia, is neutralized with sulphuric acid in the distilling vessel; and the alcohol is then distilled off, leaving a viscid mass of impure sulphate, which is drawn off and crystallizes on cooling. The mass thus obtained, having been expressed, is dissolved in boiling water, to which purified animal charcoal has been added. The solution is filtered while hot, and then allowed to cool and crystallize. Another solution and crystallization are required to get the sulphate of quinia quite pure and white. (*Note to the tenth edition.*)

From the precipitate by soda, M. Rabourdin obtains the quinia white and pure by treating it with a quantity of dilute muriatic acid insufficient to dissolve the whole of the alkaloid, whereby impurities are left behind, then filtering, and precipitating by ammonia. The same end is accomplished in the Br. process by the use of sulphuric acid. The residue of the precipitate may be reserved for future operations.

Pelletier proposed to substitute oil of turpentine for alcohol in the ordinary process for procuring sulphate of quinia. The impure quinia, precipitated by lime from the acidulous decoctions, after being washed, pressed, and dried, is digested with the oil, which dissolves the quinia. The solution thus obtained is agitated with water acidulated with sulphuric acid, by which the sulphate of quinia is formed. The oil separating, rises to the top, and is removed for future use; and the watery solution of the salt is evaporated, and treated as in the original process. A disadvantage, however, of this method is said to be, that the oil does not completely exhaust the precipitate of its quinia.

A similar process has been employed in England, *fusel oil or benzole* being substituted for oil of turpentine. In this instance, however, the new solvent is added to the impure quinia, without separation from the acidulated decoction from which it was precipitated by lime. The mixture being well agitated, the fusel oil or benzole dissolves the alkaloids, and, rising to the surface of the liquid, is drawn off by a syphon. The solution thus drawn off is treated as above with water acidulated with sulphuric acid, and the process is completed in the same manner. (See *Pharm. Journ.*, xiv. 29, 92, and 139.)

According to the French Codex, 1000 parts of yellow bark ought to yield from 29 to 30 parts of sulphate of quinia, when treated by the process first described. Messrs. Powers & Weightman, who are probably among the largest manufacturers of sulphate of quinia in the world, inform us that they have usually obtained from 2·5 to 3 per cent. as an average product.

Sulphate of quinia may be obtained from other varieties of Peruvian bark by the above processes; and from some in considerable quantity; but most of them yield a much larger proportion of sulphate of cinchonia than the Calisaya; and this, being much more soluble than the sulphate of quinia, will remain dissolved in the residuary liquor after the crystallization of the latter. To obtain the *cinchonia* separate, the following method, originally suggested by Pelletier and Caventou, may be employed. Magnesia, lime, or a solution of potassa is added to the mother-waters in excess.* The cinchonia is precipitated, together with a portion of quinia which has remained in the solution, and with the excess of magnesia or lime, if one of these earths has been employed. The precipitate is collected on a filter, washed with hot water, then dried, and treated with boiling alcohol, which dissolves the organic alkalies. The alcoholic solution is filtered while hot, and the residue afterwards treated in the same manner with successive portions of alcohol, till quite exhausted. The solutions, having been mixed, are concentrated by the distillation of the alcohol, and allowed to cool, when they deposit cinchonia in the crystalline state. Successive evaporations and refrigerations afford new crops of crystals, and the process should be continued till no more can be obtained. The cinchonia, thus procured, if impure, should be reconverted into a sulphate and treated as before, animal charcoal being employed to free it from colour. The quinia remaining in the mother-liquors, as it will not crystallize from alcohol, may be obtained by evaporation to dryness. To obtain the *sulphate of cinchonia*, mix the alkaloid with a small quantity of water, heat the mixture, and add gradually dilute sulphuric acid sufficient to saturate it; then boil with animal charcoal previously washed with muriatic acid, and filter the liquid while hot. Upon cooling it will de-

* Soda is a better precipitant, as it is probably incapable of dissolving any of the alkaloid when employed in excess. In the U.S. formula for procuring sulphate of cinchonia from the mother-waters advantage has been taken of this fact. Hence the process differs from the one given in the text, both in using soda as the precipitant, and in forming the sulphate immediately from the precipitate, which is sufficiently pure for this treatment in consequence of the use of soda, instead of first separating the alkaloid by means of alcohol, and afterwards combining it with sulphuric acid. (See *Cinchoniæ Sulphas*, page 1124.) We retain the account of Pelletier and Caventou's process in the text, in order that the reader may have an opportunity of comparing them.

posit crystals of the sulphate, and, by repeated evaporation and crystallization, will yield all the salt which it holds in solution.*

* A new mode of extracting quinia and other active vegetable principles has been proposed, which, if found as successful on trial as it is said to have been in the hands of its proposer, promises to supersede many of the processes now in use. From the experiments of M. Lebourdais, it would appear that purified animal charcoal has the property of extracting from many vegetable products not only their colouring, but their sapid principles also, and afterwards of yielding the active matter uncombined to boiling alcohol, from which it is obtained by evaporation. M. Lebourdais deprived Peruvian bark of all its soluble principles by repeated maceration in alcohol of 0·923, filtered the resulting liquors, removed the alcohol by distillation, and mixed the liquid residue with a decoction made by boiling the same bark twice in distilled water. Acetate of lead was added to precipitate the resinous matter; and the liquor, having been filtered, was made to pass slowly through purified animal charcoal, by which it was deprived of colour and taste. The charcoal was then washed, dried, and treated with alcohol of 0·848. The alcoholic solution thus obtained, upon being evaporated, yielded the quinia perfectly pure. (*Am. Journ. of Pharm.*, xxi. 92; from *Ann. de Chim. et de Phys.*) A chemist, however, who has tried this process, informs us that he has not found it to answer well in practice.

Mr. Clark proposes to prepare quinia by means of the fatty acids as follows. Having exhausted the bark as usual by acidulated water, he treats the solution with an alkaline carbonate so long as a precipitate is produced, then adds a little stearic acid, and boils the whole. The fatty acid melts, floats on the surface, and there attracts the quinia and cinchonia, forming a kind of insoluble soap, while the precipitate and liquid become black. On cooling, the fatty matter coagulates, and, on being withdrawn and boiled in water so long as this remains limpid, and then treated with boiling acidulated water, yields the quinia and cinchonia to the acid. The hot solution, being neutralized by an alkali, deposits a brown matter, which is to be separated by filtration, and on cooling yields the sulphate of the two alkaloids in a crystalline state. The quinia and cinchonia can then be separated in the ordinary mode. (See *Journ. de Pharm.*, Dec. 1861, p. 463.)

We have been told that considerable quantities of a preparation have been imported from South America, consisting of a mixture of the alkaloids of bark in an impure state, obtained by forming acidulated decoctions of bark, precipitating with lime, treating the precipitate with alcohol, and evaporating the alcoholic solution. From this material the sulphates of quinia and cinchonia have been prepared on a large scale. It has sometimes yielded 25 per cent. of quinia converted into sulphate, and more than an equal quantity of cinchonia. (*Note to the eighth and tenth editions.*)

Quinoidine. Precipitated Extract of Bark. Amorphous Quinia. Cinchonicia and Quinicia of Pasteur. Upon the evaporation of the mother-liquor left after the crystallization of sulphate of quinia in the preparation of that salt, a dark-coloured substance is obtained, having the appearance of an extract. This was habitually employed by the late Dr. Emlen and one of the authors of this work, so early as about the year 1824, in the cure of intermittent fever, in which it proved equally effectual with the pure sulphate, though only about half as strong. It was adopted in the edition of the U. S. Pharmacopœia for 1830, under the name of "*impure sulphate of quinia*," but was abandoned in the edition of 1840, on account of the difficulty of ascertaining its purity. Sertürner supposed that he had discovered a new alkaline principle in this product; but his conclusions were invalidated by the experiments of MM. Henry and Delondre, which went to prove that the alkaline matter contained in it consisted of quinia and cinchonia, obscured by admixture with a yellowish substance that interfered with their crystallization. Nevertheless, under the name of *quinoidine* or *chinoidine*, given to the supposed new alkaloid by Sertürner, there has been long employed in Europe a substance precipitated from the mother-liquor of sulphate of quinia by means of an alkaline carbonate, having a yellowish-white or brownish colour, and, when moderately heated, agglutinating into a mass of a resinous appearance. This substance was found by Dr. F. L. Winckler to contain an uncrystallizable alkaline principle, having the same combining weight as quinia, and differing from that alkaloid only in the want of the property of crystallization, and in forming uncrystallizable salts with the acids. (*Pharm. Cent. Blatt*, May, 1847, p. 310.) Liebig afterwards proved it to be identical in composition with ordinary quinia, to which he considered it as bearing the same relation that uncrystallizable sugar bears to the crystallizable. Pasteur has found that ordinary quinoidine, or amorphous quinia, consists of two alkaloids, derivatives from quinia and cinchonia, with which they are respectively isomeric, though differing in being uncrystallizable, and named, in view of their origin, *quinicia* and *cinchonicia*. The pure amorphous quinia of Liebig is the former of these alkaloids. (See *page* 316.) This substance has been found equally effectual with quinia in the cure of intermittents. In an economical point of view, it is highly important that it should be employed. It is sometimes sold under the name of *precipitated extract of bark*; and there can be little doubt that it enters into other preparations, which, under the name of extract of bark, have been put forth as peculiarly valuable for the cure of intermittents. It must not be confounded with the substance obtained by evaporating the mother-liquors, which is of uncertain composition and strength. The chief objection to it is its liability to adulteration. The *amorphous quinia*, as Liebig calls it, is entirely soluble in dilute sulphuric acid and in alcohol: and, if its solution in a dilute acid yield upon the addition of ammonia exactly as much precipitate as there was of the original substance dissolved, it may be considered pure. (See *Am. Journ. of Pharm.*, xviii. 181.) We have been informed that, in an extensive chemical manufacturing establishment in Philadelphia, since the introduction of steam heat, the loss by quinoidine in the preparation of sulphate of quinia has much diminished, showing the agency of heat in converting the crystallizable into the uncrystallizable salt.

As commercial quinoidine is often very impure, sometimes, according to the observations of M. de Vry, containing as much as 35 per cent. of foreign matters, a satisfactory method of purifying it becomes important. The following has been proposed by M. de Vry, founded on the observation of M. Pasteur, that 9 parts of quinoidine, rubbed for a long time in a mortar with a dilute

When barks containing the newly discovered alkaloids *cinchonidia* and *quinidia* (*see page* 314) are used, as their sulphates are much more soluble than that of quinia, it follows that, in the mother-waters left after the crystallization of sulphate of quinia, there will be found a portion of sulphate of cinchonidia or quinidia, or of both. In fact, there is generally, under these circumstances, more or less of the sulphates of the four alkaloids, quinia, cinchonia, quinidia, and cinchonidia, all of which are contained in many barks; and, besides these, a portion of amorphous alkaloid, incapable of crystallization, probably resulting, in part at least, from the heat employed in the process. These may in a great degree be separated through their different solubilities in water. Sulphate of quinia being least soluble will first crystallize, afterwards the salt of cinchonidia or quinidia, and finally that of cinchonia, which is the most soluble of the four; while the uncrystallizable salt will remain in solution, and may be obtained in the amorphous state by evaporation to dryness.

Properties. Sulphate of quinia is in fine silky, slightly flexible, needle-shaped crystals, interlaced among one another, or grouped in small star-like tufts. Its taste is intensely bitter, resembling that of the yellow bark. It effloresces slightly on exposure to the air, and, at a moderate heat, loses its crystalline form in consequence of the escape of its water of crystallization. At the temperature of 212° it becomes luminous, especially when rubbed. At about 240° it melts, assuming the appearance of wax. It is very slightly soluble in cold water, requiring, according to M. Baup, 740 parts at 54° F. for solution; while at the boiling point it is dissolved in 30 parts of water, which deposits it upon cooling.* Its cold solution is opalescent.† The acid salts of quinia possess fluorescent properties, but, according to Prof. Henry Morton, the chloride does not, and hydrochloric acid will destroy the fluorescence of a solution of the sulphate. It is slightly soluble in cold and freely in hot glycerin. Mr. Schlagdenhauffen affirms that by rapid cooling the glycerin can be made to retain a considerable proportion of it for some hours or days. (*Am. Journ. of Pharm.*, xlv. 71.) It is soluble in about 60 parts of cold alcohol of 0·835, but only to a very small extent in ether. The diluted acids, even tartaric and oxalic acids in excess, dissolve it with great facility. With an additional equivalent of sulphuric acid it forms another sulphate, which is more soluble in water than the officinal salt, and crystallizes from its solution with much greater difficulty. This is now considered by many as strictly

solution of 2 parts of neutral oxalate of ammonium, are at length completely dissolved, with the escape of the ammonia, and entire separation of impurities. M. de Vry boils in an iron vessel 9 parts of quinoidine with a weak solution of 2 parts of oxalate of ammonium, until ammonia ceases to escape. As the insoluble matter attaches itself in places to the surface of the vessel, he adds from time to time distilled water so as to cover this matter during the boiling. As soon as ammonia is no longer disengaged, he allows the liquor to become quite cool, and ascertains if it is made turbid by the addition of water. In this case he dilutes the solution with water, then filters, and precipitates in a capsule with an excess of solution of caustic soda. The tenacious precipitate which forms may be collected, by means of a gentle heat, in the bottom of the capsule. The clear alkaline liquid is then decanted, and the precipitated quinoidine washed repeatedly with distilled water. Thus purified, being still adhesive, it is exposed for some time to a heat of 212° to 230°, at which it parts with the water it contained, and becomes, after cooling, hard and friable. The oxalate of ammonium is used in order to get rid of lime, which is a frequent impurity in quinoidine. (*Journ. de Pharm.*, 4e sér., iv. 50.)—*Note to the thirteenth edition.*

* M. Calloud has ascertained that the solubility of sulphate of quinia is much affected by certain salts. While it is increased by chloride of ammonium, nitrate of potassium, and chloride of sodium, it is diminished by the sulphates of sodium and magnesium. Sulphate of quinia is decomposed wholly or in part by bicarbonate and phosphate of sodium. (*Pharm. Journ.*, June, 1860, p. 609.)

† *Animal Quinoidine.* The peculiar appearance characterizing solutions of quinia, even when extremely feeble, called opalescence or fluorescence, was observed by Dr. H. Bence Jones in the fluids of animals, after having taken quinia, and was subsequently noticed, as an ordinary result, even when no quinia had been given, though in a less degree. This led Dr. Jones to the supposition that there existed normally in the animal system a substance identical or analogous with quinia, which he called *animal quinoidine.* The fluids exhibiting this phenomenon answered to other tests of quinia: and, though this substance could not be isolated, probably in consequence of its extremely minute proportion, the evidence seemed very strong in favour of the idea, that a principle closely resembling quinia exists normally in the human system. A curious fact, in connection with this subject, is that the substance in question ceases apparently to exist in the system in a state of fever. This discovery opens a wide field for observation to the physiologist and pathologist; but at present would scarcely seem to fall within the province of the pharmaceutist. From an editorial in the *Lancet*, July 4, 1868, it appears that Dr. Dupré, and not Dr. Bence Jones, was really the discoverer of animal quinoidine. The value of the discovery is rendered doubtful by the assertion of Dr. Chalvert, that the same fluorescent body abounds in ordinary articles of food. ('*Schmidt's Jahrbücher*, cxli. 152.)—*Note to the thirteenth and fourteenth editions.*

neutral, and therefore entitled to the name of sulphate of quinia; while the officinal salt is thought to contain two equivalents of base to one of acid, and is therefore a *subsulphate or disulphate of quinia.* The latter name was adopted by the London College, and has been much used by chemical writers. In the U. S., Dublin, and Edinburgh Pharmacopœias, as well as in the French Codex, the name of sulphate of quinia, originally given to the officinal salt, under the impression that it was neutral, was retained; and it has been assumed in the new British Pharmacopœia. Hence has arisen a confusion of nomenclature, which must be embarrassing to the student. Our own impressions are in favour of the higher number of the equivalent of quinia, and consequently of the view which considers the officinal name of sulphate of quinia as properly representing the composition of the salt. According to M. Baup, the higher sulphate, formerly called *supersulphate*, and still considered by many if not most chemists as the *bisulphate*, is soluble in 11 parts of water at 54° F., and in its own water of crystallization at the boiling point. It is very soluble in diluted, and somewhat less so in absolute alcohol. It may be obtained by adding to a boiling concentrated solution of the ordinary sulphate, as much sulphuric acid as already exists in the salt, and then evaporating the solution. The solutions of quinia salts when long kept are liable to deterioration with the production of a fungus; this appears to be especially the case when tartaric acid is used. (*Journ. de Pharm.*, 4e sér., viii. 208.)

Composition. The officinal sulphate of quinia, the disulphate of some chemists, is the one generally used in medicine, and to this we have allusion in the present work, whenever sulphate of quinia is mentioned without any distinguishing epithet.* In the crystalline form it consists, if regarded as neutral, of one eq. of quinia 324, one of sulphuric acid 40, and eight eqs. of water 72 = 436; but if considered, in accordance with Liebig's views, as a subsulphate or disulphate, of two eqs. of quinia (each 162), one of sulphuric acid, and eight of water; the whole eq. of the salt being, of course, the same in either case. On exposure to the air, or to a heat of 212°, it effloresces, losing one-half of its water of crystallization; and at 240° it loses one-half of the remainder, retaining two eqs. or about 4 per cent. of water, of which it cannot be deprived without decomposition. (*Phillips.*)†

* *Soluble or Bisulphate of Quinia.* This salt, which contains twice as much acid as does the officinal drug, is coming more and more into use. According to J. Doude, a very fine crystalline form of it may be obtained by the following formula. Take of basic sulphate of quinia 150 grammes; of sulphuric acid, 66°, 22 grammes; of water 2 litres. Dissolve slowly the sulphate in the mixture of the acid and water at a temperature of 29° C. Filter; evaporate to 600 grammes; allow to stand twenty-four hours to crystallize; pour off the mother-liquor and evaporate for a second crop; finally the little remaining alkaloid may be saved by precipitating out with an alkali. (*Am. Journ. of Pharm.*, xliv. 445.)—*Note to the fourteenth edition.*

† *Iodide of Sulphate of Quinia, &c.* This remarkable compound of officinal sulphate of quinia was discovered by Dr. Wm. Bird Herapath, of Bristol, England, who also investigated its singular optical properties. If to a solution of sulphate of quinia in a mixture of acetic acid and diluted alcohol, tincture of iodine be added by drops, and the mixture kept at 130° F. until perfect solution takes place, upon the cooling of the liquid, crystals will gradually form, which Dr. Herapath has found to consist of iodine, quinia, and sulphuric acid, probably combined in the state of *sulphate of iodo-quinia.* To obtain fine crystals various precautions are necessary, for which the reader is referred to the paper of Dr. Herapath. The crystals are of a brilliant emerald-green when viewed by reflected light, but almost colourless by transmitted light, and present a curious play of colours under varying circumstances of position. Their shape is very diversified, but traceable to the rhombic prism. They are dissolved by heated acetic acid and heated alcohol, and deposited on cooling. Their most remarkable property is that of polarizing light, in which they are equal if not superior to the tourmaline, for which they may be substituted with advantage in experiments in this branch of optics. (*Pharm. Journ.*, xi. 448 and 449, and xiii. 378. See also *Am. Journ. of Pharm.*, xxvi. 18.) From subsequent experiments of Dr. Herapath, it appears that the other cinchona alkaloids form similar salts with iodine; so that crystals may be obtained of the *sulphates of iodo-quinidia, iodo-cinchonia,* and *iodo-cinchonidia,* as well as of iodo-quinia. But the reader will note that the nomenclature of the alkaloids adopted by Dr. Herapath differs from that of Pasteur, and unfortunately we think, as that of Pasteur is based on the analogies of the alkaloids. The quinia and cinchonia are the same with both, but the quinidia of Pasteur is the cinchonidia of Herapath, and vice versa. In the following observations the nomenclature of Dr. Herapath is used, in justice to that writer. It appears that, of these different compounds, there is a close analogy in crystalline forms between the iodo-quinia and iodo-cinchonidia salts on the one hand, and the iodo-cinchonia and iodo-quinidia salts on the other, while between the two twin sets there is a decided difference; so that there is no difficulty in deciding whether a quinia salt contains quinidia or cinchonia, or a cinchonia salt cinchonidia or quinia, yet it may not be so easy to discriminate between the salts of analogous forms. Nevertheless there are sufficient points

Incompatibles and Tests. Sulphate of quinia is decomposed by the alkalies, their carbonates, and the alkaline earths. In solution, it affords white precipitates with potassa, soda, and ammonia, which are partly soluble in an excess of alkali. It is also precipitated by astringent infusions, the tannic acid of which forms a white insoluble compound with quinia. The soluble salts of lead and of baryta occasion precipitates; and that produced by the salts of baryta is insoluble in the acids. The soluble salts of oxalic, tartaric, and gallic acids occasion more or less precipitation with solution of sulphate of quinia without excess of acid; and Mr. J. M. Maisch has ascertained the same to be true of the acetates. (*Am. Journ. of Pharm.*, xxvii. 97.) A freshly prepared solution of chlorine, added to a solution of sulphate of quinia and followed by the addition of water of ammonia, occasions an emerald-green colour, and, in certain proportions, the deposition of a green precipitate. The green compound has received the name of *Thalleiochine*. The drop of ammonia should be put in without agitation. According to Flückiger, $\frac{1}{5000}$ part of quinia can thus be found. With bromine, instead of chlorine, the test is more delicate. Flückiger states that $\frac{1}{20000}$ part of the alkaloid can be detected. (*Pharm. Journ. and Trans.*, May, 1872, p. 901.) If, previously to the use of ammonia in the chlorine test, a concentrated solution of ferrocyanide of potassium be added, a dark-red colour is produced, which persists for several hours, but ultimately passes into green. This does not take place with cinchonia; and, though sulphate of quinidia gives the same red colour, this does not disappear as with the salt of quinia, but is persistent. (Schwartzer, *Journ. de Pharm.*, 4e sér., iii. 475.) Sulphate of quinia gives a reddish-brown precipitate with iodine dissolved in a solution

of dissimilarity to enable a correct diagnosis to be made. It is not by their chemical characters that these iodo-salts can be discriminated; though the cinchonia and quinidia salts dissolve with greater difficulty than the others in consequence of their greater thickness, and less extent of surface. The crystals of the *cinchonidia* salt (*quinidia*, Pasteur), like those of the sulphate of iodo-quinia, are derived from the rhombic prism, but differ in certain points which we have not space to detail, and in reference to which we must be content to refer to Dr. Herapath's paper. They are distinguishable to the practised eye by their different tint with reflected and transmitted light. But these salts differ greatly from the *iodo-cinchonia* and *iodo-quinidia* (*iodo-cinchonidia*, Pasteur) *sulphates*. The crystals of the latter of these salts are long quadrilateral acicular prisms, of a deep-ruby or garnet-red colour, with bluish-violet or light-purplish reflection tints, or they have the form of thin plates, or long, flat, acicular prisms, which, when thin, transmit a pure yellow, but if thicker, a reddish colour tinged with brown. The analogous *iodo-cinchonia sulphate* is in long, acicular, quadrilateral prisms, of a deep purplish-black colour; and in relation to transmitted light also closely resembles the preceding. All these iodo-salts have double refractive properties. Dr. Herapath gives the following as their composition; 1. *sulphate of iodo-quinia*, $C_{57}H_{33}N_2O_5,I_2 + 2SO_3HO + 5HO = 840$; 2. *sulphate of iodo-cinchonidia* (*iodo-quinia*, Pasteur), $C_{57}H_{33}N_2O_5,I_3 + 2SO_3HO + 5HO = 967$; 3. *sulphate of iodo-cinchonia*, $C_{35}H_{19}N_2O_2.I_3 + SO_3HO + 6HO = 757$; 4. *sulphate of iodo-quinidia* (*iodo-cinchonidia*, Pasteur), $C_{35}H_{19}N_2O_4.I_2 + SO_3HO + 5HO = 637$. When the acid sulphates of the mixed alkaloids, quinia, quinidia, cinchonia, and cinchonidia, are dissolved in dilute alcohol, and the solution heated to from 80° to 120°, tincture of iodine readily separates the quinia salt; further treatment in the same manner separates the cinchonidia (*quinidia*, Pasteur) salt, more or less mixed with the preceding; still further treatment, the quinidia (*cinchonidia*, Pasteur) salt with its well-marked characters; and the cinchonia salt, being by far the most soluble, is the last to appear, but if in large proportion will be mixed with the quinidia (cinchonidia) salt. Cinchonidia (quinidia) may thus be readily detected in cinchonia, which might otherwise be considered pure. In like manner a mixture of quinidia (cinchonidia) with quinia is easily made evident. (See *Am. Journ. of Pharm.*, May, 1858, p. 246; from *Pharm. Journ.*, March, 1858.)

The rotating powers of the cinchonia salts in reference to polarized light also afford means of distinguishing them, to those who may possess the requisite apparatus. Allusion has been made to these properties under the several alkaloids in the first part of the work. It may be proper to say here that quinia and cinchonidia (*Pasteur*) are strongly lævogyrate, while cinchonia and quinidia (*Pasteur*) are strongly dextrogyrate, and quinicia and cinchonicia slightly dextrogyrate.

We may here, moreover, refer to another test, requiring instrumental aid, offered by Mr. W. Walter Stoddart. If a drop of a solution of sulphocyanide of potassium be added to a saturated and neutral solution of a suspected specimen of sulphate of quinia, and the mixture be observed, by means of the microscope, if cinchonia or quinidia (cinchonidia, *Pasteur*) be present, characteristic crystals of sulphocyanide of these alkaloids will be noticed, wholly distinct in shape from those of sulphocyanide of quinia formed at the same time. (*Pharm. Journ.*, Oct. 1864, p. 155, and *Am. Journ. of Pharm.*, Jan. 1865, p. 41.)

Still another newly discovered mode of distinguishing between quinia and cinchonia, suggested by M. Palm, is one based on the influence of polysulphuret of potassium on those alkaloids. If a solution of this reagent be added to a boiling solution of a salt of quinia, this, however small may be its proportion, will be thrown down as a red, viscid mass, which hardens upon cooling, and assumes a resinous appearance; whereas cinchonia is separated as a white powder containing sulphur. The polysulphuret is prepared by boiling a solution of potassa with an excess of sulphur. (*Journ. de Pharm.*, Mai, 1864, p. 459.)—*Notes to the eleventh and twelfth editions.*

of iodide of potassium. It is possible that under some circumstances the galvanic current may be of service in detecting the alkaloid; a paper on the electrolysis of the salt may be found in the *Journ. de Pharm.*, 4e sér., xi. 16.*

Adulterations. Sulphate of quinia has often been adulterated. The effects of adulteration may be produced by the variable quantity of water which sulphate of quinia may contain, without any observable alteration in its sensible properties. MM. Millon and Commaille, having exposed sulphate of quinia to a very moist atmosphere, at the temperature of about 62° F., found it always to increase in weight; so that a specimen of the salt, previously deprived of all its water capable of being separated by heat, had in five days absorbed 28·77 per cent. of water, and another specimen dried after its precipitation simply by draining, and supposed to contain 18 per cent. of water, had in ten days absorbed 14 per cent. more, making its whole percentage of water 32, or about one-third of its weight. (*Journ. de Pharm.*, Nov. 1862, p. 379.) This is an important fact, and will explain, to some extent, the frequently variable effects from apparently the same quantity of the salt. It is easy to detect and to obviate this natural sophistication by exposing a suspected specimen to a heat of 212°. The loss of weight will indicate the quantity of water, not essential to the salt. Sulphate of calcium, and other alkaline or earthy salts, gum, sugar, mannite, starch, stearin or margarin, caffein, salicin, phloridzin, and the sulphates of cinchonia and other cinchona alkaloids, are among the substances which are said to have been fraudulently added. By attending to the degree of solubility of the sulphate in different menstrua, and to its chemical relations with other substances already described, there can be little difficulty in detecting these adulterations. The presence of any mineral substance, not readily volatilizable, may be at once ascertained by exposing the salt to a red heat, which will completely dissipate the sulphate of quinia, leaving the mineral behind. A volatile ammoniacal salt may be detected by the smell of ammonia emitted upon the addition of potassa. The absence of organic substances may be inferred, if pure cold concentrated sulphuric acid forms a colourless solution. Gum and starch are left behind by alcohol, and fatty matters by water acidulated with sulphuric acid. Sugar and mannite cause a solution of the salt in acidulated water to have a sweet taste, after the precipitation of the quinia by an alkaline carbonate. Salicin imparts the property of becoming red upon the contact of sulphuric acid; but, according to Pelletier, this change of colour does not take place, unless the proportion of salicin exceeds one-tenth. If only in this proportion, the salicin must be isolated. To 1 part of the suspected salt, 6 parts of concentrated sulphuric acid may be added, and to the brown liquid which results, 125 parts of water. The salicin is thus separated, and may be obtained by filtration, in the form of a bitter, white powder, becoming bright red with sulphuric acid. (See *Am. Journ. of Pharm.*, xvii. 156.)† Caffein alters the solubility of the medicine in different menstrua. According to M. Calvert, a saturated solution of sulphate of quinia in cold water gives, with a solution of chloride of lime, a precipitate soluble in an excess of the latter; while a solution of sulphate of cinchonia of the same strength, treated in the same manner, gives a precipitate which is insoluble in a great excess of the reagent. The same effect is

* Morphia has been mixed with quinia with fatal results. If there be more morphia than will form $\frac{1}{1000}$ part of the solution, the Thalleiochine test fails to develop the green colour. The morphia in these cases is to be recognised by adding nitric acid or chloride of iron to the suspected powder, or, better still, iodic acid, which is decomposed by the alkaloid and forms a beautiful violet solution with chloroform. This test is said to succeed with solutions containing not more than $\frac{1}{10000}$ of morphine. (*Pharm. Journ. and Trans.*, May, 1872, p. 901.)

† For a method of detecting the presence of salicin by the saliretin produced, and of determining the proportion of salicin, by means of the glucose resulting, when the salicin is decomposed by muriatic acid, see a communication by M. Bourlier in the *Journal de Pharmacie* (Juillet, 1859, p. 34). Another method of detecting minute proportions of salicin, proposed by Parrot, is by means of chromic acid. The mode of proceeding is as follows. The suspected salt is put with a little water into a small retort, to which are added two cubic centimetres of sulphuric acid diluted with 4 parts of water, and 4 cubic centimetres of a concentrated solution of bichromate of potassium. The retort is connected with a phial by means of a tube plunging into a dozen grammes of distilled water contained in the phial; and the heat of a spirit lamp is applied. In three or four minutes, if salicin is present, hydrate of salicyl distils over, and the water in the receiver assumes a beautiful violet colour on the addition of a drop or two of solution of perchloride of iron. (*Ibid.*, Dec. 1867, p. 450.)

produced with lime-water, and solution of ammonia; and solution of chloride of calcium, while it furnishes a precipitate with a solution of sulphate of cinchonia, yields none with a solution of sulphate of quinia. (*Journ. de Pharm.*, 3e sér., ii. 394.)* The Edinburgh College gave the following mode of testing the purity of sulphate of quinia. "A solution of ten grains in a fluidounce of distilled water and two or three drops of sulphuric acid, if decomposed by a solution of half an ounce of carbonate of soda in two waters [twice its weight of water], and heated till the precipitate shrinks and fuses, yields on cooling a solid mass, which when dry weighs 7·4 grains, and in powder dissolves entirely in solution of oxalic acid." According to the London College, "100 grains dissolved in diluted hydrochloric acid, yield, on the addition of chloride of barium, 26·6 grains of sulphate of baryta, dried at a red heat." Though sulphate of quinia, as prepared for use, frequently contains a portion of one or more of the recently discovered cinchona alkaloids, the salt is probably not less efficacious on that account; as these alkaloids have been shown to possess identical therapeutical properties with those of quinia, and to be little inferior in strength, if at all, in relation to most of them.

Medical Properties and Uses. Sulphate of quinia produces upon the system, so far as we are enabled to judge by observation, the same effects as Peruvian bark, without being so apt to nauseate and oppress the stomach. (See *Cinchona*). Its effects upon the brain are even more striking than those of cinchona, probably because it is given in larger proportional doses. Even in ordinary doses, it often produces considerable cerebral disturbance, evinced by a feeling of tightness or distension in the head, ringing, buzzing, or roaring in the ears, hardness of hearing, &c. Some individuals are more liable to these effects than others, and in some even small doses produce them. A certain degree of this observable action on the brain is rather desirable than otherwise, as an evidence that the medicine is affecting the system. In very large quantities, as from a scruple to a drachm or more, besides the phenomena men-

* Liebig's test of the presence of cinchonia is perhaps the simplest. Rub together fifteen grains of the suspected salt and two ounces of solution of ammonia, put the mixture into a flask, add two ounces of ether, and shake frequently. The quinia liberated by the ammonia is dissolved by the ether, while any cinchonia that may be present remains undissolved, floating between the ethereal solution above and the ammoniacal beneath. But M. O. Henry has shown that cinchonia is slightly soluble in ammonia, so that a small portion might escape detection. It has, therefore, been proposed to modify the test by heating the mixture of the suspected salt and ammonia, so as almost entirely to drive off the excess of this alkali, and then to add the ether. If the liquid now remain quite transparent, without any turbid layer between the upper and lower stratum, it may be inferred that no cinchonia is present. For papers on this subject see *Journ. de Pharm.* (3e sér., xiii. 102, xvi. 327, and xxi. 284), and *Am. Journ. of Pharm.* (xx. 231, and xxiv. 166).

The precise quantities originally proposed in Liebig's test were one gramme of sulphate of quinia, ten grammes of ether, and two grammes of caustic ammonia. But M. Roger has proved that, with these proportions, in order that the test may succeed, it is necessary to use ether containing alcohol, which is the case with commercial ether. Of pure ether 25 grammes would be requisite for the perfect solution of the quinia from a gramme of the sulphate, while 10 grammes of ether containing but two per cent. of alcohol will produce the same effect. In these proportions the presence of quinidia as well as of cinchonia would be detected. (Roger, *Journ. de Pharm.*, Mars, 1862, p. 204.) For a method of detecting the presence of *quinidia* in sulphate of quinia, the reader is referred to a note in the first part of this work, *page* 321.

For an elaborate account by Dr. G. Kerner of the cinchona alkaloids, of which he believes that there are several not yet fully determined, and of the methods of testing commercial sulphate of quinia for the other alkaloids with which it is apt to be contaminated, we must be content with referring to the paper itself, which appeared in the *Zeitschrift für Analytische Chemie*, but a translation of which will be found in the *Pharm. Journ.* for July, 1862, and in the *Am. Journ. of Pharm.* (Sept. 1862, p. 417). Perhaps the most important practical result of these investigations is the suggestion of a new test by which the alkaloids may be distinguished: their solubilities, namely, in water of ammonia of given strength, which, according to Dr. Kerner, are more fixed and reliable than their solubilities respectively in water, or other ordinary solvent. The mode of application is by taking a certain quantity of the sulphate of the alkaloid dissolved in a certain quantity of water, and then adding the water of ammonia gradually until the precipitated alkaloid is redissolved; and the quantity of the ammoniacal liquid necessary to produce this effect indicates inversely the solubility of the alkaloid. Quinidia requires from 10 to 11 times more of the ammoniacal liquid than quinia, cinchonidia from 12 to 13 times more; while cinchonia is not dissolved by a much larger proportion than is required by either of the others, and though, when mixed in very small proportion with quinia it is dissolved at first, yet it afterwards separates on standing. For a recent paper by M. O. Hesse, in which the work of Kerner is considerably revised, see *Annalen der Chemie und Pharmacie*, clxvi. 217, abstracted in the *Journ. de Pharm.*, 4e sér., xviii. 72. (*Note to the twelfth and fourteenth editions.*)

tioned, it has been observed to occasion severe headache, vertigo, deafness, diminution or loss of sight, dilated and immovable pupil, loss of speech, general tremblings, intoxication, or delirium, coma, and great prostration. In some instances the pulse has been remarkably diminished in frequency, down to fifty or even less in the minute. In an instance recorded by Giacomini, in which a man took by mistake about three drachms, the patient became insensible, and some hours afterwards was found by the physician in a state of general prostration, from which he recovered under the use of laudanum and aromatic waters. (*Ann. de Thérap.*, A. D. 1843, p. 176.) Besides its effects on the brain, sulphate of quinia sometimes occasions great gastric and intestinal irritation, marked by oppression of stomach, nausea, abdominal pains, vomiting, and purging. In general these effects of excessive doses gradually pass off, although partial deafness often continues for several days, and sometimes much longer. It is even said that permanent deafness has resulted. Though sulphate of quinia has been proved by the experiments of Dr. Baldwin, of Montgomery, Alabama, to be fatal to dogs, if prevented from vomiting by a ligature round the œsophagus, in quantities varying from fifteen or twenty grains to two drachms, with the symptoms of narcotic poisoning; yet we have seen no well authenticated case of death from its direct action on the perfectly healthy human subject. Given largely in disease, it has repeatedly caused fatal results, not so much however by its peculiar action, as by co-operating with the disease in establishing intense local irritation or inflammation, especially in the brain. Though capable, therefore, of doing mischief if improperly used, sulphate of quinia can scarcely be ranked among the poisons.

From its occasional effect in diminishing the frequency of the pulse and the general strength, it has been supposed to be essentially sedative in large doses. Such an opinion, unless well founded, might lead to hazardous practice. The probability is that the apparently sedative effect upon the circulation arises from an overwhelming stimulant influence upon the cerebral centres, whereby the system is deprived of the support of these centres, and the heart's action is depressed with other organic functions. Similar effects may be obtained from excessive doses of most of the cerebral stimulants. Examination of the brain in the lower animals, after death from quinia, has shown great congestion of that organ and its membranes, and even meningitis. (See *Am. Journ. of Med. Sci.*, xix. 197.) In the present state of our knowledge, therefore, it is safest to consider sulphate of quinia as a direct and powerful stimulant to the brain. It probably operates through the circulation, as there is no doubt that it is absorbed, the alkaloid having been found unchanged in the urine. Quinia is said to be a specific poison for the lower organisms (*N. Y. Med. Journ.*, Sept. 1868, p. 550; from *Schmidt's Jahrbuch*); and some would be disposed to find in this property an explanation of its efficacy in miasmatic diseases.

Sulphate of quinia may be substituted for cinchona in all diseases to which the latter is applicable; and, in the treatment of intermittents, has almost entirely superseded the bark. It has the advantage over that remedy, not only that it is more easily administered in large doses, and more readily retained by the stomach, but that in cases which require an impression to be made through the rectum or the skin, it is much more effectual; because, from the smallness of its bulk, it is more readily retained in the former case, and more speedily absorbed in the latter. Still we cannot be certain that there are not other active principles in bark besides the alkaloids, which are closely analogous in their effects, nor that the mode of combination in which these principles exist may not in some measure modify their therapeutic action. Until this question is solved, we may resort to the bark if the sulphate of quinia should not answer the ends in view; and instances have occurred, under our own notice, in which it has proved successful in intermittents after the salt had failed.

A novel use of sulphate of quinia is for preservation from the attacks of cholera. Dr. La Roche, of Kurnik, recommends it strongly as a prophylactic against that disease, considering it not less efficacious than vaccination against smallpox. On the approach of the epidemic, two grains are taken every hour until the quantity amounts to twenty-four grains, after which two grains are taken three times a day for three weeks, and, finally, the same dose night and morning until the epidemic disappears. (*Med. and Surg. Reporter*, Aug. 15, 1868, p. 134; from *Ph. Centralhalle.*)

[Although it is not possible at present to point out the connection between the known physiological action of quinia and its clinical use, yet it seems proper to speak here briefly of our knowledge of its influence upon the healthy organism, referring the reader for details to my treatise on Therapeutics. It has been proven by Prof. Binz that when the alkaloid is added to blood outside of the body in a proportion of not less than one part to four thousand, it immediately checks, and finally arrests, the amœboid movements of the white blood corpuscles. How far this occurs when the medicine has been taken into the living organism has not been exactly determined. Ordinary therapeutic doses exert, however, no perceptible influence. The ozonizing power of the red corpuscles in drawn blood is lowered by the addition of quinia. How far the marked antipyretic influence exerted by large doses of quinine are dependent upon its action upon the blood is at present purely a matter of conjecture. In 1765 Dr. Pringle called attention to the power of cinchona bark over putrefaction, and it has recently been experimentally proven by Binz, Hallier, Pavesi, and others, that one part of the alkaloid in three hundred of milk, albuminous solutions, meat, honey, syrup, &c., will keep in check for a long time putrefaction and other fermentations. Prof. Binz has shown that this is due to a poisonous influence upon the low forms of life which accompany or produce these changes. An enormous amount has been written during the last ten years concerning the action of quinia upon the uterus. The result of it all seems to me to indicate very positively that the alkaloid has no power to originate uterine contractions in the pregnant female, but that when once parturition has commenced the flagging pains are greatly stimulated and increased by a dose of ten grains of the drug. When abortion is threatened through malarial influence, no hesitation need be felt in using the drug to avert the impending catastrophe. Any salt of quinia which escapes absorption in the stomach must be precipitated by the alkaline juices of the bowels, and be absorbed very slowly or not at all. What seems a priori almost inevitable has been shown to be the case by the researches of Kerner, who found the alkaloids in the feces. The importance of giving the salt in some easily soluble form, if it is intended for all of it to be absorbed, is plain. When taken into the system, it seems to find its way into all the secretions; it having been found in the tears, sweat, milk, urine, and saliva. Some of it is probably eliminated unchanged, but, according to the researches of Dr. G. Kerner, a portion of it escapes in an amorphous uncrystallizable form and a second portion as a substance free from bitter taste, though crystallizable and having the fluorescence of quinia; for this substance he has proposed the name of *dihydroxyle quinia*. Upon the elimination both of uric acid and urea the salts of quinia appear to have a decided influence, decreasing it very decidedly. H. C. W.]

Sulphate of quinia may be given in pill or solution, or suspended in water by the intervention of syrup and mucilage. The form of pill is usually preferred. (See *Pilulæ Quiniæ Sulphatis.*) The solution may be readily effected by the addition of a little acid of almost any kind to the water. Eight grains of the sulphate will dissolve in a fluidounce of water, acidulated with about twelve minims of the diluted sulphuric acid, or aromatic sulphuric acid of the Pharmacopœias; and this is the most eligible mode of exhibiting the medicine in the liquid form. The addition of a small proportion of sulphate of morphia or of laudanum will often be found advantageous when the stomach is disposed to be sickened, or the bowels to be disturbed by the quinia. Mr. J. S. Blockey ascertained that glycerin will, if gently heated, dissolve eight grains of the sulphate in each fluidrachm, and may therefore be conveniently used as a vehicle. (*Lond. Chemist*, Sept. 1857.) Dr. R. H. Thomas, of Baltimore, found that one part of tannic acid will deprive five parts of sulphate of quinia of bitterness, without impairing its medicinal efficacy. (*Am. Journ. of Med. Sci.*, N. S., xix. 541.) It is obvious that tannate of quinia is thus formed; and as this, though insoluble in water, is readily dissolved in dilute acids, and consequently in the gastric liquor when acid, there can be no doubt that it will generally prove efficacious. It may, however, happen that the stomach may be quite free from acid, and that the operation of this salt may prove less certain than that of the sulphate; and such is asserted to have been the case in some instances; but a little lemonade taken after the medicine would probably obviate the difficulty.

Twelve grains of sulphate of quinia are equivalent to about an ounce of good

bark. The dose varies exceedingly, according to the circumstances of the patient, and the object to be accomplished. As a tonic simply, a grain may be given three or four times a day, or more frequently in acute cases. In intermittents, from twelve to twenty-four grains should be given between the paroxysms, divided into smaller or larger doses according to the condition of the stomach, or the length of the intermission. From one to four grains may be given at once, and some even advise the whole amount. In malignant intermittents and remittents, the quantity may be increased to thirty grains or even a drachm between the paroxysms. M. Maillot gave one hundred and twenty-eight grains, in the course of a few hours, in a case of malignant fever occurring in Northern Africa, with the happiest results. The caution, however, is necessary, not to employ this heroic practice against easily conquerable diseases. Very large doses of the sulphate have recently been given in acute rheumatism, and with great asserted success; but the occurrence of at least one fatal case from inflammation of the brain should lead to some hesitation in this employment of the remedy. When the stomach will not retain the medicine, it may be administered with nearly as much efficacy by enema; from six to twelve grains, with two fluidounces of liquid starch, and from twenty to forty drops of laudanum, being injected into the rectum, in ordinary cases, every six hours. Should circumstances render this mode of application impracticable, an equal quantity, diluted with arrow-root or other mild powder, may be sprinkled, at the same intervals, upon a blistered surface denuded of the cuticle. The epigastrium, or the inside of the thighs and arms, would be the proper place for the blister. The sulphate has also been employed by friction in the form of ointment, in cases of malignant intermittent. The ointment should be made by incorporating a saturated alcoholic solution of the salt with lard, and should be applied to the inside of the thighs and arms. It is said that quinia is more readily absorbed when united with a fatty acid. This union may be effected by mixing solutions of soap and of a salt of quinia. The quinia soap is precipitated. Purified oleic acid will dissolve one-tenth of its weight of sulphate of quinia, if aided by a gentle heat; and this solution may be used as a liniment. (See *Am. Journ. of Pharm.*, xxvii. 73.) The salt has also been administered successfully by the hypodermic method (see *Treatise on Therapeutics and Pharmacology*, by the author, 3d ed., i. 273); and through the respiratory passages by means of the atomizer. The solution for hypodermic use should be made with tartaric acid, grain for grain, and should always be carefully filtered. The sulpho-vinate has been especially recommended, but is of doubtful advantage. (*Pharm. Journ. and Trans.*, May, 1875, p. 909.) No precaution will always prevent the production of severe local abscesses and ulcerations by the hypodermic use of quinia, and even fatal tetanus has been induced, so that the method should never be employed except in cases of emergency. In a case of obstinate intermittent, in which the stomach refused to receive the medicine, Dr. Bugeon effected a speedy and permanent cure by administering in the latter method daily, for three or four days, about seven and a half grains of the sulphate dissolved in two ounces of water. (*Journ. de Pharm. et de Chim.*, Juillet, 1867, p. 68.) In whooping-cough the use of quinia by atomization has been warmly recommended. In hay-fever a warm solution, as nearly neutral as possible, and of the strength of two grains to the fluidounce, may be used with the Thudicum's douche.

Solutions of sulphate of quinia have been advantageously employed as local applications to indolent ulcers, and chronic mucous inflammations. (Wedderburn and Fearn, *New Orleans Med. and Surg. Journ.*, iii. 161 and 341.)

Off. Prep. Ferri et Quiniæ Citras; Pilula Quiniæ, *Br.;* Pilulæ Quiniæ Sulphatis, *U. S.;* Quiniæ Valerianas, *U. S.;* Tinctura Quiniæ, *Br.;* Vinum Quiniæ, *Br.* W.

QUINIÆ VALERIANAS. *U. S. Valerianate of Quinia.*

"Take of Valerianic Acid *half a troyounce;* Sulphate of Quinia *two troyounces;* Diluted Sulphuric acid, Water of Ammonia, Water, each, *a sufficient quantity.* Dissolve the Sulphate of Quinia in a pint of Water, with the aid of Diluted Sulphuric Acid; then add Water of Ammonia in slight excess, and wash the precipitated quinia with water until freed from sulphate of ammonium. Dissolve the Valerianic Acid in five pints of Water, heated to 180°, add the quinia to the

solution, and, when it is dissolved, set the whole aside for several days to crystallize. Decant the mother-water from the crystals, dry them on bibulous paper, and keep them in a well-stopped bottle. By evaporating the mother-water at a temperature not exceeding 120°, more crystals may be obtained." *U. S.*

In this process quinia is first obtained by decomposing sulphate of quinia, by means of ammonia, and then combined directly with valerianic acid, to form valerianate of quinia, which crystallizes from the solution when it cools, because much less soluble in cold than in hot water. By the late Dublin formula, which, with the salt itself, has been omitted in the British Pharmacopœia, the valerianate was obtained by double decomposition between muriate of quinia and valerianate of sodium, resulting in the production of chloride of sodium, which remained in solution, and valerianate of quinia, which crystallized.

Valerianate of quinia is a colourless salt, crystallizing in rhomboidal plates. It has a bitter taste, and the strong, adhesive odour of valerianic acid, which is very repulsive, and quite distinct from that of oil of valerian. It is soluble in 110 parts of cold and 40 parts of boiling water, and is deposited from its warm solution in fine crystals on cooling. It is dissolved by 6 parts of cold, and by an equal weight of boiling alcohol, and is soluble also in ether. In boiling water it melts into oily globules, and undergoes decomposition, with the escape of valerianic acid; and hence the direction in the formula not to exceed 120° in evaporating the mother-water. Even at common temperatures it is probably undergoing a constant, though slow loss of the acid, of which it smells so strongly. Exposed to a dry heat, it melts and gives off white vapours. It may be given in the dose of a grain or two repeated several times a day, in cases of debility attended with nervous disorder. A combination of Peruvian bark and valerian has long been known as peculiarly efficacious in hemicrania. Perhaps the valerianate of quinia may be used advantageously in the same affection. Two instances are on record of effects similar to those of belladonna, having resulted from the exhibition of valerianate of quinia; and, on chemical examination of a portion of the same salt, the presence of atropia was detected. Nothing was known of the origin of this impurity; but it was supposed to have been purely accidental. (*Journ. de Pharm.*, 4e sér., i. 269.) W.

RESINÆ.

Resins.

The *Resinæ* or *Resins* of the U. S. Pharmacopœia constitute a peculiar class of preparations, made by exhausting the substances from which they are obtained by alcohol, and then precipitating the resinous matter from the tincture, by the addition of water, which abstracts the alcohol by its stronger affinity. It is obvious that the resins thus prepared are different substances from the alcoholic extracts, which contain all the ingredients of the medicine which alcohol is able to take from it. This set of substances has been much employed by the practitioners styling themselves "eclectics;" but with great want of discrimination. They have applied names to these resinous precipitates, which, in their proper scientific use, are employed to designate neuter proximate principles of plants, generally representing more or less completely the effects of the plants respectively on the system; as we say *columbin*, *quassin*, *santonin*, &c., themselves proper proximate principles, and representing the virtues, in part at least, of colombo, quassia, santonica, &c., from which they are obtained, and from which they derive their names. By applying similar names to their precipitated resins, such as podophylline, iridine, cimicifugine, &c., *i.e.* to the impure resins obtained by precipitating the tinctures of podophyllum, iris versicolor, cimicifuga, &c., they justify the suspicion that they ignorantly believe them to be in fact the active principles of these medicines respectively, or, that knowing better themselves, they seek to impose such a conviction upon the ignorant. The fact is that the substances thus obtained, and thus named, are impure resins, which may possibly be active, as in the case of the so-called podophylline, or may contain more or less of the active principles mixed with them, but are not entitled to names which imply that they are distinct proximate principles themselves. W.

RESINA JALAPÆ. *U. S.* JALAPÆ RESINA. *Br.* *Resin of Jalap.*

"Take of Jalap, in fine powder, *sixteen troyounces;* Alcohol, Water, each, *a sufficient quantity.* Moisten the Jalap with four fluidounces of Alcohol, pack it firmly in a cylindrical percolator, and gradually pour upon it twelve fluidounces of Alcohol. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator, to prevent evaporation, set it aside in a moderately warm place for four days; then, having removed the cork, gradually pour Alcohol upon the surface, and continue the percolation until twenty-four fluidounces have passed, or until the percolate ceases to produce turbidity when dropped into water. Distil off the alcohol, by means of a water-bath, until the tincture is reduced to six fluidounces, and add it, with constant stirring, to seven pints of Water. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice by decantation, with fresh portions of Water. Place it upon a strainer, and, having pressed out the liquid, dry the Resin with a gentle heat." *U. S.*

"Take of Jalap, in coarse powder, *eight ounces* [avoirdupois]; Rectified Spirit, Distilled Water, each, *a sufficiency.* Digest the Jalap with sixteen fluidounces of the Spirit in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and, when the tincture ceases to pass, continue the percolation with successive portions of Spirit until it ceases to dissolve anything more. Add to the tincture four fluidounces of the Water, and distil off the Spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this two or three times with hot water, and dry it on a porcelain plate by the heat of a stove or water-bath." *Br.*

The two processes probably do not differ very materially in the result; though, if jalap yield anything to alcohol that is insoluble in water besides resin, it will be necessarily found in the British preparation, while that of the U. S. Pharmacopœia consists of resin almost exclusively. The difference arises from the circumstance that, in the Br. process, probably to enable the whole of the alcohol to be saved by distillation, the water for precipitation is added before the spirit is distilled off, while, in the U. S. process, it is not added until so much of the alcohol has been distilled as to leave only enough to hold the extracted matters in solution. It is obvious, therefore, that the resin of the former contains everything insoluble in water that the alcohol had extracted; while that of the latter contains nothing which water was unable to precipitate from the half pint of concentrated tincture. The U. S. resin is probably, therefore, a purer product than the British.

The U. S. resin, though tolerably pure, and quite sufficiently so for practical purposes, is still coloured. To obtain it colourless, if this be desired, the powdered jalap should be mixed, before percolation, with an equal quantity of finely powdered animal charcoal, and, previously to the introduction of this mixture into the percolator, half the quantity of animal charcoal, similarly powdered, should be packed in the bottom of the instrument. The colouring matter is thus left behind; and the resulting tincture, treated as directed in the process, yields the resin as white as starch.

Resin of jalap consists of two portions, one of which is hard and insoluble in ether, the other is soft and soluble in that menstruum; the former constituting about 70 per cent. It is insoluble in oil of turpentine. (*Squire.*) For an account of its chemical properties the reader is referred to the article on jalap, in *Part* I. It was at one time supposed that the purgative properties of the resin resided chiefly if not exclusively in the hard resin; but experiments by Mr. John C. Long appear to prove that the soft is equally energetic. (*Am. Journ. of Pharm.*, Nov. 1861, p. 489.)

Guaiac, rosin, and other resinous substances are said to be sometimes fraudulently added to the resin of jalap. Guaiac may be detected by the green colour it produces, when a few drops of solution of chloride of sodium or of calcium are added to an alcoholic solution of the suspected resin. (*Journ. de Pharm.*, 3e sér., x. 357.) M. Blacher triturates 50 centigrammes of the pulverized suspected resin, 20 centigrammes of the black oxide of copper, and 20 drops of alcohol, and then with 5 drops of liquor ammonia, if guaiac be present in sufficient proportion, in less than a minute a beautiful apple-green colour is developed. (*Journ. de Pharm.*, Juillet, 1870.) Aloes, suspected by the bitterness of the resin, was detected in a specimen by M. Daenen,

of Brussels, who obtained carbazotic acid from it by acting on it with nitric acid. (*Am. Journ. of Pharm.*, July, 1866, p. 375.) According to G. A. Kaiser, jalap resin may be distinguished from all other resins by being gradually dissolved by concentrated sulphuric acid, and depositing, after some hours, a brown soft viscid matter. (*Chem. Gaz.*, Jan. 1845; from *Liebig's Annalen.*) A better test is probably that proposed by A. Buchner. When pure jalap resin is dissolved in an alkaline solution, it is not precipitated by the addition of sulphuric or muriatic acid, having been converted, through the agency of the alkali, into an acid soluble in water. All the adulterating resins yield precipitates under the same circumstances. The resins of scammony and of fusiform jalap act in this respect like the true jalap resin, but are distinguishable by being wholly soluble in ether, which jalap resin is not. (*Neues Repert. für Pharm.*, No. 1, 1854.)

It is now generally believed that the resin of jalap is its sole purgative principle, the gummy extractive being either simply diuretic or wholly inert. Nevertheless, the extract of jalap probably better represents the whole virtues of the root, its specially hydragogue as well as simply purgative property; or at least contains the resin so involved with other ingredients, as in some measure to qualify its irritant and griping properties, and thus favourably modify its cathartic action. To obviate the occasional harshness of the resin, it has been advised to triturate it with loaf-sugar, sulphate of potassium, almond emulsion, or other substance calculated to separate its particles. It may be conveniently made into pill with mucilage or alcohol. (Hasselby, *Pharm. Journ.*, 2d ser., vii. 231.) The dose is from two to five grains. W.

RESINA PODOPHYLLI. *U. S.* Podophylli Resina. *Br. Resin of May-apple. Resin of Podophyllum.*

"Take of May-apple, in fine powder, *sixteen troyounces;* Muriatic Acid *two fluidrachms;* Alcohol, Water, each, *a sufficient quantity.* Moisten the May-apple with four fluidounces of Alcohol, pack it firmly in a cylindrical percolator, and gradually pour upon it twelve fluidounces of Alcohol. When the liquid begins to drop from the percolator, close the lower orifice with a cork, and, having closely covered the percolator, to prevent evaporation, set it aside in a moderately warm place for four days; then, having removed the cork, gradually pour Alcohol upon the surface, and continue the percolation until twenty-four fluidounces have passed, or until the percolate ceases to produce turbidity when dropped into water. Distil off the Alcohol, by means of a water-bath, until the tincture is reduced to six fluidounces, and add it, with constant stirring, to seven pints of Water previously mixed with the Muriatic Acid. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice by decantation, with fresh portions of Water. Place it upon a strainer, and, having pressed out the liquid, dry the Resin with a gentle heat." *U. S.*

"Take of Podophyllum Root, in coarse powder, *one pound* [avoirdupois]; Rectified Spirit, *three pints*, or *a sufficiency;* Distilled Water, Hydrochloric Acid, each, *a sufficiency.* Exhaust the Podophyllum with the Spirit by percolation; place the tincture in a still, and draw off the greater part of the spirit. Acidulate the Water with one twenty-fourth of its bulk of Hydrochloric Acid, and slowly pour the liquid which remains after the distillation of the tincture into three times its volume of the acidulated water, constantly stirring. Allow the mixture to stand for twenty-four hours to deposit the resin. Wash the resin on a filter with Distilled Water, and dry it in a stove." *Br.*

There was formerly a considerable difference between the preparations of the two Pharmacopœias. The U. S. preparation was obtained simply by precipitating a concentrated tincture of the root by water, and consisted mainly of the peculiar resin of podophyllum; the British, by precipitating with water acidulated by muriatic acid, whereby berberina, an alkaloid recently found to exist in podophyllum, was thrown down in the state of an insoluble muriate. As berberina exists in the May-apple, it is so combined as to be soluble both in alcohol and water, and is therefore contained in the concentrated tincture. But, as it forms an insoluble salt with muriatic acid, it is thrown down along with the resin; so that the resulting preparation is a mixture of the resin with this salt. Hence the British resin is of a yellow colour, given to it by the muriate of berberina, while the former U. S. resin was drab coloured.

In the last revision of the U. S. Pharmacopœia the mode of preparation was altered in conformity with the suggestions of Dr. Squibb (*Amer. Journ. of Pharm.*, 1868, p. 7), and the present process is seemingly superior to the English in the use of a less quantity of muriatic acid and in the avoidance of heat. The present U. S. resin of course contains berberina. The percentage of resin obtained from the root, as given by different operators, varies from 3·12 to 5·25 per cent.

Resin of podophyllum has a light-brown colour, an acrid bitter taste, and a slight odour of the root. It consists of two resins, one soluble both in ether and alcohol, the other in alcohol only. The resin extracted by ether constitutes, according to Mr. John W. Cadbury, 75 per cent. of the whole (*Am. Journ. of Pharm.*, July, 1858, p. 301), according to Mr. Harvey Allen, 80 per cent. (*Ibid.*, May, 1859, p. 206.) The officinal resin is soluble in alkaline solutions, from which it is precipitated by acids, in this respect differing strikingly from the resins of jalap and scammony. It is insoluble in oil of turpentine. The name of *podophylline*, given to it by the practitioners calling themselves eclectics, who have long been in the habit of using this resin, is inappropriate, and should be abandoned.

Resin of podophyllum is a powerful cathartic, occasionally producing some griping and nausea, but capable of being favourably modified by combination, and of being very usefully employed in connection with other cathartics, to give them increased energy. It is supposed by some to be specially cholagogue; but though, like all other active cathartics, it may occasionally produce bilious stools by emptying the gall-bladder, there is no sufficient proof that it increases especially the secretory function of the liver. There has been much difference of opinion as to the relative activity of the two resins composing it, some maintaining that both are active, others that the activity resides mainly, if not exclusively, in the resin soluble in ether. It is difficult to resist the evidence of the experiments of Mr. Cadbury, who states in the paper above referred to that, while half a grain of the ethereal resin acted energetically, and a cathartic effect was produced by even one-fourth of a grain, the portion insoluble in that menstruum was given in the dose of one grain without any effect whatever. Moreover, this evidence has recently been confirmed by the experiments of Mr. F. B. Power (*Am. Journ. of Pharm.*, xlvi. 227). It is asserted by Mr. Power, and confirmed by Prof. Maisch (*Ibid.*, 226), that the purgative principle of podophyllum is soluble in hot water, and hence is not a resin but a substance of unknown chemical nature. The dose of the officinal resin is from one-eighth of a grain to half a grain. It should generally be given in combination. A small proportion of extract of belladonna or hyoscyamus is said much to mitigate its irritant action. W.

RESINA SCAMMONII. *U. S.* SCAMMONIÆ RESINA. *Br.* *Resin of Scammony.*

"Take of Scammony, in fine powder, *six troyounces;* Alcohol, Water, each, *a sufficient quantity.* Digest the Scammony with successive portions of boiling Alcohol until exhausted. Mix the tinctures, and reduce the mixture to a syrupy consistence by distilling off the alcohol. Then add the residue to a pint of Water, separate the precipitate formed, wash it thoroughly with Water, and dry it with a gentle heat." *U. S.*

"Take of Scammony Root, in coarse powder, *eight ounces* [avoirdupois]; Rectified Spirit, Distilled Water, each, *a sufficiency.* Digest the Scammony Root with sixteen fluidounces of the Spirit in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and, when the tincture ceases to pass, add more Spirit and let it percolate slowly until the root is exhausted. Add to the tincture four fluidounces of the Water, and distil off the Spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this several times with hot water, and dry it on a porcelain plate with the heat of a stove or water-bath. It may also be prepared in a similar way from Scammony." *Br.*

The U. S. and British resins, though procured, the former from the gum-resin, the latter from the root of the plant, are nearly identical in their effects. Indeed, the elaborate researches of Professor H. Spirgatis (*Am. Journ. of Pharm.*, xlvi. 421) appear to have established the identity of the two products. Mr. A. Hess, however (*Ibid.*, 1875, p.

210), states that the resin obtained from the root contains tannic acid. The advantage of the preparation is that the resin is obtained free from the inert matters with which it is so often associated in the scammony of commerce. When pure virgin scammony can be procured any preparation is unnecessary. Obtained according to the U. S. process, the resin is of a dirty greenish-brown colour, with a feeble odour and taste of scammony, and is very soluble in ether, alcohol, and boiling proof spirit. When purified with animal charcoal it has a pale brownish-yellow colour, and is without odour or taste; but retains its purgative property. The Br. resin is in brownish translucent pieces, with a resinous fracture, and of a sweetish, fragrant odour derived from the root, and wholly different from that of scammony.

The resin of scammony is liable to adulteration. Jalap resin may be detected by its partial insolubility in rectified ether, which dissolves that of scammony in all proportions. Sulphuric acid is the best test of common rosin or colophony, producing instantaneously with this substance an intense red colour; while in the resin of scammony it causes no immediate change. For the tests of guaiac, the reader is referred to that article in the Materia Medica. (See also *Am. Journ. of Pharm.*, xxiv. 158.) In regard to this sophistication, the Br. Pharmacopœia directs that the tincture shall not render the fresh-cut surface of a potato blue. The presence of other resins, besides those of the Convolvulaceæ, may be known by yielding precipitates when sulphuric acid is added to their alkaline solution; the resin of scammony agreeing with that of jalap in not affording a precipitate under such circumstances. Mr. Ch. Bullock has found this resin, as well as that of jalap and of podophyllum, to be insoluble in benzole, thus enabling any resin soluble in this liquid, which may be employed in their sophistication, to be readily detected. (*Am. Journ. of Pharm.*, March, 1862, p. 114.) When rubbed with unskimmed milk, the resin of scammony forms a uniform emulsion, undistinguishable from rich milk itself. This is an excellent mode of administration. The resin should always be given either rubbed up with some mild powder, or in emulsion. The dose is from four to eight grains.

Off. Prep. Extractum Colocynthidis Compositum; Mistura Scammonii, *Br.*

W.

SANTONINUM.

Santonin.

SANTONINUM, *U. S.*, *Br.* *Santonin.*

"Take of Santonica, in moderately coarse powder, *forty-eight troyounces;* Lime, recently slaked and in fine powder, *eighteen troyounces;* Animal Charcoal, in fine powder, Diluted Alcohol, Acetic Acid, Alcohol, each, *a sufficient quantity.* Digest the Santonica and Lime with twelve pints of Diluted Alcohol for twenty-four hours, and express. Repeat the digestion and expression twice with the residue, using the same quantity of Diluted Alcohol. Mix the tinctures, and reduce the mixture to eight pints by distilling off the alcohol. Then, having filtered, and evaporated to one-half, gradually add Acetic Acid until in slight excess, stirring during the addition, and set the whole aside for forty-eight hours. Place the resulting crystalline mass upon a funnel loosely stopped, wash it with water, and dry it. Next, boil the dry residue with ten times its weight of Alcohol, and, having digested the tincture for several hours with Animal Charcoal, filter it while hot, and add sufficient hot Alcohol, through the filter, to wash the Charcoal thoroughly; then set it aside in a dark place to crystallize. Lastly, dry the crystals on bibulous paper in the dark, and keep them in a well-stopped bottle, protected from the light. By evaporating the mother-water, more crystals may be obtained." *U. S.*

"Take of Santonica, bruised, *one pound* [avoirdupois]; Slaked Lime, *seven ounces* [avoird.]; Hydrochloric Acid *a sufficiency;* Solution of Ammonia *half a fluidounce;* Rectified Spirit *fourteen fluidounces;* Purified Animal Charcoal *sixty grains;* Distilled Water *a sufficiency.* Boil the Santonica with a gallon [Imperial measure] of the Water and five ounces [avoird.] of the Lime, in a copper or tinned iron vessel, for an hour, strain through a stout cloth, and express strongly. Mix the residue with half a gallon [Imp. meas.] of the Water and the rest of the Lime, boil for half an hour, strain and express as before. Mix the strained liquors, let them

settle, decant the fluid from the deposit, and evaporate to the bulk of two pints and a half [Imp. meas.]. To the liquor while hot, add, with diligent stirring, the Hydrochloric Acid until the fluid has become slightly and permanently acid, and set it aside for five days that the precipitate may subside. Remove by skimming any oily matter which floats on the surface, and carefully decant the greater part of the fluid from the precipitate. Collect this on a paper filter, wash it first with cold Distilled Water till the washings pass colourless and nearly free from acid reaction, then with the Solution of Ammonia previously diluted with five fluidounces of the Water, and lastly with cold Distilled Water till the washings pass colourless. Press the filter containing the precipitate between folds of filtering paper, and dry it with a gentle heat. Scrape the dry precipitate from the filter, and mix it with the Animal Charcoal. Pour on them nine ounces of the Rectified Spirit, digest for half an hour, and boil for ten minutes. Filter while hot, wash the charcoal with an ounce of boiling Spirit, and set the filtrate aside for two days in a cool dark place to crystallize. Separate the mother-liquor from the crystals, and concentrate to obtain a further product. Collect the crystals, let them drain, redissolve them in four ounces of boiling Spirit, and let the solution crystallise as before. Lastly, dry the crystals on filtering paper in the dark, and preserve them in a bottle protected from the light." *Br.*

By the U. S. process, which was taken from Wittstein's *Pharmaceutical Chemistry* (page 563), the santonica is first exhausted by digestion with diluted alcohol, in connection with slaked lime; the latter substance being employed to saturate the santonin, and remove colouring matter which might subsequently embarrass the proceedings. The tincture thus obtained, having been reduced by the distillation of the alcohol to little more than an aqueous solution, is filtered and treated with acetic acid, in slight excess, by which the santonin is separated from the lime which holds it in solution, and, being itself insoluble, is gradually deposited in a crystalline state. The remainder of the process is intended simply to obtain the crystals free from colouring matter, and otherwise pure.

The British process, which is that of M. Mialhe somewhat modified (*Pharm. Journ.*, June, 1864, p. 635), spares the expenditure of alcohol in the exhaustion of the santonica, by boiling it originally with water in connection with lime; and differs also from the preceding in precipitating the santonin by muriatic instead of acetic acid. The purification is effected in the same manner, except that solution of ammonia is employed in the washing, probably to remove the last trace of acid. Wormseed of Aleppo yields from 1·2 to 1·4 per cent. of santonin. (*Journ. de Pharm.*, Mars, 1864, p. 241.) It has been intimated to us that the large manufacturers of santonin, abroad, first distil off from the santonica its volatile oil, which has some commercial value in Europe; and that, so far from being injured by the operation, the process for preparing santonin is probably facilitated, in consequence of an affinity of the oil for the santonin, which may render it more difficult to obtain that principle pure.

Properties. Santonin is in colourless crystals, which have the form of flat rhombic prisms. It is inodorous, and at first nearly tasteless, but after a time produces a sense of bitterness. It is fusible by a moderate heat, and assumes the form of a crystalline mass on cooling. At a somewhat higher heat, it rises in dense, white, irritating vapours, and condenses unchanged. The air has no effect upon it, but it becomes yellow on exposure to sunlight. According to M. Sestini, the santonin is changed, through the influence of light, into formic acid, an uncrystallizable substance much more soluble in alcohol and ether than santonin itself, which he calls *photosantonic acid*, and a red resinous substance. (See *Am. Journ. of Pharm.*, Nov. 1864, p. 527.) In a subsequent account of this new substance, in which he gives further details, M. Sestini proposes to change its name to *photosantonine*, being apparently uncertain as to its acid properties. (*Chem. News*, Aug. 11, 1865, p. 61.) Santonine is nearly insoluble in cold water, or in weak acid solutions, but is dissolved by 250 parts of boiling water, by 43 parts of cold and 3 parts of boiling alcohol, and by 75 parts of ether; and its alcoholic and ethereal solutions are extremely bitter. (*U. S.*) It is also freely soluble in chloroform. Though neuter to test paper, it

unites with alkaline bases to form crystallizable and soluble salts. In its relations to polarized light, it is very strongly lævogyrate, more so than any other body previously noticed, and retains this property with acids, though losing it entirely when combined with salifiable bases. (Buignet, *Journ. de Pharm.*, Janv. 1862, p. 26.) When exposed to red heat, with excess of air, it is entirely dissipated. It consists of carbon, hydrogen, and oxygen; its formula being $C_{30}H_{18}O_6$. In chemical character it appears to be analogous to the stearoptenes, or concrete principles of the volatile oils. Under the influence of sulphuric acid and heat, it was said to be resolved into glucose and a new body, for which the name of *santoniretin* has been proposed, and was consequently supposed to rank with the glucosides. (Kosmann, *Journ. de Pharm.*, Août, 1860, p. 81.) But this statement has been disproved. Though, when long boiled with sulphuric acid, it is somewhat changed, and assumes a resinous appearance, yet the only result is the abstraction of water, and the santonin may be recovered unchanged. Not a particle of glucose can be detected. It is, therefore, not a glucoside. (Schmidt, *Ibid.*, 4e sér., iii. 394.) According to the view taken by M. Berthelot, it belongs to the class of Phenols. M. L. de Saint-Martin has obtained from it a diatomic phenol, *santonol*, thus confirming in some degree the opinion of M. Berthelot. For particulars concerning santonol the reader is referred to the *Journ. de Pharm.*, 4e sér., xvii. p. 119. With baryta santonin forms a salt, which, on the addition of muriatic acid and agitation of ether, yields *santonic acid* to the latter menstruum. This principle differs, according to MM. Cannizzaro and Sestini, from santonin in not being coloured violet by caustic potassa, or yellow by light. According to the same authorities it occurs in ortho-rhombic crystals, having the formula $C_{15}H_{20}O_4$; melts at 161 to 163° C., and is very soluble in boiling water, alcohol, ether, and chloroform. (*Journ. de Pharm.*, Avril, 1875, 363.)

Medical Properties and Uses. The effects of santonin on the system do not appear to have been very precisely determined. Without any very obvious effects on the circulation or digestive organs, it seems to produce some impression of a slightly narcotic character on the brain, and occasionally operates feebly as a diuretic. A singular effect on vision which has often been observed from santonica, is probably owing to the santonin, as similar effects have been produced by that principle. To persons under the influence of santonin, it often happens that all objects appear discoloured, generally yellow, but frequently also green, and sometimes blue. At the same time the urine is tinged of a yellow or green colour; and so rapidly does the santonin pass, that the change of colour in the urine has been observed at the end of 16 minutes.* (*Journ. de Pharm.*, Août, 1863, p. 161.) These effects are ascribed to a change of the santonin in the system analogous to that which takes place by its exposure to light; the yellow substance circulating with the blood, and passing out of the circulation with the urine. Santonin has been found to possess the vermifuge properties of santonica, and is probably its exclusive anthelmintic principle; as the volatile oil, to which this property was at one time ascribed, has little or no effect, being probably absorbed from the stomach before it reaches the worms in the bowels, while the santonin, being insoluble, or only becoming soluble by partial conversion into the santonate of sodium when it reaches the bile in the duodenum, passes into the small intestines and poisons the worms. A case of poisoning ascribed to santonin was found to be owing to strychnia mixed with it. (*Chem. News*, No. 230, p. 212.) Nevertheless, M. Pelikan, of St. Petersburg, has concluded from his investigations, that this substance is capable of producing powerful effects on the system in excessive doses; causing a species of paralysis with muscular rigidity, and acting in a manner analogous to atropia, and physostigmia. (*Ranking's Half-yearly Abstract*, xlvii. 93.) Moreover, several fatal cases of poisoning have occurred, in some of which not only were the symptoms distinct from those of strychnia poisoning, but the santonin was shown by chemical exami-

* According to Dr. Walter G. Smith, the yellow colour imparted to urine by santonin is distinguished from that produced by other substances by becoming purplish-red on the addition of ammonia or other alkali. (*Pharm. Journ. and Trans.*, Dec. 1870, p. 528.) For researches upon the character of the urinary colouring matter consult the same paper.

nation to be pure. The symptoms were giddiness, stupor deepening into coma, convulsions, great feebleness, pallor of face, dilated pupils, feeble pulse, and rapid respiration. One grain is said to have killed a feeble child five years old. (See H. C. Wood's *Treatise on Therapeutics*, 2d ed., p. 573.) Santonin has been found advantageous in amaurosis by M. Martin and M. Guépin, the latter of whom recommends it especially in cases which have succeeded acute choroiditis and iritis, with plastic exudation, after symptoms of inflammation have ceased. (*Ann. de Thérap.*, 1862, pp. 179, 183.) Dr. Z. C. McElroy, of Zanesville, Ohio, states, as the result of observation, that santonin, added to cathartic pills, materially modifies their action, increasing their activity, and obviating their griping effect. (*Med. and Surg. Reporter*, xv. 166, A.D. 1866.) Santonin may be given in doses of two or three grains twice or three times a day.* Some have recommended its salts, but Rose objects to these as being soluble, and therefore not so likely to reach the worm, in consequence of absorption; and, besides, in large doses they are injurious. In amaurosis, M. Guépin uses it in the form of syrup; its solubility being, in this case, a recommendation. The syrup may be made by mixing a drachm of santonin, dissolved in a little alcohol, with eight fluidounces of syrup, of which two teaspoonfuls may be given for a dose. Santonin may also be given in the form of lozenge, with sugar and tragacanth.† A formula will be found in the *Am. Journ. of Pharm.* (vi. N. S., p. 124). M. Guyot Darencey recommends that the lozenges should be made of the santonin in crystals, unpowdered, as in this state its unpleasant taste is almost entirely avoided. (*Ibid.*, July, 1868, p. 330.)

Off. Prep. Trochisci Santonini. W

SODA.

Preparations of Soda.

SODA. *U. S.* Soda Caustica. *Br.* *Soda. Caustic Soda.*

"Take of Solution of Soda a convenient quantity. Evaporate it rapidly in an iron vessel until ebullition ceases and the Soda melts. Pour this on a flat stone, and when it has congealed, break the mass into pieces, and keep them in a well-stopped bottle." *U.S.*

"Take of Solution of Soda *two pints*. Boil down the solution rapidly, in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which when removed on a warmed glass rod solidifies on cooling. Pour the fluid on a clean silver or iron plate, or into moulds, and, as soon as it has solidified, break it in pieces, and preserve it in stoppered green-glass bottles." *Br.*

The solution of Soda, being a solution of the caustic alkali, yields it on evaporation in the solid state. Metallic vessels are used in consequence of the chemical action of soda on earthenware or porcelain, and the product is directed to be kept in green glass bottles, because these resist its action better than those of white glass. Instead of being poured into cylindrical moulds to harden, as caustic potassa, this is allowed to solidify in mass, and is broken into irregular fragments.

* Considering the doses of santonin habitually prescribed by some practitioners, it is wonderful more serious results have not occurred. This immunity would seem to be owing to the great hardness and insolubility of the santonin crystals, which, when not pulverized, probably in great part pass through the alimentary canal of the child without solution. (*Note to the fourteenth edition.*)

† *Solution of Santonate of Sodium.* Mr. Doude prepared the santonate of sodium by the following formula. Take of Santonic Acid, in fine powder, *two ounces*; Caustic Soda Lye, pure, *four fluidounces*; Distilled Water, *twelve fluidounces*. Put all in a flask, and heat in a sand-bath, or over a stove, to 70° or 80°, until the solution of the santonin is complete, which usually requires about half an hour; then remove from the fire, and when cold it is conveniently evaporated. In cooling, prismatic crystals, with an oblique base, are obtained, containing 54 per cent. of santonin. As the santonate of sodium is soluble in one and three-fourth times its weight of water, the syrup is readily prepared. Dr. John Harley gives the following formula, which is of course only another method of getting a solution of the santonate of sodium. Take of Santonin, in powder, *twelve grains*; Bicarbonate of Sodium, *twenty grains*; Distilled Water, *three ounces*. Put the soda and water in a flask. Keep the fluid near the boiling point, adding, as it disappears, about two grains of the santonin at a time, until the whole is dissolved. By continued boiling the fluid may be reduced to two ounces, when it will contain six grains of santonin to the ounce. If the alkaline reaction be objectionable, neutralize carefully with acetic acid. (*London Practitioner*, Feb. 1871.)—*Note to the fourteenth edition.*

A method of preparing soda directly from common salt, through the agency of lead or its oxide, has been proposed in England by Mr. S. Rowbotham. The chloride of sodium is either fused with metallic lead, or mixed with the oxide and water, and allowed to stand till decomposition takes place, the whole being kept moist with steam. The salt abandons its chlorine to the lead; and the caustic soda resulting from the oxidation of the sodium, is extracted by lixiviation. The lead is recovered for future use by exposing the chloride to oxygen with heat. (*Chem. News*, May 24, 1867, p. 266.)* This plan, it is now stated, first originated with Lord Dundonald in 1794, and was carried on on a large scale by Mr. W. Losh, in 1790. It is stated that chemically pure caustic soda can now be made with commercial success from metallic sodium. The sodium is oxidized in water. (*Am. Journ. of Pharm.*, xlii. 50.) Klas Lindroth obtains a soda which contains a mere trace of carbonate and chloride by evaporating the solution of impure soda until it has a sp. gr. of 1·375, and then allowing this to crystallize at a temperature of 17° F. (*Am. Journ. of Pharm.*, xliv. 106.)

As prepared by the officinal process, caustic soda is in grayish-white fragments, opaque, brittle, and extremely corrosive. It is deliquescent, very soluble in water, soluble in alcohol, and possessed of all the alkaline properties of potassa, from which it differs in imparting a yellow colour to flame, and in not giving in solution a yellow precipitate with bichloride of platinum, or a crystalline precipitate with tartaric acid in excess. When heated it melts, and at an intense heat evaporates. In composition, it is the hydrated oxide of sodium (NaO,HO), and cannot be deprived of its water by heat. Though deliquescent, like potassa, it does not like that alkali become permanently liquid, but forms a paste, which after a time effloresces. The difference in this respect between the two alkalies is owing to the circumstance that, while both are converted into carbonates by uniting with the carbonic acid of the air, potassa forms a deliquescent, and soda an efflorescent salt. It is apt to contain impurities originating from the carbonate of sodium used in preparing the solution from which it is made; and the presence of these is recognised by the Br. Pharmacopœia, when it states that the aqueous solution, acidulated with nitric acid, gives a scanty white precipitate with nitrate of silver and chloride of barium, indicating the existence of a chloride and sulphate or carbonate. According to the same authority, it leaves scarcely any sediment when dissolved in water, and 40 grains require for neutralization about 900 grain-measures of the *volumetric solution of oxalic acid.* If the solution be coloured brown by sulphuretted hydrogen or hydrosulphate of ammonium, the presence of lead may be suspected, derived probably from the glass vessels in which it has been kept. It may be used externally as a caustic in the same manner as potassa, for which purpose it may be melted and cast into sticks. It has the advantage of being less deliquescent, and probably milder. It may be used also for making the solution of soda extemporaneously, for which purpose a drachm may be dissolved in three and a half fluidounces of distilled water. W.

SODII ARSENIAS. *U. S.* Sodæ Arsenias. *Br.* *Arseniate of Sodium.*

"Take of Arsenious Acid *ten ounces* [avoirdupois]; Nitrate of Soda *eight ounces and a half* [avoird.]; Dried Carbonate of Soda *five ounces and a half* [avoird.]; Boiling Distilled Water *thirty-five* [*fluid*]*ounces.* Reduce the dry ingredients separately to fine powder, and mix them thoroughly in a porcelain mortar. Put the mixture into a large clay crucible, and cover it with the lid. Expose to a full red heat, till all effervescence has ceased, and complete fusion has taken place. Pour out the fused salt on a clean flagstone, and as soon as it has solidified, and while it is still warm, put it into the boiling Water, stirring diligently. When the salt has dissolved, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and having dried them rapidly on filtering paper, enclose them in stoppered bottles." *Br.*

"Take of Arsenious Acid, in fine powder, *two troyounces;* Nitrate of Sodium,

* For a series of papers upon the manufacture of soda upon a large scale, see *Chemical News*, April, 1873, pp. 181, 183; May, 1874, pp. 210, 225, 327; July, 1874, p. 31; Feb. 1875, p. 87; March, 1875, pp. 103, 134; April, p. 160.

in fine powder, *eight hundred and sixteen grains;* Dried Carbonate of Sodium, in fine powder, *five hundred and twenty-eight grains;* Distilled Water, boiling hot, *half a pint.* Having mixed the powders thoroughly, put the mixture into a large clay crucible, and cover it with the lid. Expose it to a full red heat until effervescence has ceased, and complete fusion has taken place. Pour the fused salt on a porcelain slab, and, as soon as it has solidified, and while it is still warm, put it into the hot water, and stir until it is dissolved. Filter the solution, and set it aside to crystallize. Drain the crystals, and, having dried them rapidly on filtering paper, keep them in a well-stopped bottle." *U. S.*

This was first made officinal by the Br. Pharmacopœia of 1864, and by the U. S. Pharmacopœia in 1870. In the process, the arsenious acid is converted into arsenic acid at the expense of the nitric acid of the nitrate of sodium, and then combines with the soda of both salts, carbonic acid and nitrous fumes being given off. As the salt consists of two eqs. of base to one of acid, each eq. of arsenious acid, having been converted into arsenic acid by two eqs. of oxygen from one eq. of the nitric acid of the nitrate, combines with the separated eq. of soda of that salt, and with another eq. of soda of the carbonate; and the three substances employed are therefore required in the proportion of their equivalents. This is almost exactly the case in the formula, the nitrate being very slightly in excess, and the carbonate about in the same proportion deficient. According to Mr. Higgins, the gases emitted in this process contain more or less arsenic; an inconvenience which may be avoided by first dissolving the arsenious acid in a solution of caustic soda, and then adding the nitrate. The calcination should be performed in a reverberatory furnace. The gases which escape up the chimney are now free from arsenic, and consist only of ammonia and nitrous vapours. (*Journ. de Pharm.*, 4e sér., ii. 177.)

Arseniate of sodium is in colourless, transparent crystals, soluble in two parts of water (*Squire*), of a somewhat saline taste leaving a slight sense of acrimony, and with an alkaline reaction. Heated to 300° it melts, and loses its water of crystallization and 40·38 per cent. of its weight. "A solution of 10 grains of the residue, treated with 53 grain-measures of the *volumetric solution of soda*, continues to give a precipitate with the *volumetric solution of nitrate of silver* until 1613 grain-measures of the latter have been added." (*Br.*) In this test the soda is added in order that, by the decomposition of the nitrate of silver, one additional eq. of oxide of silver may be furnished, so as, with the two eqs. given up in exchange for the two eqs. of soda of the arseniate of sodium, to make up the three eqs. necessary for the formation of the arseniate of silver ($3AgO,AsO_5$). The precipitate is arseniate of silver, and the quantity precipitated should be equivalent to 6·16 grains of arsenic acid. The aqueous solution of arseniate of sodium gives white precipitates with chloride of barium, chloride of calcium, and sulphate of zinc (arseniates of barium, calcium, and zinc), and a brick-red precipitate with nitrate of silver (arseniate of silver).

Arseniate of sodium is composed of two eqs. of soda 62, one eq. of basic water 9, one eq. of arsenic acid 115, and fourteen eqs. of water of crystallization $126 = 312$; arsenic acid being tribasic. Its formula, therefore, is $2NaO,HO,AsO_5 + 14\,HO$.

In medical properties this salt agrees with the other preparations of arsenic (see *Acidum Arseniosum*), and may be employed for the same purposes. It is preferred by some, under the impression that it is milder than the arsenious acid or the arseniates; and, in the same dose, it certainly contains somewhat less metallic arsenic. The dose of the crystallized salt is stated at from one-twelfth to one-third of a grain; but it is generally prescribed in the form of solution. (See *Liquor Sodii Arseniatis.*) This may be made extemporaneously by dissolving 4 grains of the anhydrous or 6·5 grains of the crystallized salt in a fluidounce of distilled water. *Pearson's arsenical solution* is an aqueous solution of arseniate of sodium, containing one grain of the salt in a fluidounce, and therefore much weaker than the officinal solution. This preparation is considerably used on the continent of Europe in the form of bath, for which it is preferred to arsenious acid or the arsenites. M. Gueneau de Mussy recommends it strongly, administered in this way, in nodose rheumatism, or rheumatic gout, using it alone in the more acute forms of the disease,

and combined with carbonate of sodium in the chronic. He uses from half a drachm to two or three drachms of the arseniate to each bath, beginning with the smaller quantity, and gradually increasing. (*Ann. de Thérap.*, 1865, p. 270.)

Off. Prep. Ferri Arsenias, *Br.;* Liquor Sodii Arseniatis, *U. S.;* Liquor Sodæ Arseniatis, *Br.* W.

SODII BICARBONAS. *U.S.* SODÆ BICARBONAS. *Br. Bicarbonate of Sodium.*

"Take of Commercial Bicarbonate of Sodium, in powder, *sixty-four troyounces;* Distilled Water *six pints.* Introduce the powder into a suitable conical glass percolator, cover it with a piece of wet muslin, and pour the Water gradually upon it. When the liquid has ceased to drop, or when the washings cease to precipitate a solution of sulphate of magnesium, remove the Bicarbonate of Sodium from the percolator, and dry it on bibulous paper, in a warm place." *U. S.*

The U. S. Pharmacopœia directs the washing of the commercial bicarbonate of sodium because it so generally contains the carbonate.

Artus has given a process for obtaining bicarbonate of sodium, similar to that of Wöhler for forming the corresponding salt of potassa. (See *Potassii Bicarbonas.*) In this process, the effloresced carbonate, mixed with half its weight of freshly ignited and finely powdered charcoal, is saturated by a stream of carbonic acid, derived from the fermentation of sugar. The presence of the charcoal greatly promotes the absorption. (*Pharm. Cent. Blatt*, 1843, p. 254.)

Properties, &c. The pure bicarbonate of sodium is in a snow-white powder. Bicarbonate of sodium is permanent in the air, and slightly alkaline to the taste and to turmeric paper. It is soluble in thirteen parts of cold water. One eq., or 84·3 parts of the crystallized bicarbonate, should lose, on complete decomposition by dilute sulphuric acid, two eqs. or 44 parts of carbonic acid, equal to 52·1 per cent. The commercial salt is seldom so perfect as to satisfy this test; the samples generally containing from 2 to 3 per cent. of carbonate. "Twenty grains neutralise 16·7 grains of citric acid, or 17·8 grains of tartaric acid. Eighty-four grains, exposed to a red heat, leave 53 of an alkaline residue, which require for neutralisation 1000 grain-measures of the *volumetric solution of oxalic acid.*" *Br.* This is almost the precise proportion of carbonate of sodium which the bicarbonate should yield when deprived of its water and one eq. of carbonic acid; but the article furnished by the British manufacturers very rarely comes up to the requirements of their Pharmacopœia. The presence of carbonate may be known by a decided alkaline taste and reaction, by a cold solution of the salt yielding a precipitate with sulphate of magnesium, and by a solution in 40 parts of water, affording, without agitation, an orange-coloured or reddish-brown precipitate with corrosive sublimate. The pure bicarbonate is not precipitated by bichloride of platinum, nor, when treated with nitric acid in excess, by chloride of barium or nitrate of silver. The non-action of these tests shows the absence of salts of potassa, and of sulphates and chlorides. The incompatibles of this salt are the same as those elsewhere mentioned of the carbonate, except sulphate of magnesium in the cold, which decomposes the carbonate, but not the bicarbonate.

Composition. Bicarbonate of sodium, when perfect, consists of two eqs. of carbonic acid 44, one of soda 31·3, and one of water 9 = 84·3. The London College formerly prepared this salt by a faulty process, and gave it the name of sesquicarbonate. In its Pharmacopœia of 1851, it placed the salt, under the correct name of bicarbonate. in the catalogue of Materia Medica; where the commercial article now stands in the U. S. Pharmacopœia.

Off. Prep. Pulveres Effervescentes, *U. S.;* Pulveres Effervescentes Aperientes, *U.S.;* Sodæ Citro-tartras Effervescens, *Br.;* Trochisci Sodii Bicarbonatis, *U. S.;* Trochisci Sodæ Bicarbonatis, *Br.* B.

SODII CARBONAS EXSICCATA. *U.S.* SODÆ CARBONAS EXSICCATA. *Br. Dried Carbonate of Sodium.*

"Take of Carbonate of Sodium *a convenient quantity.* Expose it to heat in an iron vessel, until it is thoroughly dried, stirring constantly with an iron spatula; then rub it into powder." *U. S.*

"Take of Carbonate of Soda *eight ounces.* Expose the Carbonate of Soda in a porcelain capsule to a rather strong sand heat, until the liquid which first forms is converted into a dry cake, and, having rubbed this to powder, enclose it in a stoppered bottle." *Br.*

Carbonate of sodium contains ten equivalents of water of crystallization, and, when heated, readily undergoes the watery fusion. Upon continuing the heat, the water is dried off, and a white porous mass remains, which is easily reduced to powder. Dried carbonate of sodium is in the form of a white powder, and differs in nothing from the crystallized, except in being devoid of water of crystallization. (See *Sodii Carbonas.*) When decomposed by dilute sulphuric acid, it evolves 40·7 per cent. of carbonic acid. (*Lond. Pharm.*)

Medical Properties and Uses. This preparation was introduced into practice by Dr. Beddoes, who extolled its virtues in calculous complaints. It is applicable to the cure of such affections, only when dependent on a morbid secretion of uric acid. Its advantage over the common carbonate is that it admits of being made into pills, in consequence of being in the dried state. As the water of crystallization forms more than half of the carbonate, the dose of the dried salt must be reduced in proportion. From five to fifteen grains may be given three times a day, in the form of pill prepared with soap and aromatics. For the medical properties of this salt, see *Sodii Carbonas.*

Off. Prep. Sodii Arsenias, *U. S.;* Sodæ Arsenias, *Br.;* Sodæ Bicarbonas, *Br.*

B.

SODÆ CITRO-TARTRAS EFFERVESCENS. *Br. Effervescent Citro-tartrate of Soda.*

"Take of Bicarbonate of Soda, in powder, *seventeen ounces;* Tartaric Acid, in powder, *eight ounces;* Citric Acid, in powder, *six ounces.* Mix the powders thoroughly, place them in a dish or pan of suitable form, heated to between 200° and 220°, and when the particles of the powder begin to aggregate, stir them assiduously until they assume a granular form; then, by means of suitable sieves, separate the granules of suitable and most convenient size, and preserve the preparation in well-closed bottles." *Br.*

The object of bringing this preparation into a granular form is, we presume, to oppose the force of cohesion to that of chemical affinity, which strongly disposes to reaction between the ingredients. When dissolved in water they undergo this reaction vigorously; the two acids combining with the soda of the bicarbonate to produce tartrate and citrate of sodium, and the carbonic acid escaping with brisk effervescence. It is in this form that the preparation is intended to be used. The salts combine laxative with refrigerant properties, which adapt them to the febrile state, while the carbonic acid renders them acceptable to the stomach, and will often check nausea and vomiting when existing. The dose is one or two drachms, which may be taken in a small wineglassful or more of water, and repeated occasionally as required. W.

SODII PHOSPHAS. *U. S.* Sodæ Phosphas. *Br. Phosphate of Sodium. Medicinal Tribasic Phosphate of Sodium.*

"Take of Bone, calcined to whiteness and in fine powder, *one hundred and twenty troyounces;* Sulphuric Acid *seventy-two troyounces;* Carbonate of Sodium, Water, each *a sufficient quantity.* Mix the powder with the Sulphuric Acid in an earthen vessel; then add eight pints of Water, and, having stirred the mixture thoroughly, digest for three days, occasionally adding a little Water to replace that which is lost by evaporation, and frequently stirring the mixture. At the expiration of that time, pour in eight pints of boiling Water, and strain through muslin, gradually adding more boiling Water until the liquid passes nearly tasteless. Set by the strained liquor that the dregs may subside, and, having poured off the clear solution, boil it down to eight pints. To the concentrated liquid, poured off from the newly formed dregs and heated in an iron vessel, add by degrees Carbonate of Sodium, previously dissolved in hot Water, until effervescence ceases, and the phosphoric acid is completely saturated; then filter the liquid, and set it aside to crystallize. Having removed the crystals, add, if necessary, a small quantity of Carbonate of Sodium to

the liquid, so as to render it slightly alkaline; then alternately evaporate and crystallize, so long as crystals are produced. Lastly, keep the crystals in a well-stopped bottle." *U. S.*

"Take of Bone Ash, in powder, *ten pounds* [avoirdupois]; Sulphuric Acid *fifty-six fluidounces;* Distilled Water *four gallons and a half* [Imperial measure], or *a sufficiency;* Carbonate of Soda *sixteen pounds* [avoird.], or *a sufficiency.* Place the Bone Ash in a capacious earthenware or leaden vessel, pour on the Sulphuric Acid, and stir with a glass rod until the whole powder is thoroughly moistened. After twenty-four hours, add gradually and with constant stirring a gallon [Imp. meas.] of the Water; digest for forty-eight hours, adding Distilled Water from time to time to replace what has evaporated. Add another gallon [Imp. meas.] of the Water, stirring diligently, digest for an hour, filter through calico, and wash what remains on the filter with successive portions of Distilled Water, till it has almost ceased to have an acid reaction. Concentrate the filtrate to a gallon, let it rest for twenty-four hours, and filter again. Heat the filtrate to near the boiling point, add the Carbonate of Soda previously dissolved in two gallons [Imp. meas.] of the Water, till it ceases to form a precipitate, and the fluid has acquired a feeble alkaline reaction. Filter through calico, evaporate the clear liquor till a film forms on the surface, and set it aside to crystallize. More crystals will be obtained by evaporating the mother-liquor, a little Carbonate of Soda being added if necessary to maintain its alkalinity. Dry the crystals rapidly, and without heat, on filtering paper placed on porous bricks, and preserve them in stoppered bottles." *Br.*

The incombustible part of bones is obtained by burning them to whiteness, and consists of a peculiar phosphate of calcium, called bone-phosphate, associated with some carbonate of calcium, &c. (See *Os.*) When this is mixed with sulphuric acid, the carbonate of calcium is entirely decomposed, giving rise to effervescence. The phosphate of calcium undergoes partial decomposition; the greater part of the lime, being detached, precipitates as sulphate of calcium, while the phosphoric acid, set free, combines with the undecomposed portion of the phosphate, and remains in solution as a superphosphate of calcium, holding dissolved a small portion of the sulphate of calcium. In order to separate the superphosphate from the precipitated mass of sulphate of calcium, boiling water is added to the mixture, the whole is strained, and the sulphate washed as long as superphosphate is removed, which is known by the water passing through in an acid state. The different liquids which have passed the strainer, consisting of the solution of superphosphate of calcium, are mixed and allowed to stand; and by cooling a portion of sulphate of calcium is deposited, which is got rid of by decantation. The bulk of the liquid is now reduced by evaporation, and, in consequence of the diminution of the water, a fresh portion of sulphate of calcium is deposited, which is separated by subsidence and decantation as before. The superphosphate of calcium solution, being heated, is now saturated by means of a hot solution of carbonate of sodium. The carbonic acid is extricated with effervescence, and the alkali, combining with the *excess* of acid of the superphosphate, generates one variety of the tribasic phosphate of sodium; while the superphosphate of calcium, by the loss of its excess of acid, becomes the neutral phosphate and precipitates. The phosphate of calcium is separated by a new filtration; and the filtered liquor, which is a solution of phosphate of sodium, is evaporated so as to crystallize.

In the U.S. process, the calcined bone is to the acid as 10 to 6; in the Br. process as 10 to 6½ nearly. The proportion recommended by Berzelius is as 10 to 6·66. The acid, in the officinal processes, is added to the calcined bone in the concentrated state, and afterwards diluted with more or less water. In the process given by Berzelius it is first diluted with twelve times its weight of water. All the writers state that phosphate of sodium crystallizes more readily by allowing its solution to be slightly alkaline; and a remarkable fact is, that a neutral solution, when it crystallizes, leaves a supernatant liquid which is slightly acid and uncrystallizable. Hence it is necessary, after getting each successive crop of crystals, to render the mother-water neutral or slightly alkaline, before it will furnish an additional quantity.

M. Funcke, a German chemist, has given the following cheap and expeditious method for obtaining phosphate of sodium. To the powdered calcined bone, diffused

in water, sufficient dilute sulphuric acid is added to decompose all the carbonate of calcium which it contains. When the effervescence ceases, the matter is treated with nitric acid, which dissolves the phosphate of calcium, and leaves the sulphate. The nitric solution of the phosphate is then treated with sulphate of sodium, equal in quantity to the bone employed; and after the reaction is completed, the nitric acid is recovered by distillation. In consequence of a double decomposition, sulphate of calcium and phosphate of sodium are formed, the latter of which is separated by water, and crystallized in the usual manner.

Properties, &c. The medicinal phosphate of sodium is in large colourless crystals, which have the shape of oblique rhombic prisms. They are transparent at first, but speedily effloresce and become opaque when exposed to the air. It possesses a pure saline taste, resembling that of common salt. With tests it displays an alkaline reaction. It dissolves in four parts of cold, and in two of boiling water, but is insoluble in alcohol. Before the blowpipe it first undergoes the aqueous fusion, and afterwards, at a red heat, melts into a globule of limpid glass, which becomes opaque on cooling. It is not liable to adulteration, but sometimes contains carbonate of sodium, from this salt having been added in excess in its preparation; in which case it will effervesce with acids. If it contain sulphate of sodium, or any other soluble sulphate, the precipitate caused by chloride of barium will be a mixture of sulphate and phosphate of barium, and will not be totally soluble in nitric acid. Chloride of barium will detect carbonate of sodium also, by producing a precipitate (carbonate of barium), soluble with effervescence in nitric acid. If a chloride be present, the *yellow* precipitate caused by nitrate of silver will be a mixed one of chloride and phosphate of silver, not entirely soluble in the same acid. The salt is incompatible with soluble salts of lime, with which it gives a precipitate of phosphate of calcium, and with neutral metallic solutions. It is found in several of the animal secretions, particularly the urine. For an elaborate article upon the methods of determining the percentage of phosphates present in a substance, see *Chem. News*, Oct. 1874, p. 200.

The medicinal phosphate of sodium is one of the three tribasic phosphates of sodium, characterized by having its three bases, made up of two eqs. of soda and one of water. When crystallized, it consists of two eqs. of soda 62·6, one of basic water 9, one of phosphoric acid 72, and twenty-four of water of crystallization 216 = 359·6. Its formula is, therefore, $2NaO,HO,PO_5 + 24HO$. When gently heated it loses its water of crystallization; and at a red heat its basic water is driven off, and the salt is converted into *pyrophosphate of sodium*,* or that variety of *bibasic phosphate* which has the formula $2NaO,PO_5$. This bibasic phosphate is characterized by giving a *white* precipitate with nitrate of silver. When the medicinal salt is thus dried and ignited, it loses 63 per cent. of its weight; and the residue, dissolved in water, gives with chloride of barium a precipitate almost entirely soluble in dilute nitric acid. (*Br.*)

Medical Properties and Uses. Phosphate of sodium was introduced into practice, about the year 1800, by the late Dr. Pearson, of London. It is a mild purgative, and, from its pure saline taste, is well adapted to the cases of children, and of persons of delicate stomach. The dose is from one to two ounces, and is best given in gruel or weak broth, to which it gives a taste, as if seasoned with common salt. B.

Until recently, phosphate of sodium was not thought to possess any other medicinal virtues than those of a cathartic. Of late, however, it has been considerably used, generally in connection with other phosphates, and in small doses, to meet any real or supposed deficiency of phosphorus or of phosphates in the system, and for this purpose it is well adapted by its ready solubility. But from the observations of Dr. Wm. Stephenson, of Edinburgh, recently published, there is reason to believe that this salt, in small doses, especially in children, exercises an extraordinary influence upon the hepatic secretion. In infantile cases, with white or green stools, with diarrhœa, and sometimes with jaundice, Dr. Stephenson has found these evidences of deficient or disordered bile to yield quickly to small doses of phosphate

* This salt has recently been highly recommended for removing ink stains from coloured cotton fabrics. It is said to remove the stains slowly without affecting the other colours.

of sodium; the passages assuming their healthy yellow colour, and the attendant disease generally disappearing. The dose is from three or four to ten grains for children, according to the age, and is best administered with their food, especially milk, and may be repeated whenever there is occasion to give food. Though the experience of Dr. Stephenson has been mainly confined to children, yet he has also tried the remedy in adults presenting similar indications, and with encouraging results. In these cases he recommends from 20 to 40 grains to be given, dissolved in water, after meals. (*Edin. Med. Journ.*, Oct. 1867, p. 336.) Should Dr. Stephenson's experience be confirmed by that of other practitioners, he will have made a very important contribution to therapeutics. In the *Boston Med. and Surg. Journ.*, of Feb. 6, 1868 (*page* 5), is a communication from Dr. S. G. Webber, of Boston, giving details of several infantile cases, which, in the symptoms, treatment, and results, closely corresponded with those of Dr. Stephenson.

Off. Prep. Ferri Phosphas; Ferri Pyrophosphas, *U. S.*; Syrupus Ferri Phosphatis, *Br.* W.

SODÆ VALERIANAS. *Br.* *Valerianate of Soda.*

"Take of Amylic Alcohol (Fousel Oil) *four fluidounces* [Imperial measure]; Bichromate of Potash *nine ounces* [avoirdupois]; Sulphuric Acid *six fluidounces and a half* [Imp. meas.]; Solution of Soda *a sufficiency;* Distilled Water *half a gallon* [Imp. meas.]. Dilute the Sulphuric Acid with ten fluidounces of the Water, and dissolve the Bichromate of Potash in the remainder of the Water with the aid of heat. When both liquids are cold, mix them with the Fousel Oil in a matrass, with occasional brisk agitation, until the temperature of the mixture has fallen to about 90°. Connect the matrass with a condenser, and distil until about half a gallon of liquid has passed over. Saturate the distilled liquid accurately with the Solution of Soda, remove any oil which floats on the surface, evaporate till watery vapour ceases to escape, and then raise the heat cautiously so as to liquefy the salt. When the product has cooled and solidified, break it into pieces, and immediately put it into a stoppered bottle." *Br.*

The Valerianate of Sodium was dismissed from the U.S. Pharmacopœia in the revision of 1870. The British process, like that of the U.S. Pharmacopœia of 1860, is essentially the same as that of the late Dublin Pharmacopœia, into which the preparation was introduced in 1850. It consists of two steps; first, the artificial formation of valerianic acid, and secondly, the saturation of this acid with caustic soda. By distilling fusel oil with a mixture of sulphuric acid and bichromate of potassium, valerianic acid is formed, and passes over with water. The change is effected by the oxidizing agency of the chromic acid of the bichromate; for when fusel oil loses two eqs. of hydrogen by oxidation, and gains two of oxygen, it is converted into valerianic acid. Thus, $C_{10}H_{11}O + HO$ and $4O = C_{10}H_9O_3 + HO$ and $2HO$. (See *Potassii Bichromas* and *Alcohol Amylicum.*) The distillate, by exact saturation with the solution of caustic soda, is converted into a solution of valerianate of sodium, which, by the application of heat until the water is driven off, and the residual matter is partially liquefied, furnishes, on cooling, the concrete salt. The small portion of oil that floats on the surface of the solution is valerianate of amylic ether ($C_{10}H_{11}O,C_{10}H_9O_3$).

Properties, &c. Valerianate of sodium is a deliquescent, very soluble salt, in snow-white masses, having the disagreeable odour of valerianic acid, and a taste at first styptic, but afterwards sweetish. When heated to 285°, it fuses without loss of acid, and, upon cooling, concretes into a white solid. The salt, as officinally ordered, is in the form produced by fusion. It consists of one eq. of valerianic acid and one of soda ($NaO.C_{10}H_9O_3$). It is little used medically, having been originally introduced into the Dublin officinal catalogue for the sole purpose of forming, by double decomposition, the valerianates of iron, quinia, and zinc, and retained in the Br. Pharmacopœia for the preparation of the last-mentioned salt. It may, however, be given as a nervous stimulant in the dose of from one to five grains.

Off. Prep. Zinci Valerianas. *Br.* B.

SPIRITUS.

Spirits.

Spirits, as the term is here used, are alcoholic solutions or volatile principles, formerly in general procured by distillation, but now frequently prepared by simply dissolving the volatile principle in alcohol or diluted alcohol. The distilled spirits are prepared chiefly from aromatic vegetable substances, the essential oils of which rise with the vapour of alcohol, and condense with it in the receiver. Some of the oils, however, will not rise at the temperature of boiling alcohol, but may be distilled with water. In this case, it is necessary to employ proof spirit or diluted alcohol, with the water of which the oil comes over in the latter part of the process. As the proof spirit of the shops is often impregnated with foreign matters, which give it an unpleasant flavour, it is better to use alcohol which has been carefully rectified, and to dilute it with the due proportion of water, as directed by the U. S. Pharmacopœia. In preparing the spirits, care should be taken to avoid the colour and empyreumatic flavour arising from the decomposition of the vegetable matter by heat. Sufficient water must, therefore, be added to cover the vegetable matter after the alcohol shall have been distilled; and, as a general rule, the heat should be applied by means of a water-bath, or of steam. The aromatic should be macerated for some days with the alcohol, before being submitted to distillation; as the oil, being thus dissolved, rises more readily with the spirituous vapour than when confined in the vegetable tissue. It is necessary, during the process, frequently to renew the water in the refrigeratory; as otherwise much of the vapour will escape condensation. A good apparatus for the purpose is described and figured in *page* 965.

The aromatic spirits are used chiefly to impart a pleasant odour and taste to mixtures, and to correct the nauseating and griping effects of other medicines. They serve also as carminatives in flatulent colic, and agreeable stimulants in debility of stomach; but their frequent use may lead to the formation of intemperate habits, and should, therefore, be avoided.

We follow the example of the Pharmacopœias, in considering in the present class several articles, which, though with the title of spirit, were formerly arranged with the substances which constitute their active ingredients, as the spirits of ammonia, ether, and nitrous ether. The spirits, formerly officinal, which have been omitted in the present U. S. and Br. Pharmacopœias, are *Spiritus Carui*, Lond., Ed., *Spiritus Cassiæ*, Ed., and *Spiritus Pulegii*, Lond. W.

SPIRITUS ÆTHERIS. *Br. Spirit of Ether.*

"Take of Ether *ten fluidounces;* Rectified Spirit *one pint* [Imperial measure]. Mix. The specific gravity 0·809." *Br.*

This preparation is merely ether, diluted with twice its volume of alcohol. When prepared with materials of proper strength, its sp. gr. is 0·809. Its medical properties are similar to those of ether. The dose is from one to three fluidrachms, given with a sufficient quantity of sweetened water.

Off. Prep. Tinctura Lobeliæ Ætherea, *Br.* B.

SPIRITUS ÆTHERIS COMPOSITUS. *U.S. Compound Spirit of Ether. Hoffmann's Anodyne Liquor.*

"Take of Ether *half a pint;* Alcohol *a pint;* Ethereal Oil *six fluidrachms.* Mix them." *U. S.*

This preparation is an alcoholic solution of ether, impregnated with heavy oil of wine. In the formula, determinate measures of ether, alcohol, and oil are taken, the ether having half the volume of the alcohol. In the late revision of the British Pharmacopœias, and their consolidation into one, this preparation has been omitted; unfortunately, we think, as there is scarcely a doubt that the influence of the ether, as a composing medicine in nervous disorder, is much increased by the oil of wine.

Compound spirit of ether is a colourless, volatile liquid, having a burning, slightly sweetish taste, and the peculiar odour of ethereal oil. If it has an empyreumatic odour, it has been badly prepared. Its sp. gr. is 0·815, according to the U. S.

Pharmacopœia. When pure it is wholly volatilized by heat, and devoid of acid reaction. It becomes milky on being mixed with water, owing to the precipitation of the ethereal oil; but this change does not prove its goodness, as the same property may be given to the spirit of ether by the addition of various fixed oils. This sophistication may be detected, according to Prof. Procter, by mixing the suspected preparation with water, drawing a piece of paper over the surface of the liquid to absorb the oily globules, and exposing the paper to heat. If the globules are fixed oil, the greasy stain will remain; if ethereal oil, the stain will disappear. When fixed oils are used to adulterate this preparation, the milkiness is generally too great, and not like the translucent, leaden milkiness of the genuine article. (*Dr. Squibb.*) "It gives only a slight cloudiness with chloride of barium; but when a fluidounce of it is evaporated to dryness with an excess of this test, it yields a precipitate [residue] of sulphate of barium, which, when washed and dried, weighs 6·25 grains. When a few drops are burned on glass or porcelain, there is no visible residue, but the surface will be left with an acid taste and reaction. A pint of water, by the admixture of forty drops, is rendered slightly opalescent." *U. S.*

It is much to be regretted that our manufacturing chemists do not follow the Pharmacopœia in making Hoffmann's anodyne. In rectifying crude ether, the distillation is continued as long as the ether comes over of the proper specific gravity; after which, the manufacturer has been in the habit of changing the receiver, and obtaining an additional distillate, consisting of ether and alcohol, impregnated with a little ethereal oil. Now it is this second distillate, variously modified by the addition of alcohol, ether, or water, so as to make it conform in taste, smell, opalescence, &c. to a standard preparation, kept by the manufacturer, that is sold as Hoffmann's anodyne. (See Prof. Procter's paper on Hoffmann's anodyne in the *Am. Journ. of Pharm.* for July, 1852, p. 213.) Nothing could be more uncertain in its results than a proceeding like this; and we cannot be surprised that the medicine, as obtained from different apothecaries, varies very much in properties, and often disappoints the expectations of the physician. The chief excuse for the departure from the officinal directions is the costliness of the ethereal oil; but were this much greater than it really is, the excuse would not be valid; and it cannot be justified, on any principle of morality, to sell under the officinal title a preparation which has no claim to it whatever.

Medical Properties. This preparation is intended as a substitute for the anodyne liquor of Hoffmann, which it closely resembles when properly prepared. In addition to the stimulating and antispasmodic qualities of the ether which it contains, it possesses anodyne properties, highly useful in nervous irritation, and want of sleep from this cause. These additional virtues are probably derived from the officinal oil of wine, which is a more important substance than is generally supposed. Mr. Brande believes that the only effect of it, in the preparation under notice, is to alter the flavour of the ether. In this opinion he is certainly in error. The late Drs. Physick and Dewees of this city found the officinal oil of wine, dissolved in alcohol, very efficacious in certain disturbed states of the system, as a tranquillizing and anodyne remedy. Such indeed are the generally admitted effects of Hoffmann's anodyne, when made with a due admixture of the ethereal oil. This preparation is on many occasions a useful adjunct to laudanum, to prevent the nausea which is excited by the latter in certain habits. The dose is from thirty minims to one or two fluidrachms, given in water sweetened with sugar. B.

SPIRITUS ÆTHERIS NITROSI. *U. S.*, *Br.* Spiritus Ætheris Nitrici. *U. S.* 1850. Spiritus Nitri Dulcis. *Spirit of Nitrous Ether. Sweet Spirit of Nitre.*

"Take of Nitric Acid *four troyounces and a half;* Stronger Alcohol *seven pints;* Sulphuric Acid *three troyounces and a half;* Copper *two troyounces.* Add the Sulphuric Acid gradually to twenty fluidounces of the Stronger Alcohol; when the mixture has become cool, put it into a glass retort, connected with a Liebig's condenser, and add the Copper and four troyounces of Nitric Acid. Then cautiously apply heat, and distil thirteen fluidounces at a temperature not exceeding 180°.

Remove the heat, let the contents of the retort cool to 90°, add the remainder of the Nitric Acid, and distil two fluidounces as before. Mix the distillate with the remainder of the Alcohol, and transfer the mixture immediately to half-pint bottles, which must be well stopped and protected from the light." *U. S.*

"Take of Nitric Acid *three fluidounces* [Imperial measure]; Sulphuric Acid *two fluidounces* [Imp. meas.]; Copper in fine wire (about No. 25), *two ounces* avoirdupois]; Rectified Spirit *a sufficiency*. To one pint of the Spirit add gradually the Sulphuric Acid, stirring them together; then add in the same way, two and a half fluidounces of the Nitric Acid. Put the mixture into a retort or other suitable apparatus, into which the Copper has been introduced, and to which a thermometer is fitted. Attach now an efficient condenser, and applying a gentle heat, let the spirit distil at a temperature commencing at 170°, and rising to 175°, but not exceeding 180°, until twelve fluidounces have passed over and been collected in a bottle kept cool, if necessary, with ice-cold water; then withdraw the heat, and having allowed the contents of the retort to cool, introduce the remaining half ounce of Nitric Acid, and resume the distillation as before, until the distilled product has been increased to 15 fluidounces. Mix this with two pints of the Rectified Spirit, or as much as will make the product correspond to the tests of specific gravity and percentage of ether separated by chloride of calcium. Preserve it in well-closed vessels." *Br.*

The officinal spirit of nitrous ether is a mixture, in variable proportions, of nitrous ether (C_4H_5O,NO_3) and alcohol (rectified spirit). Nitrous ether is always generated by the reaction of nitric acid with alcohol; and it matters not whether the alcohol be mixed with nitric acid directly, or with the materials for generating it, namely, nitre and sulphuric acid. In the former U. S. Pharmacopœia the requisite nitric acid was obtained by using the materials for generating it; nitrate of potassium, namely, and sulphuric acid. The formula was modelled after a recipe communicated by Mr. John Carter, manufacturing chemist, to the Philadelphia College of Pharmacy, and recommended for adoption by a committee of that body.* The nitre and alcohol being mixed in the retort, the sulphuric acid was gradually added, and a gentle heat applied. Nitric acid was set free, and by reacting with a part of the alcohol produced the nitrous ether. Upon the subsequent increase of the heat, the ether and the remainder of the alcohol distilled over as sweet spirit of nitre. The distilled product, however, contained some acid, and hence was rectified by a distillation from carbonate of potassium. Diluted alcohol was added before commencing this distillation, to enable the operator to obtain a quantity of distilled product equal to that procured at first, without distilling to dryness, which would endanger the production of empyreuma. The alcohol was first mixed with the nitre, in the retort, and the sulphuric acid afterwards gradually added. Had the alcohol and sulphuric acid been previously mixed, the risk would have been run of generating ether before their addition to the nitre. In repeating this process the retort employed should be capable of holding twice the amount of the materials. The sweet spirit of nitre, obtained by the old formula, was estimated to contain 4 per cent. in volume of nitrous ether.

The above process, as conducted by Mr. Carter on a large scale, was performed in a copper still of about twenty gallons capacity, and furnished with a pewter head and worm. The materials for the first distillation were 18 pounds of purified nitre, 12 gallons of alcohol of 34° Baumé (0·847), and 12 pounds of sulphuric acid; and 10 gallons were drawn off. The distilled product was then mixed with a gallon of diluted alcohol, and rectified by a new distillation from lime or a carbonated alkali; the same quantity being distilled as at first. When large quantities of this preparation are made, the several portions require to be mixed in a large glass vessel, to render the whole of uniform strength; as the portion which first comes over in the rectification is strongest in nitrous ether. Previously to the redistillation, the head and worm

* The following is the formula of the U. S. Pharmacopœia of 1850. "Take of Nitrate of Potassa, in coarse powder, *two pounds*; Sulphuric Acid *a pound and a half*; Alcohol *nine pints and a half*; Diluted Alcohol *a pint*; Carbonate of Potassa *an ounce*. Mix the Nitrate of Potassa and the Alcohol in a large glass retort, and having gradually poured in the Acid, digest with a gentle heat for two hours; then raise the heat and distil a gallon. To the distilled liquor add the Diluted Alcohol and Carbonate of Potassa, and again distil a gallon." *U. S.*

must be washed thoroughly with water, to remove a little acid which comes over in the first distillation. (*Journ. of the Phil. Col. of Pharm.*, i. 308.)

In the 1860 U.S. process, which was modelled after the plan of Dr. Squibb, the nitric acid and alcohol were directly mixed in a retort containing pieces of glass to facilitate ebullition and prevent concussion, and arrangements were made for applying heat by means of a water-bath, so that it might be diminished when necessary to repress the violence of the reaction, and increased when this required invigoration. The liquid condensed in the receiver was mixed with carbonate of potassium, and again distilled in order to free it from the acid which had come over with the nitrous ether; and, being too strong with ether to meet the purposes required, was diluted with alcohol, and thus brought to the state of *spirit* of nitrous ether. It was a great improvement over the formula of earlier Pharmacopœias, and had the merit of insuring a preparation of definite strength. But in the recent revision the new British process was substituted as even better than it.

The former *British* process, which was a new one, consisted in distilling a mixture of *nitrite* of sodium, alcohol, and sulphuric acid. Instead, therefore, of using nitric acid either directly or by the decomposition of nitre, it substituted nitrous acid from the nitrate of sodium, separating it by means of sulphuric acid in the presence of alcohol, and thus bringing together the materials for forming the ether more nearly in the condition in which they are to exist in the ether when formed. But the intended results were not obtained by the process; for the nitrite of sodium, prepared by the British formula for that salt, was a mixture containing only a relatively small proportion of the proper nitrite, which, according to Mr. Squire, existed in it in variable quantities from 5 to 25 per cent; so that the resulting spirit of nitrous ether necessarily was of uncertain strength. The new British formula rejects the nitrite of sodium, but retains the principle of presenting the ingredients to each other in the form in which they are to exist in the spirit when formed; the ether resulting from the action of sulphuric acid on alcohol, and the nitrous acid from that of the copper on the nitric acid uniting to form nitrous ether, which, having been distilled over, is brought to the state of spirit of ether by admixture with somewhat less than three volumes of alcohol. The present Br. process has proved, in practice, so satisfactory as to have been adopted into the U. S. Pharmacopœia. Professor Attfield says that "the junior students were always able to make a satisfactory preparation by following the directions of that formula." (*Pharm. Journ.*, Sept. 1868, p. 156.) Nevertheless, Mr. Alfred E. Tanner states that he has never been able to obtain more than eleven instead of fifteen fluidounces of distillate, and that the strength of the preparation is not sufficient to answer the British officinal tests. He further affirms that the sweet spirit of nitre sent out by most British wholesale manufacturers does not come up to the officinal standard, but contains only 5 per cent. of nitrous ether, and that the preparation keeps best when about this strength. (*Pharm. Journ. and Trans.*, Dec. 1870, p. 463.)

Theory of the Production of Nitrous Ether, &c. One eq. of nitric acid, by reacting with one eq. of alcohol, forms one eq. of nitrous acid (formerly hyponitrous), one eq. of *aldehyd* ($C_4H_4O_2$), and two eqs. of water. Thus, NO_5 and $C_4H_6O_2 = NO_3$ and $C_4H_4O_2$ and $2HO$. The nitrous acid, as soon as formed, reacts with a second eq. of alcohol, so as to form one eq. of nitrous ether, with separation of one eq. of water. It has, however, been shown by Dr. Golding Bird that, when an excess of alcohol is used, *oxalhydric* (*saccharic*) *acid* is first formed, and that, when the formation of the nitrous ether has nearly ceased, aldehyd appears in the distilled product, and simultaneously oxalic acid in the contents of the retort, before which time the latter cannot be discovered. All these products result from the oxidizing action of the nitric acid upon the alcohol, increasing the proportion of oxygen in the substances formed, either by removing the hydrogen, or by abstracting this element and adding oxygen at the same time.

In the processes adopted in the last revision of the Pharmacopœias the nitric acid is converted into nitrous acid by yielding part of its oxygen to the copper to enable it to form with the sulphuric acid sulphate of copper. The nitrous acid now reacts with the alcohol as in the previous explanation, so as to produce the nitrous ether. The object of using the sulphuric acid is to economize the nitric acid.

Properties of Nitrous Ether. *Pure* nitrous (hyponitrous) ether is pale yellow, has the smell of apples and Hungary wines, boils at 62° (below 65° Hare), and has the sp. gr. 0·947 at 60°. The density of its vapour is 2·627. Litmus is not affected by it. When it is mixed with an alcoholic solution of potassa, hyponitrite of potassium and alcohol are formed, without producing a brown colour, showing the absence of aldehyd. It is soluble in 48 parts of water, and in all proportions in alcohol or rectified spirit. It is highly inflammable, and burns with a white flame without residue. The *impure* ether, as formerly obtained by the Edinburgh and Dublin processes for subsequent dilution to form sweet spirit of nitre, boiled at 70°, and had the density of 0·886 at 40°. The specific gravity assigned to it by the Edinburgh College was 0·899. Mixed with an alcoholic solution of potassa, it became dark-brown, with production of *aldehyd resin.* (See *page* 14.) This discoloration showed the presence of aldehyd. When kept it became acid in a short time, as shown by litmus; and nitric oxide was given off, which often caused the bursting of the bottle. Its tendency to become acid was rendered greater by the action of the air, and depended on the absorption of oxygen by the aldehyd, which thereby became acetic acid. Mr. Harvey, of Leeds, has suggested the use of pure crystals of bicarbonate of potassium in a bottle in order to prevent the development of an acid reaction. Dr. J. C. Rademacher has found that the crystals after a time are partially converted into a nitrate. (*Amer. Journ. of Pharm.*, xlii. 106.) These facts evince the propriety of preserving this ether in small, strong bottles, kept full and in a cool place. Nitrous ether consists of one eq. of nitrous acid and one of ether, and its formula is C_4H_5O,NO_3. It was, therefore, improperly called *nitric ether.* Considered as a salt, its proper name is *nitrite of ether.* In its pure and concentrated state it is never used in medicine.

Properties of Spirit of Nitrous Ether. This is a pale-yellow, volatile liquid, of a fragrant ethereal odour, and pungent, aromatic, sweetish, acidulous taste. As usually prepared it slightly reddens litmus, but does not cause effervescence with carbonate of sodium. Its officinal sp. gr. is 0·837, *U.S.;* 0·845, *Br.* The U.S. preparation contains from 4·3 to 5 per cent. of the proper nitrous ether. It keeps well in half-pint bottles, securely stopped with waxed glass stoppers, and covered with dark paper; as Dr. Squibb proved by examining some bottles thus put up, after the lapse of two years. High density is not necessarily an index of deficient strength; since it may arise from the presence of a large proportion of nitrous ether. When heated by means of a water-bath, the U. S. sweet spirit of nitre begins to boil at about 145°. If a test tube, half filled with the U. S. spirit, be plunged into water heated to 145°, and held there until its contents acquire that temperature, the spirit will begin to boil distinctly on the addition of a few small pieces of glass. (*U. S.*) Sweet spirit of nitre mixes with water and alcohol in all proportions. It is very inflammable, and burns with a whitish flame. It should not be kept long, as it becomes strongly acid with age. The Br. Pharmacopœia states, in regard to its own preparation, that, "when agitated with solution of sulphate of iron and a few drops of sulphuric acid, it becomes deep olive-brown or black;" and that "if it be agitated with twice its volume of saturated solution of chloride of calcium in a closed tube, two per cent. of its original volume will separate in the form of nitrous ether and rise to the surface of the mixture." *Br.* This indicates a strength considerably less than that of the U. S. spirit. Nitrous ether has been proposed as a test for several alkaloids, but Prof. Maisch has shown that the reactions occur only with old specimens, and are due to the acetic acid which has been developed in it. (*Amer. Journ. of Pharm.*, xlv. 67.)

Impurities and Tests. Sweet spirit of nitre is never quite free from aldehyd; and, if the distillation be too long continued, it is apt to contain a good deal of this substance, which afterwards becomes acetic acid by absorbing oxygen. The change goes on rapidly if the preparation be insecurely kept. Aldehyd, if in considerable proportion, may be detected by imparting a pungent odour and acrid flavour, and by the preparation assuming a brown tint on the addition of a weak solution of potassa, owing to the formation of aldehyd resin. The potassa test, with the best specimens, produces a straw-yellow tint within twelve hours. "When mixed with half its volume of officinal solution of potassa, previously diluted with an equal measure of

distilled water, it assumes a yellow colour, which slightly deepens without becoming brown, in twelve hours." *U. S.* Another test for aldehyd, less reliable, is the addition of an equal volume of sulphuric acid to the sweet spirit of nitre. If the sample be good, the change of colour will be slight, and the mixture will be considerably viscid; but if it contain much aldehyd, it will become dark-coloured. If water or spirit be present in undue proportion, the viscidity will be less. (*Phillips.*) Acetic acid, as well as other acids (usually nitrogen acids) that may happen to be present, may be discovered by the taste, by their acting on litmus strongly, and by their decomposing the alkaline carbonates or bicarbonates with effervescence. Nitrogen acids are known by colouring blue a piece of paper previously dipped into tincture of guaiac. These acids operate injuriously by their chemical reactions with other substances, when spirit of nitre is prescribed in mixtures. Thus, they liberate iodine from iodide of potassium, gradually decolorize compound infusion of roses, and in the compound mixture of iron, hasten the conversion of protoxide of iron into sesquioxide. To obviate these effects, Mr. Harvey, of Leeds, keeps sweet spirit of nitre standing on crystals of bicarbonate of potassium, and states that, if the preparation be of full strength, no appreciable portion of the alkali will be dissolved. (*Pharm. Journ.*, Jan. 1842.) When acid sweet spirit of nitre is rectified from calcined magnesia, it becomes acid again in a short time; but, according to M. Klauer, when rectified from neutral tartrate of potassium, it continues unchanged for months. A deep-olive colour with sulphate of protoxide of iron shows the presence of a nitrogen oxide or acid.

According to Mr. Bastick, sweet spirit of nitre contains about one-fifth of one per cent. of anhydrous hydrocyanic acid, when made from nitrous (hyponitrous) ether, formed by impregnating alcohol with nitrous acid, evolved by the action of starch on nitric acid, according to the process of Liebig. In making sweet spirit of nitre on a large scale, Dr. Squibb found that hydrocyanic acid vapours were produced if the heat happened to rise too high, and the ether ceased to be formed.

Alcohol and water are often fraudulently added to sweet spirit of nitre. When in undue proportion, they may be detected in the British preparation, as stated in the Pharmacopœia, by agitating it with twice its volume of a saturated solution of chloride of calcium. If the sweet spirit of nitre be of the full strength, two per cent. of ether will slowly separate, and rise to the surface. If less ether or none separate, the presence of too much alcohol and water will be indicated. Specific gravity is no criterion of the goodness of the preparation as obtained by any formula. The addition of water will raise its density; and the same effect will be produced by adding nitrous ether. A high density, in connection with deficient ethereal qualities, would of course indicate free acids, or an excess of water, or both. A specific gravity lower than the U. S. and Br. standard would show the presence of alcohol, either stronger than it should be, or in too large a proportion.

The fraudulent dilution of sweet spirit of nitre with alcohol and water is a great evil, considering its extensive use, and valuable remedial properties. Water is injurious, not merely as a diluent, but as the most efficient promoter of chemical changes. We have been informed that the medicine is variously diluted with twice, thrice, and even four times its weight of alcohol and water. In this way its ether strength is often reduced to less than half what it should be. Dr. Squibb examined six samples of sweet spirit of nitre, five of which were obtained from respectable wholesale druggists; and of these one sample contained 3·16 per cent. of nitrous ether, four between one and two per cent., and one under one per cent.; while a standard preparation, made according to the U. S. Pharmacopœia, contained at least 4·3 per cent. In some shops a strong and a weak preparation are kept, to suit the views of customers as to price. Some druggists are said to dilute their sweet spirit of nitre, upon the plea that the physician's prescriptions are written in view of the use of a weak preparation! All these evils would be corrected, if the manufacturing chemists of the Union would prepare it by the formula of the U. S. Pharmacopœia, at the same time adopting measures necessary to preserve it from change. A uniform preparation being thus furnished to the druggists, all that would be necessary on their part, would be to refrain from weakening it by the admixture of alcohol and water.

Medical Properties and Uses. Sweet spirit of nitre is diaphoretic, diuretic, and antispasmodic. It is deservedly much esteemed as a medicine, and is extensively employed in febrile affections, either alone or in conjunction with tartar emetic for the purpose of promoting the secretions, especially those of sweat and urine. It often proves a grateful stimulus to the stomach, relieving nausea and removing flatulence, and not unfrequently quiets restlessness and promotes sleep. On account of its tendency to the kidneys, it is often conjoined with other diuretics, such as squill, digitalis, acetate of potassium, nitre, &c., for the purpose of promoting their action in dropsical complaints. Dr. Duncan, of Edinburgh, praised a combination of it with a small proportion of aromatic spirit of ammonia, as eminently diaphoretic and diuretic, and well suited to certain states of febrile disease. The dose is from thirty minims to a fluidrachm, every two or three hours, mixed with a portion of water. When used as a diuretic, it should be given in larger doses.

When the vapour of sweet spirit of nitre is inhaled, it produces, according to Mr. D. R. Brown, of Edinburgh, among other symptoms, a leaden-purple colour of the lips, mouth, hands, &c., and extreme muscular debility, enduring for hours. In his own case, these symptoms were unaccompanied with the slightest effect on the brain; but in others the effects were different; headache being invariably produced. (*Pharm. Journ.*, March, 1857, p. 456.)*

Off. Prep. Mistura Glycyrrhizæ Composita, *U. S.* B.

SPIRITUS AMMONIÆ. *U. S.* *Spirit of Ammonia.*

"Take of Chloride of Ammonium in small pieces, Lime, each, *twelve troyounces;* Water *six pints;* Alcohol *twenty fluidounces.* Upon the Lime, in a convenient vessel, pour a pint of the Water, and stir the mixture so as to bring it to the consistence of a smooth paste. Then add the remainder of the Water, and mix it well with the Lime. Decant the milky liquid from the gritty sediment into a glass retort, of the capacity of sixteen pints, and add the Chloride of Ammonium. Place the retort on a sand-bath, and adapt to it a receiver, previously connected with a two-pint bottle containing the Alcohol, by means of a glass tube reaching nearly to the bottom of the bottle. Surround the bottle with ice cold water; and apply a gradually increasing heat until ammonia ceases to be given off. Lastly, remove the liquid from the bottle, and introduce it into small bottles, which must be well stopped." *U. S.*

Spirit of ammonia is now officinal in the U. S. Pharmacopœia only; the British Pharmacopœia not having adopted it. It is a solution of caustic ammonia in rectified spirit. As prepared by the U. S. process of 1850, the ammoniacal gas was received in the alcohol and condensed by it; and the proportions of the ingredients were so adjusted as to give a preparation containing between 10 and 11 per cent. of ammonia, and capable of saturating about 30 per cent. of officinal sulphuric acid. Accordingly it agreed, as it was intended it should, in ammoniacal strength, with the U. S. *Liquor Ammoniæ.* Its sp. gr. was 0·831, or thereabouts. But, in the present officinal process, the materials for the generation of ammonia are mixed with a large proportion of water, the vapour of which comes over to some extent with the gas, and is condensed along with it. The resulting spirit is, therefore, somewhat diluted with water, and to an indefinite extent, so that the preparation can have no precise sp. gr.; and, though the whole amount obtained contains all the ammonia generated, we have no accurate criterion of its relative strength.

Properties. The spirit of ammonia, formerly called *ammoniated alcohol*, is a transparent colourless liquid, having a strong ammoniacal odour and acrid taste. When good it does not effervesce with dilute muriatic acid; but, if old, or carelessly kept, it is apt to be partially carbonated, as shown by this test. It, however, absorbs carbonic acid more slowly than Liquor Ammoniæ.

Medical Properties and Uses. Spirit of ammonia is stimulant and antispasmodic, and is given in hysteria, flatulent colic, and nervous debility. It is, however, little

*In relation to sweet spirit of nitre, the reader is referred to the paper of D. R. Brown, of Edinburgh, contained in the *Pharm. Journ.* (March, 1856, p. 400); also to an instructive practical paper by Dr. E. R. Squibb, U. S. Navy, published in the *Am. Journ. of Pharm.* (July, 1856, p. 289), from which we have freely drawn in revising this article.

used internally; the aromatic spirit, which is pleasanter and has similar properties, being preferred. The dose is from ten to thirty drops in a wineglassful of water. Spirit of ammonia dissolves resins, gum-resins, camphor, and the volatile oils; and is a very convenient addition to spirituous liniments, intended to produce a rubefacient effect. Not more than one part of the spirit should, as a general rule, be added to six or eight parts, by measure, of the liniment. It enters into no officinal preparation.

B.

SPIRITUS AMMONIÆ AROMATICUS. *U. S., Br. Aromatic Spirit of Ammonia.*

"Take of Carbonate of Ammonium *a troyounce;* Water of Ammonia *three fluidounces;* Oil of Lemons *two fluidrachms and a half;* Oil of Nutmeg *forty minims;* Oil of Lavender *fifteen minims;* Alcohol *a pint and a half;* Water *a sufficient quantity.* Dissolve the Carbonate in the Water of Ammonia, previously mixed with four fluidounces of Water. Dissolve the Oils in the Alcohol, mix the two solutions, and add sufficient Water to make the whole measure two pints." *U. S.*

"Take of Carbonate of Ammonia *eight ounces* [avoirdupois]; Strong Solution of Ammonia *four fluidounces;* Volatile Oil of Nutmeg *four fluidrachms;* Oil of Lemon *six fluidrachms;* Rectified Spirit *six pints* [Imperial measure]; Water *three pints* [Imp. meas.]. Mix and distil seven pints [Imp. meas.]. Sp. gr. 0·870." *Br.*

In both of these formulas carbonate of ammonium and uncombined ammonia are used; but they differ in the relative proportion of the materials and the mode of conducting the process. The U. S. spirit is a mere solution of the ingredients in alcohol diluted with a small proportion of water; while the British contains such and so much of the ingredients as may rise in distillation, and be condensed with the seven pints of spirit that result. The former is of definite strength, the latter more or less indefinite, as a portion of the materials must be left behind. The translucent officinal carbonate of ammonium does not dissolve in alcohol, but is converted by it into the bicarbonate, which precipitates, and the monocarbonate, which dissolves. The object of the addition of free ammonia in the officinal processes is to convert the insoluble bicarbonate into the monocarbonate. The effloresced carbonate of ammonium of the shops having parted with some of its ammonia is a bi- instead of a sesqui-carbonate, hence when it is used, unless more than the officinal proportion of the water of ammonia is added, some of the ammonia salt remains as the precipitate of the bicarbonate of ammonium. The sp. gr. of the Br. preparation is 0·870.

Medical Properties and Uses. Aromatic spirit of ammonia is fitted to fulfil the same indications as the simple spirit; but is much more used on account of its grateful taste and smell. It is advantageously employed as a stimulant antacid in sick headache. The dose of the U. S. spirit is from thirty drops to a fluidrachm, sufficiently diluted with water. Aromatic spirit of ammonia may be usefully added to aperient draughts, to render them less offensive to the stomach; but care must be taken not to mix it with incompatible substances; and, in order that these may be avoided, it must be recollected that most of the ammonia contained in it is probably in the state of the neutral carbonate.

Off. Prep. Tinctura Guaiaci Ammoniata; Tinctura Valerianæ Ammoniata. B.

SPIRITUS AMMONIÆ FŒTIDUS. *Br. Fetid Spirit of Ammonia.*

"Take of Assafœtida *one ounce and a half* [avoirdupois]; Strong Solution of Ammonia *two fluidounces* [Imperial measure]; Rectified Spirit *a sufficiency.* Break the Assafœtida into small pieces and macerate it in a closed vessel, in fifteen fluidounces of the Spirit for twenty-four hours, then distil off the Spirit, mix the product with the Solution of Ammonia, and add sufficient Rectified Spirit to make *one pint* [Imp. meas.]." *Br.*

This is an alcoholic solution of the volatile oil of assafetida mixed with strong water of ammonia, and is an energetic nervous stimulant and antacid, adapted to certain hysterical conditions, associated with gastric weakness and acidity. It is one of the preparations formerly recognised by the British Colleges, and taken up again in the existing edition of the Br. Pharmacopœia after having been dropped by the first. The dose is from thirty minims to a fluidrachm, to be largely diluted when administered.

W.

SPIRITUS ANISI. *U. S.* ESSENTIA ANISI. *Br.* *Spirit of Anise. Essence of Anise.*

"Take of Oil of Anise *a fluidounce;* Stronger Alcohol *fifteen fluidounces.* Dissolve the Oil in the Stronger Alcohol." *U. S.*

In the preparation of its Essence the British Pharmacopœia directs *one fluidounce* of the Oil to *four fluidounces* of Rectified Spirit.

The dose of the U. S. spirit, as a stomachic and carminative, is one or two fluidrachms, that of the Br. essence one-fourth as much. W.

SPIRITUS ARMORACIÆ COMPOSITUS. *Br.* *Compound Spirit of Horse-radish.*

"Take of Horse-radish Root, scraped, Bitter Orange Peel, cut small and bruised, of each, *twenty ounces* [avoirdupois]; Nutmeg, bruised, *half an ounce* [avoird.]; Proof Spirit *one gallon* [Imperial measure]; Water *two pints* [Imp. meas.]. Mix, and distil a gallon [Imp. meas.] with a moderate heat." *Br.*

This may be used advantageously as an addition to diuretic remedies, in dropsy attended with debility, especially in the case of drunkards. The dose is from one to four fluidrachms. W.

SPIRITUS CAJUPUTI. *Br.* *Spirit of Cajuput.*

"Take of Oil of Cajuput *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.*

For an account of the medical properties and uses of oil of cajeput, of which this is simply an alcoholic solution, see *Oleum Cajuputi*, in *Part* I. The dose of this spirit, which has only one-fifth of the strength of the Br. spirit of 1864, is from 30 minims to a fluidrachm. W.

SPIRITUS CAMPHORÆ. *U. S.*, *Br.* *Spirit of Camphor.* TINCTURA CAMPHORÆ. *U.S.* 1850. *Tincture of Camphor.*

"Take of Camphor *four troyounces;* Alcohol *two pints.* Dissolve the Camphor in the Alcohol, and filter through paper." *U. S.*

"Take of Camphor *one ounce* [avoirdupois]; Rectified Spirit *nine fluidounces.* Dissolve." *Br.*

The former of these preparations is precisely the U. S. Tincture of Camphor of 1850, with a changed name. The British does not materially differ. This spirit is used chiefly as an anodyne embrocation in rheumatic and gouty pains, chilblains, and the inflammation resulting from sprains and bruises. M. Nélaton employed it, in the Clinical Hospital of Paris, in the dressing of open wounds, by compresses, lotion, or fomentation. (*Ann. de Thérap.*, 1865, p. 129.) It may also be employed internally, due regard being paid to the stimulant properties of the alcohol. The camphor is precipitated by the addition of water, but may be suspended by the intervention of sugar. The dose is from five drops to a fluidrachm, first added to sugar, and then mixed with water. W.

SPIRITUS CHLOROFORMI. *U. S.*, *Br.* *Spirit of Chloroform.*

"Take of Purified Chloroform *a troyounce;* Stronger Alcohol *six fluidounces.* Dissolve the Chloroform in the Stronger Alcohol." *U. S.*

"Take of Chloroform *one fluidounce;* Rectified Spirit *nineteen fluidounces.* Dissolve. Sp. gr. 0·871." *Br.*

The chloroform strength of these preparations is very different, the U. S. spirit having one measure of chloroform to between eight and nine of alcohol, the British one to nineteen. Solution of chloroform in alcohol in variable proportions was at one time erroneously called *chloric ether*, and was used as a respiratory anæsthetic agent in the place of chloroform, under the impression that it would be safer; the stimulant properties of the alcohol obviating the sedative action of the chloroform. It is at present, however, little if at all used in this way; they who employ chloroform, and yet wish to guard against its depressing effects, preferring ether to alcohol as the corrigent. The spirit of chloroform is a convenient form for internal exhibition, as it is more readily incorporated in mixtures than chloroform itself. The dose of the U. S. spirit is from half a fluidrachm to a fluidrachm; of the British, much more,

in order to produce an equal effect; so much more, indeed, that the effect of the alcohol would neutralize in great measure that of the chloroform. The dose, however, as mentioned by British writers, is from ten to sixty minims; in which quantity, judging from our own experience, the chloroform would be of little use except for its flavour.* W.

SPIRITUS CINNAMONI. *U. S.* *Spirit of Cinnamon.*

"Take of Oil of Cinnamon *a fluidounce;* Stronger Alcohol *fifteen fluidounces.* Dissolve the Oil in the Stronger Alcohol." *U. S.*

The spirit of cinnamon is an agreeable aromatic cordial, and may be given in debility of the stomach in the dose of from ten to twenty drops. W.

SPIRITUS JUNIPERI. *U. S., Br.* *Spirit of Juniper.*

"Take of Oil of Juniper *a fluidounce;* Stronger Alcohol *three pints.* Dissolve the Oil in the Stronger Alcohol.

"Take of Oil of Juniper *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.*

This spirit is used chiefly as an addition to diuretic infusions. The dose may be from thirty to sixty minims.

Off. Prep. Mistura Creasoti, *Br.* W.

SPIRITUS JUNIPERI COMPOSITUS. *U. S.* *Compound Spirit of Juniper.*

"Take of Oil of Juniper *a fluidrachm and a half;* Oil of Caraway, Oil of Fennel, each, *ten minims;* Alcohol *five pints;* Water *three pints.* Dissolve the Oils in the Alcohol, add the Water, and mix them." *U. S.*

This spirit is a useful addition to diuretic infusions and mixtures in debilitated cases of dropsy. The dose is from two to four fluidrachms. W.

SPIRITUS LAVANDULÆ. *U. S., Br.* *Spirit of Lavender.*

"Take of Oil of Lavender *a fluidounce;* Stronger Alcohol *three pints.* Dissolve the Oil in the Stronger Alcohol." *U.S.*

"Take of Oil of Lavender *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.*

Spirit of Lavender is used chiefly as a perfume, and as an ingredient in other preparations. The perfume usually sold under the name of *lavender water* is not a distilled spirit, but an alcoholic solution of the oil, with the addition of other odorous substances. The following is given by Mr. Brande as one of the most approved recipes for preparing it. "Take of rectified spirit five gallons, essential oil of lavender twenty ounces, essential oil of bergamot five ounces, *essence of ambergris* [made by digesting one drachm of ambergris and eight grains of musk in half a pint of alcohol] half an ounce. Mix." The *Br.* spirit is of one-fifth of the strength of the preparation of the Pharmacopœia of 1864. The dose may be from thirty minims to a fluidrachm.

Off. Prep. Mistura Ferri Composita, *U. S.* W.

* *Alcoholic Solution of Chloroform.* The following observations formed a part of the article on chloroform in the eleventh edition of the Dispensatory; but with the changes in relation to this substance in the new U. S. Pharmacopœia, they find a more appropriate place here in the present edition. A preparation for inhalation, composed of one-third pure chloroform and two-thirds nearly absolute alcohol, was recommended by Dr. Warren, under the name of *strong chloric ether.* Dr. Snow has since employed a similar mixture, using equal parts of chloroform and alcohol. The mixture, made in the proportion adopted by Dr. Snow, is commended by M. Robert as the best anæsthetic agent yet proposed. As the name chloric ether was originally applied by the late Dr. T. Thomson, of Glasgow, to the Dutch liquid, it would be well to abandon the same appellation to designate chloroform, or its mixture with alcohol. A correct name for the latter would be *alcoholic solution of chloroform*, or *tincture of chloroform.* Dr. Warren used his preparation in fifty cases with success, and considered it safer than chloroform, and more agreeable than ether. Further observation is required to determine the value of "strong chloric ether" as an anæsthetic. The alcohol may prove useful by obviating, through its stimulant properties, the depressing influence of the chloroform; and ether has been occasionally mixed with chloroform, with the same view. The preparation, sold in London and elsewhere under the name of "chloric ether," is a weak tincture of chloroform of variable quality, containing at most but 16 or 18 per cent. of chloroform, and sometimes not more than 5 or 6 per cent. (*Note to the twelfth edition.*) B.

SPIRITUS LAVANDULÆ COMPOSITUS. *U.S.* TINCTURA LAVANDULÆ COMPOSITA. *Br.* *Compound Spirit of Lavender.* *Compound Tincture of Lavender.*

"Take of Oil of Lavender *a fluidounce;* Oil of Rosemary *two fluidrachms;* Cinnamon, in moderately fine powder, *two troyounces;* Cloves, in moderately fine powder, *half a troyounce;* Nutmeg, in moderately fine powder, *a troyounce;* Red Saunders, in moderately fine powder, *three hundred and sixty grains;* Alcohol *six pints;* Water *two pints;* Diluted Alcohol *a sufficient quantity.* Dissolve the Oils in the Alcohol, and add the Water. Then mix the powders, and, having moistened the mixture with a fluidounce of the alcoholic solution of the Oils, pack it firmly in a conical percolator, and gradually pour upon it the remainder of the alcoholic solution, and afterwards Diluted Alcohol, until the filtered liquid measures eight pints." *U. S.*

The British Pharmacopœia takes *a fluidrachm and a half* of oil of lavender, *ten minims* of oil of rosemary, *one hundred and fifty grains* of bruised cinnamon, *the same quantity* of bruised nutmeg, *three hundred grains* of red saunders, and *two pints* (Imperial measure) of rectified spirit; macerates the solids in the spirit for seven days; then expresses, filters, dissolves the oils, and adds sufficient rectified spirit to make *two pints.*

When properly made, this is a delightful compound of spices. It is much employed as an adjuvant and corrigent of other medicines, and as a remedy for gastric uneasiness, nausea, flatulence, and general languor or faintness. The dose is from thirty drops to a fluidrachm, and is most conveniently administered on a lump of sugar, or mixed with sugar and water in a wineglass.

Off. Prep. Liquor Arsenicalis, *Br.;* Liquor Potassii Arsenitis, *U. S.* W.

SPIRITUS LIMONIS. *U. S.* *Spirit of Lemon.* *Essence of Lemon.*

"Take of Oil of Lemon *two fluidounces;* Lemon Peel, freshly grated, *a troyounce;* Stronger Alcohol *two pints.* Dissolve the Oil in the Stronger Alcohol, add the Lemon Peel, macerate for twenty-four hours, and filter through paper." *U. S.*

This spirit is used chiefly for flavouring mixtures. W.

SPIRITUS MENTHÆ PIPERITÆ. *U.S., Br.* TINCTURA OLEI MENTHÆ PIPERITÆ. *U. S.* 1850. *Spirit of Peppermint.* *Tincture of Oil of Peppermint.* *Essence of Peppermint.*

"Take of Oil of Peppermint *a fluidounce;* Peppermint in coarse powder, *one hundred and twenty grains;* Stronger Alcohol *fifteen fluidounces.* Dissolve the Oil in the Stronger Alcohol, add the Peppermint, macerate for twenty-four hours, and filter through paper." *U. S.*

"Take of Oil of Peppermint *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.* This spirit is only of one-fifth of the strength of the Br. spirit of 1864, and contains about nine times as much Oil of Peppermint as Spiritus Menthæ Piperitæ of the London Pharmacopœia.

Under the name of ESSENTIA MENTHÆ PIPERITÆ, or *Essence of Peppermint,* the present Br. Pharmacopœia contains a preparation much stronger than either of the above spirits, consisting of *one fluidounce* of Oil of Peppermint to *four fluidounces* of Rectified Spirit.

The distilled spirit has no advantage over a simple solution of the oil in alcohol, and this mode of preparing it has been adopted both in the U. S. and British Pharmacopœias. The present officinal spirit is the Tincture of Oil of Peppermint of the U. S. Pharmacopœia of 1850; and is much stronger than the old distilled spirit. It has long been popularly used under the name of *essence of peppermint.* The present preparation is only about half as strong as the former tincture, and differs in having a little of the dried herb added to the oil, the object of which, as we are informed, is to impart colour to the spirit. The spirit of peppermint affords a convenient method of administering a dose of the volatile oil; being of such a strength that, when dropped on loaf-sugar, it may be taken without inconvenience. The dose is from twenty to thirty drops, which may be given as just mentioned, or mixed

with sweetened water. The dose of the British Spirit is from thirty minims to a fluidrachm, that of the British Essence from ten to twenty minims. W.

SPIRITUS MENTHÆ VIRIDIS. *U. S.* TINCTURA OLEI MENTHÆ VIRIDIS. *U. S.* 1850. *Spirit of Spearmint. Tincture of Oil of Spearmint. Essence of Spearmint.*

"Take of Oil of Spearmint *a fluidounce;* Spearmint, in coarse powder, *one hundred and twenty grains;* Stronger Alcohol *fifteen fluidounces.* Dissolve the Oil in the Stronger Alcohol, add the Spearmint, macerate for twenty-four hours, and filter through paper." *U. S.*

The remarks made on the Spirit of Peppermint are equally applicable to this. Both are usually employed as carminatives. The Spirit of Spearmint may be given in the dose of thirty or forty drops. W.

SPIRITUS MYRISTICÆ. *U. S., Br. Spirit of Nutmeg.*

"Take of Oil of Nutmeg *a fluidounce;* Stronger Alcohol *three pints.* Dissolve the Oil in the Stronger Alcohol." *U. S.*

"Take of Volatile Oil of Nutmeg *one fluidounce;* Rectified Spirit *forty-nine fluidounces.*" *Br.*

The spirit of nutmeg is used chiefly for its flavour, as an addition to other medicines. The dose is one fluidrachm.

Off. Prep. Mistura Ferri Composita, *Br.* W.

SPIRITUS ROSMARINI. *Br. Spirit of Rosemary.*

"Take of Oil of Rosemary *one fluidounce;* Rectified Spirit *forty-nine fluidounces.* Dissolve." *Br.*

This spirit has only one-fifth of the strength of the Br. spirit of 1864, and contains about six times as much Oil of Rosemary as Spiritus Rosmarini of the London Pharmacopœia. It is a grateful perfume, and is used chiefly as an ingredient in lotions and liniments. W.

STRYCHNIA.

Preparations of Strychnia.

STRYCHNIA. *U.S., Br. Strychnia.*

"Take of Nux Vomica, rasped, *forty-eight troyounces;* Lime, in fine powder, *six troyounces;* Muriatic Acid *three troyounces and a half;* Alcohol, Diluted Alcohol, Diluted Sulphuric Acid, Water of Ammonia, Purified Animal Charcoal, Water, each, *a sufficient quantity.* Macerate the Nux Vomica for twenty-four hours in sixteen pints of water, acidulated with one-third of the Muriatic Acid; then boil for two hours, and strain with expression through a strong muslin bag. Boil the residue twice successively in the same quantity of acidulated Water, each time straining as before. Mix the decoctions and evaporate to the consistence of thin syrup; then add the Lime previously mixed with a pint of Water, and boil for ten minutes, frequently stirring. Pour the whole into a double muslin bag, and, having thoroughly washed the precipitate, press, dry, and powder it. Treat the powder repeatedly with Diluted Alcohol, in order to remove the brucia, until the washings are but faintly reddened by nitric acid. Then boil it repeatedly with alcohol until deprived of its bitterness, mix the several tinctures, and distil off the Alcohol by means of a water-bath. Having washed the residue, mix it with a pint of Water, and, applying a gentle heat, drop in enough Diluted Sulphuric Acid to neutralize and dissolve the alkaloid. Then add Purified Animal Charcoal, and, having boiled the mixture for a few minutes, filter, evaporate, and set aside to crystallize. Dissolve the crystals in Water, and add sufficient Water of Ammonia to precipitate the Strychnia. Lastly, dry this on bibulous paper, and keep it in a well-stopped bottle." *U. S.*

"Take of Nux Vomica *one pound* [avoirdupois]; Acetate of Lead *one hundred and eighty grains;* Solution of Ammonia, Rectified Spirit, Distilled Water, each, *a sufficiency.* Subject the Nux Vomica for two hours to steam in any convenient vessel; chop or slice it: dry it in a water-bath or hot air chamber, and immediately

grind it in a coffee mill. Digest the powder at a gentle heat for twelve hours with two pints [Imperial measure] of the Spirit and one of the Water, strain through linen, express strongly, and repeat the process twice. Distil off the Spirit from the mixed fluid, evaporate the watery residue to about sixteen [fluid]ounces, and filter when cold. Add now the Acetate of Lead, previously dissolved in Distilled Water, so long as it occasions any precipitate; filter; wash the precipitate with ten ounces of cold Water, adding the washings to the filtrate; evaporate the clear fluid to eight [fluid]ounces, and when it has cooled add the Ammonia in slight excess, stirring thoroughly. Let the mixture stand at the ordinary temperature for twelve hours; collect the precipitate on a filter, wash it once with a few ounces of cold Distilled Water, dry it in a water-bath or hot air chamber, and boil it with successive portions of Rectified Spirit, till the fluid scarcely tastes bitter. Distil off most of the Spirit, evaporate the residue to the bulk of about half an ounce, and set it aside to cool. Cautiously pour off the yellowish mother-liquor (which contains the brucia of the seeds) from the white crust of strychnia which adheres to the vessel. Throw the crust on a paper filter, wash it with a mixture of two parts of Rectified Spirit and one of Water, till the washings cease to become red on the addition of nitric acid; finally dissolve it by boiling it with an ounce of Rectified Spirit, and set it aside to crystallise. More crystals may be obtained by evaporating the mother-liquor." *Br.*

In preparing strychnia, the first step is properly to comminute the nux vomica. This may be done by rasping the seeds, or, as directed in the British Pharmacopœia, by first softening them by steam, then slicing, drying, and grinding them. The next object is to extract the strychnia. For this purpose, in the U. S. process, water is employed acidulated with muriatic acid; in the British, rectified spirit diluted with half its bulk of water. In the latter, the native igasurate of strychnia, is taken up; in the former, the muriate, which is a very soluble salt. In the U. S. process, after a concentration of the infusion, the salt of strychnia is decomposed by lime, which precipitates the strychnia along with the excess of lime employed and impurities. The strychnia is extracted from the precipitate by boiling alcohol, and may be obtained in crystals by the concentration of the solution. But in this state it is much coloured and impure. To obviate these impurities in some degree, the British Pharmacopœia directs that the concentrated liquid should be treated with acetate of lead, which precipitates much of the contaminating matter, and then that the liquor, previously filtered, should be treated with ammonia, by which the strychnia is thrown down less impure than in the U. S. process. At this stage of the proceedings, the present U. S. Pharmacopœia directs that the precipitate, which, besides strychnia, contains also brucia and various impurities, should be freed from the latter alkaloid by repeated washing with cold diluted alcohol, in which brucia is much more soluble than strychnia. This is a great improvement upon the U. S. formula of 1850, in which the brucia was allowed to accompany the strychnia to the end of the process. In the U. S. process, the impure strychnia is converted into a sulphate by the addition of sulphuric acid, and precipitated again by ammonia; being, while in the state of the sulphate, decolorized by means of animal charcoal. The Br. Pharmacopœia completes the process by washing the precipitate produced by ammonia with cold water, drying it, then exhausting it with alcohol, and concentrating the alcoholic solution. The strychnia now crystallizes, leaving most of the brucia in the mother-liquor. But, as some of the latter alkaloid still contaminates the product, the Pharmacopœia directs this to be washed with cold alcohol somewhat diluted, until the washings cease to give evidence of the presence of brucia by being reddened by nitric acid; thus accomplishing at the end of the process what was done in the U. S. formula at an earlier stage. To free the strychnia entirely from brucia requires repeated crystallizations, and a little of the latter principle is consequently almost always retained; but it is not injurious, as the effects of the two alkaloids upon the system are very similar. The bean of St. Ignatius yields strychnia more easily and more largely than nux vomica, but is less plentiful.*

* M. J. F. Molyn proposes, previously to the extraction of strychnia, to subject nux vomica to fermentation, by which the saccharine and gummy matters of the seeds are decomposed, and lac-

If thought desirable, brucia may be in great measure separated from the strychnia of the shops, by dissolving the latter in very dilute nitric acid, filtering, and concentrating. Nitrate of brucia crystallizes in short, thick, dense prisms grouped together; nitrate of strychnia in radiated tufts of long, light, capillary needles. By gentle agitation with the liquid, the latter salt is suspended and may be poured off, leaving the former. The alkaloids may be obtained by dissolving the salts in water, and precipitating with ammonia. (*Christison.*)

Properties. As usually kept in the shops, strychnia is a white or grayish-white powder. When rapidly crystallized from its alcoholic solution, it has the form of a white, granular powder; when slowly crystallized, that of elongated octohedra, or quadrilateral prisms with quadrilateral terminations. It is permanent in the air, inodorous, but excessively bitter, with a metallic after-taste. So intense is its bitterness, that one part of it is said to communicate a sensible taste to 600,000 parts of water. It melts like a resin, but has been supposed not to be volatile, being decomposed at a comparatively low temperature, and entirely dissipated at a red heat. Dr. Guy, however, has obtained from it a crystalline sublimate. He found it to sublime at a heat but a few degrees below that at which it begins to change colour and undergo decomposition. He gives its melting point at 345°, and that of sublimation at 430°. (*Pharm. Journ.*, Feb. 1868, p. 375.) According to Dr. Waddington, when heated to decomposition, it emits a most suffocating odour, resembling the smell of asphaltum. (*Ibid.*, March, 1868, p. 413.) It is soluble in 6667 parts of water at 50°, and about 2000 at the boiling point. Boiling officinal alcohol dissolves it without difficulty, and deposits it upon cooling. In absolute alcohol and in ether it is very sparingly soluble. According to the experiments of Messrs. Plummer and Kelly, strychnia is soluble, at the ordinary temperature, in 387 parts of officinal alcohol (sp. gr. 0·835), 179 parts of absolute alcohol, and 682 parts of ether. (*Am. Journ. of*

tic acid is formed, which decomposes the igasurates of strychnia and brucia, producing with these bases very soluble lactates. For the particulars of his process, see the *Am. Journ. of Pharm.* (xix. 99).

We are informed that none of the officinal processes are followed exactly by the large manufacturers, in reference to the preliminary comminution of the nux vomica. The plan most approved is to macerate the whole seeds in dilute sulphuric acid, and to pass steam through them, under pressure, in a covered vat, lined with lead. The seeds softened in this way are then ground, and the pulp lixiviated or expressed. One advantage of the sulphuric acid, thus employed, is thought to be the conversion of the bassorin, which impedes the process, into soluble dextrin. The liquors are precipitated with lime, and the process completed as officinally directed. (*Note to the tenth edition.*)

Mr. John Horsley, of Cheltenham, England, proposes a new process for preparing strychnia, which has the advantage of dispensing with alcohol. One-quarter of a pound of nux vomica is kneaded with an equal weight of commercial acetic acid, the pulpy mass thus obtained is diluted with two or three pints of cold water, and the mixture is digested for a few days. The clear liquor is then decanted, an equal quantity of cold water poured on the mass, and digestion continued for a day or two longer, or till everything soluble has been extracted. The clear liquor is again decanted, and the residue filtered through flannel. The clear liquors are mixed, and evaporated to a syrupy consistence. The residue, when cold, is diluted with an equal quantity of water, ammonia is added in excess, and the mixture set aside for a day or two, that the strychnia may crystallize. This forms little white tufts in the liquid, and on the sides of the vessel. When the crystallization is complete, the supernatant liquid is filtered through calico, and the residue, with the impure crystals collected from the vessel added to it, is allowed to drain, then collected, and dried by means of a water-bath. The substance thus obtained, consisting of strychnia, brucia, and various impurities, is digested in hot diluted acetic acid, and the solution filtered. The strychnia and brucia may be precipitated from the filtered liquid by potassa; or, if the strychnia alone be wanted, a solution of chromate of potassium may be added, which will throw down chromate of strychnia, free from brucia, if the liquid be tolerably acid. The chromate of strychnia, being well drained on a filter, may be digested in solution of ammonia, by which the alkaloid will be precipitated of a more or less snowy whiteness. Mr. Horsley thus obtained about 1 per cent. of strychnia from nux vomica, which is at least twice the ordinary yield. (*Pharm. Journ.*, xvi. 179.)

Mr. John Williams proposes the use of benzole in the preparation of strychnia. Having extracted the soluble matters of nux vomica by repeated decoction with water acidulated with sulphuric acid, he evaporates the liquid to the consistence of thin treacle, and adds a concentrated solution of caustic potassa, so as to render the liquid strongly alkaline. He then adds an equal bulk of benzole, shakes the mixture well, and keeps it in a warm place for 12 hours. The benzole, holding the alkaloids in solution, rises, and is poured off; a new portion is added, and after similar treatment is also decanted; the mixed benzole solutions are distilled; and the residue treated with acetic acid, filtered, and precipitated with caustic soda. The precipitate is white, and consists of strychnia and brucia, which may be separated in the ordinary method. (See *Am. Journ. of Pharm.*, xxvi. 339.)—*Note to the eleventh edition.*

Pharm., Jan. 1859, p. 25.) The volatile oils dissolve it freely. Benzine dissolves 0·607 per cent. of it, and amylic alcohol 0·55 per cent. (Dragendorff, *Journ. de Pharm.*, 4e sér., iv. 473.) It has an alkaline reaction on test paper, and forms salts with the acids. Nitric acid does not redden it if perfectly pure, but almost always reddens it as found in the shops, in consequence of the presence of brucia. M. Eugene Marchand proposes the following test, by which a very minute proportion of strychnia may be detected. If a little of the alkaloid be rubbed with a few drops of concentrated sulphuric acid containing one-hundredth of nitric acid, it will be dissolved without change of colour; but if the least quantity of peroxide of lead be added to the mixture, a magnificent blue colour will be instantly developed, which will pass rapidly into violet, then gradually to red, and ultimately become yellow. (*Journ. de Pharm.*, 3e sér., iv. 200.) Professor Otto recommends as a test a minute quantity of solution of bichromate of potassium, which, added to the solution of strychnia in concentrated sulphuric acid, produces a splendid violet colour. (*Am. Journ. of Pharm.*, xix. 77.) A similar change of colour is produced, according to Dr. E. W. Davy, by substituting a strong solution of ferridcyanide of potassium (red prussiate of potassium) for that of bichromate of potassium. (*Ibid.*, xxv. 414.) It appears that any substance capable of yielding nascent oxygen readily will serve to develop the characteristic violet colour, when applied after the addition of sulphuric acid. Landerer has found that solid iodic acid or iodate of potassium, heated gently with strychnia, gives rise to a beautiful violet colour, gradually passing to red, which remains unchanged for many days. (*Ibid.*, March, 1861, p. 110.) According to Mr. Wm. Copney, the least efficacious agent is chlorate of potassium, a much better is deutoxide of lead, a still better is deutoxide of manganese, and the best of all is bichromate of potassium; and the general result of numerous experiments, recently made, is that the last-mentioned reagent is the most effective. The sulphuric acid must be of not less sp. gr. than 1·84; and that of 1·85 is better. The play of colours, according to Mr. Copney, is first blue, then purple, then crimson, which is followed by red and green, the latter sometimes giving place to yellow. It is stated that the 1-500,000th part of a grain may be detected. (See *Am. Journ. of Pharm.*, xxviii. 459).* The usual mode of pro-

* This subject requires a more detailed consideration than space can be afforded for in the text. The questions have been discussed whether strychnia, taken in poisonous quantities, is decomposed after a short period in the system, so that it cannot be detected by chemical reagents either in the secretions or in the body; and whether, allowing it to remain in the system, the quantity required to produce death may not be so small, and so diffused, as to afford no evidence of its presence to chemical tests. The general results of the experiments upon these points are, that strychnia is found unaltered in the urine after being swallowed; that it strongly resists decomposition in the system; and that, in cases of poisoning, even though it may have been absorbed from the stomach, and not to be found there, it may be detected in the blood and solid tissues of the body, if taken largely enough to cause death.

But to succeed in detecting the alkaloid when mixed, in small proportion, with organic matters, it is necessary first to disintegrate the organic matter that the action of a solvent of the strychnia should not be impeded, and that the alkaloid should be completely separated from the foreign matter. The process of Messrs. Rogers & Girdwood, by which these objects are effected, is the following. Digest the substance, supposed to contain the strychnia, with a mixture of 1 part of muriatic acid and 10 of water, until it becomes apparently fluid. Filter, and evaporate the liquid to dryness by a water-bath. Treat the residue with alcohol as long as anything is dissolved, filter, and evaporate. Dissolve the residue in water and filter. Add solution of ammonia in excess to the aqueous solution, and agitate in a bottle or long tube with half an ounce of chloroform. Upon repose the chloroform subsides, holding the alkaloid in solution. Draw it off by a pipette, and evaporate the chloroform over a water-bath. Moisten the dry residue with concentrated sulphuric acid, and expose the mixture for some hours to the temperature of a water-bath, by which means all the organic matter except the strychnia is decomposed. Treat the charred mass with water, filter, add excess of ammonia, and shake the mixture with a drachm of chloroform. Separate the chloroform as before: and, if the matter left after the evaporation of a small portion of it is charred by concentrated sulphuric acid, the whole of it must be treated in the same manner as the previous chloroform solution. The last chloroform solution obtained is then to be tested for strychnia. Take up a little of it in a capillary tube, and drop it on the smallest space of a warm porcelain capsule, so that each successive drop may be evaporated. When the capsule is quite cold, moisten the spot with concentrated sulphuric acid, and add a minute fragment of bichromate of potassium. Should the characteristic colour not be developed, it is said that, if there be the minutest quantity of strychnia present, the colour will become visible by adding sulphuric acid rendered slightly yellow by chromic acid. In conducting the process, care must be taken not to stir the spot moistened by sulphuric acid with a rod before the addition of the bichromate, and not to expose the spot to a very strong light, which interferes with the chemical reactions. (*Lond. Med. Times and Gaz.*, June, 1857, p. 620.) It is probable that the process of dialysis might be advantageously applied

ceeding is to drop the solution suspected to contain strychnia upon a clean surface of porcelain, evaporate to dryness, then apply the sulphuric acid to the spot, and afterwards a minute fragment of a crystal of the bichromate, which will immediately produce the change of colour. Dr. Jno. Dougall, however, claims that chromic acid is much more sensitive than the bichromate, and that it should always be dissolved in the drop that is to be tested and the sulphuric acid added before desiccation. (*New Remedies*, Oct. 1871, p. 151.) Mr. Wm. T. Wenzell states that, when very minute quantities of the alkaloid are being dealt with, much the best plan is to prepare a reagent by dissolving in 2000 grains of sulphuric acid one grain of the permanganate of potassium. The alkaloid, during the evaporation of the fluid on the porcelain, as just described, collects in the margins of the film, and the smallest possible dot of the reagent is to be placed so that its margin comes in contact with that of the film. In this way, Mr. Wentzell affirms, he was able to detect 1-900,000th part of strychnia. (*Am. Journ. of Pharm.*, xlii. 385.) Some doubt was thrown upon the value of this test by experiments, which seemed to prove that the presence of morphia in excess, especially in connection with organic matter, so far modified or disguised the action of the test upon strychnia as to prevent the appearance of the characteristic colour; but subsequent and carefully conducted experiments, by the late Dr. Robert P. Thomas, satisfactorily determined that the conclusions in relation to the effects of morphia were erroneous, and that whether alone or associated with organic matters, in small or in large quantity, it does not prevent the operation of this colour-test if carefully applied. (*Am. Journ. of Med. Sci.*, Oct. 1861, p. 414; and April, 1862, p. 340.) Strychnia consists of carbon, hydrogen, nitrogen, and oxygen; but the proportion of its constituents is very differently given by different authors.* Liebig states the composition to be $C_{44}H_{23}N_2O_4$; in the British Pharmacopœia, it is given as $C_{42}H_{22}N_2O_4$, which is the formula inferrible from the analysis of Gerhardt. (See *Am. Journ. of Pharm.*, March, 1859, p. 135.) The salts of strychnia are for the most part soluble and crystallizable. Their solution is decomposed by the alkalies and their carbonates, and by tannic, but not by gallic acid; and is not affected by the

to the separation of strychnia from the organic matters containing it, when brought to the liquid state. (See *Dialysis*, page 933.) Diluted acetic acid may be used for extracting the alkaloid with other soluble substances from the contents of the stomach.

It is stated by Mr. C. W. Bingley that, if much tartar emetic be contained in a solution with a little strychnia, a pale-greenish colour is produced instead of the violet; and, in like manner, if chloride of antimony be present, the sulphuric acid and bichromate of potassium test fails altogether. (*Chem. Gaz.*, June 16, 1856, p. 229.) Mr. Richard Hagen, having been induced, by the assertion of Von Sicherer that this test fails when the strychnia is mixed with tartar emetic or other tartrates, or even tartaric acid, to investigate the subject, ascertained that this statement, as a general rule, is erroneous; for the reaction takes place with strychnia or its muriate, though mixed with 20 or 30 parts of tartrate of antimony; yet when *nitrate of strychnia* is used with 20 parts of the antimonial tartrate, the mass almost instantly acquires a green colour with the reagents mentioned. But even with nitrate of strychnia, the test succeeds if peroxide of lead is used instead of chromic acid as the oxidizing agent. (*Ibid.*, Oct. 15, 1857, p. 398.)

For a particular account of the results produced by the reaction of a large number of substances with strychnia, the reader is referred to a paper by Dr. T. G. Wormley, in the *Chemical News* for April 14th and 28th, 1860 (pp. 218 and 242). Among other trials made by him was that of the action of this alkaloid on frogs, proposed as a test by the late Dr. Marshall Hall. The poison was injected into the stomach of the animals through a pipette. A solution containing 1 per cent. of strychnia immediately produced rigidity and violent tetanic spasms, and death in 8 minutes. With 1 part of strychnia to 1000 of the menstruum, the spasmodic symptoms were induced in 3 or 4 minutes; with 1 in 10,000, in from 10 to 24 minutes; with 1 in 20,000, and 1 in 30,000, the symptoms were less unequivocal, though tetanic spasms were noticed in some of the animals.

Experiments by Mr. W. A. Guy on the effects of sulphuric and nitric acids on strychnia and many other alkaloids, published with tabulated results, show that in no one out of 66 proximate principles, chiefly alkaloids, was the same change of colour produced as in strychnia by concentrated sulphuric acid, followed by a crystal of bichromate of potassium. (See *Am. Journ. of Pharm.*, Nov. 1861, p. 517.) In the same number of the same journal (p. 527) is a paper by Mr. T. E. Jenkins, giving the result of experiments with sulphuric acid and bichromate of potassium on numerous alkaloids, all tending to prove the delicacy and certainty of this colour-test of strychnia. Mr. A. Wynter Blyth distils the suspected alkaloid with a solution of permanganate of potassium to dryness, condensing the vapour in a cold flask, and applying Nessler's test for ammonia to the liquid thus obtained. He finds that all the poisonous alkaloids differ, but are individually constant in the amount of ammonia yielded, and that the test is always competent to decide to which class the alkaloid belongs, and often what alkaloid it is. Strychnia yields half its nitrogen, or 5·09 per cent. of ammonia. For further particulars consult *Med. Times and Gaz.*, 1875, i. 387. (*Note to the eleventh, twelfth, and fourteenth editions.*)

* For a paper on the electrolysis of strychnia, see *Journ. de Pharm.*, 4e sér., xi. 14.

salts of sesquioxide of iron. They are precipitated by the solution of iodine in iodide of potassium, and the precipitate, though soluble in alcohol, is insoluble in the diluted acetic and muriatic acids of the U. S. Pharmacopœia. (Fairthorne, *Am. Journ. of Pharm.*, xxvii. 212.)*

Strychnia is apt to contain impurities, of which the chief, besides brucia, are colouring matter, and lime or magnesia. The two latter impurities are left behind when the adulterated alkaloid is incinerated in the open air. Pure strychnia leaves no ashes under these circumstances. Brucia is detected by the red colour which it yields with nitric acid. Neither this nor sulphuric acid colours strychnia; a test which serves to distinguish it from several other alkaloids.

Medical Properties and Uses, &c. The effects of strychnia upon the system are identical in character with those of nux vomica, and it is employed for the same purposes as a medicine. (See *Nux Vomica.*) It operates in the same way by whatever avenue it may enter into the circulation; but is said to act most powerfully when injected into the veins, or applied to a fresh wound. The blood of an animal under its influence produces similar effects in another, if transfused into its veins. There is no doubt that it is absorbed; as, after having been swallowed, it has been found in the urine, the blood, and the tissue of various organs. In overdoses it is a most violent poison. Pelletier and Caventou killed a dog in half a minute with one-sixth of a grain of the pure alkaloid. One grain or even less might prove fatal in the human subject. A case, however, is recorded in which recovery took place after seven grains had been swallowed; but the medicine was probably impure. (See *Am. Journ. of Med. Sci.*, N. S., xxx. 562.) Its most striking and characteristic effect, when taken in poisonous doses, is violent tonic spasms of the muscles, like those of tetanus, which sometimes continue after death. According to M. Duclos, the poisonous effects of strychnia upon animals subside under the application of negative electricity, while they are aggravated by the positive. (See *Am. Journ. of Pharm.*, xvi. 154.) M. Boudet has found that chlorine water alternated with tartar emetic, so as to produce vomiting, obviates these effects in dogs. (*Arch. Gén.*, Fév. 1853, p. 222.) Kermes mineral has been recommended by M. Thorel as an antidote, being thought by him to form with strychnia an insoluble sulphuret, at the same time aiding any other emetic which may be administered for its expulsion. In cases of poisoning with strychnia he recommends fifteen grains of kermes, and one and a half grains of tartar emetic. MM. Bouchardat and Gobley state that, out of the body, the ioduretted iodide of potassium acts far more powerfully in producing an absolutely insoluble compound. (See *Am. Journ. of Pharm.*, xxiii. 84.) Tincture of iodine has the same effect, as proved by the experience of Mr. Young, and afterwards confirmed by Dr. H. W. Fuller, of London. (*Lancet*, March 21, 1868, p. 373.) But, though this fact establishes the impropriety of combining solutions of iodine and strychnia in prescriptions, yet it by no means justifies the inference drawn from it, that iodine might serve as an antidote to strychnia; and, indeed, the contrary has been proved by experience, for not only did Mr. S. Darby find that the precipitate of iodide of strychnia is highly poisonous to the lower animals, and that it is in fact not altogether insoluble in the gastric liquids, as it yielded decided bitterness to water digested with it for three hours at 90° F. (*Pharm. Journ.*, May, 1868, p. 535), but a case of fatal poisoning by iodide of strychnia has occurred in man. Animal

* When an aqueous solution of sulphate of strychnia and nitrite of potassium is boiled, an effervescence takes place owing to the escape of nitrogen, and the solution becomes yellow. If ammonia be now added, a precipitate takes place, which has been found to consist of two new alkaloids, resulting from the oxidation of the strychnia in different degrees. One of these the discoverer, P. Schutzenberger, proposes to name *oxystrychnia*, and the other *binoxystrychnia*. (See *Am. Journ. of Pharm.*, March, 1859, p. 133.)

Methyl-strychnia. Methyl-brucia. These alkaloids are formed by replacing one of the eqs. of hydrogen in strychnia by methyl (C_2H_3), which is effected by acting on the alkaloids by iodide of methyl. A singular and, if verified, very important statement in relation to these modifications of strychnia and brucia, made by Stahlschmidt (*Ann. der Phys. und Chem.*), is that they are not poisonous. He gave to a rabbit five grains of methyl-strychnia, without any bad symptoms, though the same animal was afterwards killed in five minutes by one-twentieth of a grain of strychnia placed upon its tongue. The important practical inference is that iodide of methyl ought to be an antidote to strychnia. (See *Am. Journ. of Pharm.*, May, 1860, p. 220.)—*Note to the twelfth edition.*

charcoal has been employed with a view to absorb the poison; being thrown in by means of a stomach-tube. (*Lond. Med. Times and Gaz.*, April, 1855, p. 423.) Tannic acid, chlorine, and the tinctures of iodine and bromine are recommended as the best antidotes by Prof. Bellini. (See *Am. Journ. of Med. Sci.*, July, 1863, p. 276.) The indications are to evacuate the stomach, using at the same time any chemical antidote that may be at hand, and to relieve the spasms by opiates, ether, or other narcotics. Of the emetics sulphate of zinc would be among the most efficient; and powdered mustard has been highly recommended. They should be aided by the very free use of warm water. But it often happens that, before aid arrives, enough of the poison has been absorbed to produce death; so that vomiting, even aided by chemical antidotes, cannot be relied on. To relieve the spasm, besides *opium* and *ether*, *camphor* has been used with supposed success; and several cases are on record in which the inhalation of *chloroform* has not only afforded great relief, but appears to have been the means of saving life. Chloroform has been used also with seeming advantage by the stomach. In a case recorded by Dr. Dresbach, of Tiffin, Ohio, two drachms, swallowed by a patient alarmingly ill from the effects of three grains of strychnia, produced complete relief in less than fifteen minutes. (*Am. Journ. of Med. Sci.*, xix. 546; from *Western Lancet*, Feb. 1850.)* A case occurring at St. Louis, Missouri, is on record, in which a patient who had taken six grains of strychnia, was, after having been vomited, apparently saved by the internal use of infusion of *tobacco*, administered by Drs. Byrne and O'Reilly. (*Ranking's Abstract*, No. 29, p. 287.) *Aconite* has been shown by experiments on dogs, performed by Dr. Woakes, to have a similar physiological antagonism with strychnia, and has been recommended in poisoning by this alkaloid, after evacuation of the stomach. (*British Med. Journ.*, Oct. 26, 1861.) *Cannabis Indica* has proved effectual in a case reported by Dr. S. A. M. Williams, of Chicago. The patient was an adult man, and had taken five grains of strychnia. Though most violently affected, he recovered under the use of tincture of cannabis, which was given in drachm doses, repeated at first in five minutes, then twice at intervals of ten minutes, and afterwards twice in fifteen minutes, with rapid improvement. Another similar dose was given in an hour and a half; and the remedy was afterwards repeated in alternation with camphor, as the symptoms seemed to require, till complete recovery at the end of 48 hours. (*Med. and Surg. Reporter*, Feb. 2, 1867; from *Med. Examiner.*) Besides the substances above mentioned, the *Calabar bean* has been proposed as a counter-poison to strychnia by Dr. Thos. P. Frazer, of Edinburgh, on the ground of its physiological properties, and *nitrite of amyl* by Dr. B. W. Richardson, of London, who, in experiments on frogs, found the poisonous influence of strychnia to be entirely controlled by exposing the animal under its influence to the vapour of that compound. (*B. and F. Medico-chir. Rev.*, Jan. 1865, pp. 264, 265.) [Elaborate experiments made by Prof. Liebreich and M. Orr, and especially by Prof. Bennett, have demonstrated that in the lower animals chloral is an efficient remedy in strychnia poisoning, and cases have recently been reported of its successful use in man. Theoretically bromide of potassium ought to be antagonistic to strychnia, and in the few cases which have been reported it has seemed to be of the greatest service. On the whole I would be inclined to rely upon the bromide and chloral in a case of strychnia poisoning; giving, if the symptoms were severe, half an ounce of the salt followed by twenty-five grains of the chloral in half an hour if the symptoms remained threatening, and smaller doses of both remedies subsequently, at short intervals, if necessary. Of course, if in the onset the convulsions were so severe that death seemed imminent from suffocation, they should be controlled by the inhalation of chloroform or nitrite of amyl. The latter salt, indeed, may turn out to be the remedy par excellence in strychnia poisoning. H. C. W.] Different persons are very differently susceptible to the action of strychnia, and some are powerfully affected

* In a letter to the authors, from Dr. Wm. D. Barclay, dated Muscatine, Iowa, May 4, 1863, the case of a robust young man is described, who, after taking four grains of strychnia, was seized with a most violent tetanic spasm, accompanied with intense suffering, and recovered under the use of chloroform, given both internally and by inhalation. It was necessary to keep him under the influence of the medicine for thirteen consecutive hours, during which two pounds of chloroform were consumed by inhalation. Two drops were given every five minutes, by the stomach, when the mouth could be opened. (*Note to the twelfth edition.*)

by the smallest doses. Besides being more or less impure as kept in the shops, it cannot be relied on with certainty. Hence the necessity of great caution in prescribing it, and of carefully watching the patient during its use. The best plan is always to begin with very small doses, and gradually increase till its effects are observed. From one-sixteenth or even one-twenty-fourth to one-twelfth of a grain internally, and from an eighth to one-third of a grain externally, upon a blistered surface, may be employed at first; and afterwards increased if necessary. It is most conveniently administered in the form of pill. It may be given also in the saline state, which is produced by dissolving it in water acidulated with sulphuric, muriatic, nitric, or acetic acid. For its therapeutical applications, see *Nux Vomica* in *Part* I. Among the diseases in the treatment of which it has recently been introduced is epilepsy when attended with uterine disturbance. Mr. Walter Tyrrell gives the details of several cases of the kind in which it proved effective; and, though not disposed to consider it a specific, he has no hesitation in affirming that it is very beneficial in a large majority of cases. (*Med. Times and Gaz.*, April, 1868, p. 415.) It has been considerably employed of late in paralytic affections and in amaurosis from atrophy of the optic nerve by the method of hypodermic injection. From the thirty-sixth to the twenty-fourth of a grain has been found to be generally well borne, though some sensitive nervous systems require much less. (Charles Hunter, *B. and F. Med.-chir. Rev.*, April, 1868, p. 446.) In a case of hemeralopia a cure has been effected by strychnia and opium combined; the dose of strychnia being at first one-twenty-fourth of a grain, which was gradually increased to an eighth. (Dr. H. W. Gardner, *Am. Journ. of Med. Sci.*, April, 1867, p. 556.) Strychnia has also been used with supposed advantage in cholera (*Med. Times and Gaz.*, Jan. 1867, p. 8); and Dr. C. Hanfield Jones has found it successful in hypochondriasis. (*Ibid.*, May, 1867, p. 626.) Dr. Isaac Hays, of Philadelphia, has found a solution of acetate of strychnia, dropped into the eye, to possess powers similar to those of the Calabar bean, in producing contraction of the pupil, and influencing the muscles of accommodation, and has been for several years in the habit of using it for this purpose. (*Am. Journ. of Med. Sci.*, July, 1863, p. 266.)

Off. Prep. Liquor Strychniæ, *Br.;* Strychniæ Sulphas, *U. S.* W.

STRYCHNIÆ SULPHAS. *U. S.* *Sulphate of Strychnia.*

"Take of Strychnia *a troyounce;* Diluted Sulphuric Acid *nine fluidrachms*, or *a sufficient quantity;* Distilled Water *a pint.* Mix the Strychnia with the Distilled Water, heat the mixture gently, and gradually add Diluted Sulphuric Acid until the alkaloid is neutralized and dissolved. Filter the solution, and evaporate with a moderate heat, so that crystals may form on cooling. Lastly, having drained the crystals, dry them rapidly on bibulous paper, and keep them in a well-stopped bottle." *U. S.*

This salt is in colourless prismatic crystals, efflorescent on exposure, inodorous, extremely bitter, freely soluble in water, sparingly soluble in alcohol, and insoluble in ether. It melts with a moderate heat, losing nearly 14 per cent. of water of crystallization, and by a strong heat is completely dissipated. The chief advantage of this preparation over strychnia is its solubility in water, by which it is better adapted to external use, as for application to blistered surfaces, or for subcutaneous injection, should this at any time be deemed advisable, or as an ingredient in collyria. But even these advantages may be so easily gained by adding a few drops of an acid, the acetic for example, to strychnia, as much to diminish the value of this as a distinct officinal preparation. The dose is the same as that of the alkaloid itself.* W.

* *Arsenite of Strychnia* having been proposed as a remedy by Prof. Grimelli, of Modena, M. Chiappero, of Turin, undertook to prepare the salt. For this purpose he dissolved arsenious acid in water acidulated with muriatic acid, and neutralized the arsenious acid with strychnia. But, according to M. T. Cresoli, of Paris, the result was a mixture of arsenite and muriate of strychnia. The latter chemist prepares a pure arsenite of strychnia in the following manner. He takes 3·12 grammes of caustic potassa, 3·30 of arsenious acid, and 40·00 of distilled water. Having dissolved the potassa in the water, boiling-hot, he adds the arsenious acid, which is completely dissolved. He then dilutes 2·65 grammes of monohydrated sulphuric acid with 20 grammes of distilled water, and, having heated the mixture to ebullition, adds 12 grammes of pure crystal-

SUCCI. *U.S., Br.*

Juices.

Though introduced to professional notice by Mr. Squire, so long since as in the year 1835, and subsequently used by many practitioners, the Juices have now for the first time been recognised by the U.S. Pharmacopœia. They consist of the expressed juices of fresh plants, preserved by the addition of one-third of their bulk of alcohol. Considering the great inequality in strength, and of course uncertainty in operation of the fresh juices themselves, according to soil, climate, mode of cultivation, season, and age of the plant, it may be questioned whether they merit the prominence which has been given them in the British Pharmacopœia; unless, indeed, an exception may be made in the instance of the *Succus Conii*, and perhaps also of the Succus taraxaci, the only two juices recognized by the U. S. Pharmacopœia.

SUCCUS BELLADONNA. *Br. Juice of Belladonna.*

"Take of Fresh Leaves and Young Branches of Belladonna *seven pounds;* of Rectified Spirit *a sufficiency.* Bruise the Belladonna in a stone mortar; press out the juice; and to every three measures of juice add one of Spirit. Set aside for seven days, and filter. Keep it in a cool place." *Br.*

The dose of this succus is from five to fifteen minims. H. C. W.

SUCCUS CONII. *U.S., Br. Juice of Hemlock.*

"Take of Fresh Conium Leaves *a convenient quantity;* Alcohol *a sufficient quantity.* Bruise the Leaves thoroughly in a mortar, press out the juice, and to every five measures of juice add one of Alcohol. Set aside the liquid for seven days, and filter. Keep it in a cool place." *U.S.*

"Take of Fresh Leaves of Hemlock *seven pounds;* Rectified Spirit *a sufficiency.* Bruise the Hemlock in a stone mortar; press out the juice; and to every three measures of juice add one of the Spirit. Set aside for seven days, and filter. Keep it in a cool place." *Br.*

The albumen is probably coagulated under the influence of the alcohol; and hence the propriety of directing filtration. The dose of this preparation is from thirty to sixty minims.

Dr. John Harley, of London, in his experiments on the different preparations of conium, found the juice among the most efficient. When heated with a little caustic potassa, it gave out suffocating fumes of conia; and one fluidounce of it was ascer

lized strychnia, which is entirely dissolved. The two solutions being kept at about the temperature of 100° F., he pours the arsenical solution into that of strychnia. A grumous mass is produced, much of which, however, is dissolved by heat. The liquid being filtered boiling-hot from the undissolved mass, which consists almost exclusively of sulphate of potassium, the filtered liquid is evaporated nearly to dryness, and the residue dissolved in absolute alcohol, by which the sulphate of potassium is all left behind. The undissolved mass, after the first filtration, is repeatedly washed with alcohol; and the alcoholic solutions are mixed, concentrated, and set aside to crystallize. At the end of two days the arsenite separates in the form of cubic crystals.

Arsenite of strychnia is in white cubic crystals, containing water, which they lose in contact with the air, becoming almost efflorescent. They are completely decomposed by heat with an empyreumatic smell, and leave nothing but a black and porous charcoal. Toward the end of the vaporization, dense white vapours rise with the alliaceous smell of arsenic. The taste is bitter and metallic. Arsenite of strychnia is soluble in 35 parts of cold, and 10 of boiling water; is soluble also in alcohol, and less so in ether. Its formula is $C_{42}H_{22}N_2O_4.AsO_3$. Though scarcely yet employed, at least to any considerable extent, as a medicine, it would seem, from its constituents, to be likely to fulfil important indications, and has the advantage of a uniform composition. Consisting of two ingredients, each of which is perhaps scarcely inferior, as a remedy in intermittent fever, to any other except cinchona and its derivatives, it probably possesses strong antiperiodic powers, and might very properly be the subject of trial in any intermittent disease which proves rebellious to quinia; the prescriber, however, being always on his guard against its poisonous action. Its commencing dose should not be larger than the smallest dose of strychnia. (*Journ. de Pharm.*, 4e sér., i. 343.)*—*Note to the thirteenth edition.*

* Since the last edition a letter has been received by Dr. Geo. B. Wood from Dr. Wm. A. Watson, of New York, in which he states that he has been using the arsenite of strychnia since 1865. He has found it of great service in neuralgia and other nervous affections, in cutaneous diseases with debility, and in malarial disorder. (*Note to the fourteenth edition.*)

tained to contain 0·42 grains of the pure alkaloid. From two fluidrachms of it he observed in his own person no observable effect. Three fluidrachms caused some defect of muscular power with a slight giddiness, which passed off in two hours and a half. From five and a half fluidrachms, he experienced, in 45 minutes, slight giddiness from defect of adjusting power in the eye, which had much increased at the end of an hour, and was attended with wide dilatation of the pupil, and muscular lethargy, and soon afterwards weakness of the limbs, squeamishness, and faintness like that caused by tobacco, coldness, paleness, tottering, and pulse at 68. The mind was perfectly clear, but he seemed heavy and as if "well-nigh asleep." There seemed to be a direct diminution of power in all the motor nerves, and the third pair seemed almost paralyzed. In two hours and three-quarters the pulse was at 56; but the paralytic effect had lessened; and in one hour more all the symptoms had disappeared. (See *Am. Journ. of Pharm.*, July, 1867, p. 363.) From the foregoing statements it may be inferred that, in the administration of this preparation, the dose should be gradually increased till some effect is experienced, and, to maintain the effect, should be repeated every two or three hours. W.

SUCCUS HYOSCYAMI. *Br.* *Juice of Hyoscyamus.*

"Take of Fresh Leaves and Young Branches of Hyoscyamus *seven pounds;* Rectified Spirit *a sufficiency.* Bruise the Hyoscyamus in a stone mortar; press out the juice; and to every three measures of juice add one of Spirit. Set aside for seven days, and filter. Keep it in a cool place." *Br.*

The dose of this new officinal of the British Pharmacopœia is a half to one fluidrachm. H. C. W.

SUCCUS SCOPARII. *Br.* *Juice of Broom.*

"Take of Fresh Broom Tops *seven pounds;* Rectified Spirit *a sufficiency.* Bruise the Broom Tops in a stone mortar; press out the juice; and to every three measures of juice add one of the Spirit. Set aside for seven days, and filter. Keep it in a cool place." *Br.*

The dose of this preparation as a diuretic is from one to two fluidrachms. In large doses it would be apt to disturb the stomach and bowels. It is more appropriately used as an adjuvant to other diuretics than alone. W.

SUCCUS TARAXACI. *U.S.*, *Br.* *Juice of Dandelion.*

"Take of Fresh Dandelion *a convenient quantity;* Alcohol *a sufficient quantity.* Bruise the Dandelion thoroughly in a mortar, press out the juice, and to every five measures of juice add one of Alcohol. Set aside the liquid for seven days, and filter. Keep it in a cool place." *U. S.*

"Take of Fresh Dandelion Root *seven pounds;* Rectified Spirit *a sufficiency.* Bruise the Dandelion Root in a stone mortar; press out the juice; and to every three measures of juice add one of the Spirit. Set aside for seven days, and filter. Keep it in a cool place." *Br.*

The dose of this juice is from two fluidrachms to half a fluidounce.* W.

* *Preserved Juice of Taraxacum.* Mr. Donovan proposes the following plan, by which the juice of taraxacum may be obtained and preserved throughout the year, with nearly all its native efficiency. The whole herb, immediately after collection, is to be washed, bruised, and expressed; and the residue, having been mixed with as much water at 200° as will bring it to the consistence of a pulp, is to be allowed to stand for two hours, and then again expressed. The liquids thus obtained are to be mixed, and very slowly evaporated, in a wide earthen vessel, and with constant agitation, to one-half. The salts are thus obtained, though with little of the bitter principle. To supply this, a quantity of the roots equal to the weight of the herb first employed, is to be bruised and expressed. The resulting juice, which is in small quantity and bitter, is to be set aside; while the residual marc is to be mixed with the concentrated juice already prepared, previously brought to a boiling heat. When cold, the mixture is to be strongly expressed, and the liquor obtained to be mixed with one-sixth of its measure of alcohol. The liquor is then to be poured into quart bottles, but so as not to fill them. These are to be immersed in a vessel containing water as high as the liquid within them, and placed over a fire; the water is to be slowly heated to 180°; the bottles are to be withdrawn; and the reserved juice of the root is to be added to each in equal quantities. The space at first left in the bottles should be such that, after the addition of the juice, and the driving in of the cork, as little as possible should remain. The corks, being now cut off close to the glass, are to be covered with hard sealing-wax; and the bottles set by, inverted, in a cool place. The alcohol used is alone insufficient for the preservation of the juice; and hence the necessity of heating the bottles, and sealing them when quite full, according to *Appert's process.* Each ounce will contain about a drachm of the alcohol. (See *Am. Journ. of Pharm.*, xxiv. 65.)

SULPHUR.

Preparations of Sulphur.

SULPHUR PRÆCIPITATUM. *U.S., Br.* Lac Sulphuris. *Precipitated Sulphur. Milk of Sulphur.*

"Take of Sublimed Sulphur *twelve troyounces;* Lime *eighteen troyounces;* Muriatic Acid, Water, each, *a sufficient quantity.* Pour sufficient Water on the Lime to slake it, and, having mixed the Sulphur with it, add fifteen pints of Water to the mixture; then boil for two hours, occasionally adding Water to preserve the same measure, and filter. Dilute the filtered liquid with an equal bulk of Water, and drop into it Muriatic Acid so long as a precipitate is produced. Lastly, wash the Precipitated Sulphur repeatedly with Water until the washings are nearly tasteless, and dry it." *U.S.*

"Take of Sublimed Sulphur *five ounces* [avoirdupois]; Slaked Lime *three ounces* [avoird.]; Hydrochloric Acid *eight fluidounces*, or *a sufficiency;* Distilled Water *a sufficiency.* Heat the Sulphur and Lime, previously well mixed, in a pint [Imperial measure] of the Water, stirring diligently with a wooden spatula; boil for fifteen minutes, and filter. Boil the residue again in half a pint [Imp. meas.] of the Water, and filter. Let the united filtrates cool, dilute with two pints [Imp. meas.] of the Water, and, in an open place or under a chimney, add in successive quantities the Hydrochloric Acid previously diluted with a pint [Imp. meas.] of the Water, until effervescence ceases and the mixture acquires an acid reaction. Allow the precipitate to settle, decant off the supernatant liquid, pour on fresh Distilled Water, and continue the purification by affusion of Distilled Water and subsidence, until the fluid ceases to have an acid reaction and to precipitate with oxalate of ammonium. Collect the precipitated sulphur on a calico filter, wash it once with Distilled Water, and dry it at a temperature not exceeding 120°." *Br.*

In the U. S. process three eqs. of lime react with six of sulphur, so as to form two eqs. of bisulphuret of calcium, and one of hyposulphite of calcium ($3CaO$ and $6S = 2CaS_2$ and CaO,S_2O_2). On the addition of the muriatic acid, six eqs. of sulphur are precipitated (four from the two eqs. of bisulphuret of calcium and two from the one eq. of hyposulphite of calcium), and the calcium and oxygen unite with the muriatic acid, so as to form chloride of calcium and water. This rationale is not exactly applicable to the British process, in which the proportion of the sulphur to the lime employed is much greater than in that of the U. S. Pharmacopœia. The muriatic acid is the most eligible precipitant for the sulphur; as it gives rise to chloride of calcium, which is a very soluble salt, and easily washed away. Sulphuric acid is wholly inadmissible; as it generates sulphate of calcium, which, from its sparing solubility, becomes necessarily intermingled with the precipitated sulphur. According to Schweitzer, the best material from which to precipitate the sulphur is the sulphuret of potassium, formed by boiling sulphur with caustic potassa. Dr. Otto, of Brunswick, finds that sulphuret of potassium is apt to contain sulphuret of copper, and therefore prefers sulphuret of calcium. (*Pharm. Cent. Blatt*, Jan. 1845.)

Properties, &c. Precipitated sulphur is in friable lumps, of a white colour, with a pale yellowish-green tint, and consisting of finely divided particles slightly cohering. It is entirely dissipated by heat. Water boiled upon it should not redden litmus. When recently prepared, it is devoid of taste, but possesses a peculiar smell. When long exposed, in a moist state, to the air, it becomes strongly contaminated with sulphuric acid. From its colour it was formerly called *lac sulphuris*,

Professor Procter proposes the following plan. Of the fresh roots collected in September or October, twenty pounds avoirdupois are to be sliced transversely, reduced to a pulpy mass by grinding or contusion, then thoroughly incorporated with four pints of alcohol of 0·835, and set aside in stoneware jars. After a week, or a longer time, the pulpy mass is to be subjected to strong pressure, and the liquid filtered and bottled for use. Even after six months the pulp thus treated preserves the sensible properties of the dandelion in a marked degree. Should the alcohol in the expressed liquor be objected to, it may be partially removed by a gentle evaporation by means of a water-bath until the bulk of the juice has been diminished one-sixth, and then adding eight ounces of sugar for every pint. (*Ibid.*, xxv. 408.)—*Note to the tenth edition.*

or *milk of sulphur*. It is insoluble in water, but dissolves in a boiling solution of caustic potassa, and in oil of turpentine by the aid of heat. When of a brilliant white colour, the presence of sulphate of calcium may be suspected; in which case the preparation will not be wholly volatilized by heat. If pure it communicates a harsh feel when rubbed between the fingers, owing to the friction of the crystalline particles. (*Dr. Bridges.*) We have seen a sample of so-called precipitate of sulphur, which consisted almost entirely of sulphate of calcium. Precipitated sulphur differs from sublimed sulphur in being in a state of more minute division, and in presenting, after fusion, a softer and less brittle mass. Its peculiarities are supposed to depend upon the presence of water, which, however, is found in too small a quantity to constitute a regular *hydrate*. According to Rose, its white colour is occasioned by the presence of a small proportion of bisulphuretted hydrogen. Soubeiran states that it always contains some sulphuretted hydrogen, which causes it to differ as a therapeutic agent from sublimed sulphur.

Medical Properties and Uses. Precipitated sulphur possesses similar medical properties to those of sublimed sulphur. It is the form of sulphur used by Dr. Fuller, of London, as an external application in sciatica and chronic rheumatism. (See *Sulphur*, Part I.) Its state of extreme division renders it more readily suspended in liquids; but its liability to become acid by keeping is an objection to it. It is sometimes selected for forming ointments, which have the advantage of being of a lighter colour than when made with sublimed sulphur. The dose is from one to three drachms. B.

SULPHURIS IODIDUM. *U. S., Br. Iodide of Sulphur. Bisulphuret of Iodine.*

"Take of Iodine *four troyounces;* Sublimed Sulphur *a troyounce*. Rub them together until they are thoroughly mixed. Introduce the mixture into a flask, close the orifice loosely, and apply a gentle heat so as to darken the mass without melting it. When the colour has become uniformly dark throughout, increase the heat so as to produce liquefaction, and incline the flask in different directions, in order to return into the liquid any portions of Iodine which may have been condensed on the inner surface of the vessel. Lastly, withdraw the heat, and, when the liquid has congealed, remove the mass by breaking the flask, reduce it to pieces, and keep these in a well-stopped bottle." *U. S.*

The British process is precisely the same as the above, which was derived from the French Codex. Though formerly officinal with the London and Dublin Colleges, it was omitted in the first British Pharmacopœia, to be resumed in the present. It simply effects a combination of the two ingredients.

Properties, &c. Iodide of sulphur has a grayish-black colour, and radiated crystalline appearance like that of sulphuret of antimony. Its smell resembles that of iodine, and it stains the cuticle in a similar manner. It dissolves in sixty parts of glycerin, forming a solution which would probably prove useful, in some cases, as a substitute for the ointment of this iodide. It is rapidly decomposed, when in a state of powder, upon the addition of several of the volatile oils, violet vapours of iodine being evolved, and the smell of sulphur perceived. (*Dr. G. W. Patterson.*) It is entirely volatilized by heat, and by continued boiling with water is wholly decomposed, iodine escaping with the steam, and sulphur being left nearly pure. The proportion of sulphur thus obtained is about 20 per cent. (*Lond. Pharm.*) This result shows that the compound is a bisulphuret. Iodide of sulphur has been very usefully employed as an external remedy in various skin diseases, such as tinea capitis, lupus, lepra, &c., applied in the form of ointment. (See *Unguentum Sulphuris Iodidi.*) It has been used internally, associated with iodide of potassium and senna, in the form of a syrup, in scrofulous and cutaneous diseases. (*E. Levrat.*) This syrup contains iodureted iodide of potassium, and free sulphur in consequence of a reaction which takes place between the two iodides. In a case of glanders in the human subject, which terminated in recovery under the care of M. Bourdon, of Paris, the iodide of sulphur was used internally, and was thought to have exercised a favourable influence. (*Ann. de Thérap.*, 1858, p. 239.)

Off. Prep. Unguentum Sulphuris Iodidi. B.

SUPPOSITORIA. *U.S., Br.*

Suppositories.

Suppositories are solid bodies intended to be introduced into the rectum, with a view either of evacuating the bowels by irritating the mucous membrane of the rectum, or of producing a specific effect on the neighbouring parts, or on the system at large. They fulfil the same indications as enemata, and are sometimes preferable from the facility of their application, and, when the object is to produce the peculiar effect of a medicine, from the smallness of their bulk, which facilitates retention. Their form may be cylindrical, conical, or spherical; the last being preferable when the bulk is small. They should be of such a consistence as to retain their shape, but so soft as to incur no risk of wounding the rectum. For laxative purposes the suppository may be from one to three inches long, and about as thick as a common candle; with a view to the specific effects of medicines, it should be considerably smaller, as in this case it is important that the medicines should be retained, and the irritative influence of distention avoided. Soap is not unfrequently employed in this way as a laxative. A piece of solidified molasses (molasses candy) is sometimes preferred. To increase the purgative effect, and at the same time act on the uterine function, aloes may be added to the soap. Mr. A. B. Taylor, of Philadelphia, some years since called attention to cacao butter, already familiar to French pharmacy, as the best excipient for solids administered by the rectum, having more exactly the requisite degree of consistence and fusibility than any combination of suet, spermaceti, wax, &c., that could be employed. (*Am. Journ. of Pharm.*, July, 1852, p. 211.) It has been thought necessary to use wax, spermaceti, or some other substance having a comparatively high fusion point, in order to render the suppository sufficiently firm. Continued experience has, however, demonstrated that, except in the warmest weather, or in the case of camphor, carbolic acid, the essential oils, and similar medicinal substances, even the commercial cacao butter will suffice. It is stated that cacao butter is usually adulterated with some other fat which melts at a low temperature, and that if a pure article can be obtained any substance to increase its hardness is never required. When such a material is employed, wax is usually selected, although cetaceum is preferable. If not more than 10 per cent. of the spermaceti is used, the value of the suppository is not very materially affected, although it melts more slowly, and consequently requires a longer time to act than when the butter of cacao is used alone. Suppositories containing a considerable percentage of wax melt so slowly in the rectum as to be comparatively useless, or may fail altogether to soften down and be finally passed from the anus unchanged. A very good method of mixing the oil of theobroma with the hardening material is by grating with an ordinary tin grater, such as used in kitchens, and mixing the coarse powders before melting; and Mr. W. G. Ewing has proposed rubbing the powders and the medicinal substance in a mortar together, dividing the plastic mass, and shaping it with the fingers. This plan, however, is not equal to the officinal one of melting the ingredients and running them into moulds. Extempore moulds, made by rolling the paper into a cone about an inch long, may be used, but are much less convenient than permanent metallic moulds. The tendency of the hardened suppositories to cohere to the moulds may be remedied more or less perfectly by dusting the moulds with lycopodium powder, or greasing them well with olive oil. Mr. Wm. B. Addington (*Am. Journ. of Pharm.*, 1873, p. 257) advises lining the moulds with tin foil. The difficulty may also be met by the use of moulds which open lengthwise, and Mr. Chas. E. Dwight commends most highly the substitution of plaster of Paris moulds* for the metallic ones commonly employed. The mould must be very cold,

* Mr. Dwight makes these moulds in the following manner. Into a pasteboard box, about six inches long and two wide, pour liquid plaster about the consistency of thick cream until half full. Having prepared six well moulded suppositories of wax, immerse them in the soft plaster half their diameters, with their large end close to the edge of the box, in a row, and at a uniform distance. When the plaster has set, gently remove the wax, and with a knife smooth off the surface and trim the edges of each mould sharp, and between each depression made by the wax suppository dig a small cavity about the size and shape of a small pen cut through the centre. When the face

so as to chill the melted liquid at once, and prevent any separation of its ingredients by gravity. It has been proposed to condense the powdered ingredients of suppositories in a cold mould.* It has also been recommended to form the excipient into the required shape, and then, while it is still soft, make an excavation from the base upward, into which the medicine may be introduced, and afterwards enclosed by a little of the cacao butter. But as one of the objects of the excipient is an equable diffusion of the medicine to prevent irritation, this method would be altogether inapplicable to substances in any degree locally irritant. The weight—*i.e.*, the size—of suppositories should vary according to the purposes for which they are employed. When they are to be used for infants and children they should weigh from 5 to 10 grains; for adults about twenty-five grains seems to be an excellent size. The British Pharmacopœia, apparently in conformity with the recommendation of Mr. H. B. Brady (*Pharm. Journ. and Trans.*, May, 1866, p. 544, and Jan. 1868, p. 321),† adopts the weight of fifteen grains; the U. S. Pharmacopœia that of 30 grains. The officinal directions of the U. S. Pharmacopœia are as follows. Mix the medicinal portion with a small quantity of Oil of Theobroma, by rubbing them together, and add the mixture to the remainder of the Oil of Theobroma previously melted and cooled to the temperature of 95°. Then mix thoroughly without applying more heat, and immediately pour the mixture into suitable moulds, having the capacity of 30 grains each. The moulds, previously made cold, must be kept so by immersion in iced water. All difficulty in removing suppositories from the moulds may be obviated by having the moulds previously dusted with lycopodium. In the absence of suitable moulds, suppositories may be formed by allowing the mixture, prepared as above, to cool, care being taken to keep the ingredients well mixed, and dividing it into parts, each of which shall weigh thirty grains, and may be made into a conical or other convenient form for a suppository. Opium, or some one of its preparations, is very advantageously administered in the form of a suppository, in cases of irritation of the rectum, urinary passages, or genital apparatus. The other narcotics may be used in the same way; and indeed any other medicine, in reference to its effects on the system, provided the quantity be not too large, and the local effects not too irritant. Tannic acid or other astringent substance may also be very appropriately employed in this way in cases of prolapsus, or other affection depending on relaxation of the rectum or anus. The dose may in general be one and a half times that of the medicine given by the mouth.‡ W.

has become hard, grease it with linseed oil or lard, replace the wax suppositories, and raise the edges of the box by wrapping heavy paper around, which will extend about another inch above the surface of the face; pour a portion of the plaster, equal to the first, gently over the greased surface until it is about one inch deep. When hard, separate the parts carefully, trim the edges, and boil for an hour in linseed oil, which will prevent the adhesion of the substance to be moulded. To be substantial the plaster must be mixed thin and well stirred. Mr. A. B. Taylor, who has paid special attention to the subject, recommends that the shape of the suppository, instead of being strictly conical, should be somewhat incurved towards the base, where there may be a small cylindrical projection for the purpose of fitting into the end of a very convenient instrument, invented by him for the introduction of the suppository into the rectum. This instrument, which he calls a *Suppositer*, consists of a slender handle a few inches long, with a ring at one end for the finger, and an expansion at the other, having a cavity for the reception of the cylindrical base of the suppository. The suppositer is, however, unnecessary and never used. (*Am. Journ. of Pharm.*, May, 1861, p. 202.)—*Note to the twelfth and fourteenth editions.*

* The description of an apparatus for the purpose may be found in the *Amer. Journ. of Pharm.*, 1875, p. 99. (*Note to the fourteenth edition.*)

† The papers of Mr. Brady upon the subject of suppositories may be consulted with advantage; also a series of articles by several authors in the *Amer. Journ. of Pharmacy*, 1871.

‡ *Medicated Pessaries*, which have been brought into notice of late years, chiefly through the recommendation of Sir J. Y. Simpson, of Edinburgh, so closely resemble suppositories, so far as pharmacy is concerned, as to justify an allusion to them in this place. All that has been said of the materials out of which suppositories are made, and the mode of preparing them, is equally applicable to medicated pessaries. The latter, however, are considerably larger, generally weighing one or two drachms. They differ also from suppositories in the purposes to which they are applied; being used for local effect, in allaying pain, checking discharge, acting as alterative to contiguous parts, &c., while the latter preparations, though used also as topical agents, are very often prescribed with a view to their systemic effects. On the subject of both of these classes of preparations, the pharmaceutical reader is referred to an article in the *Am. Journ. of Pharm.* (May, 1868, p. 223), by Mr. J. B. Moore, of Philadelphia, for useful practical suggestions, which our limited space will not permit us to introduce here. (*Note to the thirteenth edition.*)

Urethral and Vaginal Suppositories. Medicated Bougies. These articles, which are exceedingly

SUPPOSITORIA ACIDI CARBOLICI. *U. S., Br. Suppositories of Carbolic Acid.*

"Take of Carbolic Acid *twelve grains;* Oil of Theobroma *three hundred and forty-eight grains;* Water *a sufficient quantity.* Mix the Carbolic Acid, previously dissolved in a few drops of Water, thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to directions given in the general formula at *page* 1467." *U. S.*

"Take of Carbolic Acid *twelve grains;* Curd Soap, in powder, *one hundred and eighty grains;* Starch, in powder, *a sufficiency.* Mix the Carbolic Acid with the Soap and add sufficient starch to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository." *Br.*

Each of these suppositories contains one grain of carbolic acid. They may be employed whenever it is desired to exert the local effect of the drug upon the rectum. H. C. W.

SUPPOSITORIA ACIDI TANNICI. *U. S., Br. Tannic Acid Suppositories. Tannin Suppositories.*

"Take of Tannic Acid *sixty grains;* Oil of Theobroma *three hundred grains.* Mix the Tannic Acid thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to the directions given in the general formula at *page* 1467." *U. S.*

"Take of Tannic Acid *thirty-six grains;* Benzoated Lard *forty-four grains;* White Wax *ten grains;* Oil of Theobroma *ninety grains.* Melt the Wax and Oil of Theobroma with a gentle heat, then add the Tannic Acid and Benzoated Lard previously rubbed together in a mortar, and mix all the ingredients thoroughly. Pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a *suppository.*" *Br.*

The tannic acid suppositories of the U. S. Pharmacopœia contain each five grains; those of the British Pharmacopœia only three grains. As it is hardly conceivable that a rectal dose of less than five grains should be wanted for the adult, the U. S. preparation is of the better strength. The benzoated lard has been added by the British authorities with a view of preventing rancidity, but seems to be unnecessary. The remedy is especially applicable to cases of piles and prolapsus of the rectum from relaxation. H. C. W.

SUPPOSITORIA ACIDI TANNICI CUM SAPONE. *Br. Tannic Acid Suppositories with Soap.*

"Take of Tannic Acid *thirty-six grains;* Glycerine of Starch *fifty grains;* Curd Soap, in powder, *one hundred grains;* Starch, in powder, *a sufficiency.* Mix the Tannic Acid with the Glycerine of Starch and Soap, and add sufficient Starch to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository." *Br.*

The strength of this preparation as well as its therapeutic properties are identical with the simple tannic acid suppository of the same Pharmacopœia. It seems to be a useless multiplication of officinal preparations. H. C. W.

useful for the purpose of exerting a local action upon the urethra or neck of the bladder in cases of inflammation, pain, or spasm, may be made in the same manner as ordinary suppositories, except in regard to size. The vaginal suppository should be about two to two and a half inches long, and three-quarters of an inch in diameter at the base. The urethral suppository should be cylindrical, with a conical point, and about one-fourth of an inch in diameter; their length should vary according to circumstances. They should never contain wax or other substance which does not melt readily and certainly at the temperature of the body, and which might, by a possible mishap, become the nucleus of a calculus. When it is desired to reach any considerable length of the urethra the requisite toughness may be obtained, as suggested by Mr. Jos. L. Lemberger (*Am. Journ. of Pharm.*, 1872, p. 166), by using a mould like an old fashioned candle-mould, with a candle-wick running through and projecting some distance from it. When a suppository so made is used, of course the free end of the wick should be secured with sticking-plaster or a drop of collodion externally, and after the requisite period of contact the whole be pulled out. (*Note to the fourteenth edition.*)

SUPPOSITORIA ALOES. *U. S.* *Suppositories of Aloes.*

"Take of Purified Aloes, in very fine powder, *sixty grains;* Oil of Theobroma *three hundred grains.* Mix the Aloes thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to directions given in the general formula at *page* 1467." *U. S.*

Each of these suppositories contains five grains of aloes. H. C. W.

SUPPOSITORIA ASSAFŒTIDÆ. *U. S.* *Suppositories of Assafetida.*

"Take of Tincture of Assafetida *a fluidounce;* Oil of Theobroma *three hundred and twenty grains.* Expose the Tincture of Assafetida to the air, in a capsule, in a moderately warm place, and allow it to evaporate spontaneously until reduced to the consistence of a thick syrup. Mix this thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to directions given in the general formula at *page* 1467." *U. S.*

Mr. J. B. Moore proposed in 1868 that assafetida suppositories should be made by first saponifying the resin of the assafetida with caustic potash. The use of such a powerful agent is, however, harmful and also unnecessary. The object is better obtained by using the concentrated tincture, which contains the resin and volatile oil of the drug. Each of the officinal suppositories represents five grains of assafetida. They may be used whenever it is desired to impress the system with the drug.

H. C. W.

SUPPOSITORIA BELLADONNÆ. *U. S.* *Suppositories of Belladonna.*

"Take of Alcoholic Extract of Belladonna *six grains;* Oil of Theobroma *three hundred and fifty-four grains;* Water *a sufficient quantity.* Having rubbed the Extract of Belladonna into a smooth paste, with the addition of a drop or two of Water, mix it thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to directions given in the general formula at *page* 1467." *U. S.*

Each of these suppositories contains half a grain of the extract of belladonna.

H. C. W.

SUPPOSITORIA HYDRARGYRI. *Br.* *Mercurial Suppositories.*

The British Pharmacopœia takes of Ointment of Mercury *sixty grains;* Benzoated Lard and White Wax, of each, *twenty grains;* and Oil of Theobroma *eighty grains;* and, having directed the Benzoated Lard, Wax, and Oil of Theobroma, previously melted with a gentle heat, to be thoroughly mixed with the Ointment of Mercury, without the further application of heat, completes the process precisely in the manner directed for the Tannic Acid Suppositories.

The quantity of the mercurial contained in each suppository is five grains. This is not a common method of employing mercury for affecting the system; but might be advantageously resorted to in cases of great irritability of stomach, and where objection exists to the use of the ointment by friction to the skin. When this object is aimed at, the suppository might be repeated twice or three times in 24 hours. W.

SUPPOSITORIA MORPHIÆ. *U. S.*, *Br.* *Morphia Suppositories.*

"Take of Sulphate of Morphia *six grains;* Oil of Theobroma *three hundred and fifty-four grains.* Mix the Sulphate of Morphia thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to directions given in the general formula at *page* 1467." *U. S.*

The British Pharmacopœia takes of Hydrochlorate of Morphia *six grains;* Benzoated Lard *sixty-four grains;* White Wax *twenty grains;* and Oil of Theobroma *ninety grains;* and, having melted the Wax and Oil with a gentle heat, added the Hydrochlorate of Morphia and Benzoated Lard previously rubbed together in a mortar, and mixed all the ingredients thoroughly, completes the process in the same manner as that for the Tannic Acid Suppositories.

This is an excellent remedy in strangury, tenesmus, and other cases of irritation in the lower bowels and urinary passages. It may also be used to control vomiting, and to produce the general effects of opium on the system. Each suppository con-

tains half a grain of a salt of morphia, which is about the quantity required to produce the full effects of morphia on the system in the adult. W.

SUPPOSITORIA MORPHIÆ CUM SAPONE. *Br. Morphia Suppositories with Soap.*

"Take of Hydrochlorate of Morphia *six grains;* Glycerine of Starch *fifty grains;* Curd Soap, in powder, *one hundred grains;* Starch, in powder, *a sufficiency.* Mix the Hydrochlorate of Morphia with the Glycerine of Starch and Soap, and add sufficient Starch to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository." *Br.*

The advantage of having two suppositories of morphia of equal strength is very doubtful. The indications for the use of this preparation are identical with those that call for the simple suppository of morphia. Each suppository represents a half grain of the alkaloidal salt. H. C. W.

SUPPOSITORIA OPII. *U. S. Suppositories of Opium.*

"Take of Extract of Opium *twelve grains;* Oil of Theobroma *three hundred and forty-eight grains;* Water *a sufficient quantity.* Having rubbed the Extract of Opium into a smooth paste, with the addition of a few drops of Water, mix it thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to directions given in the general formula at *page* 1467." *U. S.*

This preparation may be used for the same purposes as the suppositories of morphia. Each suppository contains the equivalent of two grains of opium or of half a grain of morphia. H. C. W.

SUPPOSITORIA PLUMBI. *U. S. Suppositories of Lead.*

"Take of Acetate of Lead, in very fine powder, *thirty-six grains;* Oil of Theobroma *three hundred and twenty-four grains.* Mix the Acetate of Lead thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to directions given in the general formula at *page* 1467." *U. S.*

Each of these suppositories contains three grains of acetate of lead, and may be used in diarrhœa and dysentery to meet suitable indications. H. C. W.

SUPPOSITORIA PLUMBI ET OPII. *U. S.* SUPPOSITORIA PLUMBI COMPOSITA. *Br. Suppositories of Lead and Opium. Compound Lead Suppositories.*

"Take of Acetate of Lead, in very fine powder, *thirty-six grains;* Extract of Opium *six grains;* Oil of Theobroma *three hundred and eighteen grains;* Water *a sufficient quantity.* Having rubbed the Acetate of Lead and Extract of Opium into a smooth paste, with the addition of a few drops of Water, mix it thoroughly with sixty grains of the Oil of Theobroma, and then, having melted the remainder of the Oil of Theobroma, proceed according to directions given in the general formula at *page* 1467." *U. S.*

The British Pharmacopœia takes of Acetate of Lead *thirty-six grains;* Opium, in powder, *twelve grains;* Benzoated Lard *forty-two grains;* White Wax *ten grains;* and Oil of Theobroma *eighty grains;* and, having melted the Wax and Oil with a gentle heat, added the other ingredients previously rubbed together in a mortar, and mixed the whole thoroughly, completes the process in the same manner as that for the Tannic Acid Suppositories.

Each suppository contains three grains of the acetate of lead and one grain of opium. An excellent remedy in some cases of diarrhœa, dysenteric irritation of the rectum, piles, and hemorrhage. W.

SYRUPI.

Syrups.

Syrups are concentrated solutions of sugar in watery fluids, either with or without medicinal impregnation. When the solution is made with pure water, it is named *syrup* or *simple syrup*, when with water charged with one or more medicinal agents, it is called in general terms a *medicated syrup*, and receives its particular designation from the substance or substances added.

Medicated syrups are usually prepared by incorporating sugar with vegetable infusions, decoctions, expressed juices, fermented liquors, or simple aqueous solutions. When the active matter of the vegetable is not readily soluble in water, is associated with soluble matter which it is desirable to avoid, or is volatilized or decomposed by a heat of 212°, it is sometimes extracted by diluted alcohol, the spirituous ingredient of which is subsequently driven off. Medicated syrups are also occasionally prepared by adding a tincture to simple syrup, and evaporating the alcohol. Another and better mode of effecting the same object, when aromatic or other volatile substances are concerned, is to mix the tincture with sugar in coarse powder, expose the mixture to a very gentle heat or in the sun till the alcohol has evaporated, and then prepare the syrup from the impregnated sugar by dissolving it in the requisite proportion of water. Since the introduction into use of the process of percolation, or filtration by displacement, it has been applied very advantageously to the preparation of various syrups, especially those made from vegetables of which the active principle is injured or dissipated by decoction. But, unless the operator be at once skilful and careful, there will be danger of imperfectly extracting the active matters, and thus making a feeble preparation. One important practical rule is, when the liquid obtained by percolation requires concentration, to set aside the first portions of filtered liquor, which are usually strongly impregnated, and to subject only the subsequent weaker portions to evaporation. For the mode of properly conducting this process the reader is referred to *pages* 971 and 981.

The quality and quantity of the sugar employed are points of importance. Refined sugar should always be preferred, as it often saves the necessity of clarification, and makes a clearer and better flavoured syrup than the impure kinds. The U. S. Pharmacopœia simply directs sugar, but explains that it is the purified or refined sugar which is indicated by that term. In relation to the quantity of sugar, if in too small proportion, fermentation is apt to occur; if too abundant, crystallization. The proper proportion is about two parts to one of the liquid. A somewhat smaller quantity will answer, where an acid, such as lemon juice or vinegar, is used.

As it is desirable, in many instances, that the active matters should be in as concentrated a state as possible in the syrup, it is often necessary to evaporate a large proportion of the watery fluid in which they are dissolved. This may be done either before the addition of the sugar or afterwards. In either case care is requisite not to apply a heat too great or too long continued, lest the active principles should be injured. When these are very volatile or easily decomposed by heat, it is expedient to dispense with concentration altogether. Some substances which are volatilized or decomposed at the temperature of boiling water remain fixed and unaltered at that which is necessary for the evaporation of alcohol. These, as before observed, may be dissolved in diluted alcohol, and the concentration effected by evaporating the spirituous part of the solvent. Independently of the injury which the medicinal ingredient of the syrup may sustain, the syrup itself is apt to become brown by a long-continued application of heat, even when the degree is not excessive. It is recommended, therefore, that syrups which admit of concentration should be boiled briskly over a lively fire, so as to accomplish the object as quickly as possible. It is important to be able to ascertain positively when they have attained the due consistence. An operator skilled in their preparation can judge with sufficient accuracy by various familiar signs; such as the slowness with which the parts of a drop of syrup coalesce, when previously separated by the edge of a blunt instrument; and the receding of the last portion of each drop, when the syrup after being cooled, is poured out drop by drop. A pellicle

forming upon the surface of the syrup when it cools, indicates that it has been too much boiled. But these signs are not to be relied on, except by those who have acquired much experience. The easiest method of ascertaining the proper point of concentration is by the use of that variety of Baumé's hydrometer called a *saccharometer;* an instrument almost indispensable to the apothecary. This should stand at 30° in boiling syrup (30½ in hot weather), and at 35° in the syrup when it is cool. Another very accurate, though less ready method, is to ascertain the sp. gr. by weighing a portion of the liquid. Syrup when boiling should have a sp. gr. of about 1·261; when cold, of about 1·319. Thomson and Duncan are mistaken in giving the proper sp. gr. of cold syrup as 1·385. We found that of a specimen of simple syrup, made with two pounds and a half of sugar to a pint of water, as directed in former editions of the U. S. Pharmacopœia, to be 1·326 at 68° F.; and this consistence is rather too great for practical convenience in cold weather. In the syrup now officinal it is only 1·317 at 60°, which is an improvement. A third method of ascertaining the proper point of concentration is by the thermometer, which, in boiling syrup of the proper consistence, stands at 221° F. This indication is founded on the fact, that the boiling point of syrup rises with the increase of its density.

When carefully prepared with the best double refined sugar, syrups usually require no other clarification than to remove any scum which may rise to their surface upon standing, and to pour them off from any dregs which may subside. But, as the sugar employed is seldom free from impurities, it may be best, as a general rule, to remove the scum as it rises during the heating process, and to strain them while hot through muslin or flannel. Should they at any time want the due degree of clearness, they may be filtered through flannel, or, when likely to be injured by the treatment, may be clarified by means of the white of eggs or animal charcoal, as mentioned under the head of *Syrupus.* But the active vegetable principles are so apt to be absorbed by the charcoal along with impurities, that this agent should be used with caution.

The medicated syrups are liable to undergo various alterations, according to their nature and mode of preparation. The acid syrups, when too much boiled, often let fall a copious white deposit, which is a saccharine matter analogous to the sugar of grapes, produced by the reaction of the acid upon the sugar. Even at ordinary temperatures, acids slowly convert common sugar into the sugar of grapes, which being less soluble than the former, is gradually deposited in the form of crystalline grains. Syrups containing too little sugar are apt to pass into the vinous fermentation, in consequence of the presence of matters which act as a ferment. Those which contain too much deposit a portion in the crystalline state; and the crystals, attracting the sugar remaining in solution, gradually weaken the syrup, and render it liable to the same change as when originally made with too little sugar. The want of due proportion of saccharine matter frequently also gives rise to mouldiness, when air has access to the syrup. It is said that syrups, enclosed while they are still hot in bottles, are apt to ferment, because the watery vapour, rising to the surface and there condensing, diminishes the proportion of sugar, so as to produce a commencement of chemical action, which gradually extends through the whole mass; but, if the bottles are well shaken, this result is obviated; and the syrups will generally keep better when thus treated. When syrups undergo the vinous fermentation, they become covered at the surface with froth, produced by the disengagement of carbonic acid, and acquire a vinous odour from the presence of alcohol; while their consistence is diminished by the loss of a portion of the sugar, which has been converted into that liquid. When the quantity of alcohol has increased to a certain point, the fermentation ceases, or goes on more slowly, owing to the preservative influence of that principle; and, as the active ingredient of the syrup has frequently undergone no material change, the preparation may often be recovered by boiling so as to drive off the alcohol and carbonic acid, and concentrate the liquid sufficiently. A syrup thus revived is less liable afterwards to undergo change, because the principles which acted as ferments have been diminished or consumed. It is obvious that syrups which depend for their virtues upon a volatile ingredient, or one readily changeable by heat, cannot be restored to their original condition.

At best syrups are too apt to change, and various measures have been proposed for their preservation. According to Dr. Macculloch, the addition of a little sulphate or chlorate of potassium which is tasteless, prevents their fermentation. M. Chereau has found sugar of milk effectual to the same end, in the instance of the syrup of poppies; and it may prove useful in others. The proportion employed by him is 32 parts of sugar of milk to 1000 of syrup. Mr. E. Durand has found that 1·3 per cent. of Hoffmann's anodyne has the effect of completely arresting or preventing fermentation, probably through the agency chiefly of the oil of wine contained in it. (*Am. Journ. of Pharm.*, xiii. 185.) Almost all of the officinal syrups would be improved by substituting glycerin for a sufficient portion of the syrup, to render the preparation permanent. But the best plan is to make small quantities of syrups at a time, and to keep them, unless when wanted for immediate use, in bottles quite full and well stopped, which should be put in the cellar or other cool place.

The Syrups, formerly officinal, which have been omitted in the present U. S. and Br. Pharmacopœias, are *Syrupus Aceti*, Ed., *Syrupus Althææ*, Lond., Ed., *Syrupus Cocci*, Lond., *Syrupus Croci*, Lond., Ed., Dub., *Syrupus Rosæ* (*Centifoliæ*), Lond., Ed., *Syrupus Sarzæ*, Lond., Ed., and *Syrupus Violæ*, Ed. W.

SYRUPUS. *U. S.*, *Br.* Syrupus Simplex. *Syrup. Simple Syrup.*

"Take of Sugar [refined], in coarse powder, *thirty-six troyounces;* Distilled Water *a sufficient quantity.* Dissolve the Sugar, with the aid of heat, in twenty fluidounces of Distilled Water, raise the temperature to the boiling point, and strain the solution while hot. Then incorporate with the solution a sufficient quantity of Distilled Water, added through the strainer, to make the syrup measure two pints and twelve fluidounces, or weigh fifty-five troyounces. Syrup thus prepared, has the specific gravity 1·317." *U. S.*

"Take of Refined Sugar *five pounds* [avoirdupois]; Distilled Water *two pints* [Imperial measure]. Dissolve the Sugar in the Water with the aid of heat; and add, after cooling, as much Distilled Water as may be necessary to make the weight of the product seven pounds and a half [avoird.]. The sp. gr. should be 1·330." *Br.*

This syrup, when properly prepared, is inodorous, of a sweet taste without peculiar flavour, thick, viscid, nearly colourless, and perfectly transparent. If somewhat turbid, as it is apt to be when made with sugar not well refined, it may be clarified by beating the white of an egg to a froth with three or four ounces of water, mixing this with the syrup, boiling the mixture for a short time that the albumen may coagulate, and taking off the scum which rises to the surface, or separating it by filtration through paper or flannel. Two gallons of the syrup may be thus clarified. Any colour and peculiar flavour which it may possess may be removed by treating it, at the same time, with a small proportion (about 5 per cent.) of animal charcoal.

The white of egg is beaten to a froth in order that, when it coagulates, it may be rendered by the air which it contains specifically lighter than the syrup, and thus rise to the surface. If not thus treated, it floats, when coagulated, in the syrup, or sinks to the bottom. Now it is obvious that, if the syrup and albumen be heated together, the latter must be deprived of a portion of the air which it contains before the point of coagulation is attained, and thus become less disposed to rise to the surface. Guibourt, therefore, recommends that it should not be added till the syrup is boiling hot, and should then be poured in from a height, in order to increase the quantity of air entangled in it.

M. Salles, an apothecary of Clermont-Ferrand, in France, recommends that syrups which require clarification should be treated in the following manner. Allow the liquor with which the syrup is to be prepared, without previously decanting or filtering it, to become quite cold; then mix with it the white of eggs unbeaten, in the proportion of one egg for every five or six pounds (avoirdupois) of sugar employed; and, having added the sugar or honey, boil the whole for half an hour, or until a portion of the syrup upon cooling exhibits flocculi of albumen floating in a transparent medium. During the ebullition care must be taken to agitate the syrup in such a manner as to prevent the formation of foam upon its surface. When allowed to cool, the coagulated albumen with the impurities subsides, and the clear syrup floats above, and may be drawn off or decanted. In this process the albumen sinks,

because not incorporated with air. M. Salles calls it clarification *per descensum*, and states that it is applicable to all syrups of a density below 30° Baumé at the boiling point. (*Journ. de Pharm.*, xxiv. 490.)

M. Magnes-Lahens has found paper pulp to be of the greatest service in the clarification of syrups. He uses a white unsized paper of good quality, reducing it to a paste by agitation in a bottle with a portion of the menstruum to be used, and heating it with the syrup during the whole process of solution, and finally filtering the product through a "swan's down paper" filter. (*Pharm. Journ. and Trans.*, April, 1872, p. 825.)

From the observations of M. Maumene, it appears that a solution of pure cane sugar, when long kept, undergoes a molecular change analogous to that produced by the reaction of weak acids; the saccharine liquid becoming brown when boiled with potassa. But, as this phenomenon is exhibited alike by uncrystallizable sugar and by glucose, the experiment does not determine which of those forms of saccharine matter has been produced. (*Comptes Rendus*, xxxix. 914.) Prof. Procter observed a similar change in simple syrup which had been kept in his cabinet for six years. (*Am. Journ. of Pharm.*, xxvii. 430.)

M. Schaeuffèle, having noticed, on one occasion, in the preparation of simple syrup, that the foam exhibited a singular blue colour, while a part of the cane sugar was rapidly transformed into the uncrystallizable variety, made investigations as to the cause of the phenomenon, and was led to the conclusion that it was the presence of indigo in the loaves of sugar, introduced with the view of giving brilliance to their whiteness; but M. Gaultier de Claubry is of the opinion that the blueness might be owing to some derivative of anilin, and that the use of such a syrup might be hazardous. (*Journ. de Pharm.*, 4e sér., ii. 161.)

Syrup is very useful in the formation of pills and mixtures, and in various other pharmaceutical operations in which sugar in solution is required.

The U. S. syrup has the sp. gr. 1·317, which is as near as may be the true standard in our climate. That of the Br. syrup is 1·330, probably adapted to the climate of Great Britain, which is not so cold in winter as ours, at least in the Northern and Middle States.

Pharm. Uses. In preparing Pilulæ Aloës et Myrrhæ, *U. S.;* Pil. Cambogiæ Composita, *Br.;* Pil. Galbani Comp., *U. S.;* Pil. Scillæ Comp., *U. S.*

Off. Prep. Confectio Opii, *Br.;* Confectio Scammonii, *Br.;* Mistura Creasoti, *Br.;* Mistura Cretæ, *Br.;* Pilula Cambogiæ Composita, *Br.;* Pilulæ Aloës et Myrrhæ, *U. S.;* Pilulæ Ferri Carbonatis, *U. S.;* Pilulæ Ferri Compositæ, *U. S.;* Syrupus Acidi Citrici, *U. S.;* Syrupus Aurantii, *Br.;* Syrupus Chloral, *Br.;* Syrupus Ferri Iodidi, *U. S.;* Syrupus Ipecacuanhæ, *U. S.;* Syrupus Lactucarii, *U. S.;* Syrupus Rhei, *U. S.;* Syrupus Rhei Aromaticus, *U. S.;* Syrupus Rubi, *U. S.;* Syrupus Zingiberis, *Br.* W.

SYRUPUS ACACIÆ. *U. S.* *Syrup of Gum Arabic.*

"Take of Gum Arabic, in pieces, *two troyounces;* Sugar [refined], in coarse powder, *fourteen troyounces;* Water *eight fluidounces.* Dissolve the Gum Arabic in the Water, without heat; then, having added the Sugar, dissolve it with a gentle heat, and strain." *U. S.*

The gum should be carefully selected; and, if its solution contain impurities, it should be strained before the addition of the sugar. On the whole, taking into consideration the great liability to the use of materials not quite pure, it might be advisable, in all cases, to heat momentarily to the boiling point, skim off what may rise to the surface, and then strain. This syrup is useful in the preparation of mixtures, pills, and troches, and is a good demulcent; but unfortunately the proportion of the gum to the sugar is too small to meet all the indications calling for the conjoint use of these two substances, and could not be much increased without endangering the stability of the preparation. Even as it is the officinal syrup is apt to alter; to obviate this Mr. C. B. Mann commends the use of one fluidounce of glycerin and seven fluidounces of water as the menstruum. W.

SYRUPUS ACIDI CITRICI. *U. S.* *Syrup of Citric Acid.*

"Take of Citric Acid, in fine powder, *one hundred and twenty grains;* Oil of

Lemon *four minims;* Syrup *two pints.* Rub the Citric Acid and Oil of Lemon with a fluidounce of the Syrup; then add the mixture to the remainder of the Syrup, and dissolve with a gentle heat." *U. S.*

This is more uniform in its character, keeps better, and is more readily prepared than lemon syrup, but does not equal it in flavour, if the latter is well made. If long kept it is apt to acquire a musty taste, and to deposit grape sugar copiously, in consequence of the action of the acid on the cane sugar. It is much employed as an agreeable and refrigerant addition to drinks, especially carbonic acid water. Tartaric acid, on account of its greater cheapness, has not unfrequently been substituted for the citric; but the syrup made with it does not keep so well, and, moreover, is more apt to irritate the stomach.

Off. Prep. Liquor Magnesii Citratis, *U. S.* W.

SYRUPUS ALLII. *U. S. Syrup of Garlic.*

"Take of Garlic, sliced and bruised, *six troyounces;* Sugar [refined], in coarse powder, *twenty-four troyounces;* Diluted Acetic Acid *a pint.* Macerate the Garlic with ten fluidounces of the Diluted Acetic Acid, in a glass vessel, for four days, and express the liquid. Then mix the residue with the remainder of the Acid, and again express until sufficient additional liquid has been obtained to make the whole, when filtered, measure a pint. Lastly, introduce the Sugar into a two-pint bottle, pour upon it the filtered liquid, and agitate until it is dissolved." *U. S.*

This preparation is made upon correct principles; as vinegar is a better solvent of the active matter of garlic than water. The syrup is given in chronic catarrhal affections of the lungs, and is particularly beneficial in infantile cases, by the stimulus which it affords to the nervous system. A teaspoonful may be given for a dose to a child a year old. W.

SYRUPUS AMYGDALÆ. *U.S. Syrup of Almond. Syrup of Orgeat.*

"Take of Sweet Almond *twelve troyounces;* Bitter Almond *four troyounces;* Sugar [refined], in coarse powder, *seventy-two troyounces;* Water *three pints.* Having blanched the Almonds, rub them in a mortar to a very fine paste, adding, during the trituration, three fluidounces of the Water and twelve troyounces of the Sugar. Mix the paste thoroughly with the remainder of the Water, strain with strong expression, add to the strained liquid the remainder of the Sugar, and dissolve it with the aid of a gentle heat. Lastly, strain the solution through muslin, and, having allowed it to cool, keep it in well-stopped bottles in a cool place." *U. S.*

This process corresponds closely with that of the French Codex. Orange-flower water, however, which is an ingredient of the French preparation, is wanting in ours. It may be added to the syrup, in the quantity of half a pint, immediately after the sugar is dissolved.

For a modified formula for preparing syrup of orgeat, by M. Capdeville, the reader is referred to the *American Journal of Pharmacy* (xxvii. 450), in which it is copied from the *Repert. de Pharm.* of January, 1855.*

This is an elegant syrup, much employed in Europe, and occasionally in this country. It is demulcent, nutritive, and, in consequence of the hydrocyanic acid of the bitter almonds, somewhat sedative. It is said to impair greatly the odour of musk and assafetida, when mixed with them. It may be added to cough mixtures, or used for flavouring drinks in complaints of the chest. W.

SYRUPUS AURANTII CORTICIS. *U.S.* SYRUPUS AURANTII. *Br. Syrup of Orange Peel.*

"Take of Sweet Orange Peel, recently dried and in moderately fine powder, *two troyounces;* Carbonate of Magnesium *half a troyounce;* Sugar [refined], in coarse powder, *twenty-eight troyounces;* Alcohol, Water, each, *a sufficient quantity.* Moisten

* *Orgeat Powder.* Dr. Enders, on account of the tendency of syrup of almond to spoil, prepares a powder by making an emulsion of twenty parts of sweet almonds with sufficient water, mixing it with seventy-two parts of sugar, rapidly evaporating with the steam bath and pulverizing the residue, and keeping in well-corked bottles. To make one hundred parts of the syrup sixty-eight parts of the powder are dissolved with the aid of heat in twenty-four parts of water, and five parts of orange-flower water and three parts of bitter almond water added. (*Am. Journ. of Pharm.*, 1874, p. 362.)—*Note to the fourteenth edition.*

the Orange Peel with half a fluidounce of Alcohol, introduce it into a conical percolator, and pour Alcohol upon it until six fluidounces of tincture have passed. Evaporate this, at a temperature not above 120°, to two fluidounces, add the Carbonate of Magnesium and a troyounce of the Sugar, and rub them together, gradually adding half a pint of Water during the trituration. Then filter, and, having added sufficient water to make the liquid measure a pint, dissolve in it the remainder of the Sugar with the aid of a gentle heat, and strain." *U. S.*

"Take of Tincture of Orange Peel *one fluidounce;* Syrup *seven fluidounces.* Mix." *Br.*

The present U. S. formula is a great improvement over that of 1850, in which water was used as the menstruum, and consequently but little relatively of the volatile oil of the rind was extracted. Not only is alcohol used, but afterwards, when, the greater part of the alcohol having been evaporated as no longer needed, water is added, care is taken, by rubbing this and the concentrated tincture with carbonate of magnesium, to enable the water to take up and hold in solution the oil extracted by the alcohol. The present syrup is consequently much more highly flavoured than the one which it has superseded. In the evaporation it is important that the heat should not exceed 120°, in consequence of the volatile nature of the active principle of the peel; and, to facilitate the solution of the sugar, it should be previously powdered. The British preparation, which is a mere mixture of the tincture with syrup, is in all respects inferior. The U. S. formula is that of Prof. Procter, which was published in the eleventh edition of the U. S. Dispensatory (*page* 1274). The use of carbonate of magnesium was first suggested by Mr. John D. Finley. Mr. Chas. Symes asserts that the syrup made from the fresh peel is much superior in aroma to the officinal product (*Amer. Journ. of Pharm.*, 1873, p. 19).

The syrup has an agreeable flavour, for which alone it is employed. Prepared according to the U. S. process of 1850, it was apt to ferment in warm weather; an objection to which the present syrup is not liable.

Off. Prep. Confectio Sulphuris, *Br.;* Trochisci Ipecacuanhæ, *U. S.* W.

SYRUPUS AURANTII FLORUM. *U. S.* Syrupus Aurantii Floris. *Br. Syrup of Orange Flowers.*

"Take of Orange Flower Water *twenty fluidounces;* Sugar [refined], in coarse powder, *thirty-six troyounces.* Dissolve the Sugar in the Orange Flower Water, with the aid of a gentle heat." *U. S.*

"Take of Orange-flower Water *eight fluidounces;* Refined Sugar *three pounds* [avoirdupois]; Distilled Water *sixteen fluidounces*, or *a sufficiency.* Dissolve the Sugar in the Distilled Water, by means of heat; strain, and when nearly cold add the Orange-flower Water, with a sufficient quantity of Distilled Water, if necessary, to make the product four pounds and a half [avoird.]. The sp. gr. should be 1·330." *Br.*

This is used chiefly for flavouring mixtures. The dose is a fluidrachm. W.

SYRUPUS CHLORAL. *Br. Syrup of Chloral.*

"Take of Hydrate of Chloral 80 *grains;* Distilled Water 4 *fluidrachms;* Simple Syrup *a sufficiency.* Dissolve the Hydrate of Chloral in the Water, and add the Syrup until the mixed product measures a fluidounce." *Br.*

Two fluidrachms of this syrup contain 10 grains of chloral and are a full dose. H. C. W.

SYRUPUS FERRI IODIDI. *U. S., Br.* Liquor Ferri Iodidi. *U. S.* 1850. *Syrup of Iodide of Iron. Solution of Iodide of Iron.*

"Take of Iodine *two troyounces;* Iron, in the form of wire and cut in pieces, *three hundred grains;* Distilled Water *three fluidounces;* Syrup *a sufficient quantity.* Mix the Iodine, Iron, and Distilled Water in a flask of thin glass, shake the mixture occasionally until the reaction ceases, and the solution has acquired a green colour and lost the smell of iodine. Then, having introduced a pint of Syrup into a graduated bottle, heat it by means of a water-bath to 212°, and through a small funnel inserted in the mouth of the bottle, filter into it the solution already prepared. When this has passed, close the bottle, shake it thoroughly, and, when the liquid has cooled, add sufficient Syrup to make the whole measure twenty fluidounces. Lastly, again shake the bottle, and transfer its contents to two-ounce vials, which must be well stopped." *U. S.*

"Take of fine Iron Wire *one ounce* [avoirdupois]; Iodine *two ounces* [avoird.], Refined Sugar *twenty-eight ounces* [avoird.]; Distilled Water *thirteen fluidounces.* Prepare a syrup by dissolving the Sugar in ten [fluid]ounces of the Water with the aid of heat. Digest the Iodine and the Iron Wire in a flask, at a gentle heat, with the remaining three [fluid]ounces of the Water, till the froth becomes white; then filter the liquid, while still hot, into the syrup, and mix. The product should weigh two pounds eleven ounces [avoird.], and should have the sp. gr. 1·385. It contains 4·3 grains of iodide of iron in a fluidrachm." *Br.*

These preparations furnish solutions of iodide of iron, rendered more permanent by sugar. The mode of making the iodide is precisely the same as that given under the head of *Ferri Iodidum.* The iodine should be quite dry; as, if moist, as British iodine often is, less iodide of iron will be formed and the syrup will be proportionably weaker. In both processes a large excess of iron is taken, being greatest in the British. A moderate excess is useful in preventing the solution of iodide of iron from undergoing any change from the absorption of oxygen during filtration, before it comes in contact with the sugar. Assuming that the iodine without loss is all converted into iodide of iron, it is easy to calculate the strength of the officinal solutions. Thus, it will be found that the U. S. solution contains 7·33 grains, and that of the British Pharmacopœia about 4·30 grains of the dry iodide to the fluidrachm. In both preparations there is sufficient sugar to constitute a syrup; the present U. S. process differing in this respect from that of 1850, which was denominated a solution, because containing insufficient sugar to be entitled to the name of a syrup. Indeed, the proportion of sugar in the old formula was insufficient duly to protect the iodide, and was therefore increased. In the solution of 1850, a coil of iron wire, or a strip of bright iron, immersed in the solution, was found to assist in preserving it from change.

The plan of protecting the solution of iodide of iron from change by saccharine matter originated with M. Frederking, of Riga, who published a formula for the purpose in *Buchner's Repertorium* in 1839. The same plan was proposed in a paper by Prof. Procter, contained in the *Amer. Journ. of Pharmacy* for April, 1840. In the *Journal de Pharmacie* for March, 1841, Dr. Dupasquier, of Lyons, claims to have made a pure iodide of iron, protected by syrup of gum, as early as 1838. In the *Pharm. Journ.* for August, 1841, the late Dr. A. T. Thomson published a paper in which he confirmed the results of Frederking and Procter, and proposed a formula for a *strong syrup,* which is the basis of that adopted by the British Pharmacopœia.

Properties. The *U. S. syrup of iodide of iron* is a transparent liquid, of a pale-green colour, and deposits no sediment on being kept; nor does it tinge a solution of starch blue, showing that it is well protected. In regard to the former U. S. preparation, Mr. E. S. Wayne observed that, when kept for some time, it occasionally deposited grape sugar, into which the cane sugar was converted, probably through the agency of hydriodic acid. According to Prof. J. M. Maisch, of this city, the solution was decomposed not only by light, but also by the action of atmospheric oxygen in bottles partly filled and frequently opened. The oxidation of the iron and the evolution of the iodine were accelerated by the action of light, when the solution was thus insecurely kept; but, when the altered solution was transferred to air-tight bottles, completely filled, and exposed to the direct light of the sun, it resumed its transparency; and its original colour was restored, or rendered much lighter. After this restoration the solution could not be the same; and Mr. Maisch thought it probable that it contained some iodate of sesquioxide of iron. (See his papers in the *Am. Journ. of Pharm.* for Sept. 1854, and May, 1855.) The removal of the apparent defects of a solution of iodide of iron by the action of sunlight is, therefore, not an admissible expedient; because it changes the nature of the solution. The same may be said of the addition of tartaric or citric acid, which has been proposed for clearing the discoloured syrup. Mr. Maisch discovered copper in a sample of this preparation. It may be detected by putting into the solution a piece of bright iron, which, by a prolonged contact, will be covered with copper, if that metal be present. Syrup of iodide of iron is rendered brown by sulphuric acid, and emits violet vapours when heated. It should not contain any free iodine, which, if present, may be detected by the production of a blue colour with starch.

These observations of Mr. Maisch in reference to the former Liquor Ferri Iodidi, so far as concerns the influence of light, are probably true of the present syrup, though the greater proportion of sugar contained gives it, no doubt, additional protection against the oxidizing influence of the air.

Dr. Squibb states, in a communication to the *American Journal of Pharmacy* (March, 1868, p. 99), that, after considerable experience with the U. S. preparation, he has known it to become discoloured only in one instance; so that with care to avoid all injurious exposure it may be expected to keep well. But, in consequence of the facility with which it undergoes decomposition, with the liberation of iodine, it is very liable to become discoloured with the least want of care. He, therefore, proposes, as a remedy for this inconvenience, to add to the discoloured syrup a very small proportion of a solution of hyposulphite of sodium, which, without injury to the preparation, removes the colour, and in a great degree restores the transparency. For this purpose fifteen or twenty grains of the crystallized hyposulphite may be dissolved in a fluidounce of water; and from fifteen to twenty minims of the solution are sufficient for a pint of syrup, if not darker than brown sherry. The solution is simply added to the syrup, and shaken up with it in the bottle. If the discolouration be deeper, more will be required; and the quantity requisite for the effect is a measure of the amount of change that may have occurred. Glycerin has been proposed as a substitute for sugar in this preparation, and it answers the same purpose, but it may be doubted whether more effectually. Such a preparation, however, would come properly under the Glycerites of the Pharmacopœia.

When the syrup is concentrated it becomes brown, and, when evaporated to dryness, forms a mass which may be called *saccharine iodide of iron*, and which is not entirely soluble again, a little sesquioxide of iron being left. This saccharine iodide, being protected by the sugar it contains, is not liable to the objections which apply to the pure solid salt, and may be made into pills.

Medical Properties. These have been detailed under the head of *Ferri Iodidum.* The dose of the syrup is from 20 to 40 minims, diluted with water. The dilution should be made at the moment it is taken; and, in order to guard against injury to the teeth, the mouth should be carefully washed after each dose.

Solution of iodide of iron is sometimes used as an external application; and when so employed, the necessary dilution should be made at the moment of applying it. B.

SYRUPUS FERRI PHOSPHATIS. *Br. Syrup of Phosphate of Iron.*

"Take of Granulated Sulphate of Iron *two hundred and twenty-four grains;* Phosphate of Soda *two hundred grains;* Acetate of Soda *seventy-four grains;* Diluted Phosphoric Acid *five fluidounces and a half;* Refined Sugar *eight ounces* [avoirdupois]; Distilled Water *eight fluidounces.* Dissolve the Sulphate of Iron in four [fluid]ounces of the Water, and the Phosphate and Acetate of Soda in the remainder; mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with Distilled Water, till the filtrate ceases to be affected by chloride of barium. Then press the precipitate strongly between folds of bibulous paper, and add to it the Diluted Phosphoric Acid. As soon as the precipitate is dissolved, filter the solution, add the Sugar, and dissolve without heat. The product should measure exactly twelve fluidounces." *Br.*

The first part of this process is almost precisely a repetition of that of the Br. Pharmacopœia for phosphate of iron. (See *Ferri Phosphas.*) But after that salt has been prepared, instead of being dried, it is first strongly pressed, and then dissolved in the dilute phosphoric acid, and made into a syrup with sugar. As the phosphate of iron is insoluble in water, it was necessary to have recourse to an acid to effect its solution, and the phosphoric acid was selected as therapeutically co-indicated. Each fluidrachm contains one grain of the phosphate of iron. (*Br.*) The syrup sometimes acquires a sherry wine colour and deposits a reddish-brown precipitate, which, according to Mr. T. B. Groves (*Pharm. Journ. and Trans.*, 2d ser., xi. 138), is an insoluble phosphate of the sesquioxide; it may be separated by filtration. The same authority also states that the colour of the syrup is due to caramel, which may be removed by animal charcoal. The precipitated phosphate in the officinal process is exceedingly liable to oxidation during the protracted

working required, and Mr. H. W. Jones (*Ibid.*, 3d ser., v. 541) proposes a formula in which the phosphate is made directly from metallic iron and phosphoric acid. For its properties and uses, see *Ferri Phosphas* (page 1227). The dose is one or two fluidrachms. W.

SYRUPUS HEMIDESMI. *Br.* *Syrup of Hemidesmus. Syrup of Indian Sarsaparilla.*

"Take of Hemidesmus Root, bruised, *four ounces* [avoirdupois]; Refined Sugar *twenty-eight ounces* [avoird.]; Boiling Distilled Water *one pint* [Imperial measure]. Infuse the Hemidesmus in the Water, in a covered vessel, for four hours, and strain. Set it by till the sediment subsides; then decant the clear liquor, add the Sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces, and should have the specific gravity 1·335."

This is a very weak preparation. The dose is stated at one fluidrachm, but the syrup may be taken almost ad libitum. (See *Hemidesmus.*) W.

SYRUPUS IPECACUANHÆ. *U. S.* *Syrup of Ipecacuanha.*

"Take of Fluid Extract of Ipecacuanha *two fluidounces;* Syrup *thirty fluidounces.* Mix them." *U. S.*

By the former U. S. process of 1850, a tincture of ipecacuanha was first formed with diluted alcohol, then reduced by evaporation so as to drive off the alcohol, and afterwards diluted with water and made into a syrup with sugar. The present process simply mixes the fluid extract, which is an officinal preparation, with syrup. The French Codex dissolves the alcoholic extract of ipecacuanha in water, and then mixes it with syrup; but it is obvious that the U. S. plan is preferable, as it spares the continued heat requisite to reduce the tincture to dryness. The present U. S. syrup, which is twice as strong as that of 1850, is made in accordance with the suggestions of Mr. Laidley, of Richmond, Va., who found the syrup, as ordinarily prepared, to spoil by keeping. (*Am. Journ. of Pharm.*, xxvi. 103.) The substitution of glycerin for a portion of the syrup would further obviate the tendency to ferment, which still exists. The unreliability of commercial fluid extracts has been urged as an objection to the officinal process. The answer to this, of course, is that if the apothecary cannot buy he should prepare a good fluid extract. For formulæ in which the crude ipecacuanha is employed, the reader may consult *Amer. Journ. of Pharm.*, 1870, p. 127; 1871, p. 104.

This syrup is chiefly applicable to the cases of children. One fluidounce of it, prepared according to the U. S. formula, should contain the virtues of thirty grains of ipecacuanha. The dose of it, as an emetic, is for an adult from four fluidrachms to a fluidounce, for a child a year or two old, from thirty minims to a fluidrachm, repeated every fifteen or twenty minutes till it acts. As an expectorant, the dose for an adult is thirty minims or a fluidrachm, for a child from two to ten minims. W.

SYRUPUS KRAMERIÆ. *U. S.* *Syrup of Rhatany.*

"Take of Rhatany, in moderately fine powder, *twelve troyounces;* Sugar [refined], in coarse powder, *thirty troyounces;* Water *a sufficient quantity.* Mix the Rhatany with half a pint of Water, and, having allowed the mixture to stand for two hours, introduce it into a glass percolator, and gradually pour Water upon it until four pints of filtered liquor are obtained. Evaporate this, by means of a water-bath, to seventeen fluidounces, and, having added the Sugar, dissolve it with the aid of a gentle heat, and strain the solution while hot. This Syrup may also be prepared in the following manner.

"Take of Extract of Rhatany *two troyounces;* Syrup *twenty-four fluidounces.* Mix them." *U. S.*

As rhatany yields a variable proportion of extract, it follows that the syrup resulting from these two modes of preparation must differ. To obviate this evil as far as possible, care should be taken, in following the first process, to select the best rhatany, and preferably the small roots, as it is these only which will yield two ounces of good extract to the pound.

In the second process, extract of rhatany as free as possible from insoluble matter should be chosen; and that prepared according to the U. S. directions will be found

the best. (See *Extractum Krameriæ.*) This preparation affords a convenient mode of exhibiting rhatany to infants. The dose for an adult is half a fluidounce, for a child a year or two old, twenty or thirty minims. W.

SYRUPUS LACTUCARII. *U. S. Syrup of Lactucarium.*

"Take of Lactucarium *a troyounce;* Syrup *fourteen fluidounces;* Diluted Alcohol *a sufficient quantity.* Rub the Lactucarium with sufficient Diluted Alcohol, gradually added, to bring it to a syrupy consistence. Then introduce it into a conical percolator, and, having carefully covered the surface with a piece of muslin, gradually pour Diluted Alcohol upon it until half a pint of tincture has passed. Evaporate this portion, by means of a water-bath, at a temperature not exceeding 160°, to two fluidounces, mix it with the Syrup, previously heated, and strain while hot." *U. S.*

This syrup has the virtues of lactucarium, free from its inert albuminous matter. It is, however, objectionable on account of its want of transparency, and in some measure also from its disagreeable taste. The former of these objections it has been proposed to obviate by the use of carbonate of magnesium as in the U. S. formula for Syrup of Tolu; the latter by the addition of one of the aromatic Waters. When the tincture obtained by percolation in the above process is reduced to two fluidounces, a deposition takes place of active matter, which is afterwards in part lost, in the straining, and in part, so far as redissolved by means of the heat, is subsequently deposited or held suspended in the syrup. Mr. P. M. Bedford proposes to rub the tincture before evaporation, and four fluidounces of water, in a mortar, with a drachm of carbonate of magnesium and a troyounce of sugar, then to filter, evaporate at 160° to six fluidounces, add thirteen ounces of sugar to form a syrup, and when this is nearly cool, to pour it into a bottle containing two fluidounces of Orange-flower Water. If necessary, water is to be added to make the measure of a pint. The rubbing with carbonate of magnesium enables the menstruum to take up, as far as it is capable of doing, the matter that would otherwise be deposited. The proportions of the ingredients are essentially those of the U. S. process. (*Am. Journ. of Pharm.*, Jan. 1869, p. 48.) A proceeding somewhat similar to Mr. Bedford's, but using powdered pumice-stone instead of carbonate of magnesium, and rubbing this and a little sugar with the tincture after evaporation instead of previously, has been recommended by Mr. James Kenworthy, who assures us that the result is a beautifully clear syrup, with the flavour and appearance of Aubergier's, and the virtues of that of the U. S. Pharmacopœia. (*Ibid.*, March, 1868, p. 113.)* The dose is two or three fluidrachms. W.

* *Aubergier's Syrup of Lactucarium.* Though probably inferior in efficacy to the U. S. syrup, that of Aubergier has a great reputation on the continent of Europe, and is occasionally prescribed here instead of the officinal. It differs so much from ours, that, when it is prescribed, the apothecary who may not have it on hand should not substitute the officinal for it, unless with the full knowledge of the prescriber. In order to obviate this inconvenience, it is advisable that there should be a formula, readily accessible, by which a syrup may be prepared, sufficiently representing Aubergier's for all practical purposes. Prof. Procter, therefore, has done the profession good service by preparing and publishing such a process, which we copy here. "Take of Lactucarium (German) *half an ounce;* Granulated Sugar *an ounce;* Simple Syrup *four and a half pints;* Citric Acid, in powder, *sixty grains;* Orange-flower Water *four fluidounces;* Diluted Alcohol, Water, each, *a sufficient quantity.* Triturate the Lactucarium with the Sugar until reduced to powder, put it into a funnel-shaped percolator, pour on Diluted Alcohol until the Lactucarium is nearly exhausted, or until ten fluidounces have passed, evaporate to two fluidounces, and add it to the Syrup, previously heated by boiling, and mix. Continue the ebullition slowly until the whole measures four pints and six fluidounces. Then add the Citric Acid and strain, and, lastly, when nearly cool, the Orange-flower Water, and mix them. Each fluidounce contains the strength of three and one-third grains of lactucarium. The syrup is light-brown and transparent." (*Am. Journ. of Pharm.*, July, 1866, p. 290.)

The French Codex has a syrup, called *Opiated Syrup of Lactucarium* (*Sirop de Lactucarium Opiacé*), in which an alcoholic extract is used in double the quantity of extract of opium. One would suppose that, in such a proportion, the action of the opium would entirely overwhelm that of the lactucarium; but we are assured by M. Deschamps, as the well-ascertained result of experiments of his own and the late M. Debout, that lactucarium given with opium very decidedly opposes, even in small proportion, the unpleasant effects caused by opium, such as nausea, stomachic spasms, headache, &c. (*Ann. de Thérap.*, 1868, p. 17); and hence the advantage of a preparation in which the two narcotics are combined. But to gain all the good results of this experience, it is unnecessary to add a new syrup to the officinal list; all that is requisite being the addition of a little of the simple syrup of lactucarium to any preparation of opium, the anticipated unpleasant effects of which it is desirable to prevent. (*Note to the thirteenth edition.*)

SYRUPUS LIMONIS. *U. S., Br. Syrup of Lemon.*

"Take of Lemon Juice, recently expressed and strained, *a pint;* Sugar [refined], in coarse powder, *forty-eight troyounces;* Water *a pint.* Mix the Lemon Juice and Water, and, having added the Sugar to the mixture, dissolve it with the aid of a gentle heat, and strain the solution while hot." *U. S.*

"Take of Fresh Lemon Peel *two ounces* [avoirdupois]; Lemon Juice, strained, *one pint* [Imperial measure]; Refined Sugar *two pounds and a quarter* [avoird.]. Heat the Lemon Juice to the boiling point, and, having put it into a covered vessel with the Lemon Peel, let them stand until they are cold, then filter, and dissolve the Sugar in the filtered liquid with a gentle heat. The product should weigh three pounds and a half [avoird.], and should have the sp. gr. 1·34." *Br.*

The British preparation has an advantage over that of the U.S. Pharmacopœia in possessing more of the aromatic flavour of the rind; and it would be an improvement to our formula to add a little grated fresh lemon-peel to the other ingredients. In the present U.S. syrup, the juice, instead of being used undiluted, as in the process of 1850, is mixed with an equal measure of water, which is an improvement.

This syrup forms a cooling and grateful addition to beverages in febrile complaints, and serves to conceal the taste of saline purgatives in solution. W.

SYRUPUS MORI. *Br. Syrup of Mulberries.*

"Take of Mulberry Juice *one pint* [Imperial measure]; Refined Sugar *two pounds* [avoirdupois]; Rectified Spirit *two fluidounces and a half.* Heat the Mulberry Juice to the boiling point, and when it has cooled filter it. Dissolve the Sugar in the filtered liquid with a gentle heat, and add the Spirit. The product should weigh three pounds six ounces [avoird.], and should have the sp. gr. 1·33." *Br.*

This may be used for the same purposes with lemon syrup. In like manner syrups may be prepared from various succulent fruits, such as *strawberries*, *raspberries*, *blackberries*, *currants*, *pineapples*, &c. When the juice is thick, it may be diluted with from one-third of its bulk to an equal bulk of water previously to the addition of the sugar. In the preparation of *raspberry syrup*, which, as ordinarily made, is apt to gelatinize, M. Blondeau recommends that the strained juice be allowed to stand from eight to fifteen hours, according to the temperature, in order to ferment. The juice separates into two portions, the upper thick, the lower clear. The latter is to be separated by straining, and made into a syrup with the usual proportion of sugar. The process of the London College for Syrupus Mori, retained in the first British Pharmacopœia, is in accordance with this recommendation. These syrups are employed to flavour drinks, and are much used as grateful additions to carbonic acid water.* W.

* Some practical remarks in relation to these syrups, so much used with artificial mineral water, may prove useful to the inexperienced pharmaceutist. Care should be taken that the fruit employed should be fully ripe, and freed from all its natural attachments, as calyx, stem, &c., and from all other impurities. Without being previously crushed, it should be put into canvas or woollen bags, which should be about two-thirds full when placed under the press. The expressing force should be gradually increased, so as effectually to remove the juice with as little of the tissue of the fruit as possible. It is customary to make a pint of syrup from a pint measure of fruit, and, if the expressed juice is insufficient for the purpose, to dilute it with water; but this is obviously an arbitrary rule, which cannot be universally applied without injuriously affecting the character of the product. The rule in the text is better; viz., to dilute the juice when too thick. In dissolving the sugar, as short an exposure to heat as possible is desirable. Some dissolve the sugar in a portion of the juice with heat, and add the remainder a few minutes before removal from the fire. Some fruits contain so much pectin that their syrups are apt to gelatinize. This is particularly the case with currants and raspberries. A mode of preventing this result has been mentioned in the text. Another method is to add to the juice, after expression, one-tenth of its bulk of the juice of sour cherries, allow the mixture to stand for fifteen hours, and then separate the coagulated pectin by very gentle pressure in a cloth. *Pineapple* syrup may be made either in the ordinary mode, or by slicing the fruit, alternating the slices with layers of powdered sugar, permitting them to stand twenty-four hours, and then expressing the syrup formed. Each pound of the pared fruit, with thirty ounces of sugar, should yield with the requisite quantity of water two pints of syrup. For some further practical remarks on the preparation of particular syrups, the reader is referred to a paper by Mr. Ambrose Smith, in the *American Journal of Pharmacy* (xxii. 212).

Cream Syrups. Under this name, there has come into use, in Philadelphia, a variety of syrups, given with carbonic acid water, to which they impart an agreeable richness of flavour. To prepare them, a gallon of fresh sweet cream is made to dissolve, without heat, 14 pounds (avoird.) of powdered sugar; and the solution, having been immediately bottled, is placed on ice, in a cold

SYRUPUS PAPAVERIS. *Br.* *Syrup of Poppies.*

"Take of Poppy Capsules, dried, freed from the seeds, and coarsely powdered, *thirty-six ounces* [avoirdupois]; Rectified Spirit *sixteen fluidounces;* Refined Sugar *four pounds* [avoird.]; Boiling Distilled Water *a sufficiency.* Mix the Poppy Capsules with four pints [Imperial measure] of the Water, and infuse for twenty-four hours, stirring them frequently; then pack them in a percolator, and adding more of the Water, allow the liquor slowly to pass until about two gallons [Imp. meas.] have been collected, or the poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to three pints [Imp. meas.]. When quite cold, add the Spirit, let the mixture stand for twelve hours, and filter. Distil off the spirit, evaporate the remaining liquor to two pints [Imp. meas.], and then add the Sugar. The product should weigh six pounds and a half [avoird.], and should have the sp. gr. 1·320." *Br.*

As the capsules contain variable proportions of the narcotic principle, the syrup prepared from them is necessarily of variable strength. It was, moreover, as formerly prepared, very apt to spoil. It is, we presume, to correct this tendency, that the direction is given in the Pharmacopœia to add alcohol to the infusion, by which coagulable matter may be separated; the alcohol itself being subsequently removed by distillation. The place, however, of this syrup, might, with great propriety, be supplied by a syrup prepared from one of the salts of morphia, which would keep well, and have the advantage of uniform strength. Four grains of the sulphate of morphia dissolved in a pint of syrup, would afford a preparation at least equal to the average strength of the syrup of poppies, and much more certain in its operation. Mr. Southall recommends that the syrup of poppies should be prepared with a cold infusion made by percolation; the same proportions being employed as directed by the late London Pharmacopœia. The virtues of the capsules are thus extracted without those principles which cause the syrup to ferment speedily. (See *Am. Journ. of Pharm.*, xv. 140.) Mr. Southall, after preparing the infusion, evaporates it to the proper measure before adding the sugar. Mr. Stockton prefers adding the sugar before the concentration is completed, and afterwards evaporating to 32° of the saccharometer. (*Pharm. Journ.*, xi. 299.) It is probable that a syrup, prepared with diluted alcohol as the menstruum, would keep better than that made on either of the above plans.*

The syrup of poppies is employed, chiefly in infantile cases, to allay cough, quiet restlessness, relieve pain, and promote sleep. It is uncertain in its strength, and one fluidrachm of it has caused death in a babe eighteen weeks old. (*Pharm. Journ. and Trans.*, 3d ser., ii. 354.) The dose is from half a fluidrachm to a fluidrachm for a young child, from half a fluidounce to a fluidounce for an adult. W.

SYRUPUS PRUNI VIRGINIANÆ. *U. S.* *Syrup of Wild-cherry Bark.*

"Take of Wild-cherry, in coarse powder, *five troyounces;* Sugar [refined], in coarse powder, *twenty-eight troyounces;* Water *a sufficient quantity.* Moisten the Wild-cherry thoroughly with Water, and allow it to stand for twenty-four hours in a close vessel; then pack it firmly in a glass percolator, and gradually pour Water upon it until a pint of filtered liquor is obtained. To this, transferred to a bottle, add the Sugar, and agitate occasionally until it is dissolved." *U. S.*

This process affords a handsome syrup, with the virtues of the bark unimpaired

cellar. It will keep from three to eight days, according to circumstances. It is added to other syrups, given with carbonic acid water, equal measures being employed. The use of cream syrups is said to have originated with Mr. C. A. Smith, of Cincinnati. Mr. A. B. Taylor, of Philadelphia, prepares *cream vanilla syrup* by mixing together three fluidrachms of strong fluid extract of vanilla, a pint of simple syrup, and a pint of cream syrup. (*Am. Journ. of Pharm.*, xxvii. 407.)—*Notes to the ninth and eleventh editions.*

* Prof. Procter has furnished us with the following formula, which he has used for many years, and found to yield a good syrup, that will keep well. "Take of Poppy Capsules, deprived of their seeds, and ground into coarse powder, *eight troyounces;* Sugar *fifteen troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with four fluidounces of the Diluted Alcohol, pack it firmly in a percolator, and pour Diluted Alcohol upon it until three pints have slowly passed. Distil off the alcohol until the residual liquid is reduced to half a pint, and filter. Allow sufficient Distilled Water to pass through the filter to make the filtrate measure half a pint; then add the Sugar, dissolve with heat, and strain." (*Note to the twelfth edition.*)

by the injurious effects of heat. It is based upon a formula proposed by Messrs. Procter and Turnpenny in the *American Journal of Pharmacy* (xiv. 27). The substitution of glycerin for a portion of the syrup of this preparation would, by rendering it more permanent, improve it. The dose is half a fluidounce. W.

SYRUPUS RHAMNI. *Br. Syrup of Buckthorn.*

"Take of Buckthorn Juice *four pints* [Imperial measure]; Ginger sliced, Pimento, bruised, of each *three-quarters of an ounce* [avoirdupois]; Refined Sugar *five pounds* [avoird.], or *a sufficiency;* Rectified Spirit *six fluidounces* [Imp. meas.]. Evaporate the Juice to two pints and a half [Imp. meas.], add the Ginger and Pimento, digest at a gentle heat for four hours, and strain. When cold add the Spirit, let the mixture stand for two days, then decant off the clear liquor, and in this dissolve the Sugar with a gentle heat, so as to make the specific gravity 1·32." *Br.*

This syrup was officinal with the Lond. and Ed. Colleges, and though dropped at the formation of the original British Pharmacopœia, seems to have so strong a hold on practitioners that it was deemed expedient to resume it in the present code. Though an efficient cathartic, it seems never to have been much used in this country, probably because, the plant not being indigenous or cultivated here, the fresh juice cannot be readily obtained. The dose is a fluidrachm. W.

SYRUPUS RHEI. *U. S., Br. Syrup of Rhubarb.*

"Take of Fluid Extract of Rhubarb *three fluidounces;* Syrup *twenty-nine fluidounces.* Mix them thoroughly." *U. S.*

"Take of Rhubarb Root, in coarse powder, Coriander Fruit, in coarse powder, of each *two ounces* [avoirdupois]; Refined Sugar *twenty-four ounces* [avoird.]; Rectified Spirit *eight fluidounces* [Imperial measure]; Distilled Water *twenty-four fluidounces* [Imp. meas.]. Mix the Rhubarb and Coriander; pack them in a percolator; pass the Spirit and Water, previously mixed, slowly through them; evaporate the liquid that has thus passed until it is reduced to thirteen fluidounces [Imp. meas.], and in this, after it has been filtered, dissolve the Sugar with a gentle heat." *Br.*

This is a new officinal of the Br. Pharmacopœia, and corresponds nearly with the U. S. syrup, except in the presence of coriander, which is perhaps better omitted, as allowing the practitioner to accommodate the aromatic addition to the taste of his patient. The U. S. formula is an improvement on that of 1850, as being more precise. The syrup is a mild cathartic, adapted to the cases of infants, to whom it may be given in the dose of a fluidrachm. W.

SYRUPUS RHEI AROMATICUS. *U. S. Aromatic Syrup of Rhubarb.*

"Take of Rhubarb, in moderately fine powder, *two troyounces and a half;* Cloves, in moderately fine powder, Cinnamon, in fine powder, each, *half a troyounce;* Nutmeg, in moderately fine powder, *one hundred and twenty grains;* Syrup *six pints;* Diluted Alcohol *a sufficient quantity.* Mix the powders, and, having moistened the mixture with two fluidounces of Diluted Alcohol, introduce it into a conical percolator, and pour Diluted Alcohol upon it until a pint of tincture has passed. Add this to the syrup, previously heated, and mix them thoroughly." *U. S.**

The substitution of glycerin for one-half of the syrup would certainly be an improvement in the former process.

The aromatic syrup of rhubarb is a warm stomachic laxative, too feeble for adult cases, but well calculated for the bowel-complaints of infants which are so frequent in our cities during the summer season, and as a remedy for which this preparation, or one analogous to it, has been long in use under the name of *spiced syrup of rhubarb.* The dose for an infant with diarrhœa is a fluidrachm, repeated every two hours till the passages indicate by their colour that the medicine has operated. It

* The following is the preferred formula of the Pharmacopœia of 1850, omitted in the present edition, in which the syrup is prepared by maceration. "Take of Rhubarb, bruised, *two ounces and a half;* Cloves, bruised, Cinnamon, bruised, each, *half an ounce;* Nutmeg, bruised, *two drachms;* Diluted Alcohol *two pints;* Syrup *six pints.* Macerate the Rhubarb and Aromatics in the Diluted Alcohol for fourteen days, and strain; then, by means of a water-bath, evaporate the liquor to a pint, and, while it is still hot, mix it with the Syrup previously heated." Care should be taken, in evaporating the tincture, not to let the heat exceed that of a water-bath, lest the aromatic oils should be driven off.

should be borne in mind that the syrup, as prepared by the present formula, contains one-seventh of diluted alcohol, which, though not injurious in most of the cases in which this syrup is used, might render it too stimulant in some instances of diarrhœa in the very young infant. W.

SYRUPUS RHŒADOS. *Br. Syrup of Red Poppy.*

"Take of Fresh Red Poppy Petals *thirteen ounces* [avoirdupois]; Refined Sugar *two pounds and a quarter* [avoird.]; Distilled Water *one pint* [Imperial measure], or *a sufficiency;* Rectified Spirit *two fluidounces and a half.* Add the Petals gradually to the Water heated in a water-bath, frequently stirring, and afterwards, the vessel being removed, infuse for twelve hours. Then press out the liquor, strain, add the Sugar, and dissolve by means of heat. When nearly cold, add the Spirit, and as much Distilled Water as may be necessary to make up for loss in the process, so that the product shall weigh three pounds ten ounces. It should have the sp. gr. 1·330." *Br.*

The object of introducing the petals into water heated by a water-bath is that they may shrink by being scalded; as otherwise they could not be completely immersed in the quantity of water directed. After this has been accomplished, they should be immediately removed from the fire, lest the liquor become too thick and ropy. The fine red colour of this syrup is its only recommendation. It is very liable to ferment. According to Dr. Enders the inconveniences which arise from this tendency can be obviated by evaporating the recently prepared syrup to dryness, keeping the powdered residue in well-stopped bottles, and dissolving it as wanted in four-fifths its weight of water. The dose is stated in the Br. Pharmacopœia at a fluidrachm. W.

SYRUPUS ROSÆ GALLICÆ. *U. S., Br. Syrup of Red Rose.*

"Take of Red Rose, in moderately fine powder, *two troyounces;* Sugar [refined], in coarse powder, *eighteen troyounces;* Diluted Alcohol, Water, each, *a sufficient quantity.* Moisten the Rose with Diluted Alcohol, pack it firmly in a conical glass percolator, and gradually pour Diluted Alcohol upon it until a fluidounce of tincture has passed. Set this aside, and continue the percolation until five fluidounces more of tincture are obtained. Evaporate this with a gentle heat to a fluidounce and a half, and mix it with seven fluidounces of Water. Then, having added the Sugar, dissolve it with the aid of a gentle heat, and strain the solution while hot. Lastly, add the reserved tincture to the solution, when it is cold, and mix them thoroughly." *U. S.*

"Take of dried Red Rose Petals *two ounces* [avoirdupois]; Refined Sugar *thirty ounces* [avoird.]; Boiling Distilled Water *one pint* [Imperial measure]. Infuse the Petals in the Water for two hours, squeeze through calico, heat the liquor to the boiling point, and filter. Dissolve the Sugar in the liquor by means of heat. The product should weigh two pounds fourteen ounces [avoird.], and should have the sp. gr. 1·335." *Br.*

The syrup of red roses is mildly astringent; but is valued more for its fine red colour, on account of which it is occasionally added to mixtures. The dose is a fluidrachm. W.

SYRUPUS RUBI. *U. S. Syrup of Blackberry Root.*

"Take of Fluid Extract of Blackberry *half a pint;* Syrup *a pint and a half.* Mix them." *U. S.*

This process might perhaps be improved by filtering the concentrated tincture before the addition of the sugar. The Syrup is a new officinal of the U. S. Pharmacopœia, called for by the popularity of similar preparations. It is very useful in diarrhœa of relaxation, and in the chronic forms of that complaint. The dose is one or two fluidrachms. W.

SYRUPUS SARSAPARILLÆ COMPOSITUS. *U. S. Compound Syrup of Sarsaparilla.*

"Take of Sarsaparilla, in moderately fine powder, *twenty-four troyounces;* Guaiacum Wood, in moderately fine powder, *three troyounces;* Pale Rose, in moderately fine powder, Senna, in moderately fine powder, Liquorice Root, in moderately fine

powder, each, *two troyounces;* Oil of Sassafras, Oil of Anise, each, *five minims;* Oil of Gaultheria *three minims;* Sugar, in coarse powder, *ninety-six troyounces;* Diluted Alcohol *a sufficient quantity.* Mix the solid ingredients, except the Sugar, with three pints of Diluted Alcohol, and allow the mixture to stand for twenty-four hours; then transfer it to a cylindrical percolator, and gradually pour Diluted Alcohol upon it until ten pints of tincture have passed. Evaporate this, by means of a water-bath, to four pints, filter, and, having added the Sugar, dissolve it with the aid of heat, and strain the solution while hot. Lastly, rub the Oils with a small portion of the solution, and mix them thoroughly with the remainder." *U. S.*

In the original edition of the U. S. Pharmacopœia published in 1820, a process for a syrup of sarsaparilla was adopted, intended to represent the famous French *sirop de Cuisinier.* This was very much improved in the revised edition published in 1830; and the amended process has been retained with little alteration in the subsequent editions; the process of percolation having been substituted in the present Pharmacopœia for simple maceration directed in the first of the two formulas of 1850. In the original process, the sarsaparilla was subjected to long decoction with water. Now it has been proved that diluted alcohol more thoroughly extracts the acrid principle of the root, upon which its activity probably depends, than water, and that this principle is either dissipated or destroyed by the long-continued application of a boiling heat.* In the present formula, therefore, which employs diluted alcohol as the menstruum, the root is more completely exhausted of its active matter; while the heat applied to the concentration, being no higher than is requisite for the evaporation of the alcohol, is insufficient to injure the preparation. The spirituous menstruum has, moreover, the advantage of not dissolving the inert fecula, which encumbers the syrup prepared by decoction, and renders it liable to spoil. In the Pharmacopœia of 1840, the pale or hundred-leaved roses were very properly substituted for the red; as their slightly laxative property accords better with the character of the preparation. The operator should be careful to comply exactly with the directions of the Pharmacopœia, not only those of the present formula, including the use of the water-bath, but also the general rules given for the management of the process of percolation. The essential oils, being intended solely to communicate an agreeable flavour, are used in very small proportion. The only objection to this process is that a portion of the resin, extracted by the alcohol from the guaiacum wood, is deposited during the evaporation of the tincture; but this is separated by the filtration directed, and is therefore of no disadvantage to the preparation. But the practitioner should be aware that much of the sarsaparilla, as it exists in the market, is nearly or quite inert, and should be prepared to meet with disappointment in the use of this or any other preparation, unless satisfied of the good quality of the drug from which it is made.

Corrosive sublimate, which is often given in connection with this syrup, is said to be completely decomposed by it, being converted into calomel. M. Lepage, of Gisors, proposes as a substitute the iodohydrargyrate of potassium (see *Part* III.), which he has found not to undergo decomposition. (*Journ. de Pharm.*, 3e sér., viii. 63.)

The dose of the syrup is half a fluidounce, equivalent to somewhat less than a drachm of the root, to be taken three or four times a day. W.

SYRUPUS SCILLÆ. *U. S., Br. Syrup of Squill.*

"Take of Vinegar of Squill *a pint;* Sugar [refined], in coarse powder, *twenty-four troyounces.* Dissolve the Sugar in the Vinegar of Squill, with the aid of a gentle heat, and strain the solution while hot." *U. S.*

"Take of Vinegar of Squill *one pint* [Imperial measure]; Refined Sugar *two pounds and a half* [avoirdupois]. Dissolve with the aid of heat." *Br.*

The present British formula is almost identical with the American, and differs from that of 1864 in taking the vinegar already formed, instead of preparing it as the first step of the process.

* See a paper by John Hancock, M.D., republished in the *Journal of the Philadelphia College of Pharmacy* (i. 295); a communication by M. Béral to the *Journal de Pharmacie* (xv. 657); another by M. Soubeiran in the same journal (xvi. 38); and a paper by T. J. Husband in the *American Journal of Pharmacy* (xv. 6).

This syrup is much employed as an expectorant, especially in combination with a solution of tartarized antimony. The dose is about a fluidrachm. In infantile cases of catarrh and other pectoral complaints, it is sometimes given, in the same dose, as an emetic. W.

SYRUPUS SCILLÆ COMPOSITUS. *U. S.* *Compound Syrup of Squill. Hive Syrup.*

"Take of Squill, in moderately fine powder, Seneka, in moderately fine powder, each, *four troyounces;* Tartrate of Antimony and Potassium *forty-eight grains;* Sugar [refined], in coarse powder, *forty-two troyounces;* Diluted Alcohol, Water, each *a sufficient quantity.* Mix the Squill and Seneka, and, having moistened the mixture with half a pint of Diluted Alcohol, allow it to stand for four days. Then transfer it to a conical percolator, and pour Diluted Alcohol upon it until a pint of tincture has passed. Boil this for a few minutes, evaporate it by means of a water-bath to half a pint, add fourteen fluidounces of boiling Water, and filter. Dissolve the Sugar in the filtered liquid, and, having heated the solution to the boiling point, strain it while hot. Then dissolve the Tartrate of Antimony and Potassium in the solution while still hot, and add sufficient boiling Water, through the strainer, to make it measure three pints. Lastly, mix the whole thoroughly together." *U. S.*

This is intended as a substitute for the popular preparation called *Coxe's hive-syrup*, from which it differs chiefly in containing sugar instead of honey. Prepared as originally directed in the Pharmacopœia, it invariably fermented from the want of sufficient concentration. This defect was corrected at the revision of 1840, when also sugar was substituted for honey, in consequence of the uncertain consistence and constitution of the latter. In the Pharmacopœia of 1850 two formulas were given for this syrup; in the first of which the virtues of the squill and seneka were extracted by long boiling with water, in the second, by percolation with water to which a small portion of alcohol was added. The latter was preferable when skilfully performed; as it avoided in great measure the injurious influence of boiling upon the seneka, exhausted both this and the squill more readily in consequence of the addition of alcohol to the menstruum, and afforded a solution of their active principles, less embarrassed with inert matters calculated to favour fermentation. In this process, the filtered liquor was raised to the boiling point in order to coagulate the albumen, after which the evaporation was conducted at a lower temperature. The present formula is a decided improvement upon the one just described; as, diluted alcohol being employed as the menstruum, less of the albuminous and mucilaginous matter is extracted; while any disadvantage from the spirituous addition is obviated by the subsequent evaporation of the alcohol and the addition of water; the provision being retained to boil the tincture for a short time to get rid of such albumen as has been taken up. Sometimes the amount of albuminous coagulum is so great as to render the process of filtration after the boiling very tedious. According to Mr. J. C. Wharton this can be remedied by rubbing up the muddy liquid with magnesia.* (*Amer. Journ. of Pharm.*, xliii. 102.)

The compound syrup of squill combines the virtues of seneka, squill, and tartar emetic, of the last of which it contains one grain in every fluidounce. It is emetic, diaphoretic, expectorant, and frequently cathartic, and may be given with advantage in mild cases of croup, in the latter stages of severe cases when the object is to promote expectoration, and in other pectoral affections in which the same indication is

* Great difficulty has been experienced in making this preparation so as to keep well. Various improvements upon the former officinal formula have been suggested. Dr. Cummings, of Portland, Maine, proposed to use diluted acetic acid as the menstruum for squill, and diluted alcohol for seneka; and thought that a syrup might thus be made which would not ferment. (*Am. Journ. of Pharm.*, xxviii. 397.) Mr. A. P. Sharp, of Baltimore, has found great satisfaction from the following method of proceeding. As soon as one portion of the syrup has been made for use, he begins to prepare another in the following manner. Coarsely powdered seneka and squill, of each ℥viij, are macerated with a gallon of a mixture of one part of alcohol and two of water, and allowed to stand till the first portion is nearly consumed, sometimes for two or three months, when the mixture is expressed or submitted to percolation. The tincture is then evaporated, till the alcohol has been driven off, the residue is filtered cold, ℔vij of sugar are added, the liquid is evaporated without boiling to Ovj, is strained if necessary, and a grain of tartar emetic added for each f℥j. (*Ibid.*, xxvii. 220.) But the improvement in the officinal formula, it is hoped, will obviate all necessity for substituted formulas in future. (*Note to the eleventh and twelfth editions.*)

presented. As an emetic, however, in croup, we prefer a simple solution of tartar emetic in water. The dose of this syrup is, for children, from ten drops to a fluidrachm, according to the age, and should be repeated in cases of croup every fifteen or twenty minutes till it vomits. As an expectorant for adults the dose is twenty or thirty drops. W.

SYRUPUS SENEGÆ. *U. S.* *Syrup of Seneka.*

"Take of Seneka, in moderately fine powder, *four troyounces;* Sugar [refined], in coarse powder, *fifteen troyounces;* Diluted Alcohol *two pints.* Moisten the Seneka with two fluidounces of the Diluted Alcohol; then transfer it to a conical percolator, and gradually pour upon it the remainder of the Diluted Alcohol. When the tincture has ceased to pass, evaporate it, by means of a water-bath, at a temperature not exceeding 160°, to half a pint; then filter, and, having added the Sugar, dissolve it with the aid of a gentle heat, and strain the solution while hot." *U. S.*

This is essentially the second of the two formulas given in the Pharmacopœia of 1850; the first having been omitted in 1860, as quite superannuated. There is no doubt that, if the existing formula be carried duly into execution, it will yield an excellent preparation. But, in consequence of the abundance of a pectin-like matter in seneka, it is difficult to get the syrup quite clear without clarification with albumen. The use of carbonate of magnesium as has been recommended, to aid in the filtration, is hardly permissible on account of the acid nature of the active principle of the drug. The syrup affords a very convenient mode of exhibiting seneka in pectoral complaints. It may be given as a stimulant expectorant in the dose of one or two fluidrachms. W.

SYRUPUS SENNÆ. *Br.* *Syrup of Senna.*

"Take of Senna, broken small, *sixteen ounces* [avoirdupois]; Oil of Coriander *three minims;* Refined Sugar *twenty-four ounces* [avoird.]; Distilled Water *five pints* [Imperial measure], or *a sufficiency;* Rectified Spirit *two fluidounces.* Digest the Senna in seventy [fluid]ounces of the Water for twenty-four hours at a temperature of 120°; press out the liquor and strain it. Digest the marc in thirty [fluid] ounces of the Water for six hours at the same temperature; again press out the liquor and strain it. Evaporate the mixed liquors in a water-bath to ten fluidounces, and, when cold, add the Rectified Spirit, previously mixed with the Oil of Coriander. Clarify by filtration, and wash what remains on the filter with Distilled Water, until the washings make up the filtrate to sixteen fluidounces. Then add the Sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces [avoird.], and should have the sp. gr. 1·310." *Br.*

The present British syrup, which has superseded the former syrups of the London and Edinburgh Colleges, differs from them, as well as from that of the U. S. Pharmacopœia of 1850, very greatly in strength; so that, in prescribing it, physicians accustomed to the doses of the former syrups must be on their guard not very seriously to overdose their patients. The syrup, as made by the above formula, contains the strength of about thirty grains of senna in each fluidrachm, and should rank with the Fluid Extracts rather than the Syrups. The dose for an adult would be from one to four fluidrachms; but for children, for whom it was originally intended, not more than from one-eighth to one-quarter of that quantity, according to the age. It has been omitted in the present edition of the U. S. Pharmacopœia, under the impression, we presume, that its place might be supplied by the fluid extract. W.

SYRUPUS TOLUTANUS. *U. S.*, *Br.* *Syrup of Tolu.*

"Take of Tincture of Tolu *two fluidounces;* Carbonate of Magnesium *one hundred and twenty grains;* Sugar [refined], in coarse powder, *twenty-six troyounces;* Water *a pint.* Rub the Tincture of Tolu first with the Carbonate of Magnesium and two troyounces of the Sugar, then with the Water gradually added, and filter. To the filtered liquid add the remainder of the Sugar, and, having dissolved it with the aid of a gentle heat, strain the solution while hot." *U. S.*

"Take of Balsam of Tolu *one ounce and a quarter* [avoirdupois]; Refined Sugar *two pounds* [avoird.]; Distilled Water *one pint* [Imperial measure], or *a sufficiency.* Boil the Balsam in the Water for half an hour in a lightly covered vessel, stirring

occasionally. Then remove from the fire, and add Distilled Water, if necessary, so that the liquid shall measure sixteen [fluid]ounces. Filter the solution when cold, add the Sugar, and dissolve with the aid of a steam or water-bath. The product should weigh *three pounds* [avoird.], and should have the sp. gr. 1·330." *Br.*

In the U. S. process, the tincture of tolu is rubbed with the carbonate of magnesium and a little sugar, and afterwards with the water, in order to enable this fluid to take from the tincture all that it is capable of dissolving; the carbonate of magnesium and the precipitated resin of the tincture being separated by filtration. The process is then completed by forming a syrup with the filtered liquid. It is in accordance with a formula proposed by Mr. J. D. Finley, and published in a note in the eleventh edition of the U. S. Dispensatory. The resulting syrup is beautifully and permanently clear, and has very decidedly the flavour of the balsam. In the British process the soluble principles of the balsam are extracted by boiling it with water, but with great waste of the material, as the water dissolves but a small portion of the active matter. To obviate this waste, the same portion of balsam is, according to Mr. Brande, usually employed in successive operations; and it long continues to impart odour and taste to boiling water. The British syrup may have an equal and possibly a finer flavour, but is less efficient medicinally than that of the U. S. Pharmacopœia. At best, however, the syrup of tolu is a feeble preparation, and is used chiefly to impart its agreeable flavour to mixtures.

Off. Prep. Trochisci Cubebæ, *U. S.* W.

SYRUPUS ZINGIBERIS. *U. S., Br. Syrup of Ginger.*

"Take of Fluid Extract of Ginger *a fluidounce;* Carbonate of Magnesium *one hundred and sixty grains;* Sugar [refined], in coarse powder, *seventy-two troyounces;* Water *forty-two fluidounces.* Rub the Fluid Extract of Ginger first with the Carbonate of Magnesium and two troyounces of the Sugar, and then with the Water, gradually added, and filter. To the filtered liquor add the remainder of the Sugar, and, having dissolved it with the aid of a gentle heat, strain the solution while hot." *U. S.*

"Take of Strong Tincture of Ginger *six fluidrachms;* Syrup *nineteen fluidounces.* Mix with agitation." *Br.*

The U. S. process for Syrup of Ginger is upon the same amended plan as that adopted for Syrup of Tolu, and yields a fine preparation entirely free from turbidness. As the active principles of ginger are soluble in water, nothing is lost by the precipitation of the concentrated tincture or fluid extract by means of water, and the separation of the resinous matter by filtration. The British syrup, being made by the simple incorporation of the tincture with syrup, has of course all the strength of the ginger, but is inferior to the U. S. preparation in appearance and flavour. The old plan of using water as the menstruum has been entirely abandoned, as the syrup thus made is encumbered with mucilage and starch, and consequently rendered more liable to decomposition.

In order that the preparation may be of the proper strength, it is necessary that the fluid extract should have been made with the best Jamaica ginger. The syrup of ginger is much used as a warm stomachic addition to tonic and purgative infusions or mixtures, and to impart flavour to drinks, particularly to carbonic acid water. The dose is a fluidrachm or more.

Off. Prep. Trochisci Zingiberis, *U. S.* W.

TINCTURÆ.

Tinctures.

Tinctures, in the pharmaceutical sense of the term, are solutions of medicinal substances in alcohol or diluted alcohol, prepared by maceration, digestion, or percolation. Solutions in spirit of ammonia and ethereal spirit are embraced under the same denomination, but are severally distinguished by the titles of *ammoniated tinctures* and *ethereal tinctures.* The advantages of alcohol as a menstruum are, that it dissolves principles which are sparingly or not at all soluble in water, and contributes to their

preservation when dissolved; while it leaves behind some inert substances which are dissolved by water. In no instance, however, is absolute alcohol employed. The U. S. Pharmacopœia directs it of the sp. gr. 0·835; the British, 0·838. When of these densities it contains water, and is capable of dissolving more or less of substances which are insoluble in anhydrous alcohol; while its solvent power, in relation to bodies soluble in that fluid, is sufficient for all practical purposes. Diluted alcohol or proof spirit is often preferable to officinal alcohol; as it is capable of extracting a larger proportion of those active principles of plants which require an aqueous menstruum, at the same time that it is strong enough, in most instances, to prevent spontaneous decomposition, and has the advantages of being cheaper and less stimulating.* The diluted alcohol of the different Pharmacopœias is not of the same strength; that of the United States consisting of equal measures of officinal alcohol and water, and having the sp. gr. 0·941; while that of the British, called *Spiritus Tenuior* or Proof Spirit, has the sp. gr. 0·920. The difference, however, is not very material. Alcohol or rectified spirit is preferred as the solvent, when the substance to be extracted or dissolved is nearly or quite insoluble in water, as in the instances of the resins, guaiac, camphor, and the essential oils. The presence of water is here injurious, not only by diluting the menstruum, but by exercising an affinity for the alcohol which interferes with its solvent power. Thus, water, added to an alcoholic solution of one of these bodies, produces a precipitate by abstracting the alcohol from it. Diluted alcohol or proof spirit is employed, when the substance is soluble both in alcohol and water; or when one or more of the ingredients are soluble in the one fluid, and one or more in the other, as in the case of those vegetables which contain extractive or tannin, or the native salts of the organic alkalies, or gum united with resin or essential oil. As these include the greater number of medicines from which tinctures are prepared, diluted alcohol is most frequently used.

In the preparation of the tinctures, the medicine should be in the dry state, and properly comminuted by being bruised, sliced, or pulverized. It is usually better in the condition of a coarse than of a very fine powder; as in the latter it is apt to agglutinate, and thus present an impediment to the penetration of the menstruum. When several substances differing in solubility are employed, they should be added successively to the spirit, those least soluble first, those most so last; as otherwise the menstruum might become saturated with the ingredient for which it has the strongest affinity, and thus be rendered incapable of dissolving a due proportion of the others.

Until recently, tinctures have been universally prepared by maceration or digestion. The Edinburgh College directed digestion to be continued usually for seven days. Our own Pharmacopœia formerly directed maceration at ordinary temperatures, and extended the period to two weeks. The latter plan was preferable, as it was more convenient and equally effectual, the lower temperature being compensated by the longer maceration. In several instances in which maceration is ordered in our Pharmacopœia, it is still continued for seven days; but the period is very properly altered to suit the character of the substance acted on, and sometimes continued no longer than is necessary for its solution, when it is wholly soluble, as in the tinctures of iodine and tolu. When circumstances require that the tincture should be speedily prepared, digestion may be resorted to. Care should always be taken to keep the vessels well stopped, in order to prevent the evaporation of the alcohol. The materials should be frequently shaken during the digestion or maceration; and this caution is especially necessary when the substance acted on is in the state of powder. The tincture should not be used till the maceration is completed; when it should be separated from the dregs either by simply filtering it through paper, or, when force is requisite, by first expressing it through linen, and subsequently filtering.

* Mr. Wm. Bastick, in a communication to the Pharmaceutical Journal and Transactions, states, as the result of his experience, that most of the tinctures prepared with proof spirit or diluted alcohol undergo deterioration by time, in consequence of acetous fermentation taking place in the alcoholic fluid. The tinctures most prone to this change are those of senna, rhubarb, columbo, henbane, digitalis, bark, hops, aloes, and the compound tincture of cinnamon. The best preventive is to keep them in full and well-closed bottles, at a low temperature. (*Am. Journ. of Pharm.*, xx. 47.)

The plan of preparing tinctures by percolation has recently been extensively adopted; and has been found to answer well when skilfully executed. In the U. S. Pharmacopœia of 1850, and in the late Ed. Pharmacopœia, this mode of preparation was given as an alternative in numerous instances; and would probably have been exclusively recommended in some, except for its liability to fail in inexperienced hands. In the present edition of our national standard, percolation has been adopted as the rule; maceration being directed in a few instances in which it was deemed preferable, and the alternative expressly allowed only in a single tincture, that, namely, of aloes and myrrh. The British Pharmacopœia, preferring maceration or digestion in several instances, has adopted percolation as a general rule; but, as if unprepared to trust this process alone, has combined with it a preliminary maceration of forty-eight hours, and a final expression, so as to separate the last remains of the tincture from the dregs. Perhaps these modifications may be desirable in instances where the operator is insufficiently skilful; but percolation, properly managed, is of itself adequate to all the desired purposes, even to the removal of almost the last drop of impregnated menstruum from the dregs; and, in our Pharmacopœia, it is taken for granted that the apothecary has acquired the requisite skill. Where the operator cannot trust himself in this respect, it would be better to recur to the old method of maceration for two weeks. The reader will find rules for the proper management of the process of percolation at *page* 984. It has been objected to this process that it yields tinctures of variable strength, according to the skill with which it is conducted; but, from numerous experiments performed, in reference to this point, by M. H. Buignet, of Paris, it appears that the tinctures made by percolation are quite as equable in strength as those prepared by maceration, while they uniformly contain more of the soluble matter of the drug in proportion to the quantity of menstruum. The same writer states that he has constantly found three parts of alcohol, used in this method, to one of the material acted on, sufficient almost wholly to exhaust drugs of their soluble matter. He has derived no advantage from the preliminary maceration usually practised. (*Journ. de Pharm.*, Sept. 1857, p. 172.) M. Personne, however, has inferred, from his own observation, that five parts of alcohol are required by most substances. (*Ibid.*, Avril, 1860, p. 274.) Our own Pharmacopœia generally exceeds this. It has been contended in opposition to percolation, applied to the preparation of tinctures, that the menstruum in this process is apt to load itself with substances, which, after the preparation of the tincture, are deposited, carrying down with them more or less of the active matter; but M. Vauflart asserts that more than twenty years of observation has demonstrated to him, that tinctures by displacement, properly filtered, deposit no more than, at the end of a certain period, those deposit prepared by maceration. (*Ibid.*, Avril, 1862, p. 262.) Besides, upon the same authority, this tendency to deposition may be easily obviated by mixing all the liquids proceeding from the percolation, and allowing the mixture to stand for a day before filtering. The tinctures thus obtained are, he states, richer than those furnished by ordinary maceration, and time produces in them only insignificant changes. (*Journ. de Pharm.*, 4e sér., iv. 411, A.D. 1866.) Finally, all agree that the percolated tinctures are apt to contain more of the soluble matter of the drug; and the objections resolve themselves altogether into a question of skill on the part of the operator.

Another mode of exhausting medicines by spirit has been proposed by Dr. H. Burton. It consists in suspending in the solvent, immediately under its surface, the solid matter contained loosely in a bag. The liquid in contact with the bag, becoming heavier by impregnation with the matters dissolved, sinks to the bottom; its place is supplied with a fresh portion, which in its turn sinks; and thus a current is established, which continues until the solid substance is exhausted, or the liquid saturated. During the maceration, the bag should be occasionally raised above the surface of the liquor in the bottle, allowed to drain, and then again immersed. It is asserted that the period of maceration is much shortened in this way. (*Lond. Med. Gaz.*, Aug. 30, 1844.)*

* For this mode of preparing tinctures, Mr. Samuel Gale has proposed the use of a cylindrical stoneware vessel, with a diaphragm capable of being supported at different heights by projections

Tinctures, prepared by adding alcohol to the expressed juices of plants, have been long in use on the Continent of Europe, and have been brought into notice in Great Britain. They are sometimes called in England *preserved vegetable juices.* The tinctures of some of the narcotic plants might no doubt be advantageously prepared in this way, as those of conium, hyoscyamus, and belladonna. Mr. Squire and Mr. Bentley have paid particular attention to these preparations. According to Mr. Squire, the leaves only of the plants should be used, and, in the case of biennial plants, those exclusively of the second year; and they should be preferably collected when the plant is in full flower. Mr. Bentley recommends the following mode of preparation. To the expressed juice, after it has stood for 24 hours, and deposited its feculent matter, alcohol of 0·838 is to be added in the proportion of one part by measure to four of the juice; and, after another period of 24 hours, the liquor is to be filtered. This proportion of alcohol has been found sufficient for the preservation of the juice, while it causes the precipitation of the suspended mucilaginous matter. But, though these preserved juices are often energetic, yet it is obvious that tinctures prepared from the fresh plant must be still more so; as they contain necessarily not only the soluble active matter of the juice, but that also which, when the juice is expressed, is left in the solid residue of the plant. . Three of them have been introduced into the British Pharmacopœia, under the name simply of *Succi* or *Juices.*

Tinctures should be kept in bottles accurately stopped, in order to prevent evaporation, which might, in some instances, be attended with serious inconvenience, by increasing their strength beyond the officinal standard.*

Medicines are most conveniently administered in tincture, which act in small doses; as the proportion of alcohol in which they are dissolved is insufficient to produce an appreciable effect. Those which must be given in large doses should be cautiously employed in this form, lest the injury done by the menstruum should more than counterbalance their beneficial operation. This remark is particularly applicable to chronic cases, in which the use of tinctures is apt to lead to the formation of habits of intemperance. The tinctures of the weaker medicines are more frequently given as adjuvants of other remedies than with the view of obtaining their own full effects upon the system.

The following general directions are given in the *U. S. Pharmacopœia.*

"When tinctures are prepared by percolation, great care should be taken to observe the directions given at page 3 [*page* 984 of this Dispensatory], so that the substances treated may be, as far as possible, exhausted of their soluble principles, and a perfectly clear tincture obtained. When prepared by maceration, they require to be frequently shaken during the process, which should be conducted in glass bottles well stopped."

The officinal Preparations formerly belonging to this class, which have been omitted in the present U. S. and Br. Pharmacopœias, are *Tinctura Ammoniæ Composita,*

from the inner surface of the jar, with corresponding notches in the diaphragm, to permit its easy passage to the lower ledges. The material is to be placed upon the diaphragm, and kept covered with the menstruum. (See *Am. Journ. of Pharm.*, xxii. 381, from *Pharm. Journ.*) The infusion jars described and figured in a note in *page* 1262 may be used also for preparing tinctures by maceration.

The following is a table showing the mode in which the tinctures of the medicines enumerated should be prepared, in the opinion of the Society of Pharmacy of Paris, as given at their session on June 25, 1862.

By Percolation with alcohol of 60°.	*By Percolation with alcohol of* 80°.	*By Maceration with alcohol of* 60°.	*By Maceration with alcohol of* 80°.	*By Maceration with alcohol of* 90°.
Belladonna.	Valerian.	Aloes.	Castor.	Assafetida.
Conium.	Cinnamon.	Arnica flowers.	Columbo.	Balsam of Peru.
Hyoscyamus.	Red Cinchona.	Catechu.	Colchicum Seed.	Balsam of Tolu.
Stramonium.	Yellow Cinchona.	Colchicum bulbs.	Cloves.	Benzoin.
Digitalis.		Gentian.	Ginger.	Ammoniac.
Quassia.		Ipecacuanha.	Jalap.	Myrrh.
Pale Cinchona.		Musk.	Nux Vomica.	Scammony.
Rhatany.		Rhubarb.	Saffron.	
Senna.		Squill.	Vanilla.	

* There is always more or less loss of alcohol during the performance of the officinal directions in making a tincture. For a table giving the amount of this loss in the British processes, see *Pharm. Journ. and Trans.*, Oct. 1870, p. 321. (*Note to the fourteenth edition.*)

Lond.; *Essentia Carui*, Dub.; *Tinct. Cassiæ*, Ed.; *Tinct. Castorei Ammoniata*, Ed.; *Tinct. Cinchonæ Pallidæ*, Lond.; *Tinct. Cinnamomi Comp.*, U.S., Lond., Ed., Dub.; *Tinct. Colchici Comp.*, Lond.; *Tinct. Cuspariæ*, Ed.; *Essentia Fœniculi*, Dub.; *Tinct. Lactucarii*, Ed.; *Tinct. Matico*, Dub.; *Essentia Myristicæ Moschatæ*, Dub.; *Essentia Pulegii*, Dub.; *Essentia Pimentæ*, Dub.; *Tinct. Quassiæ Comp.*, Ed.; *Tinct. Rhei Comp.*, Lond., Dub.; *Tinct. Rhei et Gentianæ*, U.S., Ed.; *Essentia Rosmarini*, Dub.; *Tinct. Sennæ Comp.*, Ed.; and *Tinct. Sennæ et Jalapæ*, U.S. The *Tinct. Camphoræ*, U.S., Ed., Dub., the *Tinct. Olei Menthæ Piperitæ*, U.S., and the *Tinct. Olei Menthæ Viridis*, U.S., have been transferred to the Spirits with changed names, and some change of strength; while the *Tinct. Saponis Camphorata*, U.S., has been placed among the *Liniments* with the altered name of *Linimentum Saponis*.

TINCTURA ACONITI RADICIS. *U.S.* TINCTURA ACONITI. *Br.* *Tincture of Aconite Root.*

"Take of Aconite Root, in fine powder, *twelve troyounces;* Alcohol *a sufficient quantity*. Moisten the powder with six fluidounces of Alcohol, pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it until two pints of tincture are obtained." *U.S.*

"Take of Aconite Root, in coarse powder, *two ounces and a half* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Macerate the Aconite Root for forty-eight hours, in *fifteen* [*fluid*]*ounces* of the Spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and, when the fluid ceases to pass, continue the percolation with the remaining five [fluid]ounces of Spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient Rectified Spirit to make one pint [Imp. meas.]." *Br.*

The tincture of the U.S. Pharmacopœia has three times the strength of the British. It is much stronger than that of the leaves, and too much caution cannot be observed to avoid mistaking one for the other. In preparing it, each step of the process must be carefully attended to. The root should be thoroughly comminuted, and very carefully packed in the percolator, and the displacing menstruum very gradually added. As annoyance is often occasioned in powdering aconite by the irritating dust which is apt to rise, it is best prepared by grinding in a mill; and, if the operator does not happen to have such an instrument at his command, Prof. Procter suggests that sufficient alcohol should be added to the root in a mortar, to prevent the rising of the dust. (*Am. Journ. of Pharm.*, March, 1861, p. 103.) The dose to begin with is from three to five drops, which may be repeated three times a day, and gradually increased, if necessary, until its peculiar effects are experienced. That of the British tincture is three times as much. We would here repeat the caution, already given when treating of Aconite in the first part of this work, that physicians should be careful, in prescribing the tincture of aconite, to give the whole name. The external use of the tincture requires care, as serious symptoms have followed its too free employment. (Case, *Bost. Med. and Surg. Journ.*, Feb., 1872, p. 74.)* W.

TINCTURA ALOËS. *U.S., Br.* *Tincture of Aloes.*

"Take of Socotrine Aloes, in fine powder, a *troyounce;* Liquorice [extract] *three troyounces;* Alcohol *half a pint;* Distilled Water *a pint and a half.* Macerate for seven days, and filter through paper." *U.S.*

"Take of Socotrine Aloes, in coarse powder, *half an ounce* [avoirdupois]; Extract of Liquorice *one ounce and a half* [avoird.]; Proof Spirit *a sufficiency.* Macerate the Aloes and Extract of Liquorice in fifteen fluidounces of the Spirit for seven days, in a closed vessel, with occasional agitation, then filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

* The tincture proposed by Dr. Fleming should always be expressly designated when prescribed. It is considerably stronger than the officinal; and several deaths have occurred from the use of it. The following is his formula. Take of the root, carefully dried and finely powdered, *sixteen* (*troy*) *ounces;* Alcohol *sixteen fluidounces.* Macerate for four days, put into a percolator, and add alcohol until twenty-four fluidounces are obtained. Not more than five drops of this should be given as a commencing dose, to be increased till its peculiar effects are experienced.

Prof. Procter proposes, in order to obtain a strong tincture, and at the same time completely to exhaust the root, to continue the percolation until 50 or 100 per cent. more of the filtered liquor is obtained than is wanted, and then to reduce this to the proper measure by means of a water-bath. (*Note to the eleventh edition.*)

The original tincture of aloes of the U. S. Pharmacopœia was prepared with the officinal diluted alcohol, without the addition of water. At present it is little more than an infusion, with the addition of sufficient alcohol to prevent spontaneous decomposition. But, while this change has been made in the U. S. formula, so as to produce conformity with the British Colleges, in the late construction of the British Pharmacopœia, the old formula was abandoned, and the one forsaken by us adopted. The liquorice is in both formulas added to cover the taste of the aloes; but it answers the end imperfectly, and the preparation, on account of its unpleasant bitterness, is little used, aloes being generally administered in the form of pill. M. Menière says of the tincture of aloes that it deposits crystals of aloïn, which adhere to the sides of the bottle, and in the upper part of it a yellow resinous matter. (*Journ. de Pharm.*, Avril, 1861, p. 289.) The dose as a purgative is from half a fluidounce to a fluidounce and a half, as a laxative from one to two fluidrachms. Tincture of aloes is highly recommended by M. Delioux as a local remedy in old atonic ulcers, bed-sores, and suppurating wounds, to which it may be applied on lint. (*Pharm. Journ.*, July, 1864, p. 38.) W.

TINCTURA ALOËS ET MYRRHÆ. *U. S.* TINCTURA ALOES COMPOSITA. *Lond.* *Tincture of Aloes and Myrrh.*

"Take of Socotrine Aloes, in moderately fine powder, Myrrh, in moderately fine powder, each, *three troyounces;* Alcohol *a sufficient quantity.* Mix the powders, and, having moistened the mixture with two fluidounces of Alcohol, pack it moderately in a conical percolator, and gradually pour Alcohol upon it until two pints of tincture are obtained. This Tincture may also be prepared by macerating the powders with two pints of Alcohol for seven days, and filtering through paper." *U. S.*

This tincture is a modification of the *elixir proprietatis* of Paracelsus. Saffron, which was long retained in compliance with former prejudices, can add little to the efficacy of a preparation; and, being very expensive, has with great propriety been omitted in the U. S. formula. It served, however, to impart a richness to the tincture, the want of which might be considered a defect by those accustomed to its use.

The tincture is purgative, tonic, and emmenagogue, and is considerably employed in chlorosis, and other disordered states of health in females, connected with suppressed, retained, or deficient menstruation, and with a constipated state of bowels. It may also be used as a stomachic laxative in cold, languid habits, independently of menstrual disorder. The dose is from one to two fluidrachms. W.

TINCTURA ARNICÆ. *U. S., Br.* *Tincture of Arnica.*

"Take of Arnica [flowers] *six troyounces;* Alcohol *a pint and a half;* Water *half a pint;* Diluted Alcohol *a sufficient quantity.* Mix the Alcohol and Water, and, having moistened the Arnica slightly with the mixture, bruise it thoroughly in a mortar. Then pack it firmly in a cylindrical percolator, and pour upon it the remainder of the mixture, and afterwards Diluted Alcohol, until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* gives directions for preparing this Tincture from *an avoirdupois ounce* of Arnica Root, in coarse powder, and *an Imperial pint* of rectified Spirit, precisely the same as those for preparing Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

In the article upon Arnica in *Part* I., it is stated that arnica is poisonous in overdoses, and a case is referred to in which death was attributed to it, though somewhat doubtfully. In the *Lancet* for Nov. 19, 1864 (page 570), Mr. H. Bertin, house surgeon of St. Mary's Hospital, gives the details of a case, in which a middle-aged man was brought into the hospital ten hours after having taken by mistake an ounce of tincture of arnica, intended for use as a lotion. He was in a state approaching collapse, with sunken and glassy eyes, dilated and insensible pupils, pulse fluttering and over a hundred, skin cold but dry, low and wiry voice, and severe pain in the epigastrium, which was the first striking symptom that he had experienced, and had come on upon awaking from sleep, about eight hours after he swallowed the poison. The mind was apparently clear. Though in great danger, he recovered, under the use of opium and brandy with external heat.

Either alone, or diluted with water, soap liniment, &c., tincture of arnica is often applied popularly to bruises, sprains, tumours, and local rheumatic pains, under the impression that it has extraordinary healing powers. It probably acts favourably in some instances as a gentle irritant. In some skins it produces a violent eczematous inflammation. If given internally, the dose would be from ten to thirty minims, increased until some effect was produced. W.

TINCTURA ASSAFŒTIDÆ. *U. S., Br. Tincture of Assafetida.*

"Take of Assafetida, bruised, *four troyounces;* Alcohol *two pints.* Macerate for fourteen days, and filter through paper." *U. S.*

"Take of Assafœtida, in small fragments, *two ounces and a half* [avoirdupois]; Rectified Spirit *a sufficiency.* Macerate the Assafœtida in fifteen fluidounces of the Spirit for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient Rectified Spirit to make one pint [Imperial measure]." *Br.*

This tincture becomes milky on the addition of water, in consequence of the separation of the resin. It possesses all the virtues of assafetida. The dose is from thirty minims to a fluidrachm.

Off. Prep. Suppositoria Assafœtidæ. *U. S.* W.

TINCTURA AURANTII. *U. S., Br. Tincture of Orange Peel.*

"Take of Bitter Orange Peel, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

"Take of Bitter Orange Peel, cut small and bruised, *two ounces* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, and filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

It is the peel of the Seville orange which is directed in this process; and the outer part only should be used, the inner whitish portion being inert. The substitution of fresh for dried orange peel has been proposed in England, and its propriety considerably discussed. (See *Pharm. Journ. and Trans.*, Nov. 9, 1872, also April 4, 1874.) Indeed it has met with so much favour as to be introduced among the Addenda to the Pharmacopœia. The general opinion appears to be that the tincture from the fresh peel is less powerful as a bitter than the older one, but is much superior in aroma and flavour. Six ounces of the fresh peel have been found to yield only two ounces of the dried peel, and are, therefore, required to make a pint of the tincture. The tincture of orange peel is employed as a grateful addition to infusions, decoctions, and mixtures. The dose is one or two fluidrachms.

Off. Prep. Mistura Ferri Aromatica, *Br.;* Syrupus Aurantii, *Br.;* Tinctura Quiniæ, *Br.* W.

TINCTURA AURANTII RECENTIS. *Br. Tincture of Fresh Orange Peel.*

"Take of Bitter Orange, Rectified Spirit, of each, *a sufficiency.* Carefully cut from the orange the coloured parts of the rind in thin slices, and macerate six ounces of this in a pint of the spirit for a week, with frequent agitation. Then pour off the liquid, press the dregs, mix the liquid products, and filter; finally, add sufficient Spirit to make one pint." *Br.*

Dose, one to two fluidrachms. H. C. W.

TINCTURA BELLADONNÆ. *U. S., Br. Tincture of Belladonna.*

"Take of Belladonna Leaf, recently dried and in fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it firmly in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* directs this Tincture to be prepared from *one avoirdupois ounce* of Belladonna Leaves, in coarse powder, and *one Imperial pint* of Proof Spirit, in the same manner precisely as the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.) "This Tincture has about half the strength of Tinctura Belladonnæ, *Lond., Dub.*" *Br.*

According to Menière, this tincture deposits on standing a gray pulverulent substance, starch and gum, and cubical crystals of an undetermined character. (*Journ. de Pharm.*, Avril, 1861, p. 289.) The U.S. tincture is an efficient preparation when made from the recently dried leaves; but the imported leaves are of very uncertain strength, and a tincture prepared from them is to be less relied upon than the extract. The dose is from fifteen to thirty drops. That of the British tincture is at least twice as much. W.

TINCTURA BENZOINI. *U.S.* *Tincture of Benzoin.*

"Take of Benzoin, in moderately coarse powder, *six troyounces;* Alcohol *two pints.* Macerate for seven days, and filter through paper." *U.S.*

This tincture may be exhibited in doses of twenty drops to half a fluidrachm, but was, no doubt, introduced into the Pharmacopœia chiefly or solely for the purpose of making the ointment.

Off. Prep. Unguentum Benzoini, *U.S.* H. C. W.

TINCTURA BENZOINI COMPOSITA. *U.S., Br.* *Compound Tincture of Benzoin.*

"Take of Benzoin, in coarse powder, *three troyounces;* Socotrine Aloes, in coarse powder, *half a troyounce;* Storax *two troyounces;* Balsam of Tolu *a troyounce;* Alcohol *two pints.* Macerate for seven days, and filter through paper." *U.S.*

"Take of Benzoin, in coarse powder, *two ounces* [avoirdupois]; Prepared Storax *one ounce and a half* [avoird.]; Balsam of Tolu *half an ounce* [avoird.]; Socotrine Aloes *one hundred and sixty grains;* Rectified Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient Rectified Spirit, if required, to make one pint [Imp. meas.]." *Br.*

This tincture is a stimulating expectorant, occasionally used in chronic catarrhal affections. It has been recommended also in chronic dysentery, with a view to its alterative action on the ulcerated surface of the colon; but it is most employed as a local application to indolent ulcers, chapped nipples, &c. It has been found useful injected into the nostrils in obstinate epistaxis. (*Braithwaite*, No. 37, p. 58.) It is the *balsamum traumaticum* of the older Pharmacopœias, and may be considered as a simplified form of certain complex compositions, such as *baume de commandeur*, *Wade's balsam*, *Friar's balsam*, *Jesuits' drops*, *&c.*, which were formerly in repute, and are still esteemed among the vulgar as pectorals and vulneraries. It is also an ingredient in *Turlington's balsam*, which is a popular remedy in this country for the same purposes.* It is scarcely necessary to state that the application of these preparations to fresh wounds must frequently prove injurious, by inducing too much inflammation, and thus preventing union by the first intention. The compound tincture of benzoin is decomposed by water. The dose is from thirty minims to two fluidrachms. A variety of *court plaster* is made by applying to black silk, by means of a brush, first a solution of isinglass, and afterwards an alcoholic solution of benzoin. W.

TINCTURA BUCHU. *Br.* *Tincture of Buchu.*

This Tincture is directed, in the *British Pharmacopœia*, to be prepared from *two and a half avoirdupois ounces* of Buchu Leaves, in coarse powder, and *one Imperial pint* of Proof Spirit, in the same manner precisely as Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture has the virtues of buchu leaves, and may be given in the dose of from one to four fluidrachms, either simply diluted with water, or as an addition to the infusion of the leaves. W.

TINCTURA CALUMBÆ. *U.S., Br.* *Tincture of Columbo.* *Tincture of Calumba. Br.*

"Take of Columbo, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol,

* The following is the formula for *Turlington's balsam* adopted by the Philadelphia College of Pharmacy. "Take of Alcohol Oviij, Benzoin ℥xij, Liquid Storax ℥iv, Socotrine Aloes ℥j, Peruvian Balsam ℥ij, Myrrh ℥j, Angelica Root ℥ss, Balsam of Tolu ℥iv, Extract of Liquorice Root ℥iv. Digest for ten days, and strain." (*Journ. of the Phil. Col. of Pharm.*, v. 28.)

transfer it to a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* directs this Tincture to be prepared from *two and a half avoirdupois ounces* of Calumba Root, cut small, and *one Imperial pint* of Proof Spirit, in the same manner precisely as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

The tincture of columbo of the U. S. Pharmacopœia was, with great propriety, considerably increased in strength at the revision of 1840. The larger the proportion of the tonic is to the alcohol in these bitter tinctures, the better are they calculated to meet the indications for which they are usually prescribed. When the proportion is very small, the tonic power of the bitter is lost in the stimulant influence of the alcohol. Mr. Jos. Ince recommends that the tincture should be prepared from the root as found in the shops, without further slicing or powdering it. Made as he proposes, the tincture is clear and bright; while if the powdered root is used it will be very turbid, even after filtration. (*Pharm. Journ.*, xiv. 491.) The tincture of columbo may be added to tonic infusions or decoctions, to increase their stimulant power; but, like all the other bitter tinctures, should be used with caution. The dose is from one to four fluidrachms. W.

TINCTURA CANNABIS. *U. S.* Tinctura Cannabis Indicæ. *Br. Tincture of Hemp. Tincture of Indian Hemp.*

"Take of Extract of Indian Hemp *three hundred and sixty grains;* Alcohol *a pint.* Dissolve the Extract in the Alcohol, and filter through paper." *U. S.*

"Take of Extract of Indian Hemp *one ounce* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Dissolve the Extract of Hemp in the Spirit." *Br.*

The American reader must take care not to confound the Indian Hemp, here alluded to, with Apocynum Cannabinum, known by the same name in this country. The dose, equivalent to a grain of the extract, is twenty-two minims or about forty drops, to be gradually increased till its effects are experienced. W.

TINCTURA CANTHARIDIS. *U. S., Br. Tincture of Cantharides. Tincture of Spanish Flies.*

"Take of Cantharides, in fine powder, *a troyounce;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with half a fluidounce of Diluted Alcohol, pack it in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

"Take of Cantharides, in coarse powder, *one-quarter of an ounce* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, strain, press, filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

This tincture is one of the most convenient forms for the internal use of Spanish flies, the virtues of which it possesses to their full extent. (See *Cantharis.*) When long kept it deposits fatty matter, cantharidin in rhomboidal tables, and other crystals of a quite different form. (Menière, *Journ. de Pharm.*, Avril, 1861, p. 289.) It is occasionally employed externally as a rubefacient; but its liability to vesicate should be taken into consideration. The British tincture is too feeble; containing the virtues of only 0·68 of a grain of cantharides in a fluidrachm. The dose of the U. S. tincture is from twenty drops to a fluidrachm, repeated three or four times a day. W.

TINCTURA CAPSICI. *U. S., Br. Tincture of Capsicum. Tincture of Cayenne Pepper.*

"Take of Capsicum, in fine powder, *a troyounce;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with half a fluidounce of Diluted Alcohol, pack it in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* directs this tincture to be prepared from *three-quarters of an avoirdupois ounce* of Bruised Capsicum Fruit, and *one Imperial pint* of Rectified Spirit, in the same manner precisely as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This preparation of capsicum is a useful stimulant in very low states of the system with gastric insensibility, as in malignant scarlet and typhus fevers, and in the cases of drunkards. It may also be used as a gargle, diluted with rose-water or some mucilaginous fluid. (See *Capsicum.*) Applied by means of a camel's-hair pencil to the relaxed uvula, it sometimes produces contraction, and relieves prolapsus of that part. The dose is one or two fluidrachms. W.

TINCTURA CARDAMOMI. *U. S. Tincture of Cardamom.*

"Take of Cardamom, in fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

This tincture is an agreeable aromatic, and may be advantageously added to tonic and purgative infusions. The dose is one or two fluidrachms. W.

TINCTURA CARDAMOMI COMPOSITA. *U. S., Br. Compound Tincture of Cardamom.*

"Take of Cardamom, in moderately fine powder, *three hundred and sixty grains;* Caraway, in moderately fine powder, *one hundred and twenty grains;* Cinnamon, in moderately fine powder, *three hundred grains;* Cochineal, in moderately fine powder, *sixty grains;* Clarified Honey *two troyounces;* Diluted Alcohol *a sufficient quantity.* Mix the powders, and, having moistened the mixture with half a fluidounce of Diluted Alcohol, pack it in a cylindrical percolator, and gradually pour Diluted Alcohol upon it until two pints and six fluidounces of tincture are obtained. Lastly, mix this with the Clarified Honey, and filter through paper." *U. S.*

The *British Pharmacopœia* takes of Cardamom Seeds, freed from the pericarps and bruised, and Caraway Fruit, bruised, each, *a quarter of an avoirdupois ounce;* Raisins, freed from their seeds, *two avoirdupois ounces;* Cinnamon Bark, bruised, *half an avoirdupois ounce;* Cochineal, in powder, *sixty grains;* and Proof Spirit *one Imperial pint;* and directs that the tincture should be prepared in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This is a very agreeable aromatic tincture, occasionally used as a carminative in the dose of one or two fluidrachms, but more frequently as an addition to mixtures, infusions, &c., which it renders pleasant to the taste, and acceptable to the stomach. The substitution of honey in the present U. S. formula for the raisins in that of 1850, may be regarded as an improvement, at least in a pharmaceutical point of view, as it facilitates the process, and, considering the unequal quality of raisins, gives more precision to the result.

Off. Prep. Decoctum Aloes Compositum, *Br.;* Mistura Ferri Aromatica, *Br.;* Mistura Sennæ Composita, *Br.;* Tinctura Chloroformi Composita, *Br.* W.

TINCTURA CASCARILLÆ. *Br. Tincture of Cascarilla.*

The *British Pharmacopœia* directs this Tincture to be prepared from *two and a half avoirdupois ounces* of bruised Cascarilla, and *one Imperial pint* of Proof Spirit, in the same manner precisely as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture has the properties of cascarilla, but is seldom if ever used in this country. The dose is from thirty minims to two fluidrachms. W.

TINCTURA CASTOREI. *U. S., Br. Tincture of Castor.*

"Take of Castor, bruised, *two troyounces;* Alcohol *two pints.* Macerate for seven days, express, and filter through paper." *U. S.*

"Take of Castor, in coarse powder, *one ounce* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient Rectified Spirit to make one pint [Imp. meas.]." *Br.*

As castor yields little if any of its virtues to water, alcohol is a better solvent than proof spirit. It is said also to form a more grateful preparation. The Russian castor should always be preferred when attainable. It deposits on standing a yellow organic substance, which, when moistened with water, exhibits animalcules under the microscope. (*Menière.*) This tincture is employed for the same purposes as castor in substance. The dose is from thirty minims to two fluidrachms. W.

TINCTURA CATECHU. *U. S., Br. Tincture of Catechu.*

"Take of Catechu, in moderately fine powder, *three troyounces;* Cinnamon, in moderately fine powder, *two troyounces;* Diluted Alcohol *a sufficient quantity.* Mix the powders, and, having moistened the mixture with a fluidounce of Diluted Alcohol, pack it in a conical glass percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

"Take of Pale Catechu, in coarse powder, *two and a half ounces* [avoirdupois]; Cinnamon Bark, bruised, *one ounce* [avoird.]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient proof spirit to make one pint [Imp. meas.]." *Br.*

This is a grateful astringent tincture, useful in all cases to which catechu is applicable, and in which small quantities of spirit are not objectionable. It may often be advantageously added to cretaceous mixtures in diarrhœa. The dose is from thirty minims to three fluidrachms, which may be given with sweetened water or some mucilaginous liquid, or in port wine when this is not contraindicated. Like the tincture of kino, this is said sometimes to gelatinize when kept. In this state it is unfit for use. W.

TINCTURA CHIRATÆ. *Br. Tincture of Chiretta.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Chiretta, cut small and bruised, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This is a tonic tincture, and may be given in the dose of one or two fluidrachms, three or four times a day. W.

TINCTURA CHLOROFORMI COMPOSITA. *Br. Compound Tincture of Chloroform.*

"Take of Chloroform *two fluidounces;* Rectified Spirit *eight fluidounces;* Compound Tincture of Cardamoms *ten fluidounces.* Mix." *Br.*

A convenient form for the internal use of chloroform. The dose is from twenty minims to a fluidrachm diluted with water. W.

TINCTURA CINCHONÆ. *U. S.* TINCTURA CINCHONÆ FLAVÆ. *Br. Tincture of Cinchona. Tincture of Yellow Cinchona. Tincture of Peruvian Bark.*

"Take of Yellow Cinchona, in moderately fine powder, *six troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it firmly in a glass percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *four avoirdupois ounces* of Yellow Cinchona Bark, in moderately fine powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture is very properly made with a large proportion of bark; as, in the bitter tinctures, it is important that the alcohol should bear as small a proportion to the tonic principle as possible. Even when strongest, however, it cannot, in ordinary cases, be given in doses sufficiently large to obtain the full effect of the bark, without stimulating too highly. A deposit is apt to form in the tincture when kept, consisting in chief of cinchonic red holding probably a portion of the alkaloids in combination. This was found by Mr. J. Adams to be perfectly dissolved by heat, though it uniformly reappeared on the cooling of the tincture. The addition of diluted sulphuric acid did not cause its solution; and, even though it was removed by filtering the tincture, the deposition was afterward renewed. (*Pharm. Journ.*, April, 1868, p. 470.) In reference to a mode of in some measure obviating this tendency to deposition, the reader is referred to the statements of M. Vauflart on the subject of deposition in the tinctures prepared by percolation. Mr. A. B. Taylor, in experimenting on this subject, prepared a tincture in which the menstruum consisted of two parts of alcohol, one part of water, and one of glycerin, and which was kept three months without undergoing deposition. (*Am. Journ. of Pharm.*, Jan. 1865, p. 50.) This suggests the addition of glycerin to the officinal formula, should further observation

prove the action of this solvent to be permanent. Tincture of cinchona is used chiefly as an adjunct to the infusion or decoction of bark, or the solution of sulphate of quinia, to a dose of which it may be added in the quantity of from one to four fluidrachms. W.

TINCTURA CINCHONÆ COMPOSITA. *U. S., Br. Compound Tincture of Cinchona. Compound Tincture of Peruvian Bark.*

"Take of Red Cinchona, in moderately fine powder, *four troyounces;* Bitter Orange Peel, in moderately fine powder, *three troyounces;* Serpentaria, in moderately fine powder, *three hundred and sixty grains;* Alcohol, Water, each, *a sufficient quantity.* Mix three measures of Alcohol with one of Water. Having mixed the powders, moisten them with four fluidounces of the menstruum, pack them firmly in a conical glass percolator, and gradually pour on the menstruum until two pints and a half of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes of Pale Cinchona Bark, in moderately fine powder, *two avoirdupois ounces*, Bitter Orange Peel, cut small and bruised, *one avoirdupois ounce*, Serpentaria, bruised, *half an avoirdupois ounce*, Saffron *sixty grains*, Cochineal, in powder, *thirty grains*, and Proof Spirit *one Imperial pint;* and proceeds, with these ingredients, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This is the preparation commonly known by the name of *Huxham's tincture of bark.* It is unfortunate that the British Council, following the London and Dublin Colleges, should have selected the feeblest of the officinal varieties of bark for this important tincture. The compound tincture of bark is an excellent stomachic cordial, and, though too feeble in the principles of cinchona to serve as a substitute for that tonic when its full effect is required, may be very usefully employed as an addition to the decoction or infusion, or to the salts of quinia, in low forms of fever, particularly in malignant intermittents and remittents. Huxham was in the habit of uniting with it the *elixir of vitriol*, the aromatic sulphuric acid of the Pharmacopœias. The dose is from one to four fluidrachms.

Under the name of *tinctura cinchonæ ferrata*, a preparation has been considerably employed in Philadelphia for which the following formula is given by Mr. Samuel Simes, in the *Am. Journ. of Pharm.* (xxv. 402). With *one gallon* of the compound tincture of bark, *one ounce* of hydrated sesquioxide of iron, dried at a temperature not exceeding 130° F., is digested, and the liquor filtered. The tannic acid is removed by the iron forming an insoluble tannate, which with the excess of oxide is separated by the filtration. In order not to lose any portion of the alkaloids which may adhere to the precipitate, this is to be well washed with boiling alcohol, the solution evaporated to dryness, the product dissolved in a little water acidulated with citric acid, and added to the filtered liquor. Lastly, *sixteen grains* of ammonio-citrate of iron are to be added to each fluidounce of the tincture. The dose is a fluidrachm.* W.

TINCTURA CINNAMOMI. *U.S., Br. Tincture of Cinnamon.*

"Take of Cinnamon, in fine powder, *three troyounces;* Alcohol, Water, each, *a*

* Prof. Procter observes of this preparation that, in consequence of the cincho-tannic acid not being entirely removed by the dry sesquioxide, the preparation blackens upon standing. He proposes to substitute for the sesquioxide in a dried state, the same freshly precipitated, washed, and pressed strongly between folds of bibulous paper. (*Note to the eleventh edition.*)

Ferrated Elixir of Cinchona. A formula, by Mr. J. T. Shinn, for a preparation under this name, said to be in considerable use, will be found in the *American Journal of Pharmacy* for May, 1862 (p. 204).

Elixir Cinchonæ Flavæ. The following preparation has been much used in this city, and other parts of the U. States. The formula is that of Mr. A. B. Taylor, and is taken from the *Am. Journ. of Pharm.* (Jan. 1859, p. 18). "Take of Yellow Cinchona 4 *ounces;* Orange Peel, recently dried, 2 *ounces;* Ceylon Cinnamon, Coriander Seeds, each, *an ounce;* Anise, Caraway, Cardamom, Cochineal, each, 120 *grains;* Brandy *two pints and a half;* Syrup *two pints and a half;* Alcohol and Water, each, *a sufficient quantity.* Reduce the dry substances to moderately fine powder; mix the Brandy with its bulk of water; moisten the powder with four fluidounces of the mixture; and pack it in a conical percolator. Pour on the remainder of the liquid, and continue the percolation with a mixture of one part of alcohol to three parts of water, until six and a half pints of tincture are obtained; then add the syrup and mix them." This is an elegant aromatic tonic, extensively used as an adjuvant of other medicines, and alone as a mild stimulant aromatic tonic. The dose is from one to three fluidounces. (*Note to the twelfth edition.*)

sufficient quantity. Mix two measures of Alcohol with one of Water. Moisten the powder with a fluidounce of the mixture, pack it moderately in a conical percolator, and gradually pour the mixture upon it until two pints of filtered liquor are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Cinnamon Bark, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture has the aromatic and astringent properties of cinnamon, and may be used as an adjuvant to cretaceous mixtures, and astringent infusions or decoctions. By long keeping it is apt to undergo such alterations as to unfit it for use. According to Mr. Greenish, this can be remedied by using a menstruum composed of six parts of alcohol and two parts of water. (*Pharm. Journ. and Trans.*, Feb. 1872, p. 641.) The dose is from one to three or four fluidrachms.

Off. Prep. Infusum Digitalis, *U. S.* W.

TINCTURA COCCI. *Br.* *Tincture of Cochineal.*

"Take of Cochineal, in powder, *two ounces and a half* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

This is valued chiefly for imparting colour to liquid preparations. It may, however, be given internally in nervous affections in doses varying from twenty drops to a fluidrachm. W.

TINCTURA COLCHICI. *U. S.* Tinctura Colchici Seminum. *Br.* *Tincture of Colchicum.* *Tincture of Colchicum Seeds.*

"Take of Colchicum Seed, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a cylindrical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of bruised Colchicum Seeds, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

It was at one time supposed that the tincture was quite as effective made from the unbruised as the bruised seeds, and corresponding advice was given under Colchici Semen, in the first part of this work; but the opinion has been shown to be erroneous. (*Am. Journ. of Pharm.*, xxvi. 120.) Mr. Maisch recommends, as a convenient method of comminuting the seeds, to macerate them for two or three days in a portion of the menstruum, then to remove them and bruise them in a clean iron mortar; taking care that none of the menstruum or the seeds should be wasted. (*Ibid.*, xxviii. 514.)

This tincture possesses the active properties of colchicum, and may be given whenever that medicine is indicated; but the wine, which contains less alcohol, is generally preferred. The dose is from half a fluidrachm to two fluidrachms. The tincture is sometimes used as an embrocation in rheumatic, gouty, and neuralgic pains. W.

TINCTURA CONII. *U. S.*, *Br.* Tinctura Conii Fructus. *Br.* 1864. *Tincture of Hemlock.* *Tincture of Hemlock Fruit.* *Tincture of Conium.*

"Take of Conium Leaves, recently dried and in fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it firmly in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of bruised Hemlock Fruit, and *one Imperial pint* of Proof Spirit, and proceeds as directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

The tincture of hemlock necessarily partakes of the uncertainty of the dried leaves from which it is prepared. There can be little doubt that the tincture of the British Pharmacopœia, made from the recent fruit, is the more efficient. A preparation, made by adding one measure of alcohol to three of the expressed juice, has been used

in England under the name of *preserved juice of hemlock*, and has been adopted in the British Pharmacopœia with the title of *Succus Conii* or *Juice of Hemlock.* (See *page* 1464.) The Pharmacopœias have very properly excluded cardamom from the preparation; as it can have little influence upon its medical effects, and tends to obscure the odour which is an indication of the activity of the tincture. A strong odour of conia should be emitted by the tincture upon the addition of potassa. M. Menière states that it lets fall, on standing, a yellow miliary deposit, resembling drops of oil, the form of which is modified under pressure. The dose is from thirty minims to a fluidrachm.

From recent experiments by Dr. John Harley, of London, there is reason to think that the tincture is nearly inert, or at least not to be relied on as a remedial means in any ordinary dose. Of a tincture carefully prepared from the seeds, according to the British officinal directions, Dr. Harley took himself at different times quantities varying from half a fluidrachm to two fluidounces, beginning with the smaller and gradually increasing to the larger dose, without any observable effect except a stimulant action from the large quantities of alcohol. (*Pharm. Journ.*, Jan. 1867, p. 414.) As the same experimenter obtained very decided sedative effect from the juice of hemlock in comparatively small doses, and as the tincture gave decided evidences of containing conia, the only inference to be drawn from these experiments is that the sedative action of the conium is neutralized by the stimulation of the alcohol; and consequently that the tincture is not an eligible preparation. W.

TINCTURA CROCI. *Br. Tincture of Saffron.*

The *British Pharmacopœia* takes *one avoirdupois ounce* of Saffron, and *one Imperial pint* of Proof Spirit, and proceeds as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture possesses all the properties of saffron; but is of little other use than to give colour to mixtures. The dose is from one to three fluidrachms. W.

TINCTURA CUBEBÆ. *U. S., Br. Tincture of Cubeb. Tincture of Cubebs.*

"Take of Cubeb, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Cubebs, in powder, and *one Imperial pint* of Rectified Spirit, and proceeds as directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This may be used as a carminative, and has been given with advantage in gonorrhœa in the advanced stages. The late London tincture was nearly three times as strong as the Dublin, and more than twice as strong as the U. S. tincture; but the preparation was dropped in the British Pharmacopœia; and being resumed in the present edition, was greatly reduced in strength, so as at present to be about equal in this respect with our own. The dose is from half a fluidrachm to two fluidrachms or more, the larger doses being used in gonorrhœal affections. W.

TINCTURA DIGITALIS. *U. S., Br. Tincture of Digitalis. Tincture of Foxglove.*

"Take of Digitalis, recently dried and in fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it firmly in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Digitalis Leaves, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

In preparing this tincture, great attention should be paid to the selection of the leaves, according to the rules laid down under the head of Digitalis. From a neglect of these it is apt to be weak or inefficient. The expressed juice of the leaves, preserved by means of alcohol, prepared as the British Succi, would probably be found a powerful preparation. (See *page* 1464.) The tincture of foxglove possesses all the

virtues of that narcotic, and affords a convenient method of administering it, especially in mixtures. It is said by M. Menière to deposit on standing a green oily matter, and some white lance-shaped crystals soluble in an excess of acid. (*Journ. de Pharm.*, Avril, 1861, p. 289.) The dose is from ten to twenty drops, repeated two or three times a day, and increased if necessary, but with caution. W.

TINCTURA ERGOTÆ. *Br.* *Tincture of Ergot.*

The *British Pharmacopœia* takes *five avoirdupois ounces* of Ergot, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

The dose of this tincture is from thirty minims to two fluidrachms. W.

TINCTURA FERRI ACETATIS. *Br.* *Tincture of Acetate of Iron.*

"Take of Solution of Persulphate of Iron *two and a half fluidounces* [Imperial measure]; Acetate of Potash *two ounces* [avoirdupois]; Rectified Spirit *a sufficiency.* Dissolve the Acetate of Potash in ten fluidounces, and add the [Solution of] Persulphate of Iron to eight fluidounces of the Spirit, then mix the two solutions in a two-pint bottle and shake them well together, repeating the agitation several times during an hour. Put the tincture, with the precipitated salt contained in it, upon a filter, and when the liquid has ceased to run through, put as much Rectified Spirit upon the filter as will make the filtered product measure one pint." *Br.*

This is an old formula of the Dublin College, omitted at the original formation of the British Pharmacopœia, but resumed in the present edition. As in the Dublin Pharmacopœia there was no Solution of Persulphate of Iron, it was necessary to direct the preparation of this salt as a part of the formula; otherwise the process did not essentially differ from the one now officinal.

The preparation is a tincture of the teracetate of sesquioxide of iron. The first step in making it is to dissolve the two salts in rectified spirit, and to mix the solutions. A double decomposition of the salts takes place, resulting in the formation of teracetate of sesquioxide of iron which dissolves in the spirit, and sulphate of potassium which precipitates, being insoluble in that menstruum. By filtration, therefore, the sulphate of potassium is removed, and the clear liquid constitutes the tincture under notice. This tincture is a transparent liquid, of a deep-red colour, and strong ferruginous taste. It is said to be an agreeable chalybeate, but is subject to the very serious objection that it is unstable, commencing usually to undergo serious change* in from two to three weeks after its preparation. Probably the best way of remedying this would be by having, as suggested by Messrs. Deane and Jefferson (*Pharm. Journ. and Trans.*, 2d ser., xi. 196), a liquor from which the tincture should be prepared as wanted, by the addition of alcohol. The dose is from twenty drops to a teaspoonful, sufficiently diluted with water. B.

TINCTURA FERRI CHLORIDI. *U. S.* TINCTURA FERRI PERCHLORIDI. *Br.* FERRI MURIATIS TINCTURA. *Ed.* *Tincture of Chloride of Iron.* *Tincture of Perchloride of Iron.* *Tincture of Muriate of Iron.*

"Take of Solution of Chloride of Iron *half a pint;* Alcohol *a pint and a half.* Mix them, and preserve the mixture in a well-stopped bottle." *U. S.*

"Take of Strong Solution of Perchloride of Iron *five fluidounces;* Rectified Spirit *fifteen fluidounces.* Mix, and preserve in a stoppered bottle. Sp. gr. 0·992. This Tincture has about one-third the strength of Tinctura Ferri Sesquichloridi, *Dub.*" *Br.*

As directed in the U. S. Pharmacopœia of 1850, this preparation was made with the subcarbonate of iron of the Pharmacopœia, which is a hydrated sesquioxide, containing a small but uncertain proportion of carbonate of the protoxide. This was treated with muriatic acid, which caused some effervescence in consequence of the escape of the carbonic acid of the carbonate, and the result was a solution of the sesquichloride of iron with a little protochloride. As the proportions of subcarbonate and of acid were so arranged in the formula as to leave a slight excess of the former, provided that the acid were duly saturated, there could of course be no excess of

* For elaborate experiments on causes of these changes, see *Pharm. Journ. and Trans.*, Sept. 1874, p. 241.

acid in the tincture, when completed by the addition of the alcohol. But, in consequence of the presence of a small proportion of protochloride, absorption of oxygen from the air took place, and this protochloride was converted into sesquichloride and sesquioxide of iron, the latter of which, not finding any free muriatic acid to dissolve it, was precipitated. Hence the officinal tincture was apt to deposit a little sesquioxide, with the effect of losing somewhat of its chalybeate strength; and this was an objection to the U. S. formula, though a slight one, as it was easily obviated, if thought advisable, by the addition of a little more of the acid. But there were other difficulties incident to the formula, which led to its frequent partial failure, not only in incompetent hands, but even with skilful pharmaceutists. In the first place, the muriatic acid could not always be obtained of the due officinal strength (sp. gr. 1·16), and this often proved the cause of a comparatively feeble preparation. In the second place, difficulty was often experienced in effecting the solution of the subcarbonate of iron. Properly prepared, and in its recent state, this is easily dissolved in muriatic acid; but it is exceedingly liable to undergo changes, either in its molecular condition, or state of hydration, which impair its solubility, or even render it partially insoluble. The use of heat in preparing or drying it, and the simple influence of time and exposure, have this effect in a greater or less degree; and hence the operator often found great difficulty in dissolving it in the muriatic acid. The consequence was incessant complaints of the imperfection of the formula; and, though these might not be theoretically well founded, as the formula properly executed might yield the due result, yet practically they were so, and it was certainly desirable to have a formula which would be less liable to miscarriage. Accordingly, at the 1860 revision of the U. S. Pharmacopœia, a new process was introduced, in which the objections to the old one appeared to be in great measure obviated, but which in turn was so far modified in the revision of 1870 as to be divided in two distinct processes.*

The old U. S. formula so far imitates that of the late Dublin Pharmacopœia as to prepare directly the necessary sesquichloride by the reaction between muriatic acid and metallic iron; and the proportion of acid and iron is almost the same in both; yet they differ somewhat in the manipulations; and the U. S. formula appears, in respect to the precise method of proceeding, to be copied from that of Dr. Squibb, published in the *Am. Journ. of Pharm.* (July, 1857, p. 290).† Iron wire was chosen as the form of iron to be used because it is generally the purest. This, which is in very slight excess, is first treated with a portion of the muriatic acid which forms with it the protochloride of iron, with the escape of hydrogen, producing effervescence. The action is allowed to go on spontaneously until effervescence ceases, and is then aided by heat, which causes the saturation of the acid used. The solution being filtered, the remainder of the muriatic acid is added, and afterwards the nitric acid gradually, the liquid having been heated to the boiling point before the latter addition. The nitric acid is decomposed, with the escape of nitrous fumes producing effervescence, while, through the influence of a portion of its oxygen and the additional portion of muriatic acid, the protochloride is converted into the sesquichloride; the conversion being completed when the effervescence ceases, and the previously green colour has been changed to a reddish-brown. The precise reactions by which these changes are effected have been explained elsewhere. (See *Ferri Chloridum*, page 1211.) At this point, in the revision of 1870, the process was divided into two, and a new preparation, the *liquor ferri chloridi*, introduced. When this is added to the alcohol, the latter reacts gradually with the acid, producing a small proportion

* One of the prominent difficulties in preparing this, as well as all other soluble salts of peroxide of iron, is the occasional insolubility or difficult solubility in acids of the peroxide used. This has been ascribed to some peculiar molecular condition or state of hydration, opposing itself to the action of the acid; but M. Jeannel seems to have determined that the cause of the difficulty is the presence in the peroxide of a trace of sulphuric acid in one or another mode of combination; and that, if this impurity be very carefully avoided by providing that the materials from which the oxide is prepared should be rigorously exempt from all mixture of sulphate, and that the vessels used should be washed with distilled water, the resulting peroxide will be completely soluble in acids, even diluted, and especially in muriatic acid. (*Journ. de Pharm.*, Août, 1868, p. 106.)—*Note to the thirteenth edition.*

† This process of Dr. Squibb was given in a note in the eleventh edition of the U. S. Dispensatory, page 1052.

of an ether, which gives a peculiar flavour to the tincture, and probably modifies in some degree its influence on the system.

Properties. Tincture of chloride of iron is of a reddish-brown, somewhat yellowish colour, a sour and very styptic taste, and an odour resembling that of muriatic ether. The sesquichloride of iron which it holds in solution, and on which its properties mainly depend, has been described among the preparations of iron. (See *Ferri Chloridum*, page 1211.) The specific gravity of the English preparation is officially stated at 0·992, and the American tincture should not vary much from this. As two fluidrachms of the liquor yield when precipitated with ammonia 28·25 grains of sesquioxide of iron, and as some condensation occurs on mixing the solution with the alcohol, the present tincture is as near as may be the strength of the old, which yielded 29 grains of the washed and dried sesquioxide of iron to the fluidounce.* The tincture is decomposed by the alkalies, alkaline earths and their carbonates, astringent vegetable infusions, and mucilage of gum arabic, which produces with it a brown semi-transparent jelly. All these substances are, therefore, incompatible with it in prescriptions.†

Medical Properties and Uses. This is one of the most active and certain preparations of iron, usually acceptable to the stomach, and much employed for the purposes to which the chalybeates generally are applied. It has been particularly commended as a tonic in scrofula, in which it was formerly often given, jointly with the solution of chloride of calcium, or chloride of barium. It is supposed to be diuretic, and to have a peculiar influence on the urinary passages. Hence it has been employed in gleet, old gonorrhœa, and leucorrhœa; and is said to be useful in dysury dependent on spasmodic stricture of the urethra, in the dose of ten drops repeated every ten minutes, till some effect is experienced. In hemorrhages from the uterus, kidneys, and bladder, it is thought to act advantageously, but should be confined to those of a passive character, or employed only after sufficient depletion. Upon the recommendation of Dr. Bell, of Edinburgh, it has recently been much employed in erysipelas, with great supposed advantage; and, upon the same principle, that of improving the condition of the blood, has been used in various other diseases, as scarlatina, diphtheria, and purulent infection of the blood. Externally it is sometimes used for the destruction of venereal warts, and as a styptic in cancerous and fungous ulcers. It has recently been employed, with success, as an injection in aneurismal tumours. (See *Ranking's Abstract*, xviii. 120.) A case of traumatic hemorrhage from the lungs is reported by Dr. Geo. W. Sternberg, in which the bleeding was promptly arrested by the inhalation of the spray of tincture of chloride of iron, by means of the atomizer; half an ounce of the tincture being diluted with five ounces of water, and the end of the tube from which the spray proceeded being placed "well back in the mouth." (*Med. Record*, Feb. 1, 1868, p. 534.) The dose of the U. S. tincture is from ten to thirty minims, which may be gradually increased to one or even two fluidrachms, two

* Mr. J. C. Wharton has noticed in the tincture silky abestos-like crystals, which he believes are due to an action of the acids upon the glass in which the drug is prepared. (*Am. Journ. of Pharm.*, xlii. 107.) Dr. Battey believes these crystals to be the sulphate of calcium. (*Ibid.*, xlii. 207.)—*Note to the fourteenth edition.*

† *Bestuchef's tincture*, which is much used in Europe, is simply a solution of sesquichloride of iron in a mixture of one measure of ether and three or four measures of alcohol. Fr. Mayer recommends that the sesquichloride should be prepared by passing chlorine through a solution of the protochloride, until a solution of the ferridcyanide of potassium no longer produces a blue precipitate, and then evaporating by a water-bath. In this mode crystals of the sesquichloride are obtained, one ounce of which is to be dissolved in twelve ounces of ether, mixed with four times its bulk of alcohol. The solution may be rendered colourless, if desired, by exposure to the direct rays of the sun. (*N. Y. Journ. of Pharm.*, i. 233.) This decolorization, however, is effected by a chemical change which somewhat alters the character of the preparation. The sesquichloride becomes protochloride by the loss of a portion of its chlorine, which, by abstracting hydrogen from the alcohol, becomes muriatic acid; and this reacts with unaltered alcohol to form muriatic ether.

Mr. A. Cushman recommends the following process for the above tincture. He first prepares the crystals of the sesquichloride by dissolving two ounces of iron filings in a mixture of eight fluidounces of muriatic acid and four of distilled water, then adding four fluidrachms of nitric acid, evaporating to a pellicle, and setting aside to crystallize. The crystals, having been washed in alcohol, and afterwards redissolved and crystallized, are to be dissolved in a mixture of two parts of alcohol and one of ether; the proportion being an ounce of the crystals to twelve fluidounces of the mixture. After solution, the liquid is to be filtered, and exposed for 48 hours to the direct rays of the sun. (*Am. Journ. of Pharm.*, xxix. 461; from *Am. Med. Gaz.*)—*Note to the eleventh edition.*

or three times a day. In acute febrile diseases, as erysipelas, the dose should be repeated every two hours. It is given diluted with water. W.

TINCTURA GALLÆ. *U.S., Br. Tincture of Nutgall. Tincture of Galls.*

"Take of Nutgall, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a glass percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U.S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Galls, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

The tincture of galls is powerfully astringent; but is more used as a test than as a medicine. When long kept it ceases to evince the reactions of tannic acid, in consequence of the conversion of this into gallic acid. The dose is from one to three fluidrachms. W.

TINCTURA GENTIANÆ COMPOSITA. *U.S., Br. Compound Tincture of Gentian.*

"Take of Gentian, in moderately fine powder, *two troyounces;* Bitter Orange Peel, in moderately fine powder, *a troyounce;* Cardamom, in moderately fine powder, *half a troyounce;* Diluted Alcohol *a sufficient quantity.* Mix the powders, and, having moistened the mixture with a fluidounce and a half of Diluted Alcohol, pack it in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U.S.*

The *British Pharmacopœia* takes *one and a half avoirdupois ounces* of Gentian Root, cut small and bruised, *three-quarters of an avoirdupois ounce* of Bitter Orange Peel, cut small and bruised, *a quarter of an avoirdupois ounce* of Cardamom Seeds, freed from the pericarps and bruised, and *one Imperial pint* of Proof Spirit, and proceeds with these ingredients in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This is an elegant bitter, much used in dyspepsia, and as an addition to tonic mixtures in debilitated states of the digestive organs, or of the system generally. There is, however, much danger of its abuse, especially in chronic cases. The dose is one or two fluidrachms. W.

TINCTURA GUAIACI. *U.S. Tincture of Guaiac.*

"Take of Guaiac, in moderately coarse powder, *six troyounces;* Alcohol *a sufficient quantity.* Mix the powder thoroughly with an equal bulk of dry sand, pack the mixture moderately in a conical percolator, and, having covered it with a layer of sand, gradually pour Alcohol upon it until two pints of tincture are obtained." *U.S.*

This tincture is given in chronic rheumatism and gout, in the dose of from one to three fluidrachms three or four times a day. As it is decomposed by water, it is most conveniently administered in mucilage, sweetened water, or milk, by which the separated guaiac is held in temporary suspension. The following is a form of tincture of guaiac which the late Dr. Dewees found very efficient in the cure of suppression of the menses and dysmenorrhœa. "Take of the best Guaiac, in powder, *four ounces;* Carbonate of Soda or of Potassa *one drachm and a half;* Pimento, in powder, *an ounce;* Diluted Alcohol *a pound.* Digest for a few days." Dr. Dewees directed a drachm or two of the spirit of ammonia to be added, "*pro re nata*," to four fluidounces of the tincture. (*Treat. on Diseases of Females*, A.D. 1826, p. 81.) The dose is a teaspoonful three times a day, to be gradually increased if necessary. Within our own experience, this remedy has seemed highly useful in painful menstruation, given in the intervals of the attacks. The quantity of alkaline addition is too small to produce any sensible effect, and the pimento can act only as a spice; so that the virtues of the tincture residue in the guaiac, and the officinal tincture would probably be found equally effectual. W.

TINCTURA GUAIACI AMMONIATA. *U.S., Br.* TINCTURA GUAICI COMPOSITA. *Lond. Ammoniated Tincture of Guaiac.*

"Take of Guaiac, in moderately coarse powder, *six troyounces;* Aromatic Spirit

of Ammonia *two pints.* Macerate for seven days, and filter through paper." *U. S.*

"Take of Guaiacum Resin, in powder, *four ounces* [avoirdupois]; Aromatic Spirit of Ammonia *a sufficiency.* Macerate the Guaiacum in fifteen fluidounces [Imperial measure] of the Aromatic Spirit of Ammonia for seven days in a well-closed vessel, with occasional agitation, and filter, then add sufficient Aromatic Spirit of Ammonia to make one pint [Imp. meas.]." *Br.*

This tincture is celebrated in the treatment of chronic rheumatism, and is frequently also used in amenorrhœa. It is more stimulating, and is thought to be more effectual, than the preceding. Like that, it is decomposed by water, and should be administered in some viscid or tenacious vehicle which may hold the guaiac in suspension. The dose is one or two fluidrachms. W.

TINCTURA HELLEBORI. *U. S.* *Tincture of Black Hellebore.*

"Take of Black Hellebore, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a cylindrical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

This tincture, formerly called *tinctura Melampodii*, possesses the properties of black hellebore, and, upon the recommendation of Dr. Mead, has been much used in suppression of the menses. It is said to be peculiarly applicable to cases in which the grade of action is too high for the use of chalybeates. At best, however, it is an uncertain remedy, and, though frequently almost inert from the bad quality of the root, should always be administered with caution, as it is sometimes violent in its action. The dose is from thirty minims to a fluidrachm, to be taken night and morning. W.

TINCTURA HUMULI. *U. S.* TINCTURA LUPULI. *Br.* *Tincture of Hops.*

"Take of Hops, in moderately coarse powder, *five troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it very firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Hops, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

Hops are so light and bulky that, in the proportion directed, and as prepared by the U. S. process of 1850, they absorbed almost all the spirit, which, after the requisite maceration, could be separated only by strong pressure. As this absorption of the spirit obstructed its proper action on the hops, it was necessary that the mixture should be frequently stirred during the maceration. This remark is not applicable to the present U. S. process, but continues so to that of the Br. Pharmacopœia. By thoroughly drying the hops and rubbing them between the hands, or by cutting and bruising them, they may be brought to a state of division which will in a great measure obviate the disadvantages alluded to. As the virtues of hops depend chiefly on the lupulin, and as the quantity of this substance is different in different parcels, the tincture is necessarily unequal in strength; and the tincture of lupulin itself is preferable. (See *Tinctura Lupulinæ.*) According to M. Manière, tincture of hops deposits, on standing, a yellow precipitate, and a large quantity of a white crystalline substance, which he thinks may be malate of calcium.

Tincture of hops is tonic and narcotic, and has been proposed as a substitute for laudanum when the latter disagrees with the patient; but little reliance can be placed upon it. The condition of disease to which it appears to be best adapted, is the wakefulness, attended with tremors and general nervous derangement, to which habitual drunkards are liable, and which frequently precedes an attack of delirium tremens. The dose is from one to three fluidrachms. W.

TINCTURA HYOSCYAMI. *U. S., Br.* *Tincture of Henbane. Tincture of Hyoscyamus.*

"Take of Hyoscyamus Leaves, recently dried and in fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of

Diluted Alcohol, pack it firmly in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Hyoscyamus Leaves, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture may be advantageously substituted, as an anodyne and soporific, for that of opium, when the latter disagrees with the patient, or is objectionable on account of its property of inducing constipation.* When the tincture of henbane purges, as it sometimes does, it may be united with a very small proportion of laudanum. The dose is a fluidrachm. The expressed juice preserved by means of alcohol may be used for the same purposes as the tincture. W.

TINCTURA IODINII. *U. S. Tincture of Iodine.*

"Take of Iodine *a troyounce;* Alcohol *a pint.* Dissolve the Iodine in the Alcohol." *U. S.*

This tincture has very nearly the strength of the tincture of Coindet, which contained one part of iodine to twelve of alcohol by weight; while the U. S. tincture contains one part of the former to about 12·7 parts of the latter. It is best to prepare the tincture in small quantities at a time; as the iodine reacts with the alcohol, especially when exposed to solar light, giving rise to chemical changes. The iodine should be thoroughly dried before being weighed out. The tincture should be kept in well-stopped bottles, in order to prevent the evaporation of the alcohol, and the consequent crystallization of the iodine.

The tincture of iodine has a deep-brown colour. Sixteen minims, equal to about thirty-five drops, contain one grain of iodine. It is at present less used internally than it formerly was, in consequence of an impression that it is apt to irritate the stomach. Water decomposes the tincture, and, when this is swallowed, it is supposed that the iodine is precipitated upon the mucous membrane. Besides, the tincture undergoes a gradual change when kept, owing, according to Guibourt, to a reaction between the alcohol and iodine. A portion of the latter is supposed to take hydrogen from the former, producing hydriodic acid, which combines with another portion of the iodine to form iodurетted hydriodic acid; while the place of the hydrogen in the alcohol is thought to be supplied by iodine, giving rise to another iodurетted compound. The new products are soluble in water; and consequently the tincture gradually loses by time the property of being precipitated on dilution. (*Journ. de Pharm.*, 3e sér., x. 113.) Dr. A. Göpel found the change to be so slow when the tincture is kept in the dark and at a low temperature, that in three months a specimen thus treated had lost but one per cent. of iodine. (*Pharm. Central Blatt*, No. 13, A. D. 1850.) M. Commaille, in 1859, confirmed the labours of the last mentioned investigator. Subsequent experiments have, however, given results somewhat at variance with those of Guibourt. M. Carles has found that the tincture, after exposure in a transparent glass flask to diffuse daylight for ten months, only contained one-twelfth per cent. of hydriodic acid. He was also unable to find any of the iodic ether which, according to Guibourt, is formed simultaneous with the acid. (*Pharm. Journ. and Trans.*, 3d ser., v. 88.) On account of its liability to precipitation in the stomach, the tincture of iodine is now almost exclusively employed locally Nevertheless, it has been prescribed with supposed advantage by M. Bérenger Féraud in the treatment of diabetes; the tincture being given in three or four fluidounces of water, in the dose of five drops, taken before a meal, at first once daily, afterwards twice, and afterwards gradually increased to twenty drops a day. (*Ann. de Thérap.*, 1866, p. 243.) Locally used, if undiluted, it acts as a powerful irritant to the skin, producing inflammation, desquamation of the cuticle, &c. Nevertheless, it is much used in this state in erysipelas, chilblains, and other cases of cutaneous and subcutaneous inflammation, and with happy effects. But its application requires some caution; and, in erysipelas, we are in the habit rather of surrounding the inflamed surface with a border of the tincture, embracing a portion of both the sound and the

* According to M. Donovan, the tincture, when made of leaves of only one year's growth, is inert. (*Pharm. Journ. and Trans.*, May, 1871, p. 907.)

diseased skin, so as to prevent the progress of the inflammation, than of attempting a complete cure by covering the whole surface affected. It has been found useful in rendering the variolous eruption abortive. It has also been employed externally in croup, the bites of serpents, and local rheumatism. It is most conveniently applied by means of a camel's-hair pencil. Diluted with camphorated tincture of soap, or other alcoholic liquid, it is sometimes employed as an embrocation in scrofulous tumours and other affections requiring the use of iodine. It is much used in the radical cure of hydrocele, as an injection into the sac; and a similar employment of it has been extended to other serous cavities morbidly distended with fluid, as in ovarian dropsy, ascites, and empyema; but in these latter affections it should be resorted to, if at all, with great caution. In hydrocele, M. Velpeau employed it diluted with double its volume of water. In the other cases referred to, it has been variously diluted with from three to ten times its bulk of water, or some demulcent liquid. To prevent the precipitation of the iodine, iodide of potassium is generally added in the proportion of from two scruples to a drachm to each fluidounce of the tincture. M. Luc, an officer in the French army, having been attacked with a very violent coryza, was induced to try the effect of the local application of the vapour of the tincture, and accordingly held to his nostrils a bottle of the tincture, which he kept warm by the heat of the hand. Repeating this inhalation, which lasted nearly a minute, every three minutes for about an hour, he immediately experienced relief; and the affection went on diminishing, until, in the course of three hours, it had entirely disappeared. He afterwards tried the remedy on others, and uniformly with the same success. (*Ann. de Thérap.*, 1866, p. 236.) M. Olivade asserts that he has cured elephantiasis Arabum by the external and internal use of the tincture, the dose of which he gradually increased until it reached a drachm. (*New York Med. Record*, viii. 257.)

The dose of the tincture is from ten to twenty drops, which may be gradually increased to thirty or forty drops, three times a day. It may be given in sweetened water, and still better in wine, when this is not contraindicated. M. Debauque, an apothecary of Mons, has ascertained that tannic acid has the property of rendering iodine soluble in water, and states that an ounce of syrup of orange-peel, in four or six ounces of water, will form a clear solution with a quantity of tincture of iodine containing five or six grains of the medicine. (*Journ. de Pharm.*, 3e sér., xx. 34.)* Owing to the caustic effect of the iodine, and the coagulating action of the alcohol, where it is desired to get an absorption of iodine, as in the case of enlarged glands, a solution in glycerin is far preferable to the tincture. W.

TINCTURA IODINII COMPOSITA. *U. S.* Tinctura Iodi. *Br.* *Compound Tincture of Iodine.*

"Take of Iodine *half a troyounce;* Iodide of Potassium *a troyounce;* Alcohol *a pint.* Dissolve the Iodine and Iodide of Potassium in the Alcohol." *U. S.*

"Take of Iodine *half an ounce* [avoirdupois]; Iodide of Potassium *a quarter of an ounce* [avoird.]; Rectified Spirit *one pint* [Imperial measure]. Dissolve the Iodine and the Iodide of Potassium in the Spirit." *Br.*

The U. S. tincture is rather stronger than the British, the troyounce being heavier than the avoirdupois; while the wine pint employed in the former contains about one-fifth less than the Imperial pint employed in the latter. A much more important difference is in the much larger amount of iodide of potassium in the U. S. preparation. The British tincture contains so little of the salt that the iodine precipitates on the addition of water. The advantage of this tincture over the simple tincture above described is, that the former may be diluted with water without decomposition; so that, when it is swallowed, iodine is not precipitated upon the mucous coat of the stomach, and will not, therefore, be so likely to produce gastric irritation. This is a good theoretical recommendation; but we are by no means confident that the difference of the two preparations in irritating properties will be found very striking in practice. The compound tincture of iodine may be given internally for all the purposes

* Mr. Wm. Martindale recommends highly, in various skin diseases, a mixture of one part of iodine and four of wood tar.

which iodine is capable of answering. The dose is from fifteen to thirty drops, to be gradually increased if necessary.*

Off. Prep. Vapor Iodi, *Br.* W.

TINCTURA JALAPÆ. *U. S., Br. Tincture of Jalap.*

"Take of Jalap, in fine powder, *six troyounces;* Alcohol, Water, each, *a sufficient quantity.* Mix two measures of Alcohol with one of Water. Then moisten the powder with *two fluidounces* of the mixture, pack it moderately in a cylindrical percolator, and gradually pour the mixture upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Jalap, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, p. 1492.)

In 1860 the alcoholic strength of the menstruum was considerably increased in the U. S. process, which is an improvement in view of the resinous character of the purgative principle of jalap. The tincture possesses the medical virtues of jalap, and is sometimes added to cathartic mixtures in the quantity of one or two fluidrachms, to increase their activity. W.

TINCTURA KINO. *U. S., Br. Tincture of Kino.*

"Take of Kino, in fine powder, *three hundred and sixty grains;* Alcohol, Water, each, *a sufficient quantity.* Mix two measures of Alcohol with one of Water. Then mix the powder thoroughly with an equal bulk of dry sand, and, having introduced the mixture into a conical glass percolator, gradually pour the menstruum upon it until half a pint of tincture is obtained." *U. S.*

"Take of Kino, in coarse powder, *two ounces* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, filter, and add sufficient rectified spirit to make one pint [Imp. meas.]." *Br.*

The sand which is directed to be used in the U. S. formula is for the purpose of preventing agglutination of the kino. Mr. Groves states that fresh kino will not gelatinize, and Mr. Martindale that the Botany Bay kino is much more apt to do so than the East India drug. The tincture very frequently becomes gelatinous if kept, and at length almost entirely loses its astringency. The character of the chemical reaction which takes place remains to be investigated. The air has some effect; for if this is entirely excluded the tincture keeps for a long time without undergoing the change. The apothecary should introduce it, when prepared, into very small bottles, which should be kept well corked, and only opened when wanted for use. It is in consequence of its tendency to gelatinize, that the U. S. Pharmacopœia directs it to be frequently renewed. Mr. J. D. Wood obtains a very handsome preparation, which he believes to keep perfectly and not gelatinize, by using a menstruum 2 parts alcohol ·835, and 1 part each of water and glycerin. L. Myers Connor gets rid of the gelatinizing property by using carbonate of magnesium in making the tincture, but it is most probable that a large part of the kino-tannic acid is removed

* *Tinctura Iodinii Decolorata. Colourless Tincture of Iodine.* Under this name a preparation is described by Dr. N. J. Aikin, of St. Louis, Mo., which is made by mixing equal measures of Compound Tincture of Iodine and Strong Water of Ammonia. The mixture in time becomes colourless, and, if not at the end of 24 hours, more ammonia may be added, even to the extent of one-fourth if necessary. When wanted weak, it may be diluted to any desired extent by water or glycerin. In consequence of the chemical changes which take place, it is no longer tincture of iodine, but a hydro-alcoholic solution of iodides of potassium and ammonium, with more or less ammonia. It is recommended for external use whenever a discutient is required, and has also been used for its revulsive effects in inflammatory diseases, as pneumonia and rheumatism. It is recommended also topically in erysipelas, furuncles, sprains, bruises, and neuralgic affections. (*Am. J. Med. Sci.*, Oct. 1865, p. 398.) It is stated that on the addition of ammonia, some iodide of nitrogen is generally precipitated; and, as this is an explosive compound, some caution is necessary. The deposit, however, disappears upon the completion of the decolorization. (*Am. Journ. of Pharm.*, July, 1869.) Dr. Chas. O. Curtman gives the following formula (*Am. Journ. of Pharm.*, xli. 364). Take of Iodine *one ounce and a quarter;* Alcohol *thirteen fluidounces;* Strong Water of Ammonia *three fluidounces.* Dissolve the Iodine in the Alcohol, and add the Ammonia. Allow to stand for four weeks, with occasional agitation, so that the precipitate may dissolve. A rapid preparation may be made by using an excess of ammonia, and afterwards adding, cautiously, muriatic acid until the reaction is only feebly alkaline. Mr. Jos. L. Macmillan finds that 5·3 decigrammes of a solution of caustic soda of sp. gr. 1·07 at 15·55° C. will decolorize 3·6 grammes of the tincture (*B. P.*). (*Am. Journ. of Pharm.*, xliii. 360.)—*Note to thirteenth and fourteenth editions.*

at the same time. (*Am. Journ. of Pharm.*, xlv. 260.) The dose is one or two fluidrachms. It is used chiefly as an addition to cretaceous and other astringent mixtures in diarrhœa.* W.

TINCTURA KRAMERIÆ. *U. S., Br.* *Tincture of Rhatany.*

"Take of Rhatany, in moderately fine powder, *six troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it in a cylindrical glass percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Rhatany Root, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds as directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

According to F. Boudet, the tincture of rhatany sometimes gelatinizes like that of kino (*Journ. de Pharm.*, 3e sér., i. 338); and the same observation has been made by others. The same precaution, therefore, should be observed, in relation to the mode of keeping it, as recommended in reference to tincture of kino. This is a good preparation of rhatany in cases which admit of the use of small quantities of alcohol. The dose is one or two fluidrachms.† W.

TINCTURA LARICIS. *Br.* *Tincture of Larch.*

"Take of Larch Bark, in coarse powder, *two and a half ounces* [avoirdupois]; Rectified Spirit *one pint* [Imperial measure]. Macerate the Larch Bark for forty-eight hours in fifteen fluidounces [Imp. meas.] of the Spirit in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of Spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquid, and add sufficient Rectified Spirit to make one pint." *Br.*

The dose of this new officinal of the British Pharmacopœia is from 20 to 30 minims. H. C. W.

TINCTURA LIMONIS. *Br.* *Tincture of Lemon Peel.*

"Take of Fresh Lemon Peel, sliced thin, *two and a half ounces* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, and filter; then add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

This tincture forms a grateful aromatic addition to tonic and purgative infusions, mixtures, &c. It may be used in the dose of one or two fluidrachms. W.

TINCTURA LOBELIÆ. *U. S., Br.* *Tincture of Lobelia.*

"Take of Lobelia, in fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Diluted Alcohol, pack it firmly in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* prepares this Tincture from *two and a half avoirdupois ounces* of Lobelia, in coarse powder, and *one Imperial pint* of Proof Spirit, in the same manner as Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture possesses the emetic and narcotic properties of lobelia, and is much used in asthma, in the dose of one or two fluidrachms, repeated every two or three hours till its effects are experienced. The emetic dose is half a fluidounce. A saturated tincture is strongly recommended by Dr. A. Livezey, as a local application in erysipelas, and the external poisonous effect of Rhus Toxicodendron. (*Bost. Med. and Surg. Journ.*, lv. 262.) W.

* We have received the following letter, which speaks for itself, and for which we owe our thanks to the writer.

"Louisville, Ky., June 14, 1864. *Dear Sir,*—I transmit you herewith a process for preparing Tr. Kino, which will not gelatinize, and appears to retain its qualities unimpaired. Take of Kino *one ounce and a half;* Ground Logwood *half an ounce;* Diluted Alcohol *a sufficient quantity.* Moisten the Logwood with a portion of the Diluted Alcohol, and introduce it into a displacement apparatus. Dissolve the Kino by triturating with successive portions of Dil. Alcohol, and percolate the solution through the Logwood until a pint of tincture is obtained.

"Yours, &c., P. F. Smith."

† In the *Pharm. Journ.* for October, 1868 (page 245), is a table prepared by Mr. W. G. Smith, of Dublin, giving the distinguishing properties of the Tinctures of Catechu, Kino, and Krameria, prepared according to the directions of the Br. Pharmacopœia. (*Note to the thirteenth edition.*)

TINCTURA LOBELIÆ ÆTHERIA. *Br.* *Ethereal Tincture of Lobelia.*

"Take of Lobelia, in coarse powder, *two ounces and a half* [avoirdupois]; Spirit of Ether *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient Spirit of Ether to make one pint [Imp. meas.]." *Br.*

The stimulant operation of the ether in this preparation can scarcely favour the relaxing and nauseating action for which lobelia is usually employed. The dose is the same as that of the alcoholic tincture. W.

TINCTURA LUPULINÆ. *U. S.* *Tincture of Lupulin.*

"Take of Lupulin *four troyounces;* Alcohol *a sufficient quantity.* Pack the Lupulin in a narrow cylindrical percolator, and gradually pour Alcohol upon it until two pints of tincture are obtained." *U. S.*

This is much superior to the tincture of hops of the first U. S. Pharmacopœia, in the place of which it was introduced into the second edition. In the original preparation, a certain quantity of hops was directed, from which the lupulin was to be separated by beating, and then digested in alcohol. As hops contain a variable proportion of lupulin, the tincture thus made must be of unequal strength; an objection to which the tincture of hops, even as now prepared, is in some measure liable. Besides, the amount of lupulin, contained in any quantity of hops upon which alcohol can conveniently act, is too small in proportion to the alcohol, to afford a tincture of the due strength. The tincture of lupulin is, therefore, greatly preferable. The dose is one or two fluidrachms, to be given in sweetened water or some mucilaginous fluid.* W.

TINCTURA MYRRHÆ. *U. S., Br.* *Tincture of Myrrh.*

"Take of Myrrh, in moderately coarse powder, *three troyounces;* Alcohol *a sufficient quantity.* Introduce the powder into a conical percolator, press it moderately, and gradually pour Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Myrrh, in coarse powder, and *one Imperial pint* of Rectified Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

Officinal alcohol is preferable, as a solvent of myrrh, to that fluid mixed with water; because it forms a perfectly clear solution, which is not attainable with the latter menstruum. The addition of water to the tincture renders it turbid. According to E. B. Shuttleworth (*Am. Journ. of Pharm.*, xliii. 369), the gum which is left behind in making the tincture may be utilized for making mucilage. The tincture of myrrh is scarcely ever used internally. As a local application it is employed to stimulate indolent and foul ulcers, and promote the exfoliation of bones, and, diluted with water, is applied to spongy gums, aphthous sore-mouth, and ulcerations of the throat. The dose, as a stimulant expectorant and emmenagogue, is from thirty minims to a fluidrachm. W.

TINCTURA NUCIS VOMICÆ. *U. S., Br.* *Tincture of Nux Vomica.*

"Take of Nux Vomica, in fine powder, *eight troyounces;* Alcohol *a sufficient quantity.* Mix the powder with a pint of Alcohol, and digest for twenty-four hours, in a close vessel, with a gentle heat; then transfer the mixture to a cylindrical percolator, and gradually pour Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two avoirdupois ounces* of Nux Vomica, and *one Imperial pint* of Rectified Spirit, and, having softened by steam, quickly dried, and then powdered the Nux Vomica, proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

It is of the greatest importance, in this process, that the nux vomica should be well powdered; and, in consequence of the difficult action of solvents on this substance,

* *Ammoniated Tincture of Lupulin.* Dr. Dyce Duckworth proposes as the best preparation a tincture made by macerating for seven days two ounces of lupulin in a pint of aromatic spirits of ammonia, and then filtering. The dose is from half a fluidrachm to a fluidrachm. (*Am. Journ. of Pharm.*, xli. 416.)—*Note to the fourteenth edition.*

probably from the presence of bassorin, a preliminary digestion is desirable. Mr. J. B. Moore (*Am. Journ. of Pharm.*, xliii. 106) states that in the officinal formula the powder is not sufficiently fine, and also that after maceration the powder should be expressed so that it may be packed very firmly in the percolator. The tincture is not an eligible form for administering nux vomica; as it is equally uncertain with the medicine in substance, and has the disadvantage of excessive bitterness. The alcoholic extract, or strychnia, is preferable. Mr. Geo. W. Kennedy has noticed the crystallization of strychnia in the tincture, seemingly due to the formation of ammonia in it. (*Am. Journ. of Pharm.*, xlii. 299, 392.) The dose of the tincture is twenty minims, to be increased if necessary. It is sometimes employed externally, in cases of local paralysis. W.

TINCTURA OPII. *U. S., Br. Tincture of Opium. Laudanum.*

"Take of Opium, dried, and in moderately fine powder, *two troyounces and a half;* Water, Alcohol, each, *a pint;* Diluted Alcohol *a sufficient quantity.* Macerate the Opium with the Water for three days, with frequent agitation; then add the Alcohol, and continue the maceration for three days longer. Introduce the mixture into a percolator, and, when the liquid has ceased to pass, pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

"Take of Opium, in coarse powder, *one ounce and a half* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]. It contains the soluble matter of 33 grains of opium, nearly, in one fluidounce." *Br.**

The proportion of opium in these formulas is so nearly the same that the resulting tinctures may be considered identical. The apparent difference between the British formula and ours will vanish, when the relative value of the avoirdupois weight and Imperial measure, which they employ, and of the troy weight and wine measure of our Pharmacopœia, is estimated. The drying and powdering of the opium is clearly a useful provision; as it ensures greater uniformity in the strength of the tincture. Crude opium contains variable proportions of water; and laudanum prepared from a moist specimen will be weaker than that from an equal weight of the dried. The pulverization ensures the previous drying of the drug, and is thus useful independently of the greater facility which it gives to the action of the menstruum. It is troublesome, however, and is often neglected. Innovation in so important a preparation, and one in which uniformity is so desirable, should be avoided, unless shown to be necessary. There can be little doubt, we think, that the present somewhat elaborate method of the U.S. formula ensures a more complete exhaustion of the opium than the former simple procedure of maceration for two weeks, and still more so than the British process, which macerates for only one week.

In the United States and Great Britain, this tincture is universally known by the name of *laudanum.* As this term was formerly applied to other preparations of opium, and still continues to be so on the continent of Europe, the tincture is sometimes distinguished by the epithet *liquidum*, which, however, is seldom used in this country. *Tinctura Thebaica* is another title by which the preparation is known.

About two-thirds of the opium used in the preparation of the tincture are dissolved, the residue consisting chiefly of inert matter. Allowing the opium to be wholly exhausted of its active principles, one grain would be represented by 12·8 minims, according to the U.S. formula; but a minute quantity of morphia has been detected in the residuary matter, so that the tincture is rather weaker than the proportion of opium employed would indicate. The difference, however, is insufficient to be of any practical importance. Estimating the morphia strength of opium according to the requirements of the present U.S. Pharmacopœia, the tincture should contain three and seventy-five-hundredths of a grain of morphia in every ounce. In practice laudanum very rarely fully measures up to this standard, and a large pro-

* *Tinctura Opii Muriatica.* Under this name is sometimes prescribed a preparation made in accordance with the following formula. Take of Powdered Opium *one ounce;* Muriatic Acid *one fluidounce;* Distilled Water *fifteen fluidounces.* Macerate for 14 days, filter, and add sufficient water to make a pint. (*Note to the fourteenth edition.*)

portion of that in the market is far below it. This is especially the case with the cheap laudanums which are so extensively sold to country stores.

The tincture of opium is used for all the purposes to which opium itself is applied. (See *Opium.*) The dose, equivalent to a grain of opium, is about thirteen minims, or twenty-five drops. Mr. Phillips, in his translation of the London Pharmacopœia of 1836, states that, by evaporating the tincture, and also by determining the quantity of opium left undissolved, he found the preparation to contain one grain of opium in 19 minims; and this quantity, therefore, is given as the dose equivalent to a grain of opium. But this mode of calculation is obviously fallacious; as the portion of the drug dissolved is much more active than that left behind by the menstruum. Indeed, so feeble is the latter, that Dr. Garrod gave thirty grains of the residue to a healthy adult without effect. (*Pharm. Journ.*, xi. 252.) It should be recollected that a fluid-drachm or teaspoonful of laudanum (60 minims) will yield, on an average, about 120 drops. Laudanum when long kept, with occasional exposure to the air, becomes thick from the evaporation of a portion of the alcohol, and the deposition of opium. If given in this state, it often acts with unexpected energy; and death has resulted in infants from its use in doses which would have been entirely safe if the tincture had been clear.

Denarcotized laudanum may be prepared by substituting the extract of opium in half the quantity for the opium itself, and, previously to the maceration in diluted alcohol, exhausting it of the narcotina by ether.*

Off. Prep. Enema Opii, *Br.;* Linimentum Opii, *Br.* W.

TINCTURA OPII ACETATA. *U.S. Acetated Tincture of Opium.*

"Take of Opium, dried, and in moderately fine powder, *two troyounces;* Distilled Vinegar *twelve fluidounces;* Alcohol *half a pint.* Rub the Opium with the Distilled

* *Elixir of Opium.* Under this name have been sold different liquid preparations of opium, consisting mainly, in all probability, of an aqueous solution, with sufficient alcohol to preserve it. A formula of this kind was published by Mr. Eugene Dupuy, of New York, in the *Am. Journ. of Pharm.* (xxiii. 211). Professor Procter in the same place gave a formula, differing from that of Mr. Dupuy in the employment of ether, so as to obtain at one operation a preparation analogous to the denarcotized laudanum mentioned in the text. This formula of Prof. Procter has been adopted, with some slight change, in the present edition of the U. S. Pharmacopœia, under the title of *Tinctura Opii Deodorata*, which will be found in the text.

Since the publication of the eleventh edition of the U. S. Dispensatory, the supposed composition of the nostrum, long noted and much used under the name of *McMunn's Elixir of Opium*, has been published in the *Medical and Surgical Reporter* of this city; the formula having been furnished to that journal as found among the papers of the late Dr. Chilton, of New York, who is supposed to have received it from the proprietor. The following is an abstract of the formula. Five pounds of opium were first exhausted by ether of everything soluble in that menstruum, including the narcotina and the odorous principle. The drug was then introduced into water heated short of the boiling point, which caused a strong ebullition through the escape of the ether remaining in the mass. After the expulsion of the ether, it was macerated to exhaustion with water sufficient to make, when strained, four gallons of infusion; and if the quantity fell short of this, enough boiling water was added to complete the measure. After standing for five or six days in a cool cellar, the clear liquor was removed, and, the residue having been filtered, was mixed with the filtrate. To the four gallons of watery infusion thus prepared five and a half gallons of alcohol were added, and the mixture set aside for a few days, when the clear part was ladled out and the dregs filtered as before. The strength was intended to be the same as that of laudanum. (See *Am. Journ. of Pharm.*, May, 1864, p. 262.)

In the same journal (March, 1860, p. 129) Dr. Squibb published the formula of what he denominates "*Liquor Opii Compositus,*" of which the outline is, *first*, the exhaustion of the opium with water; *secondly*, after concentration of the infusion, the addition of alcohol so as to dissolve everything soluble in that liquid; *thirdly*, after concentration of the clear alcoholic solution, the washing of the residue with ether, the ethereal washings being rejected; *fourthly*, the solution of the washed extract in water, with subsequent filtration; *fifthly*, the assaying of the watery solution to ascertain the proportion of morphia; and *lastly*, adding to the solution so much compound spirit of ether (Hoffmann's anodyne) as to make each fluidounce of the resulting compound solution of opium contain four grains of morphia and fifty-six grains of the compound spirit of ether, representing the average morphia strength of the officinal tincture of opium. For particulars the reader is referred to the communication of Dr. Squibb, in the above-mentioned journal. Most of these extra-officinal preparations of opium will probably be superseded by the excellent officinal introduced into the present [1860] edition of our Pharmacopœia, under the name of *Tinctura Opii Deodorata.* (*Note to the twelfth edition.*)

In the *Am. Journ. of Pharm.*, xlii. 33, is a very elaborate paper by Dr. Squibb, reaffirming the superiority of his Liquor Opii Compositus, proposing various improvements in the formula, and giving elaborate directions as to the methods of preparation and assay. (*Note to the fourteenth edition.*)

Vinegar; then add the Alcohol, and, having macerated for seven days, express, and filter through paper." *U. S.*

This preparation was introduced into the second edition of our Pharmacopœia as a substitute for the *Acetum Opii* or *black drop* of the original work, the advantages of which it was supposed to possess, without being liable to the same objection of uncertainty of strength. The Acetum Opii, however, having maintained its standing in the estimation of the profession, and of the public, was restored, in the edition of 1840, to its officinal rank, but so modified as to ensure a preparation as uniform as is consistent with the variable quality of the opium used. At the same time the formula for the acetated tincture was retained, as affording a useful preparation. It was originally employed by the late Dr. Joseph Hartshorne, of Philadelphia.

The acetated tincture of opium may often be advantageously used in cases in which laudanum or opium itself produces unpleasant effects, such as nausea and vomiting, intense headache, great nervous disorder, &c.; but the introduction of the salts of morphia into use has in a great measure superseded the necessity of this preparation. The dose is ten minims, or about twenty drops, equivalent to a grain of opium. W.

TINCTURA OPII AMMONIATA. *Br. Ammoniated Tincture of Opium.*

"Take of Opium, in coarse powder, *one hundred grains;* Saffron, cut small, Benzoic Acid, of each, *one hundred and eighty grains;* Oil of Anise *one fluidrachm;* Strong Solution of Ammonia *four fluidounces* [Imperial measure]; Rectified Spirit *sixteen fluidounces* [Imp. meas.]. Macerate for seven days, in a well-closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Rectified Spirit to make one pint." *Br.*

This is an old preparation of the Edinburgh Pharmacopœia, formerly used in Scotland under the name of Paregoric Elixir. It differs, however, both in composition and strength, from the very popular preparation known by the same common name in the United States. As ammonia precipitates morphia from its solutions, it was doubted whether the tincture contained any of that alkaloid; and to decide the question, Mr. Gilbert, of Nottingham, England, submitted portions of the tincture to chemical examination, and was unable to detect morphia. (*Med. Examiner*, iv. 493.) But, while ammonia precipitates morphia, a great excess of it redissolves the precipitate, and, according to Dr. Christison, if prepared according to the Edinburgh formula, in which a strong alcoholic solution is employed, there is sufficient excess of ammonia to produce this effect; while we are not informed whether the tincture examined by Dr. Gilbert was made with this spirit of ammonia, or the much weaker spirit of the London College; so that his experiments cannot be admitted as conclusive. At best, however, the preparation is of doubtful propriety; as, if the ammoniacal addition should not happen to have the requisite strength, or if the ammonia should escape or become carbonated by exposure, the strength of the tincture might be affected. Influenced, we presume, by considerations of this kind, the editors of the first British Pharmacopœia rejected the preparation altogether. But popular preference, though local, seems to have led to its readmission into the Br. Pharmacopœia at its late revision, though in a slightly modified form; strong solution of ammonia and rectified spirit being substituted for the Edinburgh spirit of ammonia, which is not officinal in the Br. Pharmacopœia. The dose is stated at from thirty minims to a fluidrachm. W.

TINCTURA OPII CAMPHORATA. *U. S.* TINCTURA CAMPHORÆ COMPOSITA. *Br. Camphorated Tincture of Opium. Compound Tincture of Camphor. Paregoric Elixir.*

"Take of Opium, dried, and in moderately fine powder, Benzoic Acid, each, *sixty grains;* Camphor *forty grains;* Oil of Anise *a fluidrachm;* Clarified Honey *two troyounces;* Diluted Alcohol *two pints.* Mix the ingredients in a suitable bottle, macerate for seven days, and filter through paper." *U. S.*

"Take of Opium, in coarse powder, Benzoic Acid, of each, *forty grains;* Camphor *thirty grains;* Oil of Anise *half a fluidrachm;* Proof Spirit *one pint* [Imperial

measure]. Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

This is the well-known *paregoric elixir.* It is a very pleasant anodyne and antispasmodic, much used to allay cough in chronic catarrh, asthma, consumption, pertussis, &c.; to relieve nausea and slight pains in the stomach and bowels; to check diarrhœa; and, in infantile cases, to procure sleep. Half a fluidounce of the U. S. and British tincture contains rather less than a grain of opium. Liquorice, which was directed in a former edition of the U. S. Pharmacopœia, was omitted in that of 1840, in consequence of giving to the preparation the dark colour of laudanum, and thus leading to mistake. The dose for an infant is from five to twenty drops, for an adult from one to two fluidrachms.*

Off. Prep. Mistura Glycyrrhizæ Composita, *U. S.* W.

TINCTURA OPII DEODORATA. *U. S. Deodorized Tincture of Opium.*

"Take of Opium, dried, and in moderately fine powder, *two troyounces and a half;* Ether, Alcohol, each, *half a pint;* Water *a sufficient quantity.* Macerate the Opium with half a pint of Water for twenty-four hours, and express; then repeat the operation twice with the same quantity of Water. Mix the expressed liquids, and, having evaporated the mixture to four fluidounces, allow it to cool and shake it repeatedly, in a bottle, with the Ether. Pour off the ethereal solution when it has separated by standing, and evaporate the remaining liquid until all traces of ether have disappeared. Mix the residue with twenty fluidounces of Water, and filter the mixture through paper. When the liquid has ceased to pass, add enough Water, through the filter, to make the filtered liquid measure a pint and a half. Lastly, add the Alcohol, and mix them together." *U. S.*

This is an excellent preparation of opium, calculated to supersede various extra-officinal *elixirs* or *solutions*, which have had more or less vogue, based upon the real advantages they afforded, in offering liquid preparations of opium exempt from certain noxious ingredients in the crude drug and in the officinal tinctures, which rendered them so offensive to some constitutions, and in some conditions of disease, as almost to forbid their use. A liquid watery extract is first made, in which are left behind all the ingredients of opium soluble in alcohol and not in water; and this being well shaken with ether, is further deprived of all the principles soluble in this fluid, including narcotina, and the noxious odorous matter, which is probably one of the most offensive and least useful constituents of opium. The ether is then entirely separated, and the residue having been dissolved in water, the solution is filtered, and mixed with enough alcohol to preserve it. The name is, we think, unfortunate, as the preparation is really not a tincture; the alcohol being used in no degree as a menstruum, but only in reference to its preservative influence. We should have preferred *Infusum Opii Deodoratum*, or some other title expressive of the fact that it is effectively a watery solution of an extract of opium, deprived of

* The following formulas have been adopted by the Philadelphia College of Pharmacy for the preparation of the two compound tinctures of opium, so much used under the names of *Bateman's drops* and *Godfrey's cordial.* So long as these nostrums are employed, it is important that they should be prepared in a uniform manner, and of a certain strength; as serious consequences may happen from diversity in the formulas, when so active a substance as opium is the chief ingredient. Such diversity has existed to a very great extent; so much so that in one formula for Bateman's drops the quantity of opium was seven and a half grains to the pint, while in another it exceeded one hundred grains. It was in order to remedy this evil that the College was induced to adopt the formulas here presented.

"*Bateman's pectoral drops.* Take of Diluted Alcohol Cong. iv, Red Saunders, rasped, ℥ij. Digest for twenty-four hours, filter, and add of Opium, in powder, ℥ij, Catechu, in powder, ℥ij. Camphor ℥ij, Oil of Anise f℥iv. Digest for ten days." This preparation is about equal in strength to the camphorated tincture of opium or paregoric elixir of the U. S. Pharmacopœia, containing about two grains of opium to the fluidounce.

"*Godfrey's cordial.* Take of Tincture of Opium, Oiss, Molasses (from the sugar refiners) Oxvj, Alcohol Oij, Water Oxxvj, Carbonate of Potassium ℥iiss, Oil of Sassafras f℥iv. Dissolve the Carbonate of Potassium in the Water, add the Molasses, and heat over a gentle fire till they simmer; take off the scum which rises, and add the Laudanum, Alcohol, and Oil of Sassafras, having previously mixed them well together. This preparation contains the strength of rather more than one grain of opium in a fluidounce. (*Journ. of the Phil. Col. of Pharm.*, v. 26 and 27.) Death has been produced by it in the infant. (*Pharm. Journ. and Trans.*, 3d ser., i. 199.)

the odorous and other injurious ingredients of that drug. It may be used in all cases in which laudanum is indicated, but in which it cannot be used in consequence of idiosyncrasy of the patient, or peculiarity in the disease. The dose is the same as that of the officinal tincture of opium. W.

TINCTURA PYRETHRI. *Br. Tincture of Pellitory.*

The *British Pharmacopœia* takes *four avoirdupois ounces* of Pellitory Root, in coarse powder, and *one Imperial pint* of Rectified Spirit, and proceeds in the manner directed for Tincture of Aconite. (See *Tinctura Aconiti*, page 1492.)

This is a new officinal of the Br. Pharmacopœia, intended exclusively for external use. It is a powerful local irritant. For its uses, the reader is referred to the article on Pellitory in *Part* I. of this work. W.

TINCTURA QUASSIÆ. *U. S., Br. Tincture of Quassia.*

"Take of Quassia, in moderately fine powder, *two troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

"Take of Quassia Wood, in chips, *three-quarters of an ounce* [avoirdupois]; Proof Spirit *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Proof Spirit to make one pint [Imp. meas.]." *Br.*

This tincture was omitted in the first British Pharmacopœia, but has been resumed in the present. The proportion of the quassia, though somewhat greater than in the old Edinburgh formula, is still much too small. A fluidrachm, which is the medium dose, represents only about two grains of the wood.

In the edition of the U. S. Pharmacopœia of 1840, the proportion of the quassia to the menstruum was very judiciously doubled. A tonic tincture can scarcely contain too large a proportion of the active ingredient. The tincture may be employed as an addition to tonic infusions or mixtures in the dose of one or two fluidrachms. It is a pure and intense bitter. W.

TINCTURA QUINIÆ. *Br. Tincture of Quinia.*

"Take of Sulphate of Quinia *one hundred and sixty grains;* Tincture of Orange Peel *one pint* [Imperial measure]. Dissolve the Sulphate of Quinia in the Tincture with the aid of a gentle heat; then allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter." *Br.*

A fluidrachm of this preparation, containing a grain of sulphate of quinia, may be given for a dose. W.

TINCTURA QUINIA AMMONIATA. *Br. Ammoniated Tincture of Quinia.*

"Take of Sulphate of Quinia *one hundred and sixty grains;* Solution of Ammonia *two and a half fluidounces* [Imperial measure]; Proof Spirit *seventeen and a half fluidounces.* Dissolve the Sulphate of Quinia in the Spirit with a gentle heat, and add the Solution of Ammonia." *Br.*

The dose of this preparation, which would seem to be a useless one, is from one-half to one fluidrachm. H. C. W.

TINCTURA RHEI. *U. S., Br. Tincture of Rhubarb.*

"Take of Rhubarb, in moderately coarse powder, *three troyounces;* Cardamom, in moderately fine powder, *half a troyounce;* Diluted Alcohol *a sufficient quantity.* Mix the powders, and, having moistened the mixture with a fluidounce of Diluted Alcohol, pack it moderately in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes of Rhubarb Root, in coarse powder, *two avoirdupois ounces;* of Cardamom Seeds, freed from their pericarps, and bruised, Coriander Fruit, bruised, and Saffron, of each, *a quarter of an avoirdupois ounce*, and *one Imperial pint* of Proof Spirit; and with these ingredients proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

The tincture of rhubarb on standing lets fall a yellow deposit. This has been shown

by Mr. Jas. T. King (*Am. Journ. of Pharm.*, xlii.) in most cases to be largely composed of chrysophanic acid. The difficulty may be met by the use of a stronger alcohol, or, as proposed by Mr. J. B. Moore (*Am. Journ. of Pharm.*, xlv. 306), by the substitution of glycerin for a portion of the alcohol. H. C. W.

TINCTURA RHEI ET ALOËS. *U. S.* 1850, *Ed.* Elixir Sacrum. *Tincture of Rhubarb and Aloes. Sacred Elixir.*

"Take of Rhubarb, bruised, *ten drachms;* Aloes, in powder, *six drachms;* Cardamom [seeds], bruised, *half an ounce;* Diluted Alcohol *two pints.* Macerate for fourteen days, express, and filter through paper." *U. S.* 1850.

The *Ed. College* took *a troyounce and a half* of Rhubarb, *six drachms* of Socotrine or E. India Aloes, both in moderately fine powder, *five drachms* of bruised Cardamom seeds, and *two Imperial pints* of Proof Spirit, moistened the solid materials with a little of the Spirit, and, having allowed the mass to stand for ten or twelve hours, packed it in a percolator, and poured on the remainder of the Spirit.

TINCTURA RHEI ET GENTIANÆ. *U. S.* 1850, *Ed.* *Tincture of Rhubarb and Gentian.*

"Take of Rhubarb, bruised, *two* [*troy*]*ounces;* Gentian, bruised, *half a* [*troy*] *ounce;* Diluted Alcohol *two pints.* Macerate for fourteen days, express, and filter through paper." *U. S.* 1850.

The *Ed. College* took *two troyounces* of Rhubarb, in moderately fine powder, *half a troyounce* of Gentian, finely cut or in coarse powder, and *two Imperial pints* of Proof Spirit, and proceeded in the same manner as above indicated for Tincture of Rhubarb and Aloes.

The foregoing tinctures of Rhubarb, of which the first only is now officinal, are all in a greater or less degree purgative, stomachic, and tonic; but, except in low states of the system, or in cases of individuals accustomed to the use of ardent spirits, they are too feebly cathartic in proportion to their stimulant power, to be advantageously employed, unless as adjuvants to other medicines. Combined with the neutral salts or other laxatives, or with tonic and stomachic infusions, mixtures, &c., they serve to render them warmer and more cordial to the stomach, and often prove beneficial in flatulent colic, dyspepsia, the costiveness of cold and irritable habits, diarrhœa, and other analogous complaints. One of them is to be preferred to another, according as its peculiar composition may, in the judgment of the practitioner, appear to adapt it to the circumstances of the case under treatment. In low forms of fever, when the indication is to evacuate the bowels, and at the same time stimulate the patient, the simple tincture (*Tinctura Rhei*) may be advantageously used in doses of two or three fluidrachms, repeated at proper intervals till it operates. The ordinary dose of these tinctures, as purgatives, is from half a fluidounce to a fluidounce; as stomachics, from one to two or three fluidrachms. According to Menière, the tincture of rhubarb yields on standing an abundant greenish precipitate, containing starch,* and consisting of two parts, one soluble and the other insoluble in alcohol, the latter having the form of long needles. (*Journ. de Pharm.*, Avril, 1861, p. 290.) From the statements of De la Rue and Muller it appears that much of the deposit in tincture of rhubarb consists of chrysophanic acid, suggesting the propriety, at least in a pharmaceutical point of view, of increasing the alcoholic strength of the menstruum. W.

TINCTURA RHEI ET SENNÆ. *U. S.* *Tincture of Rhubarb and Senna.*

"Take of Rhubarb, in moderately coarse powder, *a troyounce;* Senna, in moderately coarse powder, *one hundred and twenty grains;* Coriander, in moderately coarse powder, Fennel, in moderately coarse powder, each, *sixty grains;* Liquorice [extract], in moderately coarse powder, *thirty grains;* Raisins, deprived of their seeds, *six*

* How starch should have found its way into the tincture it is difficult to understand. The observations of M. Menière were made with the microscope. He states that the deposits are made generally with extreme slowness. Whenever he noticed starch or gum, these substances were never deposited alone. In the midst of the deposits, he has often found a white pearly matter, uncrystallized, insoluble in water, which he believes to be hydrated silica, and certain salts, such as the sulphate and carbonate of calcium, proceeding probably, as well as the silica, from the water used in diluting the alcohol. (*Journ. de Pharm.*, Avril, 1861, p. 288.)—*Note to the twelfth edition*

troyounces; Diluted Alcohol *three pints.* Macerate for seven days, express, and filter through paper." *U. S.*

This is the stomachic so well known, and so much used in this country, under the name of *Warner's gout cordial.* It is a feeble purgative, usually acceptable to the stomach, and well adapted to cases of costiveness, with gastric uneasiness, in persons of a gouty habit, and accustomed to the free use of alcoholic drink. The dose is from half a fluidounce to two fluidounces. W.

TINCTURA SABINÆ. *Br.* *Tincture of Savin.*

The *British Pharmacopœia* directs this Tincture to be prepared from *two and a half avoirdupois ounces* of Savin Tops, dried and coarsely powdered, and *one Imperial pint* of Proof Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This is a new officinal of the original British Pharmacopœia. It is a convenient form for the exhibition of savin. The dose is from twenty minims to a fluidrachm. W.

TINCTURA SANGUINARIÆ. *U. S.* *Tincture of Bloodroot.*

"Take of Bloodroot, in moderately fine powder, *four troyounces;* Alcohol, Water, each, *a sufficient quantity.* Mix three measures of Alcohol with one of Water. Moisten the powder with a fluidounce of the mixture, pack it in a conical percolator, and gradually pour the menstruum upon it until two pints of tincture are obtained." *U. S.*

This will prove emetic in the dose of three or four fluidrachms; but it is rather intended to act as a stimulant to the stomach, an expectorant, or an alterative, for which purpose from thirty to sixty drops may be given. W.

TINCTURA SCILLÆ. *U. S.*, *Br.* *Tincture of Squill.*

"Take of Squill, in moderately coarse powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* directs this Tincture to be prepared from *two and a half avoirdupois ounces* of bruised Squill, and *one Imperial pint* of Proof Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture yields a grayish, rose-coloured, very bitter, and acrid deposit, consisting of silky tufts (*Menière*), possesses all the virtues of squill, and may be given for the same purposes, whenever the spirituous menstruum is not objectionable. The dose as an expectorant or diuretic is from ten to twenty minims (twenty to forty drops), and the latter quantity frequently nauseates. W.

TINCTURA SENEGÆ. *Br.* *Tincture of Senega.*

The *British Pharmacopœia* prepares this Tincture from *two and a half avoirdupois ounces* of Senega Root, in coarse powder, and *one Imperial pint* of Proof Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

The tincture of seneka has been newly introduced into the British Pharmacopœia. It is no doubt an efficient preparation, but hardly needed while recourse can be had to the extract, syrup, and decoction. The dose is from thirty minims to two fluidrachms. W.

TINCTURA SENNÆ. *Br.* TINCTURA SENNÆ COMPOSITA. *Lond.* *Tincture of Senna.* *Compound Tincture of Senna.*

"Take of Senna, broken small, *two and a half ounces* [avoirdupois]; Raisins, freed from seeds, *two ounces* [avoird.]; Caraway Fruit, bruised, Coriander Fruit, bruised, of each, *half an ounce* [avoird.]; Proof Spirit *one pint* [Imperial measure]." With these ingredients the British Pharmacopœia prepares the tincture in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture is the *elixir salutis* of the old Pharmacopœias. It is a warm cordial purgative, useful in costiveness attended with flatulence, and in atonic gout, especially when occurring in intemperate persons. It is also added to cathartic infusions

and mixtures. The dose is from two fluidrachms to a fluidounce or more. Tincture of senna gives a yellow deposit, disposed in plates, containing starch and white crystals of calcareous salts. (*Menière.*)

Off. Prep. Mistura Sennæ Composita, *Br.* W.

TINCTURA SERPENTARIÆ. *U. S., Br. Tincture of Serpentaria. Tincture of Virginia Snakeroot.*

"Take of Serpentaria, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Serpentary Root, in coarse powder, and *one Imperial pint* of Proof Spirit, and prepares the Tincture in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture possesses the tonic and cordial properties of the root, and may be advantageously added to the infusion of Peruvian bark in low states of the system. The dose is one or two fluidrachms. W.

TINCTURA STRAMONII. *U.S., Br. Tincture of Stramonium.*

"Take of Stramonium Seed, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of bruised Stramonium Seeds, and *one Imperial pint* of Proof Spirit, and prepares the tincture as directed for the Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture may be used for all the purposes for which stramonium is given, in the dose of from ten to twenty minims (twenty to forty drops), repeated twice or thrice a day, and gradually increased till it affects the system. W.

TINCTURA SUMBUL. *Br. Tincture of Sumbul.*

The *British Pharmacopœia* directs this Tincture to be prepared from *two and a half avoirdupois ounces* of Sumbul Root, in coarse powder, and *an Imperial pint* of Proof Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This is a new officinal, very little if at all employed in this country. An account of its medical properties will be found under Sumbul, in *Part* I. of this work. The dose is from ten to thirty minims. W.

TINCTURA TOLUTANA. *U.S., Br. Tincture of Tolu.*

"Take of Balsam of Tolu *three troyounces;* Alcohol *two pints.* Macerate the Balsam with the Alcohol until it is dissolved; then filter through paper." *U. S.*

"Take of Balsam of Tolu *two ounces and a half* [avoirdupois]; Rectified Spirit *a sufficiency.* Macerate the Balsam of Tolu in fifteen fluidounces of the Spirit, in a closed vessel, with occasional agitation, for six hours, or until the Balsam is dissolved, then filter, and add sufficient Rectified Spirit to make one pint [Imperial measure]." *Br.*

The tincture of tolu has the properties of the balsam, and may be employed as an addition to expectorant mixtures in chronic catarrhal affections; but the proportion of alcohol is too large to allow of its advantageous use in ordinary cases. The dose is one or two fluidrachms. In smaller quantities it is often employed to flavour cough mixtures. It is decomposed by water.

Off. Prep. Syrupus Tolutanus, *U. S.;* Trochisci Acidi Tannici, *Br.;* Trochisci Morphiæ, *Br.;* Trochisci Morphiæ et Ipecacuanhæ, *Br.;* Trochisci Opii, *Br.* W.

TINCTURA VALERIANÆ. *U. S., Br. Tincture of Valerian.*

'Take of Valerian, in moderately fine powder, *four troyounces;* Diluted Alcohol *a sufficient quantity.* Moisten the powder with a fluidounce of Diluted Alcohol, pack it in a conical percolator, and gradually pour Diluted Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes *two and a half avoirdupois ounces* of Valerian Root, in coarse powder, and *one Imperial pint* of Proof Spirit, and proceeds in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

This tincture possesses the properties of Valerian, but cannot be given in ordinary cases, so as to produce the full effects of the root, without stimulating too highly, in consequence of the large proportion of spirit. The dose is from one to four fluidrachms. It deposits on standing a black, very cohesive precipitate, with starch, and a yellow extractive matter. (*Menière.*) W.

TINCTURA VALERIANÆ AMMONIATA. *U. S.*, *Br.* TINCTURA VALERIANÆ COMPOSITA. *Lond.* *Ammoniated Tincture of Valerian.*

"Take of Valerian, in moderately fine powder, *four troyounces;* Aromatic Spirit of Ammonia *two pints.* Macerate for seven days, express, and filter through paper." *U. S.*

"Take of Valerian Root, in coarse powder, *two ounces and a half* [avoirdupois]; Aromatic Spirit of Ammonia *one pint* [Imperial measure]. Macerate for seven days, in a well-closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Aromatic Spirit of Ammonia to make one pint [Imp. meas.]." *Br.*

The ammonia in this preparation is thought to assist the solvent powers of the alcohol, while it co-operates with the valerian in medical action. The tincture is employed as an antispasmodic in hysteria and other nervous affections. The dose is from thirty minims to a fluidrachm, and should be given in sweetened water, milk, or some mucilaginous fluid. W.

TINCTURA VERATRI VIRIDIS. *U. S.*, *Br.* *Tincture of American Hellebore.* *Tincture of Green Hellebore.*

"Take of American Hellebore, in moderately fine powder, *sixteen troyounces;* Alcohol *a sufficient quantity.* Moisten the powder with four fluidounces of Alcohol, pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* takes of Green Hellebore Root, in coarse powder, *four ounces* (avoirdupois), and of Rectified Spirit *one pint* (Imperial measure), and prepares the Tincture in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

The U. S. tincture of American hellebore is of the same strength as Dr. Norwood's tincture, which, when prepared by its author, was supposed to be saturated. This may be true of certain ingredients of the root, though probably not in reference to the active principle or principles which it may contain. The commencing dose should not exceed from three to eight drops. The British tincture is much weaker: the proportion of the root to the menstruum being, in the American tincture about as one to two, in the British as one to five. W.

TINCTURA ZINGIBERIS. *U. S.*, *Br.* *Tincture of Ginger.*

"Take of Ginger, in fine powder, *eight troyounces;* Alcohol *a sufficient quantity.* Moisten the powder with two fluidounces of Alcohol, pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it until two pints of tincture are obtained." *U. S.*

The *British Pharmacopœia* prepares this Tincture from *two and a half avoirdupois ounces* of Ginger, in coarse powder, and *one Imperial pint* of Rectified Spirit, in the manner directed for Tincture of Aconite Root. (See *Tinctura Aconiti*, page 1492.)

The tincture of the British Pharmacopœia, though more than twice as strong as was that of the London and Edinburgh Colleges, is still too weak with ginger to be used advantageously for other purposes than to impart flavour. We greatly prefer the U. S. process, which yields a preparation in which the virtues of the ginger are not completely swallowed up in the menstruum. In consequence of the mucilaginous matter contained in ginger, the tincture made with diluted alcohol or proof spirit is apt to be turbid. Alcohol or rectified spirit is, therefore, properly preferred. Good Jamaica ginger should be used.

The tincture of ginger is a useful carminative, and may often be beneficially added

to tonic and purgative infusions or mixtures, in debilitated states of the alimentary canal. The dose is from seven or eight to twenty minims. It is, however, in this country, chiefly used for the preparation of a syrup of ginger, for which purpose, however, the fluid extract is officinal, and is better even than the strong tincture of the U. S. Pharmacopœia.

Off. Prep. Syrupus Zingiberis, *U. S.* W.

TINCTURA ZINGIBERIS FORTIOR. *Br. Strong Tincture of Ginger. Essence of Ginger.*

"Take of Ginger, in fine powder, *ten ounces* [avoirdupois]; Rectified Spirit *a sufficiency.* Pack the Ginger tightly in a percolator, and pour over it carefully *half a pint* [Imperial measure] of the Spirit. At the expiration of two hours add more Spirit, and let it percolate slowly until one pint [Imp. meas.] has been collected." *Br.*

This is a new officinal of the Br. Pharmacopœia. The strengths of the three tinctures, the English, the American, and the English strong, are respectively 1 to 8, 1 to 4, 1 to 2. The dose is from five to twenty minims. It is, however, chiefly used in the preparation of the Syrup.

Off. Prep. Syrupus Zingiberis, *Br.* W.

TROCHISCI.

Troches.

Troches or *lozenges* are small, dry, solid masses, usually of a flattened shape, consisting for the most part of powders incorporated with sugar and mucilage. They are designed to be held in the mouth, and dissolved slowly in the saliva, and are, therefore, adapted for the administration of those medicines only which do not require to be given in large quantities, and are destitute of any very disagreeable flavour. They are much more used, and more skilfully prepared in Europe than in this country. Tragacanth, from the greater tenacity of its mucilage, is better suited for their formation than gum arabic. The following directions for preparing them are taken from the *Dictionnaire des Drogues.* A mucilage of tragacanth is first prepared with cold water and strained. With this the powders, including sugar, are thoroughly mixed by rubbing upon a marble slab, and are thus formed into a paste, which is spread out by means of a roller upon the surface of the marble, previously powdered over with a mixture of sugar and starch. The thickness of the extended mass is rendered uniform by a frame upon which the ends of the roller rest. The upper surface is now covered with a thin layer of sugar and starch, and the mass is divided into small cakes of a particular shape by means of a punch. These cakes are placed upon paper, and, having been exposed to the air for twelve hours, are carried into a drying-room moderately heated. When perfectly dry, they are thrown upon a sieve to separate the sugar and starch, and are then enclosed in bottles. In this way lozenges may be prepared from almost any medicine which the physician may deem it advisable to administer in that form. The following formula will serve as a guide. Take of citric acid, in powder, a drachm; refined sugar eight ounces; oil of lemons twelve minims; mucilage of tragacanth a sufficient quantity. Form them in the manner above directed into troches of twelve grains each. A species of lozenge is made by uniting the aromatic essential oils with sugar alone; but their preparation belongs to the confectioner rather than to the apothecary.

The troches, formerly officinal, which are omitted in the present Pharmacopœias, are those of *Tartaric Acid, Gum Arabic, Lactucarium,* and *Liquorice,* all of the late Ed. Pharmacopœia. W.

TROCHISCI ACIDI TANNICI. *U. S., Br. Tannin Lozenges. Troches of Tannic Acid.*

"Take of Tannic Acid a troyounce; Sugar, in fine powder, *ten troyounces;* Tragacanth, in fine powder, *one hundred and twenty grains;* Orange Flower Water *a sufficient quantity.* Rub the powders together until they are thoroughly mixed; then with the Orange Flower Water form a mass, to be divided into four hundred and eighty troches." *U. S.*

"Take of Tannic Acid *three hundred and sixty grains;* Tincture of Tolu *half a fluidounce;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce.* Dissolve the Tannic Acid in the Water, add first the Tincture of Tolu, previously mixed with the mucilage, then the Gum and the Sugar, also previously well mixed. Form the whole into a proper mass; divide it into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains half a grain of Tannic Acid." *Br.*

These are useful in relaxation of the uvula, and chronic inflammation of the fauces, being held in the mouth and allowed slowly to dissolve. Each U.S. troche contains one grain of the acid. W.

TROCHISCI BISMUTHI. *Br. Bismuth Lozenges. Troches of Bismuth.*

"Take of Subnitrate of Bismuth *fourteen hundred and forty grains;* Carbonate of Magnesia *four ounces* [avoirdupois]; Precipitated Carbonate of Lime *six ounces* [avoird.]; Refined Sugar *twenty-nine ounces* [avoird.]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Rose Water *a sufficiency.* Mix the dry ingredients, then add the Mucilage, and form the whole into a proper mass with Rose Water. Divide the mass into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains two grains of Subnitrate of Bismuth." *Br.*

These may be used to obtain the effects of subnitrate of bismuth on the system, as well as of the carbonates of magnesium and of calcium as an antacid; two or more being administered for a dose. They may also be found useful in chronic inflammation of the throat and œsophagus, by giving the mucous membrane a coating as the insoluble ingredients pass. W.

TROCHISCI CATECHU. *Br. Troches of Catechu. Catechu Lozenges.*

"Take of Pale Catechu [Gambir], in powder, *seven hundred and twenty grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *a sufficiency.* Mix the Catechu, Sugar, and Gum, and add the Mucilage and Water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat." *Br.*

These, like the troches of tannic acid, are useful in prolapsus of the uvula, and other forms of relaxation of the fauces; and may also be used, in the number of three or more at a dose, to obtain the effects of catechu on the primæ viæ and on the system. Each troche contains one grain of catechu. W.

TROCHISCI CRETÆ. *U. S. Troches of Chalk.*

"Take of Prepared Chalk *four troyounces;* Gum Arabic, in fine powder, *a troyounce;* Nutmeg, in fine powder, *sixty grains;* Sugar, in fine powder, *six troyounces.* Rub them together until they are thoroughly mixed; then with water form a mass, to be divided into four hundred and eighty troches." *U. S.*

These contain each four grains of chalk, and are used as a gentle astringent antacid in diarrhœa. W.

TROCHISCI CUBEBÆ. *U.S. Troches of Cubeb.*

"Take of Oleoresin of Cubeb *half a fluidounce;* Oil of Sassafras *a fluidrachm;* Liquorice, in fine powder, *four troyounces;* Gum Arabic, in fine powder, *two troyounces;* Sugar, in fine powder, *three troyounces;* Syrup of Tolu *a sufficient quantity.* Rub the powders together until they are thoroughly mixed; then add the Oleoresin and Oil, and incorporate them with the mixture. Lastly, with Syrup of Tolu form a mass, to be divided into four hundred and eighty troches." *U. S.*

Each lozenge contains about a drop of the oleoresin of cubeb. The preparation is intended rather for effect upon the fauces and other parts of the upper alimentary passages than on the system; and may be used advantageously in some cases of chronic cough, and in ulceration or chronic inflammation of the fauces, being held in the mouth and allowed slowly to dissolve. W.

TROCHISCI FERRI REDACTI. *Br. Reduced Iron Lozenges.*

"Take of Reduced Iron *seven hundred and twenty grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce*, or *a sufficiency.* Mix the Iron, Sugar, and Gum, and add the Mucilage and Water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one grain of reduced iron." *Br.*

From one to five of the lozenges may be taken for a dose. W.

TROCHISCI FERRI SUBCARBONATIS. *U. S. Troches of Subcarbonate of Iron.*

"Take of Subcarbonate of Iron *five troyounces;* Vanilla *thirty grains;* Sugar, in fine powder, *fifteen troyounces;* Mucilage of Tragacanth *a sufficient quantity.* Rub the Vanilla first with a part of the Sugar into a uniform powder, and afterwards with the Subcarbonate of Iron and the remainder of the Sugar until they are thoroughly mixed. Then with Mucilage of Tragacanth form a mass, to be divided into four hundred and eighty troches." *U. S.*

Each lozenge contains somewhat less than five grains of the subcarbonate, and from one to six may be given, according to the effects desired. (See *Ferri Subcarbonas.*) W.

TROCHISCI GLYCYRRHIZÆ ET OPII. *U. S.* TROCHISCI OPII. *Br. Troches of Liquorice and Opium. Opium Lozenges.*

"Take of Extract of Opium, in fine powder, *twenty-four grains;* Liquorice, in fine powder, *two troyounces;* Gum Arabic, in fine powder, *a troyounce;* Sugar, in fine powder, *three troyounces;* Oil of Anise *fifteen minims.* Rub the powders together till they are thoroughly mixed; then add the Oil of Anise, and incorporate it with the mixture. Lastly, with water form a mass, to be divided into four hundred and eighty troches." *U. S.*

"Take of Extract of Opium *seventy-two grains;* Tincture of Tolu *half a fluidounce;* Refined Sugar, in powder, *sixteen ounces* [avoirdupois]; Gum Acacia, in powder, *two ounces* [avoird.]; Extract of Liquorice *six ounces* [avoird.]; Distilled Water *a sufficiency.* Add the Extract of Opium, first softened by means of a little Water, and the Tincture of Tolu, to the Extract of Liquorice heated in a water-bath. When the mixture is reduced to a proper consistence remove it to a slab, add the Sugar and Gum previously rubbed together, and mix thoroughly. Divide the mass into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one-tenth of a grain of Extract of Opium." *Br.*

A preparation equivalent to the above is much used in Philadelphia under the name of *Wistar's cough lozenges.** Sometimes sulphate of morphia is substituted in equivalent proportion for the opium, and occasionally a little tartar emetic is added; but these modifications of the officinal formula are not admissible without a change of title. Each U. S. troche contains one-twentieth grain of the extract, the English each one-tenth of a grain.

These troches are demulcent and anodyne, and useful in allaying cough, when the case admits the employment of opium, of which each of them, prepared according to the U. S. formula, contains about one-tenth of a grain. W.

TROCHISCI IPECACUANHÆ. *U. S., Br. Troches of Ipecacuanha. Ipecacuanha Lozenges.*

"Take of Ipecacuanha, in fine powder, Tragacanth, in fine powder, each, *one hundred and twenty grains;* Arrow-Root, in fine powder, *two troyounces;* Sugar, in fine powder, *eight troyounces;* Syrup of Orange Peel *a sufficient quantity.* Rub the powders together until they are thoroughly mixed; then with Syrup of Orange Peel form a mass, to be divided into four hundred and eighty troches." *U. S.*

"Take of Ipecacuanha, in powder, *one hundred and eighty grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce,*

*For a description of a machine for making cylindrical lozenges, see *Am. Journ. of Pharm.*, 1874, p. 401.

or *a sufficiency.* Mix the powders and add the Mucilage and Water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each powder contains one-fourth of a grain of ipecacuanha." *Br.*

These are useful expectorant lozenges in catarrhal complaints. Each of the U. S. lozenges contains about one-quarter of a grain of ipecacuanha. W.

TROCHISCI MAGNESLÆ. *U. S. Troches of Magnesia.*

"Take of Magnesia *three troyounces;* Nutmeg, in fine powder, *sixty grains;* Sugar, in fine powder, *nine troyounces;* Mucilage of Tragacanth *a sufficient quantity.* Rub the Magnesia and the powders together until they are thoroughly mixed; then with Mucilage of Tragacanth form a mass, to be divided into four hundred and eighty troches." *U. S.*

These each contain three grains of magnesia, and are useful in acidity of the stomach, especially when attended with constipation. W.

TROCHISCI MENTHÆ PIPERITÆ. *U. S. Troches of Peppermint.*

"Take of Oil of Peppermint *a fluidrachm;* Sugar, in fine powder, *twelve troyounces;* Mucilage of Tragacanth *a sufficient quantity.* Rub the Oil of Peppermint with the Sugar until they are thoroughly mixed; then with Mucilage of Tragacanth form a mass, to be divided into four hundred and eighty troches." *U. S.*

Useful in slight gastric or intestinal pains, nausea, and flatulence; but employed more for their agreeable flavour than for their medicinal effects. W.

TROCHISCI MORPHLÆ. *Br. Morphia Lozenges. Troches of Morphia.*

"Take of Hydrochlorate of Morphia *twenty grains;* Tincture of Tolu *half a fluid ounce;* Refined Sugar, in powder, *twenty-four ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *a sufficiency;* Distilled Water *half a fluidounce.* Dissolve the Hydrochlorate of Morphia in the Water; add this solution to the Tincture of Tolu, previously mixed with *two fluidounces* of the Mucilage; then add the Gum and Sugar, previously mixed, and more Mucilage if necessary to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat." *Br.*

Useful for alleviating cough, and for other purposes which are answered by minute doses of morphia, of the muriate of which each lozenge contains about one-thirty-sixth of a grain. W.

TROCHISCI MORPHLÆ ET IPECACUANHÆ. *U. S., Br. Morphia and Ipecacuanha Lozenges. Troches of Morphia and Ipecacuanha.*

"Take of Sulphate of Morphia *twelve grains;* Ipecacuanha, in fine powder, *forty grains;* Sugar, in fine powder, *ten troyounces;* Oil of Gaultheria *five minims;* Mucilage of Tragacanth *a sufficient quantity.* Rub the powders together until they are thoroughly mixed; then add the Oil of Gaultheria, and incorporate it with the mixture. Lastly, with Mucilage of Tragacanth form a mass, to be divided into four hundred and eighty troches." *U. S.*

"Take of Hydrochlorate of Morphia *twenty grains;* Ipecacuanha, in fine powder, *sixty grains;* Tincture of Tolu *half a fluidounce;* Refined Sugar, in powder, *twenty-four ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *a sufficiency;* Distilled Water *half a fluidounce.* Dissolve the Hydrochlorate of Morphia in the Water; add this solution to the Tincture of Tolu, previously mixed with two fluidounces of the Mucilage; then add the Ipecacuanha, Gum, and Sugar, previously mixed, and more Mucilage if necessary to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat." *Br.*

Expectorant and anodyne, useful especially in allaying cough. The U. S. and the Br. lozenges contain each respectively one-fortieth and one-thirty-sixth of a grain of morphia salt, and one-twelfth of a grain of ipecacuanha. From one to six may be given for a dose. W.

TROCHISCI POTASSII CHLORATIS. *U. S.* TROCHISCI POTASSÆ CHLORATIS. *Br. Troches of Chlorate of Potassium. Chlorate of Potash Lozenges.*

"Take of Chlorate of Potassium, in fine powder, *five troyounces;* Sugar, in fine

powder, *eighteen troyounces;* Tragacanth, in fine powder, *two troyounces;* Vanilla *thirty grains.* Rub the Vanilla with a small quantity of the Sugar into a uniform powder, and mix this thoroughly with the remainder of the powders, avoiding pressure; then with water form a mass, to be divided into four hundred and eighty troches." *U. S.*

"Take of Chlorate of Potash *thirty-six hundred grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce*, or *a sufficiency.* Mix the powders and add the Mucilage and Water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains five grains of Chlorate of Potash." *Br.*

A new preparation, useful in cases of ulcerated and diphtheric sorethroat, operating directly on the local disease, and generally, often with great benefit, through the system. From one to six of the lozenges may be taken for a dose. W.

TROCHISCI SANTONINI. *U.S. Troches of Santonin.*

"Take of Santonin, in fine powder, *half a troyounce;* Sugar, in fine powder, *eighteen troyounces;* Tragacanth, in fine powder, *half a troyounce;* Orange Flower Water *a sufficient quantity.* Rub the powders together until they are thoroughly mixed; then with Orange Flower Water form a mass, to be divided into four hundred and eighty troches." *U. S.*

Each of these troches contains half a grain of santonin. They afford an excellent means of administration. H. C. W.

TROCHISCI SODII BICARBONATIS. *U.S.* TROCHISCI SODÆ BICARBONATIS. *Br. Troches of Bicarbonate of Sodium. Bicarbonate of Sodium Lozenges.*

"Take of Bicarbonate of Sodium *three troyounces;* Sugar, in fine powder, *nine troyounces;* Nutmeg, in fine powder, *sixty grains;* Mucilage of Tragacanth *a sufficient quantity.* Rub the Bicarbonate of Soda with the Sugar until they are thoroughly mixed; then with Mucilage of Tragacanth form a mass, to be divided into four hundred and eighty troches." *U. S.*

"Take of Bicarbonate of Soda, in powder, *thirty-six hundred grains;* Refined Sugar, in powder, *twenty-five ounces* [avoirdupois]; Gum Acacia, in powder, *one ounce* [avoird.]; Mucilage of Gum Acacia *two fluidounces;* Distilled Water *one fluidounce.* Mix the powders, and add the Mucilage and Water, to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains five grains of Bicarbonate of Soda." *Br.*

The U. S. troche contains three grains of the alkaline salt. Antacid and antilithic, useful in heartburn and uric acid gravel. From one to six may be given for a dose. W.

TROCHISCI ZINGIBERIS. *U.S. Troches of Ginger.*

"Take of Tincture of Ginger *two fluidounces;* Tragacanth, in fine powder, *half a troyounce;* Sugar, in fine powder, *twenty troyounces;* Syrup of Ginger *a sufficient quantity.* Mix the Tincture of Ginger with the Sugar, and, having exposed the mixture to the air until dry, reduce it to fine powder; to this add the Tragacanth, and mix them thoroughly. Lastly, with Syrup of Ginger form a mass, to be divided into four hundred and eighty troches." *U. S.*

Each lozenge contains two minims of the tincture, and they may be taken as required, being especially calculated to relieve gastric pains from flatulence. W.

UNGUENTA.

Ointments.

These are fatty substances, softer than cerates, of a consistence like that of butter, and such that they may be readily applied to the skin by inunction. When ointments are prepared by merely mixing medicinal substances with simple ointment or *lard*, care should be taken, if the added substance be a powder, that it be brought to the finest possible state of division, before being incorporated with the unctuous matter. If soluble in water or alcohol, it may often be advantageously rubbed with

a little of one of these liquids. Gritty matter should not be allowed to enter these preparations. When an extract is added, if not uniformly soft, it should be made so by trituration with a little water or alcohol according to its nature. Many of the ointments become rancid if long kept, and should, therefore, be prepared in small quantities at a time, or only when wanted for use. The tendency to rancidity may be in a considerable degree counteracted by imbuing the unctuous vehicle with benzoin, or with poplar buds, as recommended by M. Deschamps (see *Am. Journ. of Pharm.*, xv. 260); but care should be taken that there be no therapeutical objection to the admixture.* Slippery elm bark is said to have the same effect. (See *page* 914.) According to Dr. Geisler, ten drops of spirit of nitric ether, incorporated with an ounce of ointment, obviates the disagreeable fatty odour of these preparations. (*Pharm. Cent. Blatt*, A. D. 1847, p. 927; from *Arch. der Pharm.*) It has been proposed to substitute glycerin for oils and fats in the preparation of ointments; but, when these are to be applied by inunction, it is altogether unfit for the purpose, as it remains upon the skin, producing a rough sensation of adhesiveness, very different from the softness caused by oleaginous matter under similar circumstances.

The Cerates having been abolished as a class in the British Pharmacopœia, a few of the individual articles have been transferred to the Ointments, making the definition of the latter class of preparations, as given above, not exactly applicable to all the individual substances at present included among them in that Pharmacopœia. We consider no substance as strictly entitled to the name of ointment, which is not of such a consistence as to adapt it to application to the skin by friction or inunction. The ointments formerly officinal, which have been omitted in the present U. S. and Br. Pharmacopœias, are *Adeps Suillus Præparatus*, Dub., *Unguentum Conii*, Lond., *Ung. Cupri Subacetatis*, U. S., Ed., Dub., *Ung. Hydrargyri Iodidi*, Lond., *Ung. Hydrarg. Nitratis Mitius*, Lond., *Ung. Opii*, Lond., *Ung. Picis*, Lond., and *Ung. Sulphuris Compositum*, U. S., Lond. W.

UNGUENTUM. *U. S.* Unguentum Simplex. *Br., U.S.* 1850. *Ointment. Simple Ointment.*

"Take of Lard *eight troyounces;* Yellow Wax *two troyounces.* Melt the Wax and add the Lard gradually; then stir the mixture constantly while cooling." *U. S.*

"Take of White Wax *two ounces* [avoirdupois]; Prepared Lard *three ounces* [avoird.]; Almond Oil *three fluidounces.* Melt the Wax and Lard in the Oil on a water-bath; then remove the mixture, and stir constantly while it cools." *Br.*

This is emollient, and is occasionally employed as a mild dressing to blistered or excoriated surfaces, but more frequently as a vehicle for more active substances. It is the basis of several officinal ointments.

Off. Prep. Ceratum Zinci Carbonatis, *U.S.;* Unguentum Acidi Carbolici, *U.S.;* Ung. Antimonii Tartarati, *Br.;* Ung. Cadmii Iodidi, *Br.;* Ung. Creasoti, *Br.;* Ung. Elemi, *Br.;* Ung. Hydrargyri Ammoniati; Ung. Hydrarg. Iodidi Rubri, *Br.;* Ung. Hydrarg. Oxidi Flavi, *U. S.;* Ung. Hydrarg. Oxidi Rubri, *U. S.;* Ung. Plumbi Carbonatis; Ung. Plumbi Iodidi, *Br.;* Ung. Resinæ, *Br.* W.

UNGUENTUM ACIDI CARBOLICI. *U. S. Ointment of Carbolic Acid.*

"Take of Carbolic Acid *sixty grains;* Ointment *four hundred and twenty grains.* Mix them thoroughly."

This is a very strong ointment, which for most purposes requires dilution.

H. C. W.

* *Benzinated Lard.* M. Emile Mouchon gives the following method of applying to lard the preservative influence of poplar buds and benzoin. Having prepared, by percolation, a *tincture of poplar buds* from one part of the dried buds in powder and four of alcohol, he adds by degrees to 1000 parts of melted lard 60 parts of the tincture, so that all the alcohol may be driven off, then strains, and agitates the mixture till it concretes on cooling. The same method is pursued with the tincture of benzoin, in the same proportions; and the tincture of guaiac will answer the same purpose. Lard thus prepared keeps perfectly well for a very long time. (*Journ. de Pharm.*, xxv. 458.)

Mr. T. B. Groves has shown that the oil of pimento and balsam of Peru have, in a powerful degree, the same preservative influence on lard. (*Pharm. Journ.*, Nov. 1864, p. 249.)

UNGUENTUM ACIDI TANNICI. *U. S. Ointment of Tannic Acid.*

"Take of Tannic Acid *thirty grains;* Lard *a troyounce.* Rub the Tannic Acid with the Lard, gradually added, until they are thoroughly mixed, avoiding the use of an iron spatula." *U. S.*

Ointment of tannic acid is an excellent application in many cases of piles and prolapsus ani, and has been highly recommended in inflammation of the vagina with puruloid discharge, to which it is most conveniently applied spread thickly upon the surface of a tampon of linen. It may be used also in flabby ulcers. W.

UNGUENTUM ACONITIÆ. *Br. Ointment of Aconitia.*

"Take of Aconitia *eight grains;* Rectified Spirit *half a fluidrachm;* Prepared Lard *one ounce* [avoirdupois]. Dissolve the Aconitia in the Spirit, add the Lard, and mix thoroughly." *Br.*

For the uses of this preparation, the reader is referred to the articles on *Aconitum* and *Aconitia.* Care must be taken not to apply it to an abraded or ulcerated surface, lest it might produce serious constitutional effects. W.

UNGUENTUM ANTIMONII. *U. S.* UNGUENTUM ANTIMONII TARTARATI. *Br. Ointment of Antimony. Antimonial Ointment. Tartar Emetic Ointment. Ointment of Tartarated Antimony.*

"Take of Tartrate of Antimony and Potassium, in very fine powder, *one hundred grains;* Lard *four hundred grains.* Rub the Tartrate of Antimony and Potassium with the Lard, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Tartrated Antimony, in fine powder, *a quarter of an ounce;* Simple Ointment *one ounce.* Mix thoroughly." *Br.*

This may be most conveniently prepared, as in the Br. process, with *simple ointment*, as lard is too soft to be spread on linen, and simple ointment is sufficiently so to be applied by inunction.

The peculiar eruptive effects of tartar emetic may be procured by means of a strong solution, or of the powder sprinkled upon the surface or incorporated in the substance of some adhesive plaster, or of the ointment as above directed. The last method is, perhaps, the most convenient, and most generally resorted to. The proportion of tartar emetic may vary from one drachm with the ounce of lard to two drachms, as in the U. S. officinal formula, or even to three drachms when a speedy effect is required, or the skin is not very susceptible to its action. A small portion of the ointment may be rubbed twice a day, or more frequently, upon the surface to be affected, or it may be applied spread on a piece of linen. Care should be taken that the cuticle be entire, and that the application be not too long continued; as otherwise severe inflammation, and even gangrenous ulceration, may result. We have, however, in some instances of great urgency, applied the ointment to a surface recently scarified in the operation of cupping; but, under such circumstances, it should be used with much caution. W.

UNGUENTUM AQUÆ ROSÆ. *U. S. Ointment of Rose Water.*

"Take of Expressed Oil of Almonds *three troyounces and a half;* Spermaceti *a troyounce;* White Wax *one hundred and twenty grains;* Rose Water *two fluidounces.* Melt together, by means of a water-bath, the Oil, Spermaceti, and Wax; then gradually add the Rose Water, and stir the mixture constantly while cooling." *U. S.**

This preparation is much employed under the name of *cold cream.* It is a white, very soft, and elegant unguent, deriving a grateful odour from the rose water, which remains incorporated with the other constituents if kept enclosed in glazed vessels. It is a pleasant, cooling application to irritated and excoriated surfaces; and may be used with great advantage for chapped lips and hands, so frequent in cold weather. As the ointment is liable to become rancid when long kept, and the water to separate upon exposure, Mr. Joseph Laidley has proposed the substitution for the rose water of oil of roses and glycerin, the former in the proportion of two drops, the latter in that of four fluidrachms, the quantity of spermaceti being increased by two drachms. (*Am.*

* Mr. E. C. Marshall states that the preparation of this ointment is greatly facilitated by the use of the ordinary patent egg-beater. (*Am. Journ. of Pharm.*, xlvii. 387.)—*Note to the fourteenth edition.*

Journ. of Pharm. xii. 119.) For some purposes the substitution is useful; but the officinal preparation is preferable for chapped hands, as the glycerin, not being absorbed, leaves an unpleasant sensation of stickiness on the skin. W.

UNGUENTUM ATROPIÆ. *Br.* *Ointment of Atropia.*

"Take of Atropia *eight grains;* Rectified Spirit *half a fluidrachm;* Prepared Lard *one ounce* [avoirdupois]. Dissolve the Atropia in the Spirit, add the Lard, and mix thoroughly." *Br.*

For the uses of this ointment, see *Belladonna* and *Atropia.* Great caution must be observed that the ointment shall not come in contact with abraded, ulcerated, or wounded surfaces; and that the cuticle of the part to which it may be applied shall be entire. W.

UNGUENTUM BELLADONNÆ. *U.S., Br.* *Ointment of Belladonna.*

"Take of Extract of Belladonna *sixty grains;* Water *half a fluidrachm;* Lard *four hundred and twenty grains.* Rub the Extract with the Water, until uniformly soft, then gradually add the Lard, and thoroughly mix them." *U. S.*

"Take of Extract of Belladonna *eighty grains;* Prepared Lard *one ounce* [avoirdupois]. Rub the Extract smooth with a few drops of distilled water, then add the Lard, and mix thoroughly." *Br.*

This is a convenient form for the external application of extract of belladonna. Care must be taken in preparing it that the extract employed have the due consistence; and, if dry and lumpy, it may be restored to the proper state by rubbing it with a little water in a heated mortar. W.

UNGUENTUM BENZOINI. *U.S.* ADEPS BENZOATUS. *Br.* *Ointment of Benzoin. Benzoated Lard.*

"Take of Tincture of Benzoin *two fluidounces;* Lard *sixteen troyounces.* Melt the Lard by the heat of a water-bath, add the Tincture of Benzoin, constantly stirring, and, when the alcohol has evaporated, remove the ointment from the water-bath, and stir while cooling." *U. S.*

"Take of Prepared Lard *one pound* [avoirdupois]; Benzoin, reduced to coarse powder, *one hundred and sixty grains.* Melt the Lard by the heat of a water-bath, add the Benzoin, and, frequently stirring them together, continue the application of heat for two hours; finally remove the residual Benzoin by straining." *Br.*

Formerly, as now in the British Pharmacopœia, the U. S. officinal directions required the use of gum benzoin in the preparation of this ointment. It was objected that the resulting ointment is almost always of a dirty-white colour and granular in consistence, and, if heated over a direct fire, deposits the benzoin, which cannot be redissolved by heat. In accordance with the suggestion of Mr. Thomas Doliber, of Boston, an alcoholic solution of benzoin was substituted at the last revision of the U. S. Pharmacopœia for the balsam for incorporation with the lard. As thus prepared, the ointment is beautifully white and smooth, with a decided odour of benzoin, and is not liable to the objection of depositing the balsam when heated with other ointments. It has been found also to answer in practice quite as well as the officinal ointment, if not better, in the preservation of unctuous substances.

Benzoin has the property of obviating the rancidity to which lard and other unctuous substances are liable. Hence, the ointment under consideration is peculiarly useful as the vehicle of medicines used in this form; and may often be substituted for pure lard in the preparation of other unguents, of which lard is an ingredient, when it is desired to preserve them from change. It is recommended, moreover, by its agreeable odour; while there are very few ointments or cerates with the uses of which it would interfere. Balsam of Peru, rubbed with an ointment in the proportion of five drops to a fluidounce, will have the same effect.

The British Pharmacopœia uses its Benzoated Lard as an ingredient in all the suppositories and several of the ointments.*

Off. Prep. Unguentum Zinci Oxidi. W.

* Mr. Chas. F. Bolton gives the following formula as a ready method of benzoating an extemporaneous ointment. "Take of Benzoin *two ounces;* Ether *four ounces;* Castor Oil *one ounce.* Introduce the Benzoin into an eight-ounce bottle, add the Ether, macerate for twenty-four hours,

UNGUENTUM CADMII IODIDI. *Br.* *Ointment of Iodide of Cadmium.*

"Take of Iodide of Cadmium, in fine powder, *sixty-two grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

A new formula of the Br. Pharmacopœia. For its uses, see Iodide of Cadmium, *page* 187. W.

UNGUENTUM CANTHARIDIS. *U.S., Br.* *Ointment of Cantharides.* *Ointment of Spanish Flies.*

"Take of Cantharides Cerate *one hundred and twenty grains;* Resin Cerate *three hundred and sixty grains.* Mix them thoroughly." *U.S.*

"Take of Cantharides, Yellow Wax, each, *one ounce* [avoirdupois]; Olive Oil *six fluidounces.* Infuse the Cantharides in the Oil, in a covered vessel, for twelve hours, then place the vessel in boiling water for fifteen minutes, strain through muslin with strong pressure, add the product to the Wax previously melted, and stir constantly while the mixture cools." *Br.*

The British process is a better one than that of the U. S. Pharmacopœia. Olive oil is a good solvent of cantharidin. By its use the active matter of the flies is more uniformly diffused through the ointment than when they are directly incorporated in the state of powder, with the other ingredients. The preparation is thus better calculated to meet the end proposed of maintaining the discharge from blistered surfaces, without producing undue irritation. It has been said that the virtues of the flies are impaired by boiling; but the contrary has been proved to be the case; the cantharidin being neither altered nor volatilized at 212°. (See *Cantharis.*) It should be recollected that this ointment is intended as a dressing for blisters, not to produce vesication. *Dupuytren's ointment*, employed as a local application to prevent the loss of hair, was made by macerating a drachm of flies in a fluidounce of alcohol, and incorporating one part of the tincture thus formed with nine parts of lard. W.

UNGUENTUM CETACEI. *Br.* *Spermaceti Ointment.*

"Take of Spermaceti *five ounces* [avoirdupois]; White Wax *two ounces* [avoird.]; Almond Oil *one pint* [Imperial measure], or *a sufficiency.* Melt together with a gentle heat, remove the mixture, and stir constantly while it cools." *Br.*

This ointment is employed as a mild dressing for blisters, wounds, and excoriated surfaces. It should be made in small quantities at a time, as it is apt to become rancid when long kept. W.

UNGUENTUM CREASOTI. *U.S., Br.* *Ointment of Creasote.*

"Take of Creasote *half a fluidrachm;* Lard *a troyounce.* Mix them thoroughly." *U.S.*

"Take of Creasote *one fluidrachm;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

The British ointment is more than twice as strong as ours; but this is hardly a recommendation.

For the use of this ointment, see *Creasotum.* It may sometimes be advantageously diluted with lard when found to irritate. W.

UNGUENTUM ELEMI. *Br.* *Ointment of Elemi.*

"Take of Elemi *a quarter of an ounce;* Simple Ointment *one ounce.* Melt, strain through flannel, and stir constantly until the Ointment solidifies." *Br.*

This ointment is applied as a gentle stimulant to weak ulcers, and may be used for maintaining the discharge of issues and setons. It is the *linimentum arcæi* of the older pharmacy. W.

UNGUENTUM GALLÆ. *U.S., Br.* *Ointment of Nutgall.* *Ointment of Galls.*

"Take of Nutgall, in very fine powder, *sixty grains;* Lard *four hundred and twenty grains.* Rub the Nutgall with the Lard, gradually added, until they are thoroughly mixed." *U.S.*

with frequent agitation, pass through a filter, to the filtrate add the Oil and shake until dissolved; allow the ether to evaporate from a shallow vessel and then place in a wide-mouthed vial ready for use." (*Am. Journ. of Pharm.*, xliii. 145.).—*Note to the fourteenth edition.*

"Take of Galls, in fine powder, *eighty grains;* Benzoated Lard *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

This is used chiefly in piles and prolapsus ani, though it may also be advantageously applied to flabby and indolent ulcers. W.

UNGUENTUM GALLÆ CUM OPIO. *Br. Ointment of Galls and Opium.*

"Take of Ointment of Galls *one ounce* [avoirdupois]; Opium, in powder, *thirty-two grains.* Mix thoroughly." *Br.*

This combination of galls and opium is sometimes employed, preferably to the simple ointment of galls, in cases of irritable piles. From half a drachm to a drachm of camphor is sometimes added to the ointment. W.

UNGUENTUM HYDRARGYRI. *U.S., Br. Mercurial Ointment.*

"Take of Mercury *twenty-four troyounces;* Lard, Suet, each, *twelve troyounces.* Rub the Mercury with a troyounce of the Suet and a small portion of the Lard until the globules cease to be visible; then add the remainder of the Lard and of the Suet softened with a gentle heat, and thoroughly mix them." *U. S.*

"Take of Mercury, Prepared Lard, each, *one pound* [avoirdupois]; Prepared Suet *one ounce* [avoird.]. Rub them together until metallic globules cease to be visible." *Br.*

The Pharmacopœias unite at present in recognising but one mercurial ointment, which contains equal weights of mercury and fatty matter. When the physician wishes a weaker preparation, he may direct the ointment to be diluted with such a proportion of lard as may answer his purpose.

In the preparation of mercurial ointment, care is requisite that the mercury should be completely extinguished. The trituration is best performed in a marble mortar; as it is difficult to keep iron so clean as not to impart more or less oxide to the ointment. The mercury is known to be extinguished, when a portion of the mass, rubbed upon paper or the back of the hand, exhibits no metallic globules under a magnifying glass of four powers. The operation cannot be considered as satisfactorily accomplished when the globules are invisible merely to the naked eye. To facilitate the process, which is very tedious, the addition of various substances has been proposed, calculated to hasten the disappearance of the metal. Turpentine and sulphur have been employed, but are inadmissible; the former because it renders the ointment too irritating, the latter because it forms with the mercury an inactive sulphuret. Their presence in the ointment may be detected by the peculiar odour which they respectively emit, when exposed to heat. Sulphur, moreover, gives the ointment a darker colour than it has when pure. The addition of a little sulphuric ether, at intervals, during the trituration, is said greatly to abbreviate the process. (*Am. Journ. of Pharm.*, xvii. 80.) Rancidity in the lard employed facilitates the extinguishment of the mercury, but is liable to the same objection as turpentine, though in a much less degree. M. Fossembras found that the addition of rancid fat was required in the proportion of only ten drachms to a pound of the ointment, in order to enable eight pounds to be prepared in an hour. (*Journ. de Pharm.*, 3e sér., v. 75.) M. Guibourt recommends the addition of one-sixteenth of old mercurial ointment.* M. Simonin proposes the use of lard which has been exposed in thin layers to a damp air for fifteen days. This facilitates the extinguishment of the metal, but probably renders the preparation more irritant by the chemical alteration of the lard. The following plan of preparing the ointment was proposed by M. Chevallier. A pound

* It appears that Mr. J. Higginbottom made known, so long ago as the year 1814, this mode of extinguishing mercury. He recommends that equal weights of the old ointment and of mercury should be rubbed together, till the globules quite disappear, and the requisite proportion of lard then added. It is not necessary that the mercurial ointment should be rancid. (*Pharm. Journ.*, xvi. 215.) For a process recommended by Mr. J. M. Maisch, of which the peculiarity is the use of mercury passed through chamois leather, so as to be sprinkled in minute division over the fat, see the *Am. Journ. of Pharm.* (xxviii. 107); and for another by Mr. E. H. Hance, in which melted spermaceti is employed as the extinguishing material, and which is said to answer well for small quantities, see the same journal (xxix. 15). M. E. Mouchon uses wax or stearin to facilitate extinguishment, and recommends benzinated lard as the vehicle. (*Journ. de Chim. Méd.*, Nov. 1856, p. 652.) Geo. Boyle uses a portion of old mercurial ointment and ether. (*Am. Journ. of Pharm.*, xlvi. 561.) M. Melseur affirms that the addition of glycerin very materially hastens the process. (*Pharm. Journ. and Trans.*, Oct. 1871, p. 339.)—*Note to the eleventh and fourteenth editions.*

of mercury, and half a pound of fresh lard, previously melted, are introduced into a stone or glass bottle, shaken till the mixture acquires the consistency of very thick syrup, then poured into a mortar, and incorporated by constant stirring, with an additional half pound of lard. In this manner, according to Chevallier, a perfect ointment may be made in half an hour. When prepared with lard alone, the ointment is apt, in hot weather, to become so soft as to allow the metal to separate. Hence the addition of suet in the processes of the U. S. and British Pharmacopœias; and even a larger proportion might be employed, when the ointment is prepared for use in the summer season.

Upon the whole, it may be considered doubtful whether any of the expedients for saving labour and time in the preparation of the ointment are wholly unobjectionable. Dr. Christison states that the better plan is not to complete the process by a continuous trituration, but to operate for a short time every day, and allow the ointment in the mean time to be exposed to the air. But so much labour is required in the process, that the ointment is preferably made by machinery on the large scale. The fatty matters, kept in the fluid state by a heat of about 100°, are triturated with the metal by means of two iron balls, which are driven rapidly round in a circular trough by steam power. The extinguishment of the mercury is thus effected in about twelve hours. In buying from the manufacturer, great care should be exercised by the pharmacist, as much of the commercial ointment contains less than the officinal percentage of mercury.

A new method of preparing mercurial ointment, proposed by Orosi, is to precipitate metallic mercury, in the pulverulent form, from a solution of corrosive sublimate, by an excess of protochloride of tin, with the addition of muriatic acid; and, having poured off the supernatant fluid, washed the precipitate with warm water, and dried it between bibulous paper, to incorporate it with the prescribed proportion of lard. To prevent the precipitated mercury from running into globules, it is recommended to cover with fat the interior of the vessel in which the precipitation takes place.

Mercurial ointment has when newly prepared a bluish colour, which becomes darker by age. It has been thought to contain the mercury in the state of protoxide; but most of the metal can be separated by methods not calculated to reduce the oxide; and it is now generally admitted that by far the greater part of it exists in a state of minute division, not of chemical combination. It has been shown, however, that the metal is slightly oxidized; and the change of colour which the ointment undergoes with age is attributable to further oxidation. If the ointment be kept long melted in a narrow vessel, metallic mercury subsides, and an oily liquid floats upon the surface. After this has been filtered so as to separate everything undissolved, it is blackened by sulphuretted hydrogen, and yields oxide of mercury to acetic acid. Dr. Christison states that he has examined various samples of the ointment, and never failed to detect oxide of mercury; and he has inferred from his observations that the oxide amounts to rather more than 1 per cent. (*Christison's Dispensatory.*) But the proportion is variable, according to the age and mode of preparation of the ointment. It scarcely admits of a doubt, that the oxide of mercury formed enters into chemical combination with the lard, or one of its oily acids. Mr. Donovan advanced the idea, that the medicinal activity of the ointment depended exclusively on this compound of the lard with the mercurial oxide. An ointment made by merely mixing lard and black oxide of mercury has not the same effect; because there is no chemical union between the ingredients. But, upon exposing such a mixture to a temperature of 350°, and continually agitating it for two hours, he found that every ounce of lard dissolved and combined with twenty-one grains of oxide, and the resulting compound was proved to be equally effectual with the common ointment, and capable of being introduced into the system in one-third of the time. It has been proposed to substitute an ointment thus prepared for that made according to the officinal directions, as being more manageable, and of more uniform strength. Care, however, would be required in preparing it to avoid a temperature either too high or too low; as the former might decompose the oxide, and the latter would be insufficient to effect its union with the lard. There would be danger, also,

that the lard might be rendered irritant by the influence of the heat. Dr. F. Von Baerensprung has rendered it extremely probable that metallic mercury, no matter in what state of division it may be, is unable to enter the blood-vessels, and that whatever effects on the system are produced by the ointment, or any similar preparation, or even by the vapours of mercury, are owing to the previous oxidation of the metal. (See *Chem. Gaz.*, Sept. 1, 1850, p. 321.)

From experiments by a committee of the College of Pharmacy, of New York, it appears that the ointment, contained in jars, becomes somewhat unequal in consequence of the settling of the metallic ingredient. The inference is that, after long standing, the contents of the jar should be triturated so as to restore an equable strength before being dispensed. (*Am. Journ. of Pharm.*, xvi. 2.)

Medical Uses. Mercurial ointment, when rubbed upon the surface of the body, produces, in consequence of its absorption, the general effects of mercury upon the system. It is resorted to either alone, when circumstances prevent or discourage the internal use of mercury, or conjointly with the internal use of the medicine, to produce a more speedy or powerful effect in urgent cases. It may also be advantageously employed as a resolvent in local affections; as in the case of venereal buboes, and of chronic glandular swellings, upon which it may be made to operate directly by being applied in the course of the absorbents passing through the enlarged glands. The proper quantity to be employed at one time, with a view to salivation, is about a drachm, which should be applied night and morning, by means of friction, to the inner surface of the thighs, legs, or arms, and continued till the system is affected.

In urgent cases, or in local affections, it may also be rubbed on other parts of the body, or applied to blistered surfaces. The friction should on each occasion be continued till the whole of the ointment is absorbed. When frequently rubbed upon the same part, it is apt to produce a disagreeable eruption, which interferes with its continued application. Camphor is sometimes added, in order to render it more easy of absorption; but, without producing this effect, it increases the liability of the ointment to irritate the skin, and is of no other advantage than to soften its consistence when too firm from a large proportion of suet. Mercurial ointment has been employed, with some success, to prevent the maturation of the smallpox pustule, and the consequent pitting. For this purpose it may be applied to the face or other part, thickly spread on patent lint or muslin, care being taken to prevent the access of the air to the covered part. To be successful it must be applied before the third or fourth day of the eruption. The ointment has been recommended also in erysipelas and chilblains. Iodide of potassium, rubbed with mercurial ointment, is said to promote the separation of the mercury in the form of globules (*Journ. de Pharm.*, 3e sér., x. 356); but the effect does not take place if the iodide is thoroughly dried and well powdered, and the ointment added to it by small portions at a time. (*Ibid.*, x. 421.) The ointment, diluted with twice or three times its weight of lard, is sometimes applied to ulcers, and to certain cutaneous eruptions.

Off. Prep. Linimentum Hydrargyri, *Br.;* Suppositoria Hydrargyri, *Br.;* Unguentum Hydrargyri Compositum, *Br.* W.

UNGUENTUM HYDRARGYRI AMMONIATI. *U. S.*, *Br.* Unguentum Præcipitati Albi. *Ed.* *Ointment of Ammoniated Mercury, Ointment of White Precipitate.*

"Take of Ammoniated Mercury, in very fine powder, *forty grains;* Ointment *a troyounce.* Rub the Ammoniated Mercury with the Ointment, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Ammoniated Mercury *sixty-two grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

This ointment is employed chiefly in cutaneous eruptions, such as psora, porrigo, and herpes. W.

UNGUENTUM HYDRARGYRI COMPOSITUM. *Br.* *Compound Ointment of Mercury.*

"Take of Ointment of Mercury *six ounces;* Yellow Wax, Olive Oil, of each, *three*

ounces; Camphor *one ounce and a half.* Melt the Wax with a gentle heat and add the Oil, then, when the mixture is nearly cold, add the Camphor in powder, and the Ointment of Mercury, and mix the whole thoroughly together." *Br.*

The addition of camphor to mercurial ointment tends to soften it, and is thought by some to promote the absorption of the mercury. W.

UNGUENTUM HYDRARGYRI IODIDI RUBRI. *U. S., Br. Ointment of Red Iodide of Mercury.*

"Take of Red Iodide of Mercury, in very fine powder, *sixteen grains;* Ointment *a troyounce.* Rub the Iodide of Mercury with the Ointment, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Red Iodide of Mercury, in fine powder, *sixteen grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

This ointment contains only one-fourth as much of the red iodide as the ointment of the Dublin College, which it supersedes. It is employed as a dressing to scrofulous ulcers, especially when they are very indolent. W.

UNGUENTUM HYDRARGYRI NITRATIS. *U. S., Br.* UNGUENTUM CITRINUM. *Ed. Ointment of Nitrate of Mercury. Citrine Ointment.*

"Take of Mercury *a troyounce and a half;* Nitric Acid *three troyounces and a half;* Lard *sixteen troyounces and a half.* Dissolve the Mercury in the Acid; then heat the Lard in an earthen vessel, and, when the temperature reaches 200°, remove the mixture from the fire. To this add the mercurial solution, and with a wooden spatula stir constantly, so long as effervescence continues, and afterwards occasionally until the ointment stiffens." *U. S.*

"Take of Mercury, by weight, *four ounces* [avoirdupois]; Nitric Acid *twelve fluidounces;* Prepared Lard *fifteen ounces* [avoird.]; Olive Oil *thirty-two fluidounces.* Dissolve the Mercury in the Nitric Acid with the aid of a gentle heat; melt the Lard in the Oil, by a steam or water-bath, in a porcelain vessel capable of holding six times the quantity; and, while the mixture is hot, add the Solution of Mercury, also hot, mixing them thoroughly. If the mixture do not froth up, increase the heat till this occurs. Keep it stirred until it is cold." *Br.*

The chemical changes which take place in the preparation of this ointment are not precisely known. They differ somewhat according to the circumstances under which the operation is performed; for example, according to the proportion and strength of the acid, the nature of the fatty matter, and the degree of heat employed. The mercury, in the first step of the process, is oxidized at the expense of a portion of the acid, nitrous fumes escape, and the undecomposed acid unites with the oxidized metal, forming binitrate of deutoxide of mercury if heat be employed, and a mixture of this with nitrate of the protoxide, if the process be conducted at a low temperature. When the mercurial solution is added to the fatty matter, a reaction takes place, which probably results in the production of the yellow subnitrate of the deutoxide of mercury, of one or more of the fatty acids, as the oleic, margaric, and stearic, and of elaïdin or elaïdic acid, or both. (See *page* 607.) It is also highly probable that portions of these fatty acids combine with the oxide of mercury. But the degree to which these changes take place is influenced greatly by the temperature to which the mixture is exposed. If this be low, there is little or no escape of gas; if elevated, there is a copious evolution of nitrous fumes. In the former case the changes are obviously less considerable than in the latter.

As formerly prepared, this ointment, though at first beautifully yellow and of the proper consistence, soon began to change, acquiring in time a dirty greenish and mottled colour, and becoming so hard and friable as to be unfit for use unless mixed with lard. These results were ascribed to various causes, and as many different modifications of the process were proposed in order to obviate them. The U. S. process of 1860 was based upon the fact, that the olive oil of the former British process is hardened by nitrous acid or the nitrate of mercury, while the same effect is not produced upon neats-foot oil. As at first published, the process was defective in the direction to add the mercurial solution to the mixed oleaginous fluid when it begins to

stiffen on cooling. When this direction was complied with, at least with the acid of the ordinary strength, the preparation had a brown colour and semi-liquid consistence; but, with some modifications such as were introduced into the revised formula of the Pharmacopœia of 1850, the process yielded an excellent ointment, which, though it sometimes assumed a greenish colour on exposure, retained permanently a soft unctuous consistence. We have had specimens of the ointment in our possession for several years, which have retained a uniform yellowish colour, and a perfectly good unctuous consistence. It is said that the lard of this formula may be advantageously replaced by the same quantity of neats-foot oil. (*Am. Journ. of Pharm.*, ix. 197.) In the last revision of the Pharmacopœia the neats-foot oil was, it may be unwisely, stricken out of the formula. It is stated that when prepared by the new process the ointment soon changes colour and hardens. (*Am. Journ. of Pharm.*, xlvii. 385.) R. Rother, however, affirms that the fault is not in the components, but in the processes of the officinal formula (*Am. Journ. of Pharm.*, xlii. 420); especially in the use of too high a heat.* The drying vegetable oils do not appear, like olive oil, to be converted by nitrous acid or the nitrate of mercury into elaïdin; and it was a fair inference that they might be employed advantageously in the preparation of citrine ointment. Accordingly, Dr. Fessenden, of North Carolina, states, in an inaugural essay, that he substituted linseed oil for the neats-foot oil of the U. S. process, and succeeded in obtaining a perfectly good and durable ointment. M. Falieres has found the oil of the ground nut (*Arachis hypogæa*) to answer very well. (*Pharm. Journ. and Trans.*, June, 1873, p. 1031.) It is stated that the failure of many operators, who have followed the former British officinal process, has been owing not so much to the character of the particular oil employed, as to deficiency of strength in the nitric acid, and the want of a due degree of heat. Mr. Alsop asserts that, if the nitric acid be of the sp. gr. 1·5, or if the quantity of a weaker acid be increased so as to compensate for its deficiency in strength, and if the fatty matters be mixed with the mercurial solution at an elevated temperature, a permanently soft and golden-coloured ointment will result. (*Pharm. Transact.*, Sept. 1841.) The difficulty arose out of a deficiency of the nitric acid in that formula, which has been corrected in the amended British process. It is probable that the discoloration which is so apt to take place in the preparation is owing to the deoxidizing influence of the fatty matter upon the mercurial oxide. Now if, by a sufficient excess of acid, and an elevated temperature, the fats be well oxidized during the process, they will have less affinity for oxygen afterwards, and consequently less ability to take it from the oxide of mercury. That they are oxidized at the expense of the nitric acid, when heat is used, is proved by the abundant extrication of nitrous fumes during the operation.

But, when the fatty matter and mercurial solution are mixed, care must be taken that the heat applied be not too great. Gas is extricated at 180°, and at 212° escapes so abundantly that the mixture boils over unless the vessel is very large. (*Alsop.*) Besides, if the heat is too great, a portion of the mercury is reduced, and the colour of the ointment impaired. When large quantities of materials are operated upon, the reaction which occurs produces of itself a sufficient heat; but in ordinary cases the temperature should be kept at about 190° by means of a water-bath, and if it exceed 205° should be reduced. It should always be sufficient to produce a copious extrication of gas. The ointment should be prepared in a glass, porcelain, or well-glazed earthen vessel; and a glass rod or wooden spatula should be employed for stirring the mixture.

* M. Rother's formula is as follows. "Take of Mercury 1½ troyounces; Nitric Acid, sp. gr. 1·42, 3½ troyounces; Lard, pure, 16½ troyounces. Dissolve the Mercury in 900 grains of the Nitric Acid, with the aid of heat, and keep the solution gently warm to prevent crystallization before it is used. Melt the Lard in a suitable vessel, with a moderate heat; then add the remainder of the Nitric Acid, and continue the heat, *without* stirring the mixture, as long as moderate effervescence continues; but if this becomes too violent, remove the mixture from the fire, and only replace it when the action slackens too much. Finally, when effervescence ceases, and the liquid only boils even under an increased heat, remove the mixture from the fire altogether; and when it begins to stiffen add the mercurial solution and mix thoroughly." (*Am. Journ. of Pharm.*, xlii. 420.) (For a formula in which neats-foot oil is used, claimed by Mr. Thos. J. Covell to be superior to the officinal, and for a bibliography of the subject, see *Am. Journ. of Pharm.*, xlii. 211. (*Note to the fourteenth edition.*)

In the present U. S. and British formulas, the provision in relation to the application of heat is incorporated; and either of them will yield a good ointment with due care in the manipulations. For some useful practical hints upon this point, the reader is referred to a communication by Mr. Joseph Laidley in the *Am. Journ. of Pharm.* (xxii. 119). It is due to Mr. Duncan, a chemist and druggist of Edinburgh, to state that he appears to have been the first to ascertain the value of heat in the preparation of this ointment.

Medical Uses. This ointment is much and very advantageously employed, as a stimulant and alterative application, in porrigo or tinea capitis, impetigo larvalis or crusta lactea, psoriasis and pityriasis, certain forms of chronic eczema, psorophthalmia and inflammation of the eye and eyelids connected with porrigo of the face or scalp, and various other ulcerative and eruptive affections. It should be diluted with lard, unless in cases which require a very stimulant application. Some care is requisite in its use, to avoid the risk of salivation. When hard and friable, it must be rubbed up with fresh lard before it can be applied.

An ointment prepared with lard and nitric acid, called *Alyon's ointment*, after the person who first prepared it, was formerly much used in cases similar to those in which the citrine ointment is now employed. The *ointment of nitric acid* of the former Edinburgh and Dublin Pharmacopœias, discarded in the last edition of those works, was of this character. W.

UNGUENTUM HYDRARGYRI OXIDI FLAVI. *U. S.* *Ointment of Yellow Oxide of Mercury.*

"Take of Yellow Oxide of Mercury, in very fine powder, *sixty grains;* Ointment *four hundred and twenty grains.* Rub the Oxide of Mercury with the Ointment, gradually added, until they are thoroughly mixed." *U. S.*

This new officinal was introduced into the U. S. Pharmacopœia on account of its use by the oculists. In preparing it the character of the unctuous vehicle is of much importance. Without being so liquid as to allow the powder to subside, it must yet be of so soft a consistence as to melt at the heat of the body, and thus, when introduced into the eye, to spread equably over the surface. It should, moreover, be as far as possible chemically indifferent to the oxide, and, while perfectly bland in its proper state, should not be liable to become irritating by rancidity. Simple ointment has been adopted by the revisers of the Pharmacopœia; but *cold cream*, consisting of spermaceti, wax, and almond oil, without the rose-water, or a mixture of butter of cacao and almond oil, would probably be better, as they are more elegant. (*Pharm. Journ.*, 2d ser., vii. 324.) H. C. W.

UNGUENTUM HYDRARGYRI OXIDI RUBRI. *U. S.*, *Br.* *Ointment of Red Oxide of Mercury.*

"Take of Red Oxide of Mercury, in very fine powder, *sixty grains;* Ointment *a troyounce.* Rub the Oxide of Mercury with the Ointment, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Red Oxide of Mercury, in very fine powder, *sixty-two grains;* Yellow Wax *one-quarter of an ounce* [avoirdupois]; Oil of Almonds *three-quarters of an ounce* [avoird.]. Melt the Wax at a gentle heat, mix the Oil with it, and when the mixture is nearly cold, add the Oxide of Mercury, and mix the whole thoroughly together." *Br.*

The red oxide of mercury here referred to is that prepared from the nitrate, and usually called *red precipitate.* It is important that the oxide should be thoroughly pulverized before being mixed with the lard; as otherwise it might prove injurious in cases of ophthalmia, in which it is sometimes used. When great care is taken to have the red oxide very finely pulverized the colour is more yellowish than is usual. This ointment loses its fine red colour when long kept, probably in consequence of the conversion of the red oxide into the black, or its reduction to the metallic state. It is best to prepare it only in small quantities at a time. We have been informed that, if the preparation be made by mixing the red oxide with poplar-bud ointment, it will keep a long time without change. According to R. H. Stabler, of Alexandria, Va., an equally effectual method is to mix two drops of Liquor Potassæ with each

ounce of the ointment when prepared (*Am. Journ. of Pharm.*, xxiii. 123), but Mr. Kalish states that this is not effectual. According to Mr. Emil Martin, if a mixture of six parts of castor oil to two of wax be used as the basis of the ointment, the green colour remains unchanged for years. (*Am. Journ. of Pharm.*, xliv. 202.) Mr. Julius Kalish substitutes oil of sweet almonds for the castor oil, on account of the unpleasant odour of the latter. (*Am. Journ. of Pharm.*, xlv. 69.)

Ointment of red oxide of mercury is a highly useful stimulating ointment, much employed in indolent and foul ulcers, in porrigo of the scalp, psorophthalmia and chronic conjunctival ophthalmia, especially when attended with thickening of the inner membrane of the eyelids, or with specks upon the cornea. It may be diluted with lard if found too stimulating. W.

UNGUENTUM HYDRARGYRI SUBCHLORIDI. *Br.* Unguentum Calomelanos. *Br.* 1864. *Ointment of Subchloride of Mercury. Ointment of Calomel.*

"Take of Subchloride of Mercury *eighty grains;* Prepared Lard *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

There is little occasion for such a preparation as this. Calomel is much inferior for affecting the system by inunction to the mercurial ointment; and as an application to ulcerated surfaces the form of cerate would be better. It may, however, be useful in certain cutaneous eruptions by being rubbed upon the part. W.

UNGUENTUM IODINII. *U. S. Ointment of Iodine.*

"Take of Iodine *twenty grains;* Iodide of Potassium *four grains;* Water *six minims;* Lard *a troyounce.* Rub the Iodine and Iodide of Potassium first with the Water, and then with the Lard, until they are thoroughly mixed." *U. S.*

The object of the iodide of potassium and water is simply to bring the iodine into a state in which it may be thoroughly and equably incorporated with the lard. They have been found to answer better in practice than the alcohol formerly used.

Owing to the evaporation of the water, this and the following ointment are said at times to contain sharp crystals of iodine. The use of glycerin instead of water would obviate this. When rubbed upon the skin it imparts to it an orange colour, which, however, slowly disappears with the evaporation of the iodine. It is useful as a local application in goitre, scrofulous swellings of the glands and other chronic tumefactions, internal or external, operating probably through the medium of absorption. When continued for some time it occasionally produces a pustular eruption upon the portion of skin to which it is applied. Dr. Cerchiari strongly recommends it in cases of enlarged tonsils, after the disappearance of inflammation. It should be applied to the tonsils morning and evening by means of a camel's-hair pencil. In two months, according to the author, the enlargement disappears. (*Am. Journ. of Pharm.*, viii. 83.) It has also been recommended in chilblains. The ointment should be prepared only when wanted for use; for it undergoes change if kept, losing its deep orange-brown colour, and becoming pale upon the surface. W.

UNGUENTUM IODINII COMPOSITUM. *U. S.* Unguentum Iodi. *Br. Compound Ointment of Iodine.*

"Take of Iodine *fifteen grains;* Iodide of Potassium *thirty grains;* Water *thirty minims;* Lard *a troyounce.* Rub the Iodine and Iodide of Potassium first with the Water, and then with the Lard, until they are thoroughly mixed." *U. S.*

"Take of Iodine, Iodide of Potassium, of each, *thirty-two grains;* Proof Spirit *one fluidrachm;* Prepared Lard *two ounces* [avoirdupois]. Rub the Iodine and Iodide of Potassium well together, with the Spirit, in a glass or porcelain mortar, add the Lard gradually, and mix thoroughly." *Br.*

This preparation is employed for the same purposes as the preceding, from which it differs chiefly in being somewhat stronger with iodine; as the iodide of potassium is probably not peculiar in its effects, and the spirit is employed only to facilitate the admixture. W.

UNGUENTUM MEZEREI. *U. S. Ointment of Mezereon.*

"Take of Fluid Extract of Mezereon *four fluidounces;* Lard *fourteen troyounces;* Yellow Wax *two troyounces.* Melt the Lard and Wax together with a moderate

heat, add the Fluid Extract of Mezereon, and stir the mixture constantly until the alcohol has evaporated; then continue to stir while cooling." *U. S.*

This ointment is equivalent to the *pommade épispastique au garou* of the French Codex, which is prepared from the bark of *Daphne Gnidium*. It may also be made, as proposed by Guibourt, by mixing two drachms of the alcoholic extract of mezereon with nine ounces of lard and one of wax. It is used as a stimulating application to blistered surfaces in order to maintain the discharge, and to obstinate, ill-conditioned, and indolent ulcers. W.

UNGUENTUM PICIS LIQUIDÆ. *U. S., Br. Tar Ointment.*

"Take of Tar, Suet, each, *twelve troyounces*. Mix the Tar with the Suet previously melted with a moderate heat, and, having strained the mixture through muslin, stir it constantly while cooling." *U. S.*

"Take of Tar *five ounces;* Yellow Wax *two ounces*. Melt the Wax with a gentle heat, add the Tar, and stir the mixture briskly while it cools." *Br.*

This ointment is highly useful as a stimulant application in various scaly and scabby eruptions, particularly in psoriasis and lepra, and in that form of porrigo usually called tinea capitis, or scald-head. In the last-mentioned affection, it should be applied night and morning; and in bad cases the patient should constantly wear a cap, thickly coated internally with the ointment. As it is often applied to the surface with friction, the suet of the U. S. process is, we think, better suited to give a proper consistence than the wax of the British. W.

UNGUENTUM PLUMBI ACETATIS. *Br. Ointment of Acetate of Lead.*

"Take of Acetate of Lead, in fine powder, *twelve grains;* Benzoated Lard *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

A new officinal of the Br. Pharmacopœia, used as a dressing for inflamed and excoriated surfaces, though inferior, we think, to the cerate of the subacetate. W.

UNGUENTUM PLUMBI CARBONATIS. *U. S., Br. Ointment of Carbonate of Lead.*

"Take of Carbonate of Lead, in very fine powder, *sixty grains;* Ointment of Lard *four hundred and twenty grains*. Rub the Carbonate of Lead with the Ointment, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Carbonate of Lead, in fine powder, *sixty-two grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

This ointment is used as a dressing to blistered or excoriated surfaces, burns, &c. W.

UNGUENTUM PLUMBI IODIDI. *U. S., Br. Ointment of Iodide of Lead.*

"Take of Iodide of Lead, in very fine powder, *sixty grains;* Ointment *four hundred and twenty grains*. Rub the Iodide of Lead with the Ointment, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Iodide of Lead, in fine powder, *sixty-two grains;* Simple Ointment *one ounce* [avoirdupois]. Mix thoroughly." *Br.*

For the uses of this ointment, see *Plumbi Iodidum*. W.

UNGUENTUM PLUMBI SUBACETATIS COMPOSITUM. *Br. Compound Ointment of Subacetate of Lead.*

See CERATUM PLUMBI SUBACETATIS.

UNGUENTUM POTASSÆ SULPHURATÆ. *Br. Ointment of Sulphurated Potash.*

"Take of Sulphurated Potash *thirty grains;* Prepared Lard *one ounce* [avoirdupois]. Triturate the Sulphurated Potash in a porcelain mortar and gradually add the Lard, rubbing them together until the ointment is perfectly smooth and free from grittiness. The ointment when used should be recently prepared." *Br.*

This is another officinal novelty of the Br. Pharmacopœia, which, considering its extreme simplicity of preparation, and the expediency of making it only when wanted, might well have been left to extemporaneous prescription. It may be used as a

local remedy in scabies, the advanced stages of favous and eczematous affections, and all other cutaneous diseases which may have their origin in microscopic organisms. Its offensive odour may be corrected by incorporation with a little oil of anise. (See *Oleum Anisi.*) W.

UNGUENTUM POTASSII IODIDI. *U. S., Br. Ointment of Iodide of Potassium.*

"Take of Iodide of Potassium, in fine powder, *sixty grains;* Water, boiling hot, *a fluidrachm;* Lard *four hundred and twenty grains.* Dissolve the Iodide of Potassium in the Water, in a warm mortar, then add the Lard gradually, and thoroughly mix them." *U. S.*

"Take of Iodide of Potassium *sixty-four grains;* Carbonate of Potash *four grains;* Distilled Water *one fluidrachm;* Prepared Lard *one ounce* [avoirdupois]. Dissolve the Iodide of Potassium and Carbonate of Potash in the Water, and mix thoroughly with the Lard." *Br.*

The U. S. preparation is apt to become discoloured by time in consequence of the liberation of iodine. It is said that this may be prevented by mixing two drops of *Liquor Potassæ* with each ounce of the freshly-prepared ointment. (*Am. Journ. of Pharm.*, xxiii. 123.) The addition of carbonate of potash by the present Br. Pharmacopœia is no doubt made with this object.

This ointment is employed for the discussion of goitres, scrofulous tumours, and other indolent swellings; and is sometimes preferred to the ointment of iodine, as it does not, like that, discolour the skin.* W.

UNGUENTUM RESINÆ. *Br. Ointment of Resin.*

See CERATUM RESINÆ.

UNGUENTUM SABINÆ. *Br. Ointment of Savin.*

See CERATUM SABINÆ.

UNGUENTUM STRAMONII. *U. S. Ointment of Stramonium.*

"Take of Extract of Stramonium *sixty grains;* Water *half a fluidrachm;* Lard *four hundred and twenty grains.* Rub the Extract with the Water until uniformly soft, then gradually add the Lard, and thoroughly mix them." *U. S.*

This is a more certain preparation than that of the former editions of the U. S. Pharmacopœia, which was made by boiling the fresh leaves in lard. For remarks by Mr. A. P. Sharp, of Baltimore, on the preparation of this ointment, see the *American Journal of Pharmacy* (xxvii. 391). A useful anodyne application in irritable ulcers, painful hemorrhoids, and certain cutaneous eruptions. W.

UNGUENTUM SULPHURIS. *U. S., Br. Ointment of Sulphur.*

"Take of Sublimed Sulphur *a troyounce;* Lard *two troyounces.* Rub the Sulphur with the Lard, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Sublimed Sulphur *one ounce;* Benzoated Lard *four ounces.* Mix thoroughly." *Br.*

The U. S. ointment is twice as strong as the British. Sulphur ointment is a specific for the itch. It should be applied every night till the complaint is cured; and it is recommended that only one-fourth of the body should be covered at a time. We have usually directed it to be applied over the whole surface, and have found no inconvenience to result. Four applications are generally sufficient to effect a cure. It is thought by some that powdered roll sulphur is more efficacious than the sublimed. Sulphur ointment, applied freely over the variolous eruption, in its early stage, is said to prevent the maturation of the pustules in consequent pitting. The disagreeable

* *Elder Ointment.* UNGUENTUM SAMBUCI, *Lond.* Though omitted in the British Pharmacopœia, we retain this preparation in its present position from its long popularity. The following was the London formula. "Take of Elder [flowers], Lard, each, *two pounds.* Boil the Elder in the Lard till it becomes crisp; then express through linen." Elder flowers impart odour to lard without adding to its virtues. An ointment, prepared in like manner from the leaves, has a green colour, and is popularly employed as a cooling application in England. Mr. Joseph Ince says of the ointment prepared according to the officinal directions, that it is apt to be somewhat brownish, and to become hard and rancid; but if, after the straining through linen, it be set aside for a few days, and, after deposition and concretion, be filtered through a funnel kept hot with steam, these disadvantages will be obviated. (*Pharm. Journ.*, xiv. 489.)

odour of the ointment may be in some measure concealed by a little oil of lemons, or oil of bergamot. W.

UNGUENTUM SULPHURIS IODIDI. *U.S., Br. Ointment of Iodide of Sulphur.*

"Take of Iodide of Sulphur, in very fine powder, *thirty grains;* Lard *a troyounce.* Rub the Iodide of Sulphur with the Lard, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Iodide of Sulphur *thirty grains;* Prepared Lard *one ounce* [avoirdupois]. Triturate the Iodide of Sulphur in a porcelain mortar, and gradually add the Lard, rubbing them together until the ointment is perfectly smooth and free from grittiness." *Br.*

This is admirably adapted, as a local remedy, to the treatment of chronic cutaneous eruptions, unattended with inflammation; and is especially useful in psoriasis, lepra, porrigo, and the very advanced stages of eczema and impetigo, when they have become dry. W.

UNGUENTUM TABACI. *U.S. Ointment of Tobacco.*

"Take of Tobacco, in fine powder, *half a troyounce;* Lard *eight troyounces;* Water *a sufficient quantity.* Moisten the Tobacco with a little Water, introduce it into a conical glass percolator, and, having pressed it firmly, pour Water upon it until four fluidounces of filtered liquid have passed. Evaporate this to the consistence of a soft extract, and mix it thoroughly with the Lard." *U. S.*

In the first edition of the U.S. Pharmacopœia, this ointment, under the name of "Tobacco Liniment," was directed to be prepared by boiling together lard and common dried tobacco; but in this condition the leaves do not yield their virtues to lard. The error was corrected in the second edition, in which fresh tobacco was directed. Though the tobacco plant is not an object of general culture in the Northern States, it may readily be produced in gardens, in quantities sufficient to supply any demand for the fresh leaves.

Fresh narcotic vegetables yield their active principles, and chlorophyll or green colouring matter, to oleaginous substances, when heated with them; and ointments have long been prepared in this manner. In the pharmacy of the continent of Europe, olive oil is frequently employed as the solvent, and the resulting preparations are called *olea infusa.* Several of these are ordered by the French Codex, as the oils of henbane, stramonium, tobacco, &c. Lard is preferred in British and American pharmacy, as affording preparations of a more convenient consistence. The boiling takes place at a lower temperature than that necessary for the evaporation of the lard or oil, and is owing to the escape of the watery parts of the plants. It should be continued till all the water is driven off, as this, if allowed to remain, would render the ointment more liable to spontaneous decomposition; and, besides, the colouring matter of the narcotic is not freely extracted till after the dissipation of the water. In the latest revision, however, of the Pharmacopœia, it was thought expedient to discard this method of preparing the ointment altogether, and to substitute a concentrated infusion of the dried leaves mixed with lard. The new preparation is probably quite as efficient as the old, if not more so, while pharmaceutically it is much neater.

Tobacco ointment is useful in irritable ulcers, and various cutaneous eruptions, particularly *tinea capitis;* but great care must be taken, especially in children, not to employ it in such quantities as to endanger the production of the constitutional effects of the narcotic. W.

UNGUENTUM TEREBINTHINÆ. *Br. Ointment of Turpentine.*

"Take of Oil of Turpentine *one fluidounce;* Resin, in coarse powder, *sixty grains;* Yellow Wax, Prepared Lard, of each, *half an ounce* [avoirdupois]. Melt the ingredients together by the heat of a steam or water-bath. Remove the vessel, and stir the mixture constantly while it cools." *Br.*

This is a somewhat stronger preparation than the British *Linimentum Terebinthinæ,* but is probably intended for the same purpose; as a dressing, namely, for burns, for which it is sometimes more convenient by its firmer consistence. W

UNGUENTUM VERATRIÆ. *U. S., Br. Ointment of Veratria.*

"Take of Veratria *twenty grains;* Lard *a troyounce.* Rub the Veratria with a little of the Lard; then gradually add the remainder, and thoroughly mix them." *U. S.*

"Take of Veratria *eight grains;* Prepared Lard *one ounce* [avoirdupois]; Olive Oil *half a fluidrachm.* Rub the Veratria and the Oil together; then mix them thoroughly with the Lard." *Br.*

This ointment has been substituted for the Ointment of White Hellebore of the former edition of the U. S. Pharmacopœia, which was made by rubbing together two ounces of the powdered root, twenty minims of the Oil of Lemons, and eight ounces of Lard, and which has sometimes been employed with advantage in the itch. It is less disagreeable, but also less certain and more apt to produce disagreeable symptoms than is sulphur ointment. For the uses of veratria ointment, see the article on *Veratria.* It should be noticed that the U. S. ointment is more than twice as strong as the British. It should be employed with caution in children. W.

UNGUENTUM ZINCI OXIDI. *U.S.* UNGUENTUM ZINCI. *Br. Ointment of Oxide of Zinc. Ointment of Zinc.*

"Take of Oxide of Zinc *eighty grains;* Ointment of Benzoin *four hundred grains.* Rub the Oxide of Zinc with the Ointment of Benzoin, gradually added, until they are thoroughly mixed." *U. S.*

"Take of Oxide of Zinc *eighty grains;* Benzoated Lard *one ounce* [avoirdupois]. Add the Oxide of Zinc to the Benzoated Lard, previously melted with a gentle heat, and stir the mixture constantly while it cools." *Br.*

This is employed as a mild astringent application in chronic ophthalmia with a relaxed state of the vessels, in cutaneous eruptions, and in sore nipples and other instances of excoriation or ulceration. It has taken the place of the discarded *unguentum tutiæ*, or *tutty ointment*, prepared from tutty or the impure oxide of zinc, by mixing it with five parts of simple ointment.* W.

VAPORES.

Vapours. Inhalations.

This is a wholly new class of preparations introduced by the British Pharmacopœia, the expediency of which, in a pharmaceutical code, is, to say the least, doubtful. There is no such complexity in the preparations as to require peculiar skill, and the whole process, in each case, is more appropriate to the duties of a nurse in the sick chamber, than to those of the pharmaceutist in the shop.

VAPOR ACIDI HYDROCYANICI. *Br. Inhalation of Hydrocyanic Acid.*

"Take of Diluted Hydrocyanic Acid *ten to fifteen minims;* Water (cold) *one fluidrachm.* Mix in a suitable apparatus and let the vapour that arises be inhaled." *Br.*

VAPOR CHLORI. *Br. Inhalation of Chlorine.*

"Take of Chlorinated Lime *two ounces;* Water (cold) *a sufficiency.* Put the powder into a suitable apparatus, moisten it with the Water, and let the vapour that arises be inhaled." *Br.*

VAPOR CONIÆ. *Br. Inhalation of Conia.*

"Take of Extract of Hemlock *sixty grains;* Solution of Potash *one fluidrachm;* Distilled Water *ten fluidrachms.* Mix. Put 20 minims of the mixture on a sponge, in a suitable apparatus, so that the vapour of hot water passing over it may be inhaled." *Br.*

The object of the potassa is to decompose the salt of conia in the extract, taking the acid, and liberating the alkaloid, which, being volatile, escapes with the vapour

* The use of the ordinary paint mill is said by Mr. Alfred H. Bolton (*Am. Journ. of Pharm.*, xlv. 4) to greatly facilitate the making of this ointment. The oxide of zinc should simply be stirred into the melted ointment and the whole passed through the warmed mill, the temperature if necessary being maintained by a spirit lamp. Mr. G. A. Alden gets a smooth ointment by rubbing up the oxide into a paste with glycerin and then with the ointment. (*Ibid.*, 157.)—*Note to the fourteenth edition.*

of water. The genuineness of the vapour may be known by the strong mouse-like odour which is perceived. W.

VAPOR CREASOTI. *Br.* *Inhalation of Creasote.*

"Take of Creasote *twelve minims;* Boiling Water *eight fluidounces.* Mix the Creasote and Water in an apparatus so arranged that air may be made to pass through the solution, and may afterwards be inhaled." *Br.*

VAPOR IODI. *Br.* *Inhalation of Iodine.*

"Take of Tincture of Iodine *one fluidrachm;* Water *one fluidounce.* Mix in a suitable apparatus, and, having applied a gentle heat, let the vapour that arises be inhaled." *Br.*

VERATRIA.

Veratria.

VERATRIA. *U.S., Br.* *Veratria.*

"Take of Cevadilla, in moderately fine powder, *twenty-four troyounces;* Alcohol, Sulphuric Acid, Magnesia, Water of Ammonia, Purified Animal Charcoal, Water, each, *a sufficient quantity.* Digest the Cevadilla with eight pints of Alcohol, for four hours, in a distillatory apparatus, with a heat approaching to boiling, and pour off the liquid. To the residue add eight pints more of Alcohol mixed with the portion distilled, and, having digested for an hour, pour off the liquid as before. Digest for a third time with the same quantity of Alcohol, together with the portion last distilled, and again pour off. Press the remains of the Cevadilla, mix and strain the liquids, and, by means of a water-bath, distil off the Alcohol. Boil the residue three or four times in Water acidulated with Sulphuric Acid, mix and strain the liquids, and evaporate to the consistence of syrup. Add Magnesia in slight excess, shake the mixture frequently, then express, and wash what remains. Repeat the expression and washing two or three times, and, having dried the residue, digest it with a gentle heat several times in Alcohol, and strain after each digestion. Distil off the Alcohol from the mixed liquids, boil the residue for fifteen minutes in water mixed with a little Sulphuric Acid and Purified Animal Charcoal, and strain. Having thoroughly washed what remains, mix the washings with the strained liquid, evaporate with a moderate heat to the consistence of thin syrup, and drop in sufficient Water of Ammonia to precipitate the Veratria. Lastly, wash the alkaloid with Water, and dry it with a gentle heat." *U.S.*

"Take of Cevadilla *two pounds* [avoirdupois]; Distilled Water, Rectified Spirit, Solution of Ammonia, Hydrochloric Acid, of each, *a sufficiency;* Purified Animal Charcoal *sixty grains.* Macerate the Cevadilla with half its weight of boiling Distilled Water, in a covered vessel, for twenty-four hours. Remove the Cevadilla, squeeze it, and dry it thoroughly with a gentle heat. Beat it now in a mortar, and separate the seeds from the capsules by brisk agitation in a deep narrow vessel, or by winnowing it gently on a table with a sheet of paper. Grind the seeds in a coffee mill, and form them into a thick paste with Rectified Spirit. Pack this firmly in a percolator, and pass Rectified Spirit through it till the Spirit ceases to be coloured. Concentrate the spirituous solution by distillation, so long as no deposit forms; and pour the residue, while hot, into twelve times its volume of cold Distilled Water. Filter through calico, and wash the residue on the filter with Distilled Water, till the fluid ceases to precipitate with Ammonia. To the united filtered liquids add the Ammonia in slight excess, let the precipitate completely subside, pour off the supernatant fluid, collect the precipitate on a filter, and wash it with Distilled Water till the fluid passes colourless. Diffuse the moist precipitate through twelve fluidounces of Distilled Water, and add gradually with diligent stirring sufficient Hydrochloric Acid to make the fluid feebly but persistently acid. Then add the Animal Charcoal; digest at a gentle heat for twenty minutes, filter, and allow the liquid to cool. Add Ammonia in slight excess, and, when the precipitate has completely subsided, pour off the supernatant liquid, collect the precipitate on a filter, and wash it with cold Distilled Water till the washings cease to be affected by nitrate of silver acidu-

lated with nitric acid. Lastly, dry the precipitate first by imbibition with filtering paper, and then by the application of a gentle heat." *Br.*

In the U. S. process the first step is to obtain a tincture of cevadilla. In the British process, which is mainly that of the late Edinburgh Pharmacopœia, the use of alcohol is preceded by measures calculated to bring the seeds into a proper state for its action. This is not satisfactorily effected by mere bruising. The seeds are not thus separated from the capsules; and, on account of their elasticity, they cannot be conveniently comminuted in a mortar. The mode of proceeding given in the British Pharmacopœia was suggested by Christison, and is said by him to answer the purpose. In the U. S. process, the tincture, when made, is evaporated to the consistence of an extract. This contains the veratria combined with a vegetable acid, probably the gallic, as it exists in the seeds. From the extract the alkaloid is dissolved by the acidulated water, which at the same time converts it in great measure into a sulphate, a small portion possibly remaining in the solution combined with an excess of the native acid. The magnesia combines with the acids and throws down the veratria, which is then taken up by alcohol, and again yielded in a purer state by evaporation. To purify it still further, it is redissolved in water by the agency of sulphuric acid, is submitted to the action of animal charcoal, and is finally precipitated by ammonia. In the British process, the tincture is concentrated until it begins to let fall a precipitate, and is then poured into water, which throws down the resin and oil with a portion of the colouring matter, and retains the salt of veratria. This is then decomposed by ammonia, and the precipitated veratria is slightly washed with cold water to free it from adhering impurities. If much water is employed in the washing, a considerable portion of the veratria is lost, in consequence of being in some degree soluble in that menstruum in its ordinary impure state. The remaining steps of the British process consist in the purification of the veratria by forming a muriate in solution, decolourizing this by animal charcoal, and again precipitating by ammonia.*

* Mr. James Beatson, manufacturing chemist of the U. S. Naval Laboratory at New York, recommends the following method of preparing veratria as less complicated and troublesome than the officinal, and quite satisfactory in its results. Take 73 pounds (avoirdupois) of cevadilla, rub it upon a coarse wire sieve so as to separate the seeds from the capsules, and reduce the former to a coarse powder by a Swift's drug mill. Pass the capsules also through the mill, separate the finer portion, and mix it with the ground seeds. Moisten the mixture with alcohol, and allow it to stand 12 hours; then introduce it into a displacement apparatus, and pour upon it 30 gallons of alcohol. When a convenient quantity of the liquid has passed, submit it to distillation, and return the distilled alcohol to the displacement apparatus; and proceed in the same way until the cevadilla is thoroughly exhausted. Collect all the alcoholic liquor from the exhausted seeds, and continue the distillation until the tincture has a syrupy consistence. Pour this while hot into eight times its volume of cold water, throw the whole on a calico filter, and wash until the washings cease to indicate the presence of the veratria. Mix the washings with what first passed through the filter, and add aqua ammoniæ in excess (about 4 pounds). Wash the precipitated veratria with cold water, and dry it with a very gentle heat. Mr. Beatson obtained by this process eleven and a quarter ounces of veratria, but faintly tinged with colouring matter. (*Am. Journ. of Pharm.*, xxvi. 5.)—*Note to the tenth edition.*

M. Auguste Delondre, in a paper upon veratria in the *Journ. de Pharm.* for June, 1855 (p. 417), having stated that he had found the veratria of commerce to contain only from 75 to 85 per cent. of the pure alkaloid; that in the ordinary modes of obtaining it with the aid of heat, much is lost in consequence of its extreme facility of volatilization; and that the operator is from the same cause exposed to excessive irritation of the air-passages, eyes, &c., from its vapours; proposes the following plan of preparing it as the result of many experiments and long attention to the subject.

The powdered cevadilla is treated, by means of percolation, with cold water slightly acidulated with muriatic acid until the liquid which passes strongly reddens litmus paper, when the percolation is finished with pure water. It is known that the cevadilla has been exhausted, when the last liquid which passes gives no precipitate with ammonia. The liquid thus obtained is precipitated by slight excess of the ammoniacal solution; the grayish precipitate formed is drained and washed; and the washings as well as the decanted liquid are set aside. The precipitate, having been carefully dried and powdered, is treated, in a well-closed bottle, with twice its weight of ether for four hours, with occasional agitation; and the ethereal solution is filtered upon shallow porcelain vessels and allowed to evaporate. A second treatment with half the quantity of ether serves to extract all the alkaloid. The veratria is allowed to dry, and is then carefully detached from the plates so as to avoid unpleasant consequences to the operator, and kept for use. M. Delondre considers his process more productive, cheaper and less inconvenient than the one generally employed; as the injurious effects of heat are avoided, and there are less frequent solutions.

The alkaloid, *veratrin*, being insoluble in ether, is left behind after the operation of that liquid. It is extracted by alcohol, which, on evaporation, yields a brown resinous matter, from which the veratrin may be obtained by heating it with water acidulated with sulphuric acid, and precipi-

The U. S. process is essentially that of M. Couerbe. The veratria obtained by it, though not pure, is sufficiently so for medical use. A drachm of it, in this state, may be procured from a pound of cevadilla. Besides veratria, M. Couerbe states that principles, which he calls respectively *sabadillin* (*sabadillia*) and *veratrin*, are also contained in this product. These are separated in the following manner. Into the solution of impure sulphate of veratria obtained in the above process, nitric acid is to be introduced by drops. This occasions an abundant precipitate, from which the clear liquor is to be decanted. A weak solution of potassa is then to be added to the liquor, and the precipitate which it produces is to be washed with cold water, and treated with boiling alcohol. The substance obtained by evaporating the alcohol yields the *sabadillia* to boiling water, which deposits it upon cooling; a substance, called by M. Couerbe *resini-gum* of sabadilla, remaining in solution. If the residue of the substance, treated as just mentioned with boiling water, be submitted to the action of ether, it yields to this liquid the proper *veratria*, which may be obtained entirely pure by the spontaneous evaporation of the ether. The matter remaining undissolved is the resinous substance which M. Couerbe called *veratrin*. *Sabadillia* is white, crystallizable, insupportably acrid, fusible by heat, readily soluble in hot water, which deposits it upon cooling, very soluble in alcohol, and wholly insoluble in ether. It is capable of saturating the acids. (*Journ. de Pharm.*, xix. 527.) According to Simon, sabadillia is a compound of resinate of sodium and resinate of veratria. Fr. Hübschmann confirms the views of Couerbe as to the separate existence of sabadillia. He obtained it by treating the matter considered as veratria with ether, which removed the pure veratria, and left the sabadillia. The latter does not irritate the nostrils like veratria. (*Am. Journ. of Pharm.*, xxv. 133.)

Properties, &c. In the impure state in which it is obtained by either of the above officinal processes, veratria is a grayish or brownish-white powder, without odour, and of a bitter, acrid taste, producing a sense of tingling or numbness in the tongue, and exciting violent sneezing and coryza, when admitted into the nostrils. When pure, it is white, pulverulent, inodorous, extremely acrid, fusible at 200° F., and volatilizable at 360° F. (*Guy*), inflammable, scarcely soluble in cold water, soluble in a thousand parts of boiling water which it renders sensibly acrid, in eleven parts of alcohol of 0·847, and in six parts of ether (Delondre, *Journ. de Pharm.*, xxvii. 421), and capable of neutralizing acids, with several of which, particularly the sulphuric and muriatic, it forms crystallizable salts. As commonly obtained, it is uncrystallizable; but G. Merck, by dissolving it in highly rectified alcohol, and allowing the solution to evaporate spontaneously, obtained fine crystals in the form of rhombic prisms. The quantity obtained in crystals was but a small proportion of the veratria used, which Merck considered to be a mixture of resin with the pure alkaloid, and on this account to be uncrystallizable. (See *Am. Journ. of Pharm.*, xxviii. 134.) The composition of veratria is expressed, according to Couerbe, by the formula $C_{34}H_{22}NO_6$; but Merck, who obtained it crystallized, and therefore pure, gives the formula $C_{64}H_{52}N_2O_{16}$. (*Ibid.*, p. 135.) It may be recognised by its sensible properties, incapacity of crystallization as ordinarily procured, combustibility, fusi-

tating by ammonia. It exists, however, in very minute proportion, and is difficult to obtain pure. Its effects have not been determined; but its powder produces sneezing, though much less violently than veratria.

The washings and decanted fluid, which had been set aside, yield on evaporation an extract, which, when dried, and treated with ether, gives a little additional veratria; the sabadillin and resini-gum of M. Couerbe remaining behind. If the residue be dissolved in cold water, and the solution filtered and slowly evaporated, a mixture of crystals of sabadillin and resini-gum is obtained, which it is very difficult to separate.

Commercial veratria may be purified with great facility by means of ether, which dissolves the pure alkaloid, leaving the impurities. (*Note to the eleventh edition.*)

Dr. Murray Thomson, of Edinburgh, operates in a similar manner with M. Delondre in exhausting the seeds with water, acidulated with muriatic acid, and in precipitating with ammonia; but, instead of exhausting the precipitate with ether, he uses hot alcohol for the purpose, and then proceeds by evaporating the tincture, treating the residue with acidulated water, decolorizing with a little animal charcoal, and precipitating with ammonia. The alkaloid thus obtained may be rendered purer by again dissolving and precipitating as before. Dr. Thomson has thus obtained veratria in the proportion of 20 grains to an avoirdupois ounce of the seeds. (*Pharm. Journ.*, May, 1861, p. 548.) It is, however, obvious, from what is said in the preceding note, that the veratria of Dr. Thomson contains veratrin. (*Note to the twelfth edition.*)

bility, peculiar solubilities, alkaline reaction, the intense red colour it assumes upon contact with concentrated sulphuric acid, the yellow solution it forms with nitric acid, and the white precipitates which its solution in dilute acetic acid yields with ammonia and the infusion of galls. Chlorine at first colours a solution of its salts yellow, and afterwards produces a white precipitate. (*Cent. Blatt*, June 28, 1856, p. 454.) Compound solution of iodine causes a reddish-brown precipitate, soluble in alcohol. (Fairthorne, *Am. Journ. of Pharm.*, xviii. 212.) According to Trapp, of St. Petersburg, the smallest trace of veratria, if dissolved in highly concentrated muriatic acid, gives a solution which, though colourless at first, becomes red by boiling, and intensely red like permanganate of potassium if the boiling be long continued. (See *Am. Journ. of Pharm.*, Nov. 1863, p. 556.) When mixed with four or five times its weight of sugar, and a little sulphuric acid added to it, a light yellow appears, slowly followed by green, and finally a beautiful blue. A minute drop of bromine water will cause the rapid development of these colours. (H. Weppen, *Am. Journ. of Pharm.*, xlvi. 558.) It is entirely dissipated by a red heat. It is said sometimes to be sophisticated with lime, which is easily detected by incineration, and may be separated by dissolving the powder in diluted alcohol, precipitating by sulphuric acid, filtering, evaporating the alcohol, and precipitating the veratria by ammonia. (*Chem. Gaz.*, Feb. 1845, p. 73.) Mr. John E. Carter, of Philadelphia, found a specimen which he examined to contain 38 per cent. of magnesia. (*Am. Journ. of Pharm.*, Jan. 1858, p. 16.) It may be used either in the uncombined state, or united with acids; as in both forms it produces essentially the same effects.

Medical Properties and Uses. Veratria is locally irritant, and exercises a peculiar influence on the nervous system. Rubbed upon the skin it excites a sensation of warmth and a peculiar tingling. Sometimes an evanescent blush is produced, and still more rarely an eruption upon the skin; but, in general, no decided signs of inflammation are evinced. Upon the denuded cutis, however, veratria and its salts are powerfully irritating; in the mouth and fauces they produce an almost insupportable sense of acrimony, and snuffed up the nostrils excite violent sneezing. Magendie states that, when taken internally in the dose of a quarter of a grain, they promptly produce abundant alvine evacuations, and in larger doses provoke more or less violent vomiting. Other experimenters have observed similar effects. Dr. Turnbull, on the contrary, says that he has very seldom found them to purge, even when largely administered. According to this author, their first effect, when given in moderate doses, is a feeling of warmth in the stomach, gradually extending itself over the abdomen and lower part of the chest, and ultimately to the head and extremities. If the medicine is continued, this feeling of warmth is followed by a sense of tingling, similar to that produced by the external use of the medicine, which manifests itself in different parts of the body, and sometimes over the whole surface, and is frequently accompanied by perspiration and some feeling of oppression. Occasionally also diuresis is produced. A still further continuance of the medicine, or the use of large doses, excites nausea and vomiting. It occasions no narcotic effects. In overdoses it is a violent poison. Dr. J. L. Van Praag has experimented with veratria on the lower animals, and gives as the result of his observations, that it lowers the circulation and respiration, diminishes the irritability of many of the nerves, especially the cutaneous, and produces muscular relaxation; while, at the same time, it frequently vomits, and in large doses purges. The secretion of saliva is much increased, but that of urine little affected. In poisonous doses, before producing the depressing effects above referred to, it accelerates the pulse and respiration, occasions tonic and clonic spasms of the muscles, and exalts the nervous irritability generally. Tetanic stiffening of the limbs, followed by a dancing movement, is a characteristic symptom of poisoning with this alkaloid. Death seems to result from paralysis of the spinal cord. (*B. and F. Medico-chirurg. Rev.*, July, 1855, Am. ed., p. 185; from *Virchow's Archiv.*)

The diseases in which veratria has been employed are chiefly gout, rheumatism, and neuralgia. M. Piedagnel has used it with great supposed advantage in acute articular rheumatism, which he has found generally to get well under its use in seven or eight days. (See *Am. Journ. of Med. Sci.*, N. S., xxvi. 496.) Dr. Turnbull has

found it useful also in dropsy, and in diseases of the heart, particularly those of a functional character. He thinks he has also seen it do good in structural diseases of that organ, but chiefly by acting as a diuretic, and thus removing effusion in the pericardium. Prof. Vogt, of Berne, employs it in pneumonia, giving 5 milligrammes (about the thirteenth of a grain) every two hours, and five or six times that amount during the day, increased in insusceptible persons to ten or twelve times the quantity; the dose being continued or increased till vomiting and reduction of the pulse are produced. (See *Am. Journ. of Pharm.*, May, 1860, p. 222.) Dr. D. Martin, of the French army, has experienced great advantage from it in choroido-iritis. (*Ann. de Thérap.*, 1867, p. 16.) Veratria has also been employed in dysmenorrhœa, and in various nervous affections, as paralysis, hooping-cough, epilepsy, hysteria, and disorders dependent upon spinal irritation. From one-twelfth to one-sixth of a grain may be given in the form of pill, and repeated every three hours till the effects of the medicine are experienced. Some prefer the salts for internal use. Dr. Turnbull states that the tartrate is least disposed to irritate the stomach. The sulphate or acetate, however, may be used. Any one of these salts may be prepared by treating veratria with water acidulated with the acid to perfect neutralization, and then carefully evaporating to dryness.

But veratria is much more employed externally than by the stomach, and is applicable in this way to all the complaints already mentioned. It has been highly praised as a local application in chronic swellings, stiffening, and induration of the joints, whether from rheumatism, scrofula, or simply from local injuries, as sprains. It may be used either dissolved in alcohol, or rubbed up with lard or other unctuous substance, in the proportion of from five to twenty grains to the ounce. It is advisable that the alkaloid should be dissolved in a little alcohol before being mixed with the lard. Of the ointment thus prepared, a portion of the size of a filbert may be rubbed upon the skin over the part affected, night and morning, from five to fifteen minutes, or until the more urgent symptoms are relieved. Veratria may be used in this way to the amount of from four to eight grains in the day. Care must be taken that the cuticle is sound over the parts to which it is applied. When the skin is irritable, smaller quantities than those above mentioned must be used.

Off. Prep. Unguentum Veratriæ. W.

VINA MEDICATA.

Medicated Wines.

The advantages of wine as a pharmaceutic menstruum are that, in consequence of the alcohol it contains, it dissolves substances insoluble in water, and, to a certain extent, resists their tendency to spontaneous change; while, at the same time, it is less stimulant than rectified or proof spirit, both from its smaller proportion of alcohol, and from the modified state in which this fluid exists in its composition. The acid which it usually contains serves in some instances to increase its solvent power. But most wines, particularly the light varieties, are liable to undergo decomposition; and even the strongest acquire such a liability from the principles which they extract from vegetable substances; so that medicated wines, though they keep much better than infusions or decoctions, are inferior in this respect to the tinctures. The proportion of alcohol, moreover, is not constant; and the preparations, therefore, made with them, are of unequal strength. From these causes, few medicated wines are at present retained. In the choice of wine, the purest and most generous should be selected. Sherry, as directed by the U. S. and British Pharmacopœias, Teneriffe, or Madeira should be preferred. The medicated wines, in consequence of their liability to change, should be prepared in small quantities, without heat, and should be kept in well-stopped bottles in a cool place.

The Wines, formerly officinal, which have been omitted in the present Pharmacopœias, are *Vinum Gentianæ*, Ed., and *Vinum Veratri Albi*, U. S., Lond. W.

VINUM ALOËS. *U. S., Br. Wine of Aloes.*

"Take of Socotrine Aloes, in fine powder, *a troyounce;* Cardamom [seeds], in moderately fine powder, Ginger, in moderately fine powder, each, *sixty grains;*

Sherry Wine *a pint.* Macerate for seven days, with occasional agitation, and filter through paper." *U. S.*

"Take of Socotrine Aloes *one ounce and a half* [avoirdupois]; Cardamom Seeds, freed from the pericarps and bruised, Ginger, in coarse powder, of each, *eighty grains;* Sherry *two pints* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation; filter the liquor, and add sufficient Sherry to make two pints [Imp. meas.]." *Br.*

The wine of aloes is a warm stomachic purgative, useful in constipation, dependent on a want of due irritability of the alimentary canal, and in complaints connected with this state of the bowels. It has long been used in chlorosis, amenorrhœa, dyspepsia, gout, paralysis, &c. It is said to leave behind it a more lax condition of the bowels than most other cathartics. The dose as a stomachic is one or two fluidrachms, as a purgative from half a fluidounce to a fluidounce. W.

VINUM ANTIMONII. *U. S.* VINUM ANTIMONIALE. *Br. Antimonial Wine. Wine of Antimony.*

"Take of Tartrate of Antimony and Potassium *thirty-two grains;* Boiling Distilled Water *a fluidounce;* Sherry Wine *a sufficient quantity.* Dissolve the Salt in the Distilled Water, and, while the solution is hot, add sufficient Sherry Wine to make it measure a pint." *U. S.*

"Take of Tartarated Antimony *forty grains;* Sherry *one pint* [Imperial measure]. Dissolve." *Br.*

In the first edition of the United States Pharmacopœia, the proportion of tartar emetic was four grains to the fluidounce of wine. In the revision of 1830, the quantity was reduced to two grains, and, as this was very nearly the proportion directed by the British Colleges, the highly important object was accomplished, of uniformity in the strength of this very popular preparation. The seeming discrepancy between the British formula and that of the U. S. Pharmacopœia will disappear, when it is considered that the Imperial pint, employed in the former, contains twenty fluidounces, each very nearly equal to the fluidounce of the ordinary apothecaries' measure. The U. S. officinal name was adopted as most convenient, sufficiently expressive, and in accordance with the nomenclature of several other metallic preparations, such as *Emplastrum Ferri, Mistura Ferri Composita,* &c.

Difficulty is often experienced in effecting a solution of tartar emetic in wine; and precipitation is apt to occur after the solution has been effected. These results are attributable either to impurity in the antimonial salt, which frequently contains bitartrate of potassium and various insoluble substances, or to inferiority in the character of the wine, which holds in solution vegetable principles that form insoluble compounds with the teroxide of antimony. Dr. Paris stated that he had seen the decomposition of the tartar emetic so complete, that no traces of the salt could be detected in the supernatant liquid. The difficulty is not avoided by the plan adopted in the U. S. Pharmacopœia, of first dissolving the antimonial in water, and then adding the wine; for, even allowing that the solution may be accomplished, the same ingredients are present, and their mutual reaction must ultimately result in the same effects. The proper course is to select perfectly pure crystallized tartar emetic, and sound Sherry or Teneriffe wine, which make a permanent solution. To obviate the risk of decomposition, the Dublin College directed water and rectified spirit in about the proportion in which these exist in the wines just mentioned. The only objection to this menstruum is the want of colour, which renders the preparation liable to be confounded with less active liquids.

The advantages of antimonial wine are, that it affords the means of administering minute doses of tartar emetic, and is more permanent than an aqueous solution of that salt, which is liable to spontaneous decomposition. It is usually administered in small doses as a diaphoretic or expectorant, or as an emetic in infantile cases. When a considerable quantity of tartar emetic is requisite, it should always be given in extemporaneous aqueous solution. The dose of the wine, as an expectorant or diaphoretic, is from ten to thirty drops, given frequently; as an emetic for children, from thirty drops to a fluidrachm, repeated every fifteen minutes till it operates.

Off. Prep. Mistura Glycyrrhizæ Composita, *U. S.* W.

VINUM AURANTII. *Br. Orange Wine.*

"Wine made in Britain, by the fermentation of a Saccharine Solution to which the fresh Peel of the Bitter Orange has been added." *Br.*

This preparation has a taste and aroma derived from the bitter orange peel, is slightly acid to test paper, and contains about 12 per cent. of alcohol. It is a mild, pleasant aromatic tonic, but is used rather as a vehicle of other tonics than by itself.

Off. Prep. Vinum Ferri Citratis, *Br.;* Vinum Quiniæ, *Br.* W.

VINUM COLCHICI RADICIS. *U. S.* VINUM COLCHICI. *Br. Wine of Colchicum Root.*

"Take of Colchicum Root, in moderately fine powder, *twelve troyounces;* Sherry Wine *a sufficient quantity.* Moisten the powder with four fluidounces of Sherry Wine, pack it firmly in a conical percolator, and gradually pour Sherry Wine upon it until two pints of filtered liquid are obtained." *U. S.*

"Take of Colchicum Corm, sliced, dried, and bruised, *four ounces* [avoirdupois]; Sherry *one pint* [Imperial measure]. Macerate the Colchicum in the Wine for seven days in a closed vessel, with occasional agitation, press and strain through calico; then add sufficient Sherry to make up one pint [Imp. meas.]." *Br.*

This is intended to be a saturated vinous tincture of colchicum. As the colchicum bulb imported into the United States is of variable strength, the only method by which an active preparation can be ensured, is to employ a large quantity of it in proportion to that of the menstruum. If the former should happen to be in excess, no other injury could result than a slight pecuniary loss; while a deficiency in the strength of the preparation would frequently be of serious detriment in urgent cases of disease. A wine made from the fresh bulb is occasionally imported from England, and is thought by some to be more efficacious than our officinal preparation; but we have seldom been disappointed in obtaining the effects of colchicum from the wine prepared according to the directions of the U. S. Pharmacopœia. The dose of the officinal wine is from ten minims to a fluidrachm, repeated three or four times a day, or more frequently in severe cases, till its effects are experienced. In gout it is frequently given in connection with magnesia and its sulphate; and in neuralgic cases we have found much advantage from combining it with the solution of sulphate of morphia, especially when we have desired to give it a direction rather to the skin than the bowels. It has been employed externally with asserted advantage in rheumatism. In overdoses it may produce fatal effects. Death is said to have occurred in one instance from two drachms and a half of the wine; but much more would probably in general be requisite to produce this result. W.

VINUM COLCHICI SEMINIS. *U. S. Wine of Colchicum Seed.*

"Take of Colchicum Seed, in moderately coarse powder, *four troyounces;* Sherry Wine *two pints.* Macerate for seven days, with occasional agitation; then express, and filter through paper." *U. S.*

As the seeds of colchicum are less liable to injury than the bulb, and are, therefore, of more uniform strength, there is not the same necessity for preparing a saturated tincture. Dr. Williams, who introduced the seeds into use, supposed that their active properties resided in their coating, and that it was, therefore, not advisable to bruise them in preparing the wine or tincture. But this has been shown to be an error by the experiments of Mr. Bonnewyn, who found a larger portion of colchicia in a tincture of the bruised than in one of the unbruised seeds. (See *Am. Journ. of Pharm.*, xxvi. 120.) In order that the seeds may be properly comminuted, Prof. Maisch recommends that they should be macerated for two or three days in a portion of the wine, before being bruised. (*Ibid.*, xxviii. 514.) It is stated that sometimes this tincture becomes turbid from the development of the yeast fungus in it. (Vulpius, *Am. Journ. of Pharm.*, xliv. 212.) The dose is from thirty minims to two fluidrachms. Two fluidounces have proved fatal. W.

VINUM ERGOTÆ. *U. S. Wine of Ergot.*

"Take of Fluid Extract of Ergot *four fluidounces;* Sherry Wine *twenty-eight fluidounces.* Mix them, and filter through paper." *U. S.*

The large proportion of fixed oil in ergot interferes with the solvent action of the

menstruum, unless the grains are finely powdered. It is, therefore, best to employ the ergot in this process well powdered, instead of merely bruised, as was formerly officinally directed.

The dose of this wine is for a woman in labour two or three fluidrachms; for other purposes, one or two fluidrachms, to be repeated several times a day, and gradually increased if necessary. W.

VINUM FERRI. *Br. Wine of Iron.*

"Take of Fine Iron Wire (about No. 35) *one ounce* [avoirdupois]; Sherry *one pint* [Imperial measure]. Macerate for thirty days in a closed vessel, the Iron being almost but not quite wholly immersed in the Wine, and the vessel frequently shaken, and the stopper removed; then filter." *Br.*

When wine is made to react on metallic iron with presence of air, the metal is oxidized, and then unites with the excess of acid of the bitartrate of potassium, which is the characteristic salt of wines. The ferruginous salt, therefore, formed is the tartrate of iron and potassium, or tartarated iron of the Br. Pharmacopœia; and this was the old method of preparing the Wine of Iron. But it is obvious that the strength in iron cannot be entirely uniform, as the quantity dissolved must depend on the proportion of the bitartrate in the wine, which is variable, and on various circumstances of the manipulation. In consideration of these objections, it was thought best, in the Br. formula of 1864, to substitute a simple solution in the wine of the tartrate of iron and potassium already formed, and to abandon the old tedious formula. But it is obvious that a solution of the ferruginous salt in wine is not exactly the same as the wine of iron prepared with the metal, as it contains the bitartrate of potassium unaltered. For this, or other reasons, the Br. Pharmacopœia has returned to the old method. The dose of the wine of iron is from one to four fluidrachms.* W.

VINUM FERRI CITRATIS. *Br. Wine of Citrate of Iron.*

"Take of Citrate of Iron and Ammonia *one hundred and sixty grains;* Orange Wine *one pint* [Imperial measure]. Dissolve, and let the solution remain for three days in a closed vessel, shaking it occasionally; afterwards filter. Dose one to four *fluidrachms.*" *Br.*

VINUM IPECACUANHÆ. *U. S., Br. Wine of Ipecacuanha.*

"Take of Fluid Extract of Ipecacuanha *two fluidounces;* Sherry Wine *thirty fluidounces.* Mix them, and filter through paper." *U. S.*

"Take of Ipecacuanha, bruised, *one ounce* [avoirdupois]; Sherry *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, strain, press, and filter; then add sufficient Sherry to make one pint [Imp. meas.]." *Br.*

The preparations of the two Pharmacopœias are not of the same strength; the U. S. wine containing the virtue of 30 grains, the British of only somewhat more than 20 grains in a fluidounce. In the preparation of the British Pharmacopœia, the strength of this wine was reduced almost one-third. Wine of ipecacuanha possesses all the medical properties of the root, and may be used as a substitute when it is desirable to administer the medicine in the liquid form. As it is milder, without being less efficacious than antimonial wine, it is in some instances preferable as an emetic for infants, especially when the antimonial, as not unfrequently happens, is

* *Bitter Wine of Iron.* Under this name are much used various combinations of iron and bitter principles. The following formula is said by Mr. Chas. L. Mitchell to yield an elegant preparation.

Take of ground Calisaya Bark 192 grains; ground Gentian Root 128 grains; Soluble Citrate of Iron 192 grains; Sherry Wine 13 fluidounces; Brandy 1 fluidounce; Alcohol 1 fluidounce; Oil of Orange 12 minims; Sugar 2 ounces; Solution of Tersulphate of Iron 2 fluidounces; Water of Ammonia q. s. Dissolve the Oil in the Alcohol and mix with the Sherry Wine and Brandy. Percolate with this the ground drugs, recover 15 fluidounces of tincture by pouring on water. Dilute the iron solution with twice its bulk of water and add Ammonia in slight excess. Wash and drain the precipitate thoroughly. Mix this with the tincture, and agitate occasionally until a filtered portion has a light-yellow colour and does not precipitate with tincture of the Chloride of Iron. Filter, dissolve the Citrate of Iron and Sugar, and bring up the measure with a little water to 16 fluidounces; a fluidounce represents 12 grains of Calisaya Bark, 8 grains of Gentian Root, and 12 grains of Citrate of Iron.

Dose, one to three fluidrachms. (*Note to the fourteenth edition.*)

disposed to irritate the bowels. It is much used as an expectorant and diaphoretic; and the effects of the Dover's powder may be obtained by combining it with laudanum, or other liquid preparation of opium. The dose as an emetic for an adult is a fluidounce; as an expectorant and diaphoretic, from ten to thirty minims. A fluidrachm may be given as an emetic to a child one or two years old, and repeated every fifteen minutes till it operates. W.

VINUM OPII. *U. S., Br. Wine of Opium. Sydenham's Laudanum.*

"Take of Opium, dried, and in moderately fine powder, *two troyounces;* Cinnamon, in moderately fine powder, Cloves, in moderately fine powder, each, *sixty grains;* Sherry Wine *a sufficient quantity.* Mix the powders with fifteen fluidounces of Sherry Wine, and macerate for seven days, with occasional agitation; then transfer the mixture to a conical percolator, and, when the liquid has passed the surface, gradually pour on Sherry Wine until a pint of filtered liquid is obtained." *U. S.*

"Take of Extract of Opium *one ounce* [avoirdupois]; Cinnamon Bark, bruised, Cloves, bruised, of each, *seventy-five grains;* Sherry *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, and filter." *Br.*

The wine made according to the directions of the U. S. Pharmacopœia is a saturated vinous tincture of opium. It contains about the same proportions of the ingredients as the *laudanum of Sydenham*, from which it differs only in wanting a drachm of Saffron. The aromatic additions are thought to adapt it to certain states of the stomach or system, in which laudanum is found to produce unpleasant effects. On being long kept it deposits insoluble matter, a sample of which M. Bihot, of Malines, has shown to consist mainly of narcotina, with possibly a little codeia, without any discoverable trace of morphia. (*Journ. de Pharm.*, xxx. 200.) Mr. Ware recommended it as a local application to the eye, in the latter stages of ophthalmia, when the vessels of the conjunctiva still remain turgid with blood. Two or three drops are introduced into the eye every morning till the redness disappears. The dose of the wine of opium is fifteen to twenty drops.* W.

VINUM QUINIÆ. *Br. Wine of Quinia.*

"Take of Sulphate of Quinia *twenty grains;* Citric Acid *thirty grains;* Orange Wine *one pint* [Imperial measure]. Dissolve first the Citric Acid, and then the Sulphate of Quinia in the Wine; allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter. The dose is from half a fluidounce to a fluidounce." *Br.*

VINUM RHEI. *U. S., Br. Wine of Rhubarb.*

"Take of Rhubarb, in moderately coarse powder, *two troyounces;* Canella, in moderately fine powder, *sixty grains;* Sherry Wine *fourteen fluidounces;* Diluted Alcohol *a sufficient quantity.* Mix two fluidounces of Diluted Alcohol with the Sherry Wine, and moisten the powders, previously rubbed together, with half a fluidounce of the mixture; then transfer them to a conical percolator, and gradually pour upon them the remainder of the mixture, and afterwards Diluted Alcohol until a pint of filtered liquid is obtained." *U. S.*

"Take of Rhubarb Root, in coarse powder, *one ounce and a half* [avoirdupois]; Canella Alba Bark, in coarse powder, *sixty grains;* Sherry *one pint* [Imperial measure]. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient Sherry to make one pint [Imp. meas.]." *Br.*

This is a warm cordial laxative applicable to debilitated conditions of the system or alimentary canal requiring evacuation of the bowels. The dose is from one to four fluidrachms or more, according to the amount of effect required, and the condition of the patient. W.

* *Rousseau's laudanum* is a tincture of opium made with very weak alcohol, which may be classed with propriety along with the above preparation. It is made according to the following formula. "Take of white honey *twelve ounces;* warm water *three pounds.* Having dissolved the honey, set the solution aside in a warm place; and, as soon as fermentation begins, add of selected opium *four ounces*, previously dissolved in *twelve ounces* of water. Allow the mixture to stand for a month at the temperature of 24° Reaumur (86° F.); then strain, filter, and evaporate to *ten ounces;* finally strain, and add *four ounces and a half* of alcohol of 20° B. Seven drops contain about a grain of opium." (*Pharmacop. Univers.*, ii. 265.)

VINUM TABACI. *U. S. Wine of Tobacco.*

"Take of Tobacco, in moderately fine powder, *a troyounce;* Sherry Wine *a pint.* Macerate for seven days, with occasional agitation; then express, and filter through paper." *U. S.*

The dose of the wine of tobacco, as a diuretic, is from ten to thirty minims. It is very seldom used. W.

ZINCUM.

Preparations of Zinc.

Of the officinal Preparations of Zinc formerly treated of under this head, *Sulphate of Zinc* has been transferred, in the U. S. Pharmacopœia, to the Materia Medica catalogue; *Prepared Calamine*, U. S., Lond., Ed., has been omitted in the present Pharmacopœias; and *Solution of Chloride of Zinc*, Dub., has been placed with the Liquores or Solutions.

ZINCI ACETAS. *U. S., Br. Acetate of Zinc.*

"Take of Commercial Oxide of Zinc *two troyounces;* Acetic Acid *eight fluidounces and a half;* Distilled Water *five fluidounces.* Mix the Acid and Water, and digest the Oxide of Zinc in the mixture for half an hour, then heat to the boiling point, filter while hot, and set aside to crystallize. Drain the crystals in a funnel, and dry them upon bibulous paper. An additional quantity of crystals may be obtained by evaporating the mother-liquor to one-half, slightly acidulating with acetic acid, and crystallizing." *U. S.*

"Take of Carbonate of Zinc *two ounces* [avoirdupois]; Acetic Acid *five fluidounces*, or *a sufficiency;* Distilled Water *six fluidounces.* Add the Carbonate of Zinc in successive portions to three [fluid]ounces of the Acetic Acid, previously mixed with the Water in a flask; heat gently, add by degrees the remainder of the Acid till the carbonate is dissolved; boil for a few minutes, filter while hot, and set it aside for two days to crystallize. Decant the mother-liquor; evaporate to one-half, and again set it aside for two days to crystallize. Place the crystals in a funnel to drain, then spread them on filtering paper on a porous tile, and dry them by exposure to the air at ordinary temperatures." *Br.*

In the present U. S. process the oxide of zinc is acted upon directly by the acetic acid. Formerly the salt was prepared by precipitating acetate of lead with zinc. The crystals of acetate of zinc, as thus obtained, were apt to be coloured with iron. Should this be the case, a boiling solution of them in distilled water is to be treated by the addition of successive portions of precipitated carbonate of zinc, until a small quantity of the liquid, being filtered, passes colourless. The zinc of the carbonate of zinc precipitates the iron, and takes its place in the solution; and the iron is known to be all removed, when a portion of the solution is found, upon trial, to filter colourless. This mode of purifying the acetate of zinc from iron was suggested by Professor Procter, and was adopted in the U. S. Pharmacopœia of 1850, in place of the mode by means of a solution of chlorinated lime, which he found to separate the iron imperfectly. The necessary carbonate of zinc may be obtained extemporaneously, by converting one-thirtieth of the coloured solution of the acetate into carbonate by precipitating it with carbonate of potassium in slight excess, as originally proposed by Prof. Procter. The precipitated carbonate, first washed from acetate of potassium, is added in the state of magma to the coloured solution, boiling hot. During the evaporation of the solution of the acetate of zinc, a small portion of the acetic acid is lost; and hence the necessity of acidulating with a few drops of acetic acid before crystallizing. In the *British* process, there is simply a decomposition of the carbonate of zinc by acetic acid, with the formation of acetate of zinc in solution, and the escape of carbonic acid. Though not economical, the present officinal processes have the recommendation of being easily performed, and of yielding a pure product. In relation to the acetate of zinc, see a paper by Mr. Ambrose Smith, contained in the *Amer. Journ. of Pharm.* (vii. 14).

Properties, &c. Acetate of zinc, when carefully crystallized, is in colourless hexagonal plates, which effloresce in a dry air. As found in the shops it is in white

micaceous crystals. It is very soluble in water, moderately so in rectified spirit, and has an astringent, metallic taste. The solution yields white precipitates with ferrocyanide of potassium and hydrosulphuret of ammonium. The precipitate thrown down by ammonia from the pure salt is entirely redissolved by an excess of the precipitant; but, if sesquioxide of iron be present, it will be left undissolved. Acetate of zinc is decomposed by the mineral acids, with the escape of acetous vapours. It consists of one eq. of acetic acid 51, one of protoxide of zinc 40·3, and two of water 18 = 109·3 ($ZnO,C_4H_3O_3 + 2HO$).

Medical Properties. Acetate of zinc is used almost exclusively as a local remedy. It is employed principally as an astringent collyrium in ophthalmia, and as an injection in gonorrhœa, after the acute stage in these affections has passed. The strength of the solution, usually prescribed, is one or two grains to a fluidounce of distilled water. B.

ZINCI CARBONAS PRÆCIPITATA. *U. S.* Zinci Carbonas. *Br.* *Precipitated Carbonate of Zinc.* *Carbonate of Zinc.*

"Take of Sulphate of Zinc, Carbonate of Sodium, each, *twelve troyounces;* Water *eight pints.* Dissolve the salts separately, with the aid of heat, each in four pints of the Water. Then mix the solutions, and, having stirred the mixture, set it by that the powder may subside. Lastly, having poured off the supernatant liquid, wash the precipitate with hot water until the washings are nearly tasteless, and dry it with a gentle heat." *U. S.*

" Take of Sulphate of Zinc *ten ounces* [avoirdupois]; Carbonate of Soda *ten ounces and a half* [avoird.]; Boiling Distilled Water *a sufficiency.* Dissolve the Carbonate of Soda with a pint [Imperial measure] of the Water in a capacious porcelain vessel, and pour into it the Sulphate of Zinc also dissolved in a pint [Imp. meas.] of the Water, stirring diligently. Boil for fifteen minutes after effervescence has ceased; and let the precipitate subside. Decant the supernatant liquor, pour on the precipitate three pints of boiling Distilled Water, agitating briskly; let the precipitate again subside; and repeat the process of affusion of hot Distilled Water and subsidence, till the washings are no longer precipitated by chloride of barium. Collect the precipitate on calico, let it drain, and dry it with a gentle heat." *Br.*

In view of the impurities and frequent falsification of the native carbonate of zinc, the revisers of the U. S. Pharmacopœia conceived that it would be best to discard altogether the old preparation, which in the edition of 1850 was still retained under the changed name of *Calamina*, and to recognise exclusively the new one first adopted in 1850. In the U. S. formula a double decomposition takes place between the salts employed, resulting in the formation of sulphate of sodium in solution, and carbonate of zinc which precipitates. Carbonate of sodium is preferable to carbonate of potassium for decomposing the sulphate; since the former gives rise to sulphate of sodium, which is more easily washed away than sulphate of potassium derived from the latter. Boiling water is properly used in the process, in order to obtain a pulverulent precipitate, which is readily washed. If cold solutions are used, a gelatinous precipitate is formed, which is washed with difficulty. The present *British* formula is essentially the same with that of the U. S. Pharm., having superseded the Dublin process, in which the reacting salts were chloride of zinc and carbonate of sodium.

Properties, &c. Precipitated carbonate of zinc is in the form of a very soft, loose, white powder, resembling magnesia alba. It dissolves in dilute sulphuric acid with effervescence, forming a solution having the characters of a solution of sulphate of zinc. If adulterated with chalk, it will be only partly soluble in this acid. Precipitated carbonate of zinc is often sold under the incorrect name of flowers of zinc, a name which properly belongs only to the oxide, as obtained by combustion. When obtained from boiling solutions of sulphate of zinc and carbonate of sodium, it has the composition, according to Schindler and Lefort, $8ZnO,3CO_2 + 6HO$. (*Journ. de Pharm.*, 3e sér., xi. 329.) According to the Br. Pharmacopœia, it consists, as thus prepared, of one eq. of carbonate and two eqs. of oxide of zinc, with three eqs. of water ($ZnO,CO_2 + 2ZnO + 3HO$). The basic character of the salt is explained by the fact that effervescence of carbonic acid takes place on mixing the solutions. It

is employed for the same purposes as prepared calamine, and is gradually superseding the spurious article usually sold under that name. The U. S. Pharmacopœia orders a cerate made from it as a substitute for calamine cerate. (See *Ceratum Zinci Carbonatis.*)

Off. Prep. Zinci Acetas, *Br.;* Ceratum Zinci Carbonatis, *U. S.;* and Zinci Oxidum.

B.

ZINCI CHLORIDUM. *U. S., Br. Chloride of Zinc. Butter of Zinc.*

"Take of Solution of Chloride of Zinc *a convenient quantity.* Evaporate the Solution to dryness in an evaporating dish, fuse the dry mass, pour the liquid on a flat stone, and when it has congealed, break the mass in pieces, and keep the fragments in a well-stopped bottle." *U. S.*

"Take of Granulated Zinc *sixteen ounces* [avoirdupois]; Hydrochloric Acid *forty-four fluidounces* [Imperial measure]; Solution of Chlorine *a sufficiency;* Carbonate of Zinc *half an ounce* [avoird.], or *a sufficiency;* Distilled Water *one pint* [Imp. meas.]. Put the Zinc into a porcelain basin, add by degrees the Hydrochloric Acid previously mixed with the Water, and aid the action by gently warming it on a sand-bath until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow it to stand on a cool part of a sand-bath for twenty-four hours, stirring frequently. Filter the product into a gallon bottle, and pour in the Solution of Chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odour of chlorine. Add the Carbonate of Zinc, in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter through paper into a porcelain basin, and evaporate until a portion of the liquid, withdrawn on the end of a glass rod and cooled, forms an opaque white solid. Pour it out now into proper moulds, and when the salt has solidified, but before it has cooled, place it in closely stoppered bottles." *Br.*

In the U. S. process the chloride of zinc is obtained by evaporating the previously formed solution. The British first prepares the chloride of zinc in solution; and in order to get rid of the iron uses chlorine, which combines with the iron to form a sesquichloride; and, the carbonate of zinc being added, the zinc combines with the chlorine to increase the product of chloride of zinc, while the oxygen of the oxide of zinc unites with the iron and water as hydrated sesquioxide of iron, which is deposited, while the carbonic acid is set free. As this preparation is used chiefly as a caustic, it is melted and cast into moulds as the last step in the Br. process. In relation to this chloride, the reader is referred to a paper by Mr. B. J. Crew in the *Am. Journ. of Pharm.*, May, 1853, p. 203.

M. Rhighini prepares this chloride by double decomposition between solutions of chloride of barium and sulphate of zinc. Sulphate of barium is precipitated, and chloride of zinc remains in solution, from which it is obtained in white flaky crystals by due evaporation.

Properties. Chloride of zinc is generally in white, amorphous or granulated masses, sometimes in cylinders or tablets, and very deliquescent. When pure, it is wholly soluble in water, alcohol, and ether; but, as prepared by the U. S. formula, it contains some oxychloride, which is left undissolved by water. According to M. Lassaigne, commercial chloride of zinc sometimes contains as much as 12 per cent. of arseniate of zinc, which, being insoluble in solution of chloride of zinc, will be left undissolved when the chloride is treated with water. (*Phillips's Trans. of the Lond. Pharm.*, 1851, p. 375.) Its solution yields with nitrate of silver a white precipitate (chloride of silver) insoluble in nitric acid; and with ammonia and potassa a white precipitate, soluble in those reagents when added in excess. The carbonates of potassium and sodium also throw down white precipitates, which are not dissolved by an excess of the precipitants. Chloride of zinc has a strong tendency to combine with organic bases, forming crystallizable compounds, as with strychnia, morphia, quinia, cinchonia, &c.; in this respect resembling certain other metallic chlorides, as of platinum, palladium, gold, and mercury. (*Journ. de Pharm.*, 4e sér., iii. 56.) When exposed to heat chloride of zinc first melts and then sublimes. When pure it gives white precipitates with ferrocyanide of potassium and hydrosulphuret of ammonium. A blue precipitate with the former test would indicate iron, a dark

one with the latter, lead. It consists of one eq. of zinc 32·3, and one of chlorine 35·5 = 67·8.*

Medical Properties and Uses. This chloride was introduced into medicine by Dr. Papenguth, of St. Petersburg, and subsequently recommended by Prof. Hancke, of Breslau, and Dr. Canquoin, of Paris. Internally it has been given as an alterative and antispasmodic in scrofula, epilepsy, chorea, and, combined with hydrocyanic acid, in facial neuralgia. Its chief use, however, has been as an escharotic, applied to cancerous affections, and to ulcers of an anomalous and intractable character. When thus used, it not only destroys the diseased structure, but excites a new action in the surrounding parts. As a caustic it has the advantage of not causing constitutional disorder from absorption, an effect which is sometimes produced by the arsenical preparations.

Dr. Canquoin prepares the chloride of zinc, as an escharotic, by thoroughly and quickly mixing it with wheat flour and water into a paste of four different strengths, containing severally an ounce of the chloride, incorporated with two, three, four, and five ounces of flour; fifteen drops of water being added for every ounce of flour, or sufficient to form the paste. It is applied in cakes from a twelfth to a third of an inch in thickness, and produces an eschar more or less deep (from a line to an inch and a half), according to the thickness and strength of the paste, the length of the application, and the nature of the part acted on. The strongest paste is applied to lardaceous and fibro-cartilaginous structures; the second to carcinomatous tumours, and very painful cancers which have not much thickness, and the third to cancerous affections in persons who have a dread of the use of the knife. These preparations, applied to the skin denuded of its cuticle by means of a blister, excite in a few minutes a sensation of heat, and afterwards violent burning pain. The eschar, which is white, thick, and very hard, falls off, with the aid of an emollient poultice, between the eighth and twelfth days. To destroy thick cancerous tumours, having an uneven surface, and situated in fleshy parts, Dr. Canquoin uses a caustic formed of one part of chloride of zinc, half a part of chloride of antimony, and two and a half parts of flour, made into a paste with water. In all cases the caustic is to be reapplied, after the falling off of the eschar, until the whole morbid structure is destroyed. When the skin is unbroken, it is now usual to destroy, not merely the cuticle, but the true skin also, by means of the acid nitrate of mercury, to the extent desired for the chloride to operate. This is applied, spread on lint, and the dressing is covered with a portion of cotton wadding, to absorb any discharge, and to preserve a uniform temperature. The surrounding skin should be protected from the caustic by a thickly-spread dressing of simple cerate, containing as much chloroform as it will take up, as recommended by Dr. E. S. Haviland, of London. M. Bonnet has applied the paste of chloride of zinc to the treatment of aneurism. He has reported the complete cure of one case of subclavian aneurism from a penetrating wound, by a continued series of applications of the paste. Every two or three days, the superficial layers of the slough were removed by a bistoury. At the end of the second month, the eschar began to detach itself without any hemorrhage, and the clot came away with the eschar. Chloride of zinc has also been used successfully by MM. Bonnet and Gensoul in the treatment of aneurism by anastomosis. (*Med. Times and Gaz.*, July 23, 1853.) Instead of flour, Dr. Alex. Ure, of Glasgow, mixes the chloride with pure anhydrous sulphate of calcium in impalpable powder. He states that this has the advantages of furnishing a porous medium from which the escharotic gradually exudes into the morbid structure, and of forming afterwards, by acquiring a firmer consistence, an impervious case for the eschar. Mr. Cock, of Guy's Hospital, has imitated this mode of preparing the chloride, so as to form a caustic which may be limited in its action, and does not run. It may be prepared as a caustic seton, by thickly covering a waxed cotton wick with Dr. Canquoin's caustic paste, and then rolling it out in the form of a cylinder, according to the plan of M. Ancrénis, of Lyons. A thread is wound spirally round the cylinder to give it firmness. Mr. Calloway, of Guy's Hospital, has employed the chloride of zinc with considerable

* For the chemistry of its influence on camphor, see *Chem. News*, xx., 1869, p. 229.

success in the treatment of nævi materni. He rubs it, at intervals, on the part until the skin becomes slightly discoloured. The late Mr. Guthrie used it with advantage for penetrating the hard case of new bone which forms over a sequestrum, in order to expose the latter, and permit its convenient extraction.

Chloride of zinc is an ingredient in the complex caustic formed of chlorides, employed by Prof. Landolfi, of Naples, in the treatment of cancer. For his formula, see *page* 184. This treatment was reported on unfavourably, in 1856, by a committee of the French Academy of Medicine, headed by M. Broca. (See *Ranking's Abstract*, No. 24, p. 100.) The cancer caustic of Dr. J. W. Fell consists of chloride of zinc, mixed with bloodroot, and made into a paste with flour and water. It is not supposed that the bloodroot has any decided caustic effect; so that the local treatment of cancer by Dr. Fell is virtually the same as that recommended in certain cases by Dr. Canquoin.

Chloride of zinc, with a view to its escharotic effect, may be formed extemporaneously by means of *galvanism*, on the plan recommended by an English physician, Dr. Thomas Smith. A simple galvanic circle is formed by riveting a disc of zinc, of the size of the eschar desired, to a disc of silver of equal size; the pair being excited by a piece of spongio-piline, placed on the silver, and moistened with a solution of common salt. The little battery is then fixed upon the skin by means of strips of adhesive plaster. Once in twelve hours it must be removed, and washed in salt and water, and then reapplied. By the electrolysis of the common salt chlorine is liberated, which, combining with the zinc, converts it to a certain extent into the chloride. This, acting on the skin, exercises its caustic effect; and at the end of twelve days a white eschar is formed. This mode of forming an issue has, according to Dr. Smith, the advantage of being less painful than those usually employed.

According to M. E. Robiquet, chloride of zinc may be made into a very malleable, pliable caustic, susceptible of taking any shape desired by the surgeon, by melting it with an equal weight of gutta-percha. (See *page* 463.)

For internal exhibition, the most convenient form is a solution in the spirit of ether, in the proportion of half an ounce to three fluidounces. Of this from four to eight drops may be given twice a day. Dr. Lloyd, of London, has found chloride of zinc useful as an injection in the acute stage of gonorrhœa, made of the strength of about two grains to three fluidounces of distilled water, and employed once in five or six hours. A solution of one grain to the fluidounce is used by Mr. Critchett, of the Royal Ophthalmic Hospital, London, as a collyrium in vascular and thickened conjunctiva, forming a sort of gleet of the eye.

In overdoses chloride of zinc acts as a corrosive poison, producing burning pain in the gullet and stomach, nausea and vomiting, cold sweats, depression of the pulse, and cramps of the legs. According to Dr. T. Stratton, surgeon R. N., who treated two cases of poisoning with this chloride at Montreal, the best antidotes are the carbonated alkalies, which act by converting the poison into carbonate of zinc. Should the alkalies not be at hand, a solution of common soap should be immediately and freely given. (*Med. Exam.*, Feb. 1849; from the *Brit. Am. Journ. of Med. and Phys. Sci.*) Dr. Letheby reports a fatal case of poisoning by this chloride occurring in a child. The form of chloride swallowed was Burnett's disinfecting fluid. (See *Liquor Zinci Chloridi.*) Its local effect was that of a corrosive on the lips, mouth, and fauces. Among the constitutional effects were paralysis of the voluntary muscles, coldness of the surface, dilated pupil, and coma.*

Off. Prep. Liquor Zinci Chloridi, *Br.* B.

ZINCI OXIDUM. *U. S., Br. Oxide of Zinc.*

"Take of Precipitated Carbonate of Zinc *twelve troyounces.* Expose it, in a shallow vessel, to a low-red heat until the water and carbonic acid are wholly expelled." *U. S.*

"Take of Carbonate of Zinc *six ounces.* Place the Carbonate of Zinc in a loosely covered Hessian crucible, and expose it to a dull red heat until a portion, taken from

* The following table, showing the percentage of anhydrous chloride of zinc in solutions of different densities, prepared by Mr. Charles Bullock, should have been given under the heading of Liquor Zinci Chloridi, but had not attracted our attention when revising that article for the present

the centre of the contents of the crucible and cooled, no longer effervesces when dropped into diluted sulphuric acid. Let the crucible cool, and transfer the product to stoppered bottles." *Br.*

Both the Pharmacopœias prepare the oxide of zinc from the carbonate already formed. By referring to the article on Precipitated Carbonate of Zinc, it will be found that it is obtained in the U. S. and Br. processes from sulphate of zinc, by the decomposing influence of carbonate of sodium. Other methods of obtaining the carbonate of zinc are by the mutual decomposition of the chloride and carbonate of sodium and the sulphate and carbonate of ammonium; but the officinal plan is to be preferred. M. Lefort found it to furnish a carbonate which is washed with facility, and is convertible by calcination into a pure oxide, readily reduced to an impalpable and very light powder. (*Journ. de Pharm.*, 3e sér., xi. 329.) It is, besides, more economical. The carbonate of zinc, in whatever way obtained, is exposed to heat to drive off the carbonic acid and water, in order to obtain the oxide. According to Mohr, a full red heat is not necessary; a temperature between 536° and 572° being sufficient. It is probable that an unnecessarily high heat injures the oxide as a therapeutic agent.

Oxide of zinc may be obtained by the combustion of the metal; and in this way it was formerly prepared by the Dublin College. Zinc melts at 773°, and immediately becomes covered with a film of gray oxide. When the temperature reaches nearly to redness, it takes fire and burns with an intense white light, generating the oxide in the form of very light and white flocculi, resembling carded wool, which quickly fill the crucible, and are in part driven into the atmosphere by the current of air. The late Mr. G. D. Midgely, of London, several years ago, called attention to the production of oxide of zinc by combustion, and gave a description of the apparatus by which he was enabled to prepare from one to two hundred weight of the oxide at one operation. It consisted of a large muffle, heated to redness in a suitable furnace, and supplied with zinc from time to time as the combustion proceeded. The necessary draught of air was conveyed from the muffle by a tube, passing through the top of the furnace, and terminating in a vessel of water, in which the portion of oxide carried up by the current was retained. The resulting oxide was freed from particles of metallic zinc by being passed through a sieve.

Properties. The officinal oxide of zinc is an inodorous, tasteless, yellowish-white powder, insoluble in water and alcohol, and anhydrous. As obtained by combustion it is perfectly white. It dissolves readily in acids without effervescence; and in po-

edition of the Dispensatory. The table is taken from the *Am. Journ. of Pharm.*, Sept. 1868, p. 397. The densities marked * were found by experiment, the others were calculated.

Per Ct.	Sp. Grav.	Per Ct.	Sp. Grav.	Per Ct.	Sp. Grav.	Per Ct.	Sp. Grav.
1	*1·0090	24	1·1939	47	1·3549	70	1·5133
2	*1·0186	25	1·2014	48	1·3615	71	1·5199
3	*1·0273	26	1·2088	49	1·3681	72·8	*1·5264
4	*1·0361	27	1·2163	50	1·3748	73	1·5325
5	*1·0448	28	1·2238	51	1·3814	74	1·5387
6	*1·0535	29	1·2313	52	*1·3881	75	1·5448
7	*1·0611	30·3	*1·2388	53	1·3955	76	1·5509
7·9	*1·0686	31	1·2457	54	1·4030	77	1·5571
9·1	*1·0779	32	1·2527	55	1·4105	78	1·5632
10·1	*1·0860	33	1·2597	56	1·4180	79	1·5694
11	1.0938	34	1·2666	57	1·4255	80	1·5755
12·05	*1·1016	35	1·2736	58	1·4330	81	1·5817
13	1·1094	36	1·2806	59	1·4405	82	1·5878
14	1·1172	37	1·2875	60·6	*1·4480	83	1·5939
15	1·1250	38	1·2945	61	1·4545	84	1·6001
16	1·1328	39	1·3015	62	1·4611	85	1·6062
17	1·1406	40·4	*1·3085	63	1·4676	86	1·6124
18	1·1484	41	1·3151	64	1·4741	87	1·6185
19	1·1562	42	1·3217	65	1·4807	88	1·6246
20·2	*1·1640	43	1·3284	66	1·4872	89	1·6308
21	1·1715	44	1·3350	67	1·4937	90	1·6369
22	1·1789	45	1·3416	68	1·5003	91	*1·6431
23	1·1864	46	1·3483	69	1·5068		

tassa and soda, but not in their carbonates. Being anhydrous, it is insoluble in ammonia; but the impure oxide found in the shops, being generally hydrated, is soluble in that alkali. At a low white heat it fuses, and at full whiteness sublimes. When prepared by combustion it was formerly called *pompholix, nihil album, lana philosophica*, and *flowers of zinc*. Its neutral solution in acids should give a white precipitate with ferrocyanide of potassium and hydrosulphuret of ammonium. If the precipitate with the former test is bluish-white, iron is indicated; if black with the latter, lead is shown. Prepared by the old officinal process, namely, by precipitating sulphate of zinc with ammonia, it contains the subsulphate, the acid of which may be detected by dissolving the oxide in nitric acid, and precipitating by nitrate of baryta. Sometimes it is obtained by precipitating chloride of zinc with ammonia, in which case the oxide contains subchloride, easily detected by nitrate of silver. If it contain white lead or chalk, it will not be entirely soluble in dilute sulphuric acid, but an insoluble sulphate of lead or of lime will be left. If iron be present, brownish-red flocks of sesquioxide of iron will remain undissolved, when the muriatic solution of the oxide is treated with ammonia in excess. Oxide of zinc consists of one eq. of zinc 32·3, and one of oxygen 8 = 40·3.

The powder sold in the shops as oxide of zinc is often very impure. Sometimes the carbonate is substituted for it, showing that the exposure to a red heat has been omitted. In this case the preparation will effervesce with acids. Most samples contain a large proportion of subsulphate, showing that the discarded but productive process of precipitating the sulphate of zinc solution by ammonia has been employed. Again, other samples contain subchloride. These spurious oxides are pointed out by Mr. Redwood, of London, as occurring in the English market, and, no doubt, are sold in the shops of the United States. (See *Pharm. Journ.*, Jan. 1855, p. 301.) Unfortunately, a white oxide is preferred by purchasers, though whiteness is generally a sign of impurity; the officinal oxide being yellowish-white.

Medical Properties and Uses. This oxide is tonic, antispasmodic, and astringent. It has been given in chorea, epilepsy, hooping-cough, spasm of the stomach dependent on dyspepsia, and other similar affections, and the diarrhœa of infants. Externally it is employed as an exsiccant to excoriated surfaces, sometimes by sprinkling it on the affected part, but generally in the form of ointment. (See *Unguentum Zinci Oxidi.*) It has also been used in gonorrhœa. (*New Remedies*, July, 1874.) The dose is from two to eight grains or more, repeated several times a day, and given in the form of pill. As a cosmetic it has the great advantage over the preparations of lead of not being poisonous.

Oxide of zinc, prepared by combustion, is extensively used in painting as a substitute for white lead, over which it has the advantage of not being discoloured by sulphuretted hydrogen. It has, moreover, the merit of not producing injurious effects on the workmen at all comparable to those caused by white lead. It is, indeed, usually considered innocuous, but a case of chronic poisoning by it has been reported by Prof. Botkin. (*Brit. and For. Med.-chir. Rev.*, ii., 1873, p. 254.) The oxide thus prepared, even though pure, should not be substituted for the officinal, as its state of aggregation is probably different.

Off. Prep. Unguentum Zinci, *Br.;* Unguentum Zinci Oxidi, *U. S.* B.

ZINCI VALERIANAS. *Br. Valerianate of Zinc.*

"Take of Sulphate of Zinc *five ounces and a half* [avoirdupois]; Valerianate of Soda *five ounces* [avoird.]; Distilled Water *a sufficiency*. Dissolve the Sulphate of Zinc and the Valerianate of Soda, each in two pints [Imperial measure] of the Water; raise both solutions to near the boiling point, mix them, cool, and skim off the crystals which are produced. Evaporate the mother-liquor at a heat not exceeding 200°, till it is reduced to four [fluid]ounces; cool again, remove the crystals which have formed, and add them to those which have been already obtained. Drain the crystals on a paper filter, and wash them with a small quantity of cold Distilled Water, till the washings give but a very feeble precipitate with chloride of barium. Let them now be again drained, and dried on filtering paper at ordinary temperatures." *Br.*

This salt was formerly officinal in the U. S. Pharmacopœia, but was very properly dropped at the last revision. The directions for its preparation were very similar to

those of the present British Pharmacopœia, both formulas being essentially the same as that of the late Dublin Pharmacopœia. In the formation of the salt a double decomposition takes place between the reacting salts, resulting in the production of valerianate of zinc and sulphate of sodium. Upon mixing the hot solutions, crystals of the sparingly soluble valerianate of zinc form on the surface of the liquid; and, during the progress of its concentration to one-tenth, more of them are successively produced. These are then washed with cold distilled water to separate adhering sulphate of sodium, drained on a filter, and dried.

Properties. This salt is in white, pearly scales, having a faint odour of valerianic acid, and a metallic, styptic taste. It dissolves in 160 parts of cold water, and in 60 of alcohol of 0·833. The solutions, which have an acrid reaction, become turbid on the application of heat, but clear again on cooling. The salt, as obtained by the officinal formulas, is anhydrous; but, when formed by exactly saturating carbonate of zinc, made into a paste with water, with valerianic acid, it contains twelve eqs. of water, and, when dried at 122°, perfectly resembles the anhydrous salt. (*G. C. Wittstein.*) Acetate of zinc, impregnated with oil of valerian, has been substituted for this salt; but at present, from the relative costliness of the oil, there is no inducement to this fraud. The butyrate of zinc has been sold in Paris for the valerianate, and is so like it as not to be distinguished by its physical properties. The two salts, however, may be discriminated by adding a concentrated solution of the acid of the suspected salt, obtained by distillation with sulphuric acid, to a concentrated solution of acetate of copper. If the acid is the butyric, its addition to the solution of the acetate disturbs the transparency of the latter, by the formation of a bluish-white precipitate; while, if the valerianic, no change is produced. (Larocque and Huraut, *Journ. de Pharm.*, 3e sér., ix. 430.)

Medical Properties. Valerianate of zinc was proposed as a remedy, on theoretical grounds, by Prince Louis-Lucien Bonaparte. Upon trial it was found to possess antispasmodic properties. By some of the Italian physicians it has been extolled as a remedy in neuralgic affections. Dr. Namias, of Venice, employed it with advantage in anomalous nervous affections, attended with palpitation of the heart, constriction of the throat, and pain in the head. Dr. Francis Devay, of Lyons, found it useful in epilepsy, and in the nervous affections which accompany chlorosis. The dose is one or two grains, repeated several times a day, and given in the form of pill. (See a paper on this valerianate by Prof. Procter, in the *Am. Journ. of Pharm.* for April, 1845.) B.

ZINCUM GRANULATUM. *Br.* *Granulated Zinc.*

"Take of Zinc of commerce *one pound.* Fuse it in an earthen crucible, heated to a sufficient but not excessive degree in a suitable fire, and pour the fluid metal in a thin stream into a vessel containing two gallons of cold water. Remove the Granulated Zinc from the water and dry it." *Br.*

Off. Prep. Liquor Zinci Chloridi, *Br.;* Zinci Chloridum, *Br.;* Zinci Sulphas, *Br.*

TESTS.

In the Appendix of the British Pharmacopœia, two series of tests are given, one qualitative, the other quantitative, to which frequent reference is made throughout that work, and which, so far as they are not incidentally described in the Dispensatory, require a special notice in this place; as, otherwise, much that has been stated in regard to the British Preparations would be unintelligible.

1. *Qualitative Tests.*

Those here given are all in the state of solution, and are used for determining the character of particular substances, whether isolated or in composition; thus enabling us to ascertain the identity of medicines, their purity or impurity, and the character of the foreign ingredients which may be mixed with them accidentally, or with a view to adulteration.

SOLUTION OF ACETATE OF COPPER. "Take of Subacetate of Copper of Commerce, in fine powder, *half an ounce* [avoirdupois]; Acetic Acid *one fluidounce* [Imperial measure]; Distilled Water *a sufficiency*. Dilute the Acid with half a fluidounce [Imp. meas.] of the Water; digest the Subacetate of Copper in the mixture at a temperature not exceeding 212° with repeated stirring, and continue the heat until a dry residue is obtained. Digest this in four [fluid]ounces of boiling Distilled Water, and by the addition of more of the Water make up the solution to five fluidounces. Filter it."

SOLUTION OF ACETATE OF POTASSA. Dissolve half an avoirdupois ounce of Acetate of Potassa in five fluidounces of Distilled Water, and filter.

SOLUTION OF ACETATE OF SODA. Dissolve half an avoirdupois ounce of Acetate of Soda in five fluidounces of Distilled Water, and filter.

SOLUTION OF ALBUMEN. Mix, by trituration in a mortar, the White of one Egg and four fluidounces of Distilled Water, and filter through clean tow previously moistened with Distilled Water. The solution should be prepared when wanted for use.

SOLUTION OF AMMONIO-NITRATE OF SILVER. "Take of Nitrate of Silver, in crystals, *a quarter of an ounce* [avoirdupois]; Solution of Ammonia *half a fluidounce*, or *a sufficiency;* Distilled Water *a sufficiency*. Dissolve the Nitrate in eight fluidounces of the Water, and to the solution add the Ammonia until the precipitate first formed is nearly dissolved. Filter, and add Distilled Water, so that the bulk may be ten fluidounces."

SOLUTION OF AMMONIO-SULPHATE OF COPPER. "Take of Sulphate of Copper, in crystals, *half an ounce* [avoirdupois]; Solution of Ammonia, Distilled Water, each, *a sufficiency*. Dissolve the Sulphate in eight fluidounces of the Water, and to the solution add the Ammonia until the precipitate first formed is nearly dissolved. Filter, and then add Distilled Water, so that the bulk may be ten fluidounces."

SOLUTION OF AMMONIO-SULPHATE OF MAGNESIA. "Take of Sulphate of Magnesia *one ounce* [avoirdupois]; Chloride of Ammonium *half an ounce;* Solution [Water] of Ammonia *half a fluidounce;* Distilled Water *a sufficiency*. Dissolve the Sulphate and Chloride in eight fluidounces of the Water, and to the Solution add the Ammonia, and as much Distilled Water as will make up the bulk to ten fluidounces. Filter it."

SOLUTION OF BORACIC ACID. Dissolve *fifty grains* of Boracic Acid in one fluidounce of Rectified Spirit, and filter.

SOLUTION OF BROMINE. Upon *ten minims* of Bromine, in a bottle furnished with an accurately fitting glass stopper, pour *five fluidounces* of Distilled Water, and shake several times. Keep the solution excluded from the light.

SOLUTION OF CARBONATE OF AMMONIA. "Take of Carbonate of Ammonia, in small pieces, *half an ounce* [avoirdupois]; Distilled Water *ten fluidounces*. Dissolve and filter."

SOLUTION OF CHLORIDE OF AMMONIUM. *Solution of Hydrochlorate of Ammonia.* Dissolve *one avoirdupois ounce* of Chloride of Ammonium in *ten fluidounces* of Distilled Water, and filter.

SATURATED SOLUTION OF CHLORIDE OF CALCIUM. Dissolve *four ounces* [avoirdupois] of Chloride of Calcium in *five fluidounces* of Distilled Water, and filter.

SOLUTION OF CHLORIDE OF GOLD. "Take of fine Gold, reduced by a rolling machine to a thin lamina, *sixty grains;* Nitric Acid *one fluidounce and a half* [Imperial measure]; Hydrochloric Acid *seven fluidounces* [Imp. meas.]; Distilled Water *a sufficiency*. Place the Gold in a flask with the Nitric and six fluidounces of the Hydrochloric Acid, first mixed with four fluidounces of the Water, and digest until it is dissolved. Add to the solution the additional fluidounce of Hydrochloric Acid, evaporate at a heat not exceeding 212° until acid vapours cease to be given off, and dissolve the Chloride of Gold thus obtained in five fluidounces of Distilled Water. The solution should be kept in a stoppered bottle."

SOLUTION OF CHLORIDE OF TIN. "Take of Granulated Tin *one ounce* [avoirdupois]; Hydrochloric Acid *three fluidounces;* Distilled Water *a sufficiency*. Dilute the Acid in a flask with one fluidounce of the Water, and, having added the Tin, apply a moderate heat until gas ceases to be evolved. Add as much of the Water as will make up the bulk to five fluidounces, and transfer the solution, together with the undissolved tin, to a bottle with an accurately ground stopper."

SOLUTION OF GELATIN. "Take of Isinglass [Ichthyocolla], in shreds, *fifty grains;* Warm Distilled Water *five fluidounces*. Mix and digest for half an hour on a water-bath with repeated shaking, and filter through clean tow moistened with Distilled Water."

SOLUTION OF IODATE OF POTASH. "Take of Iodine, Chlorate of Potash, each, *fifty grains;* Nitric Acid *eight minims;* Distilled Water *ten fluidounces and a half*. Rub the Iodine and Chlorate of Potash together to a fine powder; place the mixture in a Florence flask, and, having poured upon it half a [fluid]ounce of the Water acidulated with the Nitric Acid, digest at a gentle heat until the colour of the iodine disappears. Boil for one minute, then transfer the contents of the flask to a capsule, and evaporate to perfect

dryness at 212°. Finally dissolve the residue in the remaining ten [fluid]ounces of Distilled Water, filter the solution, and keep it in a stoppered bottle."

Solution of Iodide of Potassium. Dissolve *one avoirdupois ounce* of Iodide of Potassium in *ten fluidounces* of Distilled Water, and filter.

Solution of Oxalate of Ammonia. "Take of Oxalate of Ammonia *half an ounce* [avoirdupois]; Warm Distilled Water *one pint* [Imperial measure]. Dissolve and filter."

Solution of Perchloride of Platinum. "Take of thin platinum foil *a quarter of an ounce* [avoirdupois]; Nitric Acid, Hydrochloric Acid, each, *a sufficiency;* Distilled Water *seven fluidounces.* Mix a fluidounce of the Nitric Acid with four fluidounces of the Hydrochloric Acid and two fluidounces of the Water; pour the mixture into a small flask containing the Platinum, and digest at a gentle heat, adding more of the Acids mixed in the same proportion, should this be necessary, until the metal is dissolved. Transfer the solution to a porcelain capsule, add to it a fluidrachm of Hydrochloric Acid, and evaporate on a water-bath until acid vapours cease to be given off. Let the residue be dissolved in the remaining five [fluid]ounces of Distilled Water. Filter and preserve in a stoppered bottle."

Solution of Phosphate of Soda. Dissolve *one avoirdupois ounce* of crystallized Phosphate of Soda in *ten fluidounces* of Distilled Water, and filter.

Solution of Red Prussiate of Potash. *Solution of Ferridcyanide of Potassium.* Dissolve *a quarter of an ounce* [avoirdupois] of crystallized Red Prussiate of Potash in five fluidounces of Distilled Water, and filter.

Solution of Sulphate of Indigo. "Take of Indigo, dry and in fine powder, *five grains;* Sulphuric Acid *ten fluidounces.* Mix the Indigo with a fluidrachm of the Acid in a small test tube, and apply the heat of a water-bath for an hour. Pour the blue liquid into the remainder of the Acid, agitate the mixture, and when the undissolved indigo has subsided, decant the clear liquid into a stoppered bottle."

Solution of Sulphate of Iron. Dissolve *ten grains* of Granulated Sulphate of Iron in *one fluidounce* of boiling Distilled Water, and filter. This solution should be prepared when wanted for use.

Solution of Sulphate of Lime. "Take of Plaster of Paris *a quarter of an ounce* [avoirdupois]; Distilled Water *one pint* [Imperial measure]. Rub the Plaster of Paris in a porcelain mortar for a few minutes with two [fluid]ounces of the Water, introduce the mixture thus obtained into a pint bottle [Imp. meas.] containing the rest of the Water, shake well several times, and allow the undissolved sulphate to subside. When this has occurred, filter."

Solution of Sulphide of Ammonium. "Take of Solution of Ammonia *five fluidounces.* Put three fluidounces of the Ammonia into a bottle, and conduct into this a stream of Sulphuretted Hydrogen so long as this gas continues to be absorbed; then add the remainder of the Ammonia, and transfer the solution to a green-glass bottle furnished with a well-ground stopper."

Solution of Tartaric Acid. Dissolve *one avoirdupois ounce* of crystallized Tartaric Acid in *eight fluidounces* of Distilled Water, add *two fluidounces* of Rectified Spirit, and keep the solution in a stoppered bottle. The spirit is added to preserve the solution.

Solution of Yellow Prussiate of Potash. *Solution of Ferrocyanide of Potassium.* Dissolve *a quarter of an ounce* [avoirdupois] of crystallized "Yellow Prussiate of Potash" in five fluidounces of Distilled Water, and filter.

2. *Quantitative Tests.*

The quantitative tests are intended to estimate the quantity of any particular substance in the mixture or compound submitted to examination. They are all liquid, being denominated in the British Pharmacopœia *Volumetric Solutions*, and have individually been frequently referred to, throughout the Dispensatory, when it was deemed proper to indicate a method of determining the strength of medicines or their preparations recognised in the British Pharmacopœia. The method of operating in volumetric analysis is simple. The quantities of the substance to be tested are expressed by grains, those of the test solution by grain-measures, that is, the volume of a grain of distilled water at 60°. A glass tube (*burette*) is to be provided, capable, when filled up to a point marked 0, of containing 1000 grains of distilled water at 60° F., and beneath this point graduated into 100 equal parts. Each part, therefore, corresponds to 10 grain-measures. Into this tube the volumetric solution is to be introduced of a certain strength, so that the quantity of the substance dissolved which may be consumed in the application of the test is at once known, by observing the number of grain-measures of the volumetric solution which have disappeared.

This quantity, being known, measures the quantity of the substance acted on by the test, supposing the nature of the reactions to be understood, and the equivalents of the several substances well ascertained. For convenient measurement it will be necessary to have a cylindrical glass jar, capable of holding 10,000 grains of distilled water up to a point marked 0, and below this point graduated into 100 equal parts; and a flask which, when filled to a mark on the neck, contains precisely 10,000 grains of distilled water at 60°, or in other words, has a capacity of 10,000 grain-measures. The volumetric solutions, before being used, should be well shaken, in order that they may be uniform throughout. They should be kept in stoppered bottles. All the measurements should be made at 60° F.

Volumetric Solution of Bichromate of Potassa. Formula of the salt $KO,2CrO_3 = 147{\cdot}5$. "Take of Bichromate of Potash 147·5 grains; Distilled Water a sufficiency. Put the Bichromate into the 10,000 grain flask, and, having half filled the flask with the Water, allow the salt to dissolve; then dilute the solution with more Water, until it has the exact bulk of 10,000 grain-measures." (*Br.*) "The quantity of this solution which fills the volumetric tube to 0 (1000 grain-measures), contains one-tenth of an equivalent, in grains (14·75 grains), of the Bichromate of Potash, and, when added to a solution of a protosalt of iron acidulated with hydrochloric acid, is capable of converting one-tenth of six eqs. of iron (16·8 grains) from the state of a protosalt to that of a persalt [sesquisalt]. In practising this volumetric process, it is known that the whole of the protosalt has been converted into a persalt, when a minute drop of the solution, placed in contact with a drop of the solution of ferridcyanide of potassium, on a white plate, ceases to strike with it a blue colour." *Br.* 1864.

It is obvious, therefore, that, by means of this test, it is possible to estimate the quantity of protoxide, protochloride, protiodide, or protobromide of iron in any mixture or compound in which it may exist. The rationale, in reference to the protoxide of iron, is that two eqs. of the bichromate containing two eqs. of chromic acid ($2CrO_3$), and of course six eqs. of oxygen, give up three eqs. of oxygen, whereby the acid becomes sesquioxide of chrome (Cr_2O_3), to six eqs. of the protoxide of iron ($6FeO$), converting them into three eqs. of the sesquioxide ($3Fe_2O_3$); and, in reference to haloid salts, it is only necessary that each of them should be preliminarily converted, through the instrumentality of the water present, into the protoxide and the acid corresponding with its other element, in order that the same reaction should be exerted upon it as on the protoxide.

Volumetric Solution of Hyposulphite of Soda. Formula of the crystallized salt $NaO,S_2O_2 + 5HO = 124$. "Take of Hyposulphite of Soda, in crystals, 260 *grains;* Distilled Water *a sufficiency.* Dissolve the Hyposulphite in 10,000 grain-measures of the Water. Fill a burette with this solution and drop it cautiously into 1000 grain-measures of the volumetric solution of Iodine until the brown colour is just discharged. Note the number of grain-measures (n) required to produce this effect; then put 8000 grain-measures of the same solution into a graduated jar, and augment this quantity by the addition of Distilled Water until it amounts to $\frac{8000 \times 1000}{N}$ grain-measures. If, for example, $n = 950$, the 8000 grain-measures of solution should be diluted to the bulk of $\frac{8000 \times 1000}{950} = 8421$ grain-measures. Of this solution 1000 grain-measures contain 24·8 grains of the hyposulphite ($\frac{1}{10}$th of $2(NaO,S_2O_2 + 5HO)$, in grains), and, therefore, correspond to 12·7 grains of iodine ($\frac{1}{10}$th of an equivalent)." *Br.*

"This solution is used for estimating free iodine, an object which it accomplishes by forming with the iodine, iodide of sodium and tetrathionate of soda. One thousand grain-measures of it include one-tenth of two eqs. of the hyposulphite in grains, and therefore correspond to 12·7 grains of free iodine." *Br.* 1864.

Tetrathionic acid consists of four eqs. of sulphur and five of oxygen; and tetrathionate of soda would be represented by the formula NaO,S_4O_5. When the hyposulphite (*dithionate*) of soda (NaO,S_2O_2) reacts with iodine, two eqs. of the salt are called into action, and, by the substitution of one eq. of iodine for one eq. of oxygen of the soda, become one eq. of iodide of sodium, and one of tetrathionate of sodium; as represented by the following equation, $I + 2(NaO,S_2O_2) = NaI + NaO,S_4O_5$. Two eqs. of the test salt are therefore capable of neutralizing and rendering invisible one eq. of iodine; and, as the eq. of the salt is 124 and that of iodine 127, it follows that 248 grains of it should neutralize 127 grains of iodine, or every grain of the former consumed would indicate the neutralization of ·512 grain of the latter as nearly as may be.

Volumetric Solution of Iodine. Formula $I = 127$. "Take of Iodine 127 *grains;* Iodide of Potassium 180 *grains;* Distilled Water *a sufficiency.* Put the Iodide of Potassium and Iodine into the 10,000 grain flask, fill the flask to about two-thirds of its bulk with the Distilled Water, gently agitate until solution is complete, and then dilute the solution with more of the Water, until it has the exact volume of 10,000 grain-measures. Of this solution 1000 grain-measures contain $\frac{1}{10}$th of an eq. in grains (12·7 grains) of iodine, and therefore correspond to 1·7 grains of sulphuretted hydrogen, 3·2 grains of sulphurous, and 4·95 grains of arsenious acid."

This solution may be employed for determining the amount of sulphuretted hydrogen or of a metallic sulphuret in a fluid, but is chiefly used for the estimation of sulphurous and arsenious acids. It is dropped from the volumetric tube into the liquid to be tested until free iodine begins to appear in the solution.

Volumetric Solution of Nitrate of Silver. Formula of the salt $AgO,NO_5 = 170$. "Take of Nitrate of Silver 170 *grains;* Distilled Water *a sufficiency.* Put the Nitrate into the 10,000 grain flask, and having half filled the flask with the Water, allow the salt to dissolve; then dilute the solution with more of the Water until it has the exact bulk of 10,000 grain-measures. The solution should be kept in an opaque stoppered bottle. Of this solution 1000 grain-measures contain $\frac{1}{10}$th of an eq. in grains of nitrate of silver, or 17·0 grains." Upon dropping it into dilute hydrocyanic acid rendered alkaline by soda, the precipitate first formed is upon agitation redissolved, and continues to be so until the whole of the cyanogen of the acid has united with the sodium and silver, forming the double cyanide of sodium and silver. In such experiments 1000 grain-measures of the solution correspond to 5·4 grains of absolute hydrocyanic acid.

Volumetric Solution of Oxalic Acid. Formula of crystallized oxalic acid $2HO, C_4O_6 + 4HO = 126$. "Take of Purified Oxalic Acid, in crystals, quite dry, but not effloresced, 630 *grains;* Distilled Water *a sufficiency.* Put the Oxalic Acid into the 10,000 grain flask, fill the flask to about two-thirds of its bulk with the Water, allow the acid to dissolve, and then dilute the solution with more of the Water until it has the exact volume of 10,000 grain-measures. Of this solution 1000 grain-measures contain half an eq. in grains (63) of oxalic acid, and are therefore capable of neutralizing one eq. in grains of an alkali or alkaline carbonate."

Volumetric Solution of Soda. Formula of hydrate of soda $NaO,HO = 40$. "Take of Solution of Soda, Distilled Water, each, *a sufficiency.* Fill a burette with the Solution of Soda, and cautiously drop this into 63 grains of Purified Oxalic Acid dissolved in about two ounces of the Water, until the acid is exactly neutralized as indicated by litmus. Note the number of grain-measures (n) of the solution used, and having then introduced 9000 grain-measures of the Solution of Soda into a graduated jar, augment this quantity by the addition of Water, until it becomes $\frac{9000 \times 1000}{N}$ grain-measures. If, for example, $n = 930$, the 9000 grain-measures should be augmented to $\frac{9000 \times 1000}{930} = 9677$ grain-measures. Of this solution 1000 grain-measures contain one eq. in grains (40 grains) of hydrate of soda, and will, therefore, neutralize one eq. in grains of any monobasic acid." *Br.*

PART III.

DRUGS AND MEDICINES NOT OFFICINAL.*

In the progress of the medical art, numerous remedies have at different times risen into notice and employment, which, by the revolutions of opinion incident to our science, or by the discovery of more efficient substitutes, have so far fallen into disrepute as to have been discarded from general practice, and no longer to hold a place in the officinal catalogues. Of these, however, some are still occasionally employed by practitioners and referred to by writers, and many retain a popularity as domestic remedies, or among empirics, which they have lost with the medical profession generally. The attention of physicians must, therefore, frequently be called to them in the course of practice; and it is highly desirable to possess some knowledge of their properties and effects, in order to be enabled to judge of their agency in any particular case, and at the same time to avoid the suspicion of incompetence which might attach to the exhibition of entire ignorance in relation to them. The remark is true also of other substances, which, though at no time ranked among regular medicines, are yet habitually employed in families, and the influence of which, either remediate or otherwise, must often enter into our estimate of the causes which produce or modify disease. New medicines, moreover, are frequently brought forward, which, without having obtained the sanction of the medical authorities, are occasionally prescribed, and therefore merit notice. To supply, to a certain extent, the requisite means of information in regard to these extra-officinal remedies, is the object of the following brief notices, among which are also included accounts of substances not employed as medicines, but usually kept in the drug stores for various purposes connected with the arts, or with domestic convenience. In a work intended for the use as well of the apothecary and druggist as of the physician and medical student, the introduction of such accounts is obviously proper, if kept in due subordination to the more important object of teaching the properties of medicines, and the modes of preparing them. The authors regret that the limits, which practical convenience appears to require in a Dispensatory, do not admit of a more complete enumeration of the various drugs and medicines of the kind above alluded to, or of ampler details in relation to those actually treated of, than will be found in the following pages. They have endeavored, however, in the selection of objects, to choose those which are likely most frequently to engage the attention of the medical and pharmaceutical professions, and, in the extent of the descriptions, to consult as far as possible the relative importance of facts, of which they could not detail the whole. In relation to the nomenclature employed, it may be proper to observe that all those vegetable remedies, which, not being generally kept in the shops, have no current commercial name, are described under the scientific title of the plant producing them; while other substances are designated by the names which ordinary usage has assigned them. W.

* By the term officinal medicines, here as well as elsewhere in this work, are meant such as are embraced in the United States and British Pharmacopœias.

ABROMA AGUSTUM. A viscid white fluid found in the fleshy bark of the root of this plant, which is a native of India, is stated by B. B. Mohun Sircor to be of great service in dysmenorrhœa. A half drachm of the fresh root is given at a dose. (*Am. Journ. Med. Sci.*, July, 1873, p. 276.) H. C. W.

ACERATES DECUMBENS. This plant, which grows in New Mexico, is stated by Dr. Wm. J. Wilson, U.S.A., to be used by the Mexicans as a specific in snake-bite. (*Philada. Med. Times*, v. 183.) H. C. W.

ACETATE OF ALUMINIUM. This salt may be obtained by the direct combination of hydrated alumina with acetic acid, or by reaction between sulphate of aluminium and acetate of lead. According to Crum, when pure tersulphate of aluminium and neutral acetate of lead are mixed, the resulting salt is apparently biacetate of aluminium, which remains in solution with one eq. of pure acetic acid, as there is no teracetate of aluminium. The solution, filtered to separate the sulphate of lead and evaporated, yields a gummy mass, which reddens litmus, and has an astringent taste. But if means are used to evaporate the solution quickly, at a low temperature, the salt is obtained dry and in a perfectly soluble state ($Al_2O_3,2C_4H_3O_3+4HO$). (*Gmelin's Handbook*, viii. 303.) It is deliquescent. Acetate of aluminium is valuable only as a disinfectant, operating in this way like the sulphate of aluminium, and employed in the same manner. (See *Aluminii Sulphas* in *Part* II., page 1048.) W.

ACETATE OF COPPER. *Cupri Acetas. Crystals of Venus.* This salt is prepared by dissolving verdigris, with the assistance of heat, in vinegar or dilute acetic acid. The solution, after having been sufficiently concentrated, is transferred to suitable vessels, where it crystallizes on cooling. Another method of preparing it is recommended by M. Jonas, who dissolves sulphate of copper in water of ammonia to complete neutralization, and then, having added an excess of concentrated vinegar, boils all together. Fine crystals of neutral acetate of copper soon make their appearance on the surface of the liquid. The change is so rapid that the liquor in a little while appears to consist of two parts, of which the upper is translucent, and of a greenish colour, and the lower is formed of fine crystals of acetate of copper. From 1000 parts of the sulphate, 750 parts of the acetate are thus obtained. The crystals procured in this manner differ from those of commerce in having a brighter green colour, and a more ready solubility in water. (*Journ. de Pharm.*, 4e sér., ii. 314.) Acetate of copper is a slightly efflorescent salt, crystallizing in rhomboidal prisms, and having a rich deep-green colour and strong styptic taste. It dissolves in water without residue, a character which serves to distinguish it from verdigris. It consists of one eq. of acetic acid, one of protoxide of copper, and one of water. Its popular name of *distilled verdigris* is inappropriate; as no distillation is practised in its preparation. This salt is used for colouring maps. It was formerly the chief source of acetic acid. It has been used in the form of tincture by Dr. Rademacher in fevers; but with no very definite object. B.

ACETATE OF MAGNESIUM. *Magnesii Acetas.* This salt has been proposed as a purgative by M. Renault, of Paris. It is deliquescent, and cannot be crystallized without difficulty. (*Carl von Hauer.*) It has the merit of extreme solubility both in water and alcohol. Though without much taste, it is inferior in that respect to citrate of magnesium, for which it is proposed as a substitute. It is prepared for therapeutic use by saturating 120 parts of carbonate of magnesium with acetic acid, and evaporating the resulting liquid, after filtration, to 300 parts. The product is a syrupy acetate of magnesium, which is to be mixed with three times its weight of syrup of oranges, to form the preparation of M. Renault. Of this about four ounces is the dose. An objection to the liquid acetate is, that, owing to its attraction for moisture, it cannot be preserved of uniform strength for mixing with the syrup of oranges. (*Journ. de Pharm.*, 3e sér., xiii. 260.) B.

ACETIC ETHER. *Æther Aceticus.* This ether, which has been included among the addenda to the British Pharmacopœia, may be formed by several processes, the chief of which are the following.—1. Mix 100 parts of alcohol (sp. gr. 0·83) with 63 parts of concentrated acetic acid, and 17 parts of strong sulphuric acid, and distil 125 parts into a receiver, kept cold with wet cloths. 2. Distil to dryness a mixture of three parts of acetate of potassium, three of alcohol, and two of sulphuric acid, mix the distilled product with one-fifth of sulphuric acid, and distil a second time an amount of ether equal to the alcohol employed. 3. Distil two parts of effloresced acetate of lead with one part of alcohol, and a little more than one part of sulphuric acid. In the last two processes, the acetic acid is set free by the action of the sulphuric acid on the acetate employed. Acetic ether is colourless, of a grateful odour, and a peculiar, agreeable taste. Its sp. gr. is 0·866, and its boiling point 160°. It undergoes no change by keeping. By contact with flame it burns readily, diffusing an acid odour. It dissolves in 7·5 parts of water, and unites in all proportions with alcohol. It consists of one eq. of acetic acid 51, and one of oxide of ethyl (ether) 37=88 ($C_4H_5O,C_4H_3O_3$).

Acetic ether is occasionally used in medicine as a stimulant and antispasmodic. It has been found by Dr. H. C. Wood to be capable of being used as an anæsthetic, but is too slow in its action for practical purposes. The dose is from fifteen to thirty drops,

sufficiently diluted with water. It is sometimes employed externally, by friction, as a resolvent, and for rheumatic pains. B.

ACHILLEA MOSCHATA. *Iva.* This herb, a native of Switzerland, has recently been investigated by Dr. A. V. Planta-Reichenau. For particulars the reader is referred to *Pharm. Journ. and Trans.*, March, 1871, p. 727. H. C. W.

ACTÆA SPICATA. *Baneberry. Herb Christopher.* This is a perennial, herbaceous, European plant, growing in the woods of mountainous regions, and attaining a height of two feet or more. The root is of a dark-brown colour, and bears some resemblance to that of Helleborus niger, for which it is said to be occasionally substituted. Its odour, in the recent state, is sweetish and rather nauseous, but is in great measure dissipated by drying. The taste is bitterish and somewhat acrid. In its operation on the system, the root is purgative and sometimes emetic, and is capable, in overdoses, of producing dangerous effects. It is unknown in this country. We have, however, a native species of Actæa, *A. Americana* of Pursh, of which there are two varieties—*alba* and *rubra*—distinguished by the colour of their berries, which in the former are white, and in the latter red. They are sometimes called *white* and *red cohosh*, a name derived from the language of the aborigines. By some botanists they are treated of as distinct species, under the names of *Actæa alba* and *Actæa rubra*. They grow in the rich deep mould of rocky woods, from Canada to Virginia. They are said to have been much esteemed by the Indians. Their medical properties are probably similar to those of *A. spicata*. The name *baneberry*, given to different species of Actæa, was derived from the reputed poisonous properties of their berries. Mr. Frederick Stearns, in his account of the medical plants of Michigan, speaks of the rhizome of Actæa alba as being violently purgative. (*Proceed. of the Am. Pharm. Assoc.*, 1858, p. 240.) W.

ADANSONIA DIGITATA. *Baobab.* A tree of enormous magnitude, belonging to the Linnæan class and order Monadelphia Polyandria, and to the natural family Sterculiaceæ (*Lindley*). It is a native of Africa, extending quite through that continent from Senegal to Abyssinia, and has been introduced into the West Indies. The leaves and bark of this tree abound in mucilage, and have little smell or taste; yet extraordinary virtues have been ascribed to them. Adanson found the leaves very useful as a preventive of fevers, and they are employed habitually by the native Africans with a view to their diaphoretic property. Dr. Duchassaing, of Guadaloupe, has published a statement of his experience with the bark, in the miasmatic diseases of the West Indies. Out of 93 cases, chiefly of intermittent fever, he failed only in three. M. Pierre has subsequently employed the remedy with success in intermittent fever at Burgogne, in France. (*Arch. Gén.*, 3e sér., xxiii. 535.) The bark has the advantage over cinchona of being almost without taste, and quite acceptable to the stomach. It produces no other observable physiological effect than increase of appetite, increased perspiration, and perhaps diminished frequency of pulse. An ounce may be boiled in a pint and a half of water to a pint, and the whole taken in a day. (*Journ. de Pharm.*, 3e sér., xiii. 412 and 421.) The fruit, which contains a subacid not disagreeable pulp, is used by the Africans in dysentery and other bowel complaints. W.

ADENIA VENENATA. This is a climbing passion-flower of Africa, said by the traveller Schweinfurth to be used as a vesicant by the natives. (*Pharm. Journ. and Trans.*, March, 1874, p. 759.) H. C. W.

ADIANTUM PEDATUM. *Maidenhair.* An indigenous fern, the leaves of which are bitterish and aromatic, and have been supposed to be useful in chronic catarrhs and other pectoral affections. A European species, known by the same vulgar name, is the *A. Capillus Veneris*, which has similar properties, though feebler, and has been much used as a pectoral, on the continent of Europe, from very early times. It is given in the form of infusion, sweetened with sugar or honey; and a syrup prepared from it is popular in France, under the name of *sirop de capillaire*. The name of maidenhair has also been given to *Asplenium Trichomanes*, the leaves of which have a mucilaginous, sweetish, somewhat astringent taste, and have been used for the same purposes with those of the plants above mentioned. Another species of A splenium, *A. Adiantum nigrum*, has been substituted for the genuine maidenhair; but neither of them has the aromatic flavour of that fern. W.

ÆSCULUS HIPPOCASTANUM. *Horsechestnut.* The horsechestnut is a native of Asia, and was introduced about the middle of the sixteenth century into Europe, where, as well as in this country, it is now extensively cultivated as an ornamental tree. Quercitrin has been found by Rochleder in very small proportion in the leaves. (*Journ. de Pharm.*, Mai, 1859, p. 393.) *Fraxin*, a peculiar principle of the bark of Fraxinus excelsior, has been detected also, by Mr. Stokes, in the bark of the horsechestnut; and Rochleder has discovered in the capsules of the fruit a peculiar acid, which he names *capsulœscic acid.* (*Ibid.*, Août, 1860, p. 151.) The fruit and bark have been used in medicine. The *fruit* abounds in starch, but has a rough, disagreeable, bitter taste, which renders it unfit for food, though it is said to be eaten with avidity by horses, oxen, hogs, and sheep. It may be deprived, in great measure, of the bitter principle by maceration in an alkaline solution. The starch may be readily obtained in a state of purity, and is

said to excel as an article of diet that procured from the potato. (*Dict. de Mat. Méd.*) Considerable quantities have recently been prepared in France for use; the nut being reduced to a pulp, washed, and treated like the potato. (*Am. Journ. of Sci. and Arts*, Sept. 1856, p. 264.) The bitter principle is denominated *esculin*, and, according to Rochleder, may be obtained by precipitating with acetate of lead a decoction of the rind, filtering, treating the filtered liquor with sulphuretted hydrogen, again filtering, evaporating to the consistence of syrup, and setting the residue aside in a cool place. In a few days, the liquid is converted into a mass of crystals, which are to be expressed, and purified by repeated crystallization from alcohol, and afterwards from boiling water. If now washed on a filter with cold water till they have lost one-third of their weight, they are rendered as pure as it is possible to obtain them. For another process of preparing it, see *Am. Journ. of Pharm.*, xliv. 400. Esculin is in shining white, prismatic crystals, inodorous, bitter, but slightly soluble in cold water, more soluble in boiling water, and very readily so in boiling alcohol, and in alkaline solutions. Its solution is precipitated by subacetate of lead. It consists of carbon, hydrogen, and oxygen; and its formula, according to Rochleder, is $C_{60}H_{33}O_{37}$. (*Journ. de Pharm.*, 3e sér., xxiii. 474, and xxiv. 292.) When treated with dilute sulphuric acid, it is converted into grape sugar, and a peculiar substance called *esculetin*. (*Chem. Gaz.*, Jan. 15, 1857, p. 27.) The powdered kernel of the fruit, snuffed up the nostrils, produces sneezing, and has been used with advantage as a sternutatory in complaints of the head and eyes. A fixed oil extracted from the kernels by percolation with ether, and obtained separate by evaporating the ether, has recently been used in France as a topical remedy in gout and rheumatism, being applied by means of a hair brush to the part affected, which is then covered with waxed paper, cotton wadding, or flannel. The extract of the wood is used in dyeing silk black. The kernels yield only one-tenth of 1 per cent. of the oil. (See *Am. Journ. of Pharm.*, May, 1859, p. 231.)

The *bark* of the horsechestnut has attracted much attention on the continent of Europe, as a substitute for cinchona. That of the branches from three to five years old is considered best. It should be collected in the spring. It has little odour, but an astringent and bitter, though not very disagreeable taste. It contains, among other ingredients, a bitter principle and tannin, and imparts its virtues to boiling water. The tannin is found in all parts of the tree, including the *leaves* as well as the bark and fruit. According to Rochleder, when pure, it is white and soluble in water, alcohol, and ether; becomes red by the absorption of oxygen; colours *green* the persalts of iron, but *violet* on the addition of a little alkali; precipitates gelatin but not tartar emetic; in concentrated solution is precipitated, at least partially, by sulphuric, muriatic, and metaphosphoric acids, while acetic acid is opposed to this result; and forms also, with the sulphites of potassium and sodium and the hydrosulphate of ammonium, precipitates which are dissolved by dilute acetic acid. (*Journ. de Pharm.*, Janv. 1868, p. 72.) By many physicians it has been found very efficacious in the treatment of intermittent fever; but it has entirely failed in the hands of many others, and certainly cannot be considered comparable to the Peruvian bark in its power over that complaint. It is at present seldom used, and never in this country. It has been given in substance, decoction, and extract. From half an ounce to an ounce of the powder may be given in the course of twenty-four hours. The decoction is prepared and administered in the same manner as that of Peruvian bark. Esculin was given, with complete success by M. Monyenoux, in four cases of periodical neuralgia, in one of which quinia had failed. He gave 30 grains, at two doses, mixed with sweetened water. (*Ann. de Thérap.*, 1859, p. 160.) At a later period, the same principle has been found useful in neuralgia of the uterus, stomach, and bowels, and in periodical fevers, by M. Vicaire, in doses varying from seven to thirty grains. (*Ibid.*, 1860, p. 198.) W.

Æsculus Pavia. This is the Red Buckeye of the Southern States. The fruit is said to be actively poisonous, producing symptoms analogous to those caused by strychnia. An elaborate chemical investigation has been made by Mr. E. C. Batchelor. (*Am. Journ. of Pharm.*, xlv. 144.) He finds that the cotyledons of the seeds contain about 2½ per cent. of a peculiar glucoside. H. C. W.

AGARIC. *Touchwood. Spunk. Tinder.* This is the product of different species of a genus of mushrooms denominated *Boletus*. Several species are used as food, several are poisonous, and two at least have been ranked among officinal medicines in Europe. *Boletus laricis*, which grows upon the larch of the old world, is the *white agaric* or *purging agaric* of medical writers. It is of various sizes, from that of the fist to that of a child's head, or even larger, hard and spongy, externally brownish or reddish; but, as found in commerce, it is deprived of its exterior coat, and consists of a light, white, spongy, somewhat farinaceous, friable mass, which, though capable of being rubbed into powder upon a sieve, is not easily pulverized in the ordinary mode, as it flattens under the pestle. It has a sweetish very bitter taste, and consists, according to Braconnot, of 72 parts of resinous matter, 2 of bitter extractive, and 26 of *fungin*, a nutritious animalized principle, constituting the base of the fleshy substance of mushrooms. It contains also benzoic acid and various saline compounds, and, according to recent analyses by M. G. Fleury and E. Masing, a very large amount of resinous matter. (*Journ. de Pharm.*, Mars,

1870, p. 202; Avril, 1875, p. 279; *Am. Journ. of Pharm.* xlvii. 208.) In the dose of four or six grains, it is said to act powerfully as a cathartic; but Lieutaud asserts that it may be given in the quantity of thirty grains or a drachm without sensibly purging. M. Andral has found it useful in checking the night-sweats of phthisis. He uses it in doses of eight grains, and gradually increases to a drachm during the day, without any observable inconvenience to the digestive functions. In this country it is scarcely employed, though we have met with it in the shops. That which is most esteemed is said to be brought from Siberia; but it is probably produced wherever the European larch grows. Dr. Wm. M. McPheeters has published, in the *St. Louis Med. and Surg. Journ.* (x. 421), an account of several cases, in which he tried a specimen of Boletus laricis, brought from the Rocky Mountains, in almost all of which it proved decidedly cathartic. The dose was 25 grains, which it was sometimes necessary to repeat. A tincture of the agaric of the Canadian larch has been used successfully in rheumatism by Dr. J. A. Grant. (*British-Am. Journ.*, April, 1862.)

Boletus igniarius, or *agaric of the oak*, like the species just described, is compared in shape to the horse's hoof. Its diameter is from six to ten inches. It is soft like velvet when young, but afterwards becomes hard and ligneous. It usually rests immediately upon the bark of the tree, without any supporting footstalk. On the upper surface it is smooth, but marked with circular ridges of different colours, more or less brown or blackish; on the under, it is whitish or yellowish, and full of small pores; internally it is fibrous, tough, and of a tawny-brown colour. It is composed of short tubular fibres compactly arranged in layers, one of which is added every year. The best is that which grows on the oak, and the season for collecting it is August or September. It has neither taste nor smell. Among its constituents, according to Bouillon-Lagrange, are extractive, resin in very small proportion, azotized matter also in small quantity, chloride of potassium, and sulphate of calcium; and in its ashes are found iron, and phosphate of calcium and magnesium. It is prepared for use by removing the exterior rind or bark, cutting the inner part into thin slices, and beating these with a hammer until they become soft, pliable, and easily torn by the fingers. In this state it was formerly much used by surgeons for arresting hemorrhage, being applied immediately, with pressure, to the bleeding vessel. It probably acts mechanically, like any other soft porous substance, by absorbing the blood and causing it to coagulate, and is not relied on in severe cases. In the obstinate hemorrhage which occasionally takes place from leech-bites, especially those of the European leech, it may be used advantageously, though perhaps not more so than well-prepared lint. It has been sometimes applied to the purposes of moxa.

When prepared agaric is steeped in a solution of nitre, and afterwards dried, it becomes very readily inflammable, and is employed as tinder. Some recommend the substitution of chlorate of potassium for nitre. The preparation is usually known by the name of *spunk*, and is brought to us from Europe. Spunk or tinder, the *amadou* of the French, is in flat pieces, of a consistence somewhat like that of very soft, rotten buckskin leather, of a brownish-yellow colour, capable of absorbing liquids, and inflammable by the slightest spark. It is said to be prepared also from various other species of Boletus, as *B. ungulatus*, *B. fomentarius*, *B. ribis*, &c. W.

AGARICUS MUSCARIUS. *Fly Fungus.* This fungus has been used from time immemorial by the Tartars as a means of producing intoxication. Various attempts have been made to isolate its active principle, but MM. Schmiedeberg and Koppe first obtained the alkaloid *muscaria* in a state of purity. The physiological as well as the chemical relations of the poison have been very fully investigated by its discoverers. (*Das Muscarin*, Leipzig, 1869.) We have only room for a few prominent facts. It resembles Calabar bean somewhat in its action, and is antagonistic to atropia, producing free salivation and weeping, vomiting, diminution of the force and frequency of the pulse, dyspnœa, great muscular weakness, deepening into paralysis and finally death, usually by arrest of respiration. The pupil is intensely contracted, but dilates before death. The diastole of the heart is very much prolonged, and after very large doses diastolic arrest occurs. This is due to an action upon the inhibitory nerves, and if atropia be given so as to paralyze them the cardiac movements re-occur. The vaso-motor nerves are said to be paralyzed. The action on the abdominal viscera is very marked. The muscles of the intestines, bladder, and spleen are tetanically contracted. Thus the intestines are transformed into hard white cords, or afterwards, becoming somewhat relaxed, exhibit a tumultuous peristalsis. The abdominal secretions are greatly increased. Most of the physiological results obtained by Schmiedeberg and Koppe have been confirmed by M. J. L. Prevost. (*Journ. de Pharm.*, 4e sér., xx. 385.) H. C. W.

AGAVE AMERICANA. *American Agave. American Aloe. Maguey.* An evergreen succulent plant, indigenous in Florida, Mexico, and other parts of tropical America, and largely cultivated, chiefly for hedges, in the South of Europe, especially in Spain. This and other species of Agave bear a considerable resemblance, in appearance, to the plants of the genus Aloe, with which they are sometimes confounded. From the root and leaves of the American agave, when cut, a saccharine juice flows out, which may be converted by evaporation into syrup and even sugar, and by fermentation into a vinous liquor. According to M. Lenoble, this juice when fresh has an herbaceous somewhat

nauseous odour and acrid taste, and reddens litmus paper. It is said to be laxative, diuretic, and emmenagogue. Dr. G. Perin, of the U. S. army, has found the juice an admirable remedy in scurvy, being more prompt and efficacious even than lime-juice. He gave two fluidounces three times a day. (*N. Y. Journ. of Med.*, N. S., vii. 181.) It is stated that General Sheridan once arrested a severe epidemic of scurvy by enforcing the free use of the fresh juice by the men. According to M. Bazire, however, it is not the *A. Americana* which produces the sweet juice from which the intoxicating *pulqué* of the Mexicans is obtained, but another species, bearing considerable resemblance to the Americana. The latter plant, he informs us, yields a very bitter, viscid, and astringent juice, while it is from the Agave *pulqué* that the sweet fermentable juice is procured. (*Journ. de Pharm.*, 4e sér., iv. 103–4.) The expressed juice, evaporated to the consistence of a soft extract, forms a lather with water, and is employed as a substitute for soap. The fibres of the old leaves, separated by bruising and maceration in water, are used for forming thread. In the vicinity of Cordova, in Spain, the author had an opportunity of seeing the preparation of those fibres by the peasantry. Hung up to dry, they appeared at a little distance like bundles of silk. M. Lenoble found in the leaves an acrid volatile oil, a gum-resinous principle, lignin, salts of potassa and lime, and silica; and thinks that a vinegar or ointment of the leaves might be advantageously used as an epispastic. (*Journ. de Pharm. et de Chim.*, xv. 350.) It is said that a gum exudes and hardens on the leaves of the Maguey, which has been compared to gum arabic, but in fact differs from it in containing a much larger proportion of lime, and in being only partially soluble in water; the soluble portions resembling pure gum, but the larger insoluble portions having all the characteristics of bassorin. (*Ibid.*, 4e sér., iv. 104.) *Agave Virginica*, which grows in our Southern States, and is known in South Carolina by the name of *rattlesnake's master*, has a very bitter root, which is used, in the form of tincture, in flatulent colic, and as a counter-poison in the bites of serpents. (Robert King Reid, *Inaug. Thes.*, A. D. 1849.) W.

AGRIMONIA EUPATORIA. *Common Agrimony.* This species of agrimony is a perennial herb, inhabiting Asia, Europe, and North America, and, in this country, found in fields and on the borders of woods, and flowering during the summer months. Its stem, which rises from one to three feet in height, is hairy, furnished with interruptedly pinnate leaves, and terminated by a long simple spike of yellow flowers. Both the herb and root have been employed. The former has a weak but agreeable aromatic odour, and a rough, bitterish, somewhat aromatic taste. The fragrance is strongest in the flowers. The root has similar properties; but its taste is more bitter and astringent. A volatile oil may be obtained from the plant by distillation. Agrimony is a mild corroborant and astringent. The herb has been employed in relaxed conditions of disease, as in passive hemorrhages, and chronic affections of the mucous membranes. It has been recommended, also, as a deobstruent in jaundice and visceral obstructions, and as an alterative in diseases of the skin. In Europe it is popularly used, in the form of a gargle, in affections of the throat. The Indians of North America and the Canadians are reported to have employed the root with advantage in fevers. The plant may be given in substance, infusion, or decoction. The dose of the powder is a drachm or more. W.

AILANTHUS GLANDULOSA. This tree is well known in the United States, where it has within a few years been extensively cultivated as a shade tree, for which purpose it would be admirably adapted by its rapid growth and abundant foliage, as well as by its exemption from the attacks of insects, were it not for the offensive odour emitted by it in its flowering period. The tree belongs to Polygamia Monœcia in the Linnæan system, and to the natural order of Rutaceæ, *Juss.*, Xanthoxylaceæ, *Lindley*. In its general aspect and the character of its foliage, it appears like a gigantic sumach, and it was at one time considered as a Rhus. The name of *Japan varnish* (*vernis du Japon*), by which it is known in France, arose from its having been mistaken for the true Japan varnish tree, which is a species of Sumach. M. Hétet, Professor in the Marine Medical School at Toulon, has found this plant to possess properties which promise to render it of great use in medicine, especially as a vermifuge. Recently attention has been called to its use in dysentery. (*Am. Journ. of Pharm.*, 1874, p. 276.) Before it had engaged Prof. Hétet's notice as a medical plant, it had begun to assume considerable economical importance in France: its leaves having been found to be suitable food for a species of silk worm, *Bombyx cinthia*, imported from China. The bark is the part in which its anthelmintic virtues have been shown to reside. This, in powder, is of a greenish-yellow colour, a strong, narcotic, nauseating odour, in its recent state, and of a strongly bitter taste. When chewed, besides the bitterness, it appears, through its influence on the gustatory nerves, to produce in a few moments a general uneasiness, a sense of increasing weakness, dazzling, cold sweats, with shivering and nauseous sensations, which are very remarkable, but seem to be well attested. The inference from these effects is that it has probably a powerful depressing agency on the nervous system, similar to that of tobacco. Examined chemically, the bark has been found to contain lignin, chlorophyll, a yellow colouring principle, a gelatinous substance (pectin), a bitter substance, an odorous resin, traces of a volatile oil, an azotized fatty matter, and several salts. An *oleoresin* is ob-

tained from the bark by the action of alcohol, which has the consistence of tar, a very dark greenish-brown colour, and in a high degree the smell and taste of the bark. M. Hétet experimented upon dogs with the powdered bark, powdered leaves, and various preparations of the bark. As a general result, they were found to produce a purgative effect, with copious stools and the discharge of worms. The resin purged, but rarely acted as an anthelmintic. The depressing effects on the nervous system in man were found to depend on the volatile oil, as the resin alone had no such influence. The oil is so powerful that persons exposed to the vapours, in preparing the extract, are liable to be seized with vertigo, cold sweats, and vomiting. The powdered bark has been given in several cases of tape-worm in the human subject, and proved remarkably successful in its expulsion, at the same time operating on the bowels. The oleoresin produced the same effect in a somewhat smaller dose, and has the advantage that it keeps better than the bark, which loses its powers with age. A fact worthy of remark is that neither the bark nor its preparation, taken internally, produce vomiting in man; while this effect is determined by the inhalation of its vapours, when it is boiled. The cathartic operation is not violent. The dose of the powder which was found sufficient for the expulsion of the tape-worm was from seven or eight to thirty grains. (*Journ. de Pharm.*, Mars, 1859, p. 163.) W.

AILANTHUS EXCELSA. This is a rather common tree of India and Ceylon, the bark of whose trunk and, to some extent, root has been largely used in its native country as a bitter tonic. It is said to occur in rough, dirty green pieces, originally large, but of so friable a character that in handling they become very much broken down. It has been examined chemically by Mr. Narayan Daji, who found a peculiar bitter uncrystallizable principle and a bitter nitrogenous acid, to which he attributes the medical virtues of the bark. For the method of preparation and properties of *Ailanthic Acid* the reader is referred to the *Pharm. Journ and Trans.*, Aug. 1870, p. 155. H. C. W.

AJUGA CHAMÆPITYS. *Ground Pine. Chamæpitys.* A low, creeping, annual, labiate plant, a native of Europe, and found also in some parts of the United States. The leaves, which bear some resemblance to those of the pine in shape, have a strong, peculiar, resinous, not disagreeable odour, and a bitter, balsamic taste. They yield by distillation with water a small proportion of volatile oil, resembling that of turpentine. They are said to be stimulant, diuretic, and aperient; and have been given in rheumatism, gout, palsy, and amenorrhœa. The dose of the leaves in powder is one or two drachms; but their infusion in wine is considered the best preparation.

Ajuga reptans or *common bugle*, and *A. pyramidalis*, perennial plants of Europe, have also been used in medicine. They are nearly inodorous, but have a somewhat astringent, bitterish, and saline taste. Their virtues are probably those of a mild astringent and tonic. They have been recommended in pulmonary consumption, hæmoptysis and other hemorrhages, and in hepatic obstructions, and have enjoyed considerable reputation as vulneraries; but they are at present nearly obsolete. W.

AKAZGA. *Boundou.* These are the native names of an ordeal poison, used in a district on the West Coast of Africa, extending far into the interior, north and south of the equator, from the use of which in their trials thousands of persons are said to perish annually. It is referred to in the works of Du Chaillu and of Wisemond Reade. It comes in bundles consisting of long, slender, crooked stems, with the root generally attached, sometimes of the branches, but seldom of the whole plant. This is about six feet high, with a yellowish-orange bark, in some parts light-red, and covered by a gray efflorescence. The leaves are opposite, oval-acuminate, with a linear prolongation at the end more than an inch long. The precise botanical character of the plant is not known, but it is thought to be a Loganiacea. The active principle of the plant has been extracted by Dr. Thos. R. Fraser, and, having been found to possess the properties of the alkaloids, has been named by its discoverer *akazgia*. It is colourless, crystallizable with difficulty, soluble in 60 parts of cold absolute alcohol, 16 parts of officinal alcohol, 130 parts of anhydrous ether, and in 13,000 parts of water at 60° F. It is freely soluble in chloroform, bisulphuret of carbon, benzole, and ether of 0·735. The alcoholic extract of the plant acts on the system in a manner very similar to nux vomica; and the alkaloid has precisely the same physiological properties. (*Chem. News*, Oct. 18, 1867, p. 203.)

This is probably the same poison referred to under the name of *boundou* or *icaja*, by MM. Pecholier and Saint Pierre, who consider the plant producing it as belonging to the *Apocyneæ*, and state that it is used as an ordeal poison by the natives of Gaboon, in Africa. They extracted from it a poisonous principle, which, like that discovered by Dr. Fraser, resembled nux vomica in its action on the system. (See *Am. Journ. of Pharm.*, March, 1867, p. 124.) W.

ALBUMINATE OF IRON AND POTASSIUM, SYRUP OF. This syrup, proposed by M. Lassaigne, is made as follows. Dissolve 100 parts of white of eggs in 100 of distilled water, and precipitate the filtered solution with 36 parts of a solution of the tersulphate of sesquioxide of iron, marking 5° of the areometer. Then add 2 parts of alcoholic potassa, previously dissolved in 50 parts of water. This, by agitation, will gradually dissolve the precipitate caused by the ferruginous solution, forming a deep orange-yellow

liquid. The liquid is then converted into a syrup by dissolving in it one and a half times its weight of coarsely powdered sugar, and filtered. The syrup has a slightly alkaline and sweetish taste, totally devoid of inky flavour. Each fluidounce contains about six grains of anhydrous sesquioxide of iron. Mr. A. J. Cooley has proposed to make a simple *albuminate of iron* by dissolving the freshly precipitated oxides of iron in a filtered solution of albumen. B.

ALBUMINATE OF IRON AND SODIUM. Angelico Fabri, observing that simple contact of the white of eggs with a salt of iron and soda was sufficient to produce a soluble albuminate of iron and sodium, the composition of which is so stable that it is not disturbed by ferrocyanide of potassium unless with the presence of an acid, and inferring that this is the condition in which the several ingredients of the compound exist in the blood, proposes this salt as likely to meet better than any other those wants of the system which call for the use of chalybeates. He prepares the salt by pouring upon the whites of four eggs, previously beaten up, solutions separately made of 112 grains of caustic soda and 104 of sulphate of iron in sufficient distilled water; shaking the mixture, and placing it on a filter to separate the excess of hydrated oxide of iron which has precipitated; adding lime-water to the filtrate to separate the sulphuric acid of the sulphate of sodium which exists in the solution; again filtering, and precipitating the lime held in the solution by passing through it a stream of carbonic acid; filtering a third time to separate the carbonate of calcium; and finally reducing the liquid with a moderate heat to the measure of a pint. A transparent orange-yellow solution is thus obtained, having a slightly saltish and chalybeate taste, and unaffected by ferrocyanide of potassium unless with the presence of an acid. Each fluidounce contains 4 grains of the albuminate, with an excess of albumen and soda, which gives it an alkaline reaction, and renders it conformable to the state in which the compound exists in the blood. The albuminate of iron and sodium is represented by the formula $C_{30}H_{50}O_{10} + HO + Fe_2O_3 + NaO + 2HO = Al,Fe_2O_3,NaO + 2HO$. It may be obtained in radiated crystals by evaporating the salt to dryness. (*Am. Journ. of Pharm.*, Jan. 1863, p. 69; from *Journal of Rational Medicine*, May, 1862.) W.

ALCHEMILLA VULGARIS. *Ladies' Mantle.* A perennial European herb, growing in meadows, on the banks of rivulets, and in the borders of woods. The whole plant has an astringent, bitterish taste, which is strongest in the root. It was formerly employed in diarrhœa, and other complaints requiring the use of astringents. By the ancients it was highly esteemed; and extraordinary powers were ascribed to it by the alchemists, from whom, according to Linnæus, it derived its generic title. W.

ALCORNOQUE. Under this name a bark was introduced into Europe from South America, more than fifty years since, and for a short time attracted considerable attention. It has been conjecturally referred by different writers to different plants, but its precise origin is unknown. It is in large thick pieces, composed of two layers, of which the external is reddish, cracked, granular, spongy, and two or three lines in thickness, the internal lamellated, woody, and possessed of the quality of imparting a yellow colour to the saliva when chewed. It is inodorous. The outer layer is of an astringent, somewhat bitter taste, and was thought to have febrifuge powers; the inner is much more bitter, and is decidedly emetic. The bark was brought into notice chiefly as a remedy in phthisis; but, having been found useless in that complaint, has fallen into entire neglect. It was given in the form of powder, in the dose of thirty grains; or half an ounce of it was boiled in a pint of water down to half a pint, and two or three tablespoonfuls of the decoction were administered every two hours. In these doses it acted as an emetic. The bark known in Spain by the name of *alcornoque* is obtained from the cork-tree (*Quercus Suber*), and has sometimes been confounded in European pharmacy with that derived from South America. It has the properties of the ordinary oak barks. W.

ALDEHYD. ACETIC. ($C_4H_4O_2$.) This substance, which is produced by the slow oxidation of alcohol, has been physiologically investigated. It resembles alcohol in many of its properties, having the same solvent powers, and coagulating albumen. It possesses very marked antiputrescent properties, meat being preserved for months by its two per cent. aqueous solution. The intoxication caused by it in animals is characterized by a very great loss of sensibility. It appears to paralyze the vagi, although its cardiac action is comparatively feeble. Upon the respiration it exerts a most powerful influence, in small doses quickening it, in large doses assisting it. The temperature is very much diminished. Locally it is very irritating. (*Med. Times and Gaz.*, Sept. 1875, p. 340.) H. C. W.

ALETRIS. *Star Grass. Aletris Farinosa*, Wild. *Sp. Plant.* ii. 183; Bigelow, *Am. Med. Bot.* iii. 92, is an indigenous perennial plant, the leaves of which spring immediately from the root, and spread on the ground in the form of a star. Hence have originated the popular names of *star grass*, *blazing star*, and *mealy starwort*, by which it is known in different parts of the country. The leaves are sessile, lanceolate, entire, pointed, very smooth, longitudinally veined, and of unequal size, the largest being about four inches in length. From the midst of them a flower-stem rises, one or two feet in height, nearly naked, with remote scales, which sometimes become leaves. It terminates in a slender scattered spike, the flowers of which stand on very short pedicles, and have

minute bractes at the base. The calyx is wanting. The corolla is tubular, oblong, divided at the summit into six spreading segments, of a white colour, and when old, of a mealy or rugose appearance on the outside. The plant is found in almost all parts of the United States, growing in fields and about the borders of woods, and flowering in June and July.

The root, which was formerly included in the U. S. secondary list, is small, crooked, branched, blackish externally, brown within, and intensely bitter. The bitterness is extracted by alcohol, and the tincture becomes turbid upon the addition of water. The decoction is moderately bitter; but much less so than the tincture. It affords no precipitate with the salts of iron. (*Bigelow.*) In small doses it appears to be simply tonic, and may be employed advantageously for similar purposes with other bitters of the same class. When freely given, it is apt to occasion nausea. In very large doses, it is said to be cathartic and emetic, and to produce some narcotic effect. It has been employed, with asserted benefit, in colic, dropsy, and chronic rheumatism. The powder may be administered as a tonic in the dose of ten grains. W.

ALEURITES TRILOBA, OIL OF. This is a small tree belonging to the Natural Order Euphorbiaceæ. It is widely diffused through the tropics, being indigenous in the East Indies and Islands of the Pacific, and naturalized in the West Indies. The fruit is a nut nearly as large as a walnut, consisting of a thick shell enclosing a kernel containing much azotized matter and rich in oil, of which it is said to yield nearly one-half its weight by expression. The nuts, strung together on the fibres of the palm-leaf, are used in the South Pacific Islands as a substitute for candles. The oil has been long known in the various countries inhabited by the plant, being called in Jamaica *Spanish walnut oil*, in India *Belgaum walnut oil*, in Ceylon *kekune oil*, and in the Sandwich Islands *kukui oil*. It may be obtained by boiling with water the kernels previously beaten in a mortar, or by expression. Sixteen pints of kernels yield about three pints of oil. The yearly product of the Sandwich Islands is said to be 10,000 gallons. (M. C. Cooke, *Pharm. Journ.*, Nov. 1860, p. 282.) The oil has been used in the arts; but it is only of late that attention has been called to its medicinal qualities by Mr. O'Rorke. The following account of its properties and uses we take from *Bouchardat's Annuaire* (1859, p. 117). The oil is very fluid, of an amber colour, without taste or smell, congealing at 32° F., insoluble in alcohol, readily saponifiable, "and very strongly drying." As a medicine it acts as a prompt and efficient but mild cathartic, without any tendency to produce nausea, vomiting, or griping pains, and destitute of any other medical property. It seems to be admirably adapted to cases in which castor oil is used, and has the great advantages over that cathartic that it does not nauseate, and that its taste is agreeable, resembling, it is said, that of hazel-nuts. The dose is from one-half to one ounce; the smaller quantity generally answering. The cake left after the expression of the oil, given to a dog in the dose of about half an ounce, produced no vomiting, but acted strongly as a purgative. Should all that has been said of the oil prove correct upon further trial, it would be likely to supersede castor oil to a considerable extent. W.

ALISMA PLANTAGO. *Water Plantain.* A perennial herbaceous plant, common to Europe and the United States, and growing in streams, pools, ditches, and other standing waters. The *root* has when fresh an odour like that of Florentine orris, but loses it when dried. Its taste is acrid and nauseous. It acquired at one time considerable credit as a preventive of hydrophobia, for which purpose it was said to have been used with great advantage in Russia; but subsequent experiments have proved its total inefficacy. The Calmucks are said to use it for food. The *leaves* are rubefacient, and will sometimes even blister when applied to the skin. They have been recommended in gravel and complaints of the bladder, in the dose of a drachm. The root has recently been used in chorea and epilepsy with asserted advantage. The dose of the powdered root, at first about 8 or 10 grains morning and evening, is rapidly increased to a teaspoonful, and in the end carried to three or four spoonfuls in the course of the day. (*Ann. de Thérap.*, 1859, p. 62.) W.

ALKANET. This is the root of *Anchusa tinctoria*, or *dyers' alkanet*, an herbaceous perennial plant, growing in the Grecian Archipelago and the South of Europe. It is said in some medical works to be cultivated abundantly in the South of France; but another plant is probably referred to — *Lithospermum tinctorium* of Linnæus and De Candolle, *Anchusa tinctoria* of Lamarck — which is a native of that country, and the root of which is considered as the true alkanet by the French writers. Alkanet, as found in the shops, is in pieces three or four inches long, from the thickness of a quill to that of the little finger, somewhat twisted, consisting of a dark-red, easily separable bark, and an internal ligneous portion, which is reddish externally, whitish near the centre, and composed of numerous distinct, slender, cohering fibres. As it comes to us it is usually much decayed internally, very light, and of a loose, almost spongy texture. The fresh root has a faint odour, and a bitterish, astringent taste; but when dried it is nearly inodorous and insipid. Its colouring principle, which abounds mostly in the cortical part, is soluble in alcohol, ether, and the oils, to which it imparts a fine deep red; but is insoluble in water. It may be obtained by first exhausting the root with water, and then treating it with a weak

solution of the carbonate of potassium or sodium, from which the colouring principle may be precipitated by an acid. According to Pelletier, by whom it was discovered, it possesses acid properties, forming with the alkalies and earths neutral compounds, which are of a blue colour, and soluble in alcohol and ether. He calls it *anchusic acid*, and states that it may be sublimed unchanged. (*Journ. de Pharm.*, xix. 105.) The tincture of alkanet has its colour deepened by acids, changed to blue by alkalies, and again restored by neutralizing the latter substances. It may, therefore, be used as a test. The extract obtained by evaporating the tincture is dark-brown. Alkanet is somewhat astringent, and was formerly used in several diseases; but it is now employed exclusively for colouring oils, ointments, and plasters, which are beautifully reddened by one-fortieth of their weight of the root. It is said also to be used in the preparation of spurious port wine. W.

ALLIARIA OFFICINALIS. *Erysimum Alliaria.* Linn. *Hedge Garlic.* A perennial European herb, having an alliaceous odour when rubbed, and a bitterish, somewhat acrid taste. When eaten it communicates its smell to the breath. Mr. Wertheim obtained from the root a volatile oil, apparently identical with that of mustard. (*Ann. der Chem. und Pharm.*, liii. 52.) The herb and seeds are esteemed diuretic, diaphoretic, and expectorant, and have been given in humoral asthma, chronic catarrh, and other complaints in which garlic is useful. The herb has also been recommended as an external application in gangrenous affections, and to promote suppuration. W.

ALNUS GLUTINOSA. *Common European Alder.* A European tree twenty-five feet or more in height, growing in swamps, on the sides of streams, and in other damp places. The bark and leaves are very astringent, and somewhat bitter. The former has been used in intermittent fever, the latter as a topical remedy in wounds and ulcers. The bruised leaves are sometimes applied to the breast for the purpose of repelling the milk. The cones also are astringent, and form a useful gargle in complaints of the throat. All these parts of the tree are used in dyeing, and the leaves and bark in tanning. The tannic acid, however, appears to differ from that of galls and oak bark, as, according to Dr. Stenhouse, it does not yield glucose when acted on by sulphuric acid. (*Pharm. Journ.*, Dec. 1861, p. 331.) F. Dreykorn and E. Reichardt, however, state that it is resolved by sulphuric acid into alnine red and sugar. (*Am. Journ. of Pharm.*, xlii. p. 403.) *Alnus serrulata*, or common *American alder*, and the *Alnus urcana*, or *Tag alder*, appear to have analogous properties. The latter has been strongly commended as a hæmostatic. (*New Remedies*, Jan. 1872.) W.

ALUMINII SUBACETAS. *Subacetate of Aluminium.* This salt is sometimes used as a local astringent in ulcers, various skin affections, etc. For a method of preparing it, see *Am. Journ. of Pharm.*, xliv. p. 104. H. C. W.

AMARANTHUS HYPOCHONDRIACUS. *Prince's Feather.* An annual plant, growing spontaneously though sparingly in the Middle States, but believed to have been derived from tropical America. (*Gray's Manual*, p. 368.) It is cultivated in our gardens on account of its flowers, which are in densely crowded spikes, and of a deep-red colour. The leaves are said to be astringent, and to be used internally and topically in the complaints to which the astringents generally are applicable. W.

AMBERGRIS. *Amber Grisea.* This substance, which is found floating on the sea, or thrown by the waves upon the shores of various countries, particularly in the southern hemisphere, is now generally believed to be produced in the intestines of the *Physeter macrocephalus*, or spermaceti whale, and perhaps in those of some other fish. It is in roundish or amorphous pieces, usually small, but sometimes of considerable magnitude; and masses have been found weighing 50, 100, and even 200 pounds. These pieces are often composed of concentric layers. They are of various colours, usually gray, with brownish, yellow, and white streaks, often dark-brown or blackish on the external surface. They are opaque, lighter than water, and of a consistence like that of wax. Ambergris has a peculiar aromatic agreeable odour, is almost tasteless, softens with the warmth of the hand, melts under 212°, is almost completely volatilizable by heat, and is inflammable. It is insoluble in water, but is readily dissolved, with the aid of heat, by alcohol, ether, and the volatile and fixed oils. It consists chiefly of a peculiar fatty matter analogous to cholesterin, and denominated by Pelletier and Caventou *ambrein*. This may be obtained by treating ambergris with heated alcohol, filtering the solution, and allowing it to stand. Crystals of ambrein are deposited. It is incapable of forming soaps with the alkalies. When pure it has little or no odour. Ambergris is often adulterated; but does not then exhibit its ordinary fusibility and volatility. It was long regarded as a cordial and antispasmodic, somewhat analogous to musk; and has been recommended in typhoid fevers, and various nervous diseases. It formerly entered into many officinal preparations, and is still retained in some European Pharmacopœias. The French Codex directs a tincture to be prepared by macerating, for ten days, 100 parts of powdered ambergris with 1000 parts of alcohol at 80°, expressing and filtering. M. Stan. Martin assures us that the tincture will keep better, deposit nothing, and have a more agreeable odour, if the ambergris, instead of being merely powdered in a mortar, be subjected to porphyrization, especially with the addition of washed sand. Heat, he says,

should never be used in its preparation. (*Journ. de Pharm.* 4e sér., i. 448.) It is, however, feeble as a remedy, and is much more used in perfumery than in medicine. The dose is from five grains to a drachm. W.

AMBROSIA TRIFIDA. *Ragweed.* (*Gray's Manual*, p. 212.) This and another indigenous species, *A. artemisiæfolia*, both annual plants, and usually ranked among worthless weeds, have found a place in the Materia Medica of the eclectics, by whom they are deemed astringent and somewhat exciting, and are given in low forms of fever, and other conditions of the system in which the vital actions are enfeebled. W.

AMMONIATED IRON. Ferrum Ammoniatum. *Ammoniated Iron. Ammoniochloride of Iron.* Though discharged from the officinal lists at the late revisions of the Pharmacopœias, this preparation has too long occupied a conspicuous place in the Materia Medica to justify its omission in a work of this kind. It was recognised until recently both by the U. S. and London Pharmacopœias, which contained formulas for its preparation. The following was the U. S. process. "Take of Subcarbonate of Iron *three ounces;* Muriatic Acid *ten fluidounces;* Muriate of Ammonia *two pounds and a half;* Distilled Water *four pints.* Mix the Subcarbonate of Iron with the Muriatic Acid in a glass vessel, and digest for two hours; then add the Muriate of Ammonia, previously dissolved in the Distilled Water, and, having filtered the liquor, evaporate to dryness. Rub the residue to powder." (*U. S.*) The process of the *London College* was essentially the same as the above, of which, in fact, it was the original. By the mutual action of muriatic acid and the sesquioxide of iron of the subcarbonate, water and sesquichloride of iron are formed; and the solution of the latter, being evaporated along with that of the chloride of ammonium, yields a mixture of the two salts. If any carbonate of iron be present in the subcarbonate, a portion of protochloride of iron must also be formed, which, however, would probably be converted into sesquichloride during the operation. The preparation was formerly made by subliming a mixture of red oxide (sesquioxide) of iron and chloride of ammonium. A portion of the chloride of ammonium was decomposed; the ammonia escaping, and the muriatic acid reacting upon the sesquioxide of iron so as to form water and sesquichloride of iron, the latter of which was sublimed with the undecomposed chloride of ammonium. By this mode of preparation the proportion between the two salts was variable. The late officinal plan has the double advantage of uniformity in the result, and greater facility in the process. There is no reason to believe that the sesquichloride of iron and chloride of ammonium are chemically combined in the preparation. According to Mr. Phillips, they are in the proportion of 15 parts of the sesquichloride to 85 of the muriate.

Properties. Ammoniated iron, thus prepared, is in crystalline grains, of a fine reddish-orange colour, and a sharp, styptic, saline taste. It is entirely soluble in water and diluted alcohol, is deliquescent, and should be kept in well-stopped bottles. By the alkalies and their carbonates, and by lime-water it is decomposed, with the precipitation of about 7 per cent. of sesquioxide of iron; and potassa in excess occasions the evolution of ammonia. Like the other chalybeates, it is incompatible with vegetable astringents. As procured by sublimation, it is of a yellow colour and feeble odour, and is probably the result of a chemical reaction between the ingredients.

Medical Properties and Uses. This preparation unites aperient properties with those belonging to the chalybeates generally, and is said to have been used with advantage in amenorrhœa, epilepsy, scrofula, rickets, &c.; but it is at best uncertain, and is now very seldom prescribed. The sublimed preparation was formerly employed under the names of *flores martiales* and *ens martis.* From four to twelve grains may be given in the form of pill, electuary, or solution, several times a day. W.

AMPELOPSIS QUINQUEFOLIA. *Virginia Creeper. American Ivy.* (*Gray's Manual*, p. 78.) This woody creeper, which is a common indigenous plant, and conspicuous in autumn by its bright crimson leaves, has been used by the eclectics as an alterative, tonic, and expectorant. The bark and twigs are the parts employed. The remedy has been recommended by Dr. J. McCall, in the *Memphis Journal of Medicine*, in the treatment of dropsy. He believes it to act rather by stimulating absorption than as a diuretic. Dr. McCall employs the bark collected late in the fall, and exhibits it in the state of decoction or infusion. (*Penins. and Independ. Med. Journ.*, June, 1858, p. 169.) W.

AMYLAMINE, HYDROCHLORATE OF. The physiological action of this salt has been investigated by M. Dujardin-Beaumetz. (*Comptes Rendus*, lxxvii. 1247.) In small doses (1 to 5 centigrammes to a rabbit) it lowered the temperature and also the force and frequency of the pulse. In larger amounts it produced profound nervous disturbance, with tonic and clonic convulsions, ending often in death. In man he found it, in doses of from 7 to 15 grains, to diminish the pulse and temperature. H. C. W.

AMYLEN. *Valeren.* This compound was alluded to under amylic alcohol, *page* 92. It is an iso-equivalent carbohydrogen, having the formula $C_{10}H_{10}$. Amyl is $C_{10}H_{11}$, and amylic alcohol (fusel oil) is the hydrated oxide of amyl $C_{10}H_{11}O + HO$, or the bihydrate of amylen $C_{10}H_{10} + 2HO$. Amylen was discovered by M. Balard, of Paris, in 1844. It is prepared by distilling amylic alcohol with a concentrated solution of chloride of zinc.

The product is redistilled, and that which comes over first, constituting the more volatile part, is separately collected, and agitated with concentrated sulphuric acid, when the amylen, freed from water, will rise to the surface. Amylen is a colourless, very mobile liquid, having the density 0·695 at 56°. Its boiling point is 102° (95° *Duroy*), and the density of its vapour 2·45. Its smell is peculiar and disagreeable. It is soluble in alcohol and ether, in all proportions, but very sparingly so in water. When pure it does not act on potassium, and is not coloured by a prolonged contact with caustic potassa.

Amylen was proposed as a new anæsthetic by Dr. Snow, in a paper read before the London Medical Society on the 10th of Jan. 1857. The advantages claimed for it, compared with other anæsthetics, were that its vapour is less pungent; that it abolishes pain with a stupor less deep; and that there is no struggling on the part of the patient, and no sick stomach after its administration. Its bad smell was admitted as an objection. These alleged advantages have not been found to counterbalance the dangers of its use. Dr. Snow admits "the absolute safety which seems to attend sulphuric ether under all circumstances;" an admission which makes it less necessary to seek for a new anæsthetic. Already, within the brief period during which it was tried, two deaths have occurred, although the amylen was administered by Dr. Snow himself. The French Academy of Medicine, after a deliberate examination of its alleged advantages, have condemned it as dangerous. From a chemical examination of various specimens of commercial amylen, as well as of the purest form of it as prepared by the process of M. Balard, Dr. Schauenstein has found that they all contain chlorine; and the uncertainty thus thrown upon the nature of the compound adds to the motives, previously existing, for abandoning the use of it as an anæsthetic agent. (See *B. and F. Med.-chir. Rev.*, Am. ed., Jan. 1858, p. 193.)

Hydruret of Amyl (*hydride of amyl*), $C_{10}H_{11}H$, is another new anæsthetic, proposed by Prof. Simpson, of Edinburgh. It was discovered by Dr. E. Franklin, of Manchester, who obtained it by a complicated process, which has been rendered more easy of execution by Messrs. T. & H. Smith, of Edinburgh, who prepared the substance at the request of Prof. Simpson. (See T. & H. Smith's paper, in the *Pharm. Journ.*, June, 1857.) Hydruret of amyl is a colourless, volatile, mobile liquid, possessing a grateful fruity odour, but no taste. It is the lightest liquid known, having the sp. gr. 0·638 at 57°. It boils at 86°, and the density of its vapour is 2·5. It is very inflammable, and burns with a brilliant white flame. It is readily soluble in alcohol and ether, but insoluble in water. "It is a very stable compound, resisting the action of fuming sulphuric acid and the most powerful oxidizing agents." We have not seen any precise account of its mode of action as an anæsthetic. B.

Besides the hydruret of amyl, other compounds have been examined by Dr. B. W. Richardson, of London, among which are *amylic alcohol*, the *iodide*, the *acetate*, and the *nitrite*. Of these the nitrite has become so important as to need a special notice.

In relation to *amylen*, Dr. Richardson observed that, though it is capable of producing insensibility, this is attended with a kind of consciousness, leading to certain actions, of which there is no remembrance after awaking. *Amylic alcohol*, when inhaled by men or the lower animals, produces a state of muscular paralysis with paroxysms of convulsive trembling, which are excited by the slightest cause, as a simple touch, or breathing on the surface. *Iodide of amyl* acts similarly to amylic alcohol, with this superadded symptom, that when the animal begins to move, whether spontaneously or under excitation, he does so for a considerable time in a circle. The *acetate of amyl* exerts an influence similar to those of the nitrite and iodide, but less marked. All of these compounds have the property of preventing putrefaction in vegetable substances. None of them can be used as anæsthetic agents; as they do not, like the compounds of formyl or ethyl, produce general insensibility to pain. (*B. and F. Med.-chir. Rev.*, Jan. 1857, p. 245.) The *valerianate of amyl* is said by Dr. W. F. Wade, of Birmingham, to act similarly to valerian, and to afford a most elegant remedy. He dissolves one part of it in nineteen of alcohol and two per cent. of a spirit of acetate of amyl (one part to twenty). The dose is from six to eight drops. W.

AMYL NITRIS. *Br. Nitrite of Amyl. Amylo-nitrous Ether.* This substance, which was discovered by M. Ballard in 1844, is included among the additions to the British Pharmacopœia, and ought therefore to have been described in the first part of this work. It is an amber-coloured, very volatile liquid, of a penetrating, peculiar odour, resembling that of ripe pears. Its sp. gr. is 0·877. According to the British Pharmacopœia its boiling point is 205° F., but Mr. A. B. Tanner states (*Pharm. Journ. and Trans.*, Nov. 1871, p. 421) that when perfectly dry it boils at 99° C. (210⅘° F.). It is insoluble in water, freely soluble in alcohol. Chemically it is a nitrite of oxide of amyl, or, according to the new nomenclature, an amylo-nitrous ether, entirely parallel in its composition to the nitrite of oxide of ethyl or ethylo-nitrous ether, of sweet spirit of nitre. "If it be added, drop by drop, to caustic potash, while fused by the application of heat, valerianate of potash will be formed." *Br.* Its formula is $C_{10}H_{11}O,NO_3$ or $C_5H_{11}NO_2$.

Nitrite of amyl may be prepared by passing a stream of nitrous acid (hyponitric acid) gas through purified amylic alcohol at a temperature of 132° C. As pointed out by Prof. Jno.

M. Maisch, this process is tedious and difficult, some hours being required for the saturation of the amylic alcohol, and the resultant containing not only the nitrite but also the valerianate of amyl, besides nitrate of ammonium and a black non-volatile substance, so that a complicated process of purification is necessary. For these reasons Prof. Maisch prefers acting upon amylic alcohol with nitric acid, as originally suggested by Ballard. The alcohol should always first be purified according to the method of Hirsch (*Am. Journ. of Pharm.*, 1862, pp. 139, 328), by agitating with an equal bulk of strong solution of common salt, then distilling in a retort with a thermometer, collecting what comes over between 257° F. and 284° F., and redistilling this until it has a boiling point near 269·6° F. The purified alcohol should be mixed with about an equal bulk of nitric acid in a capacious glass retort, being gradually heated until it approaches boiling, when the fire is to be removed. As soon as a thermometer inserted into the tubulures rises above 212°F. the receiver is changed, because both ethyl, amylic ether, and nitrite of amyl at such temperatures come over freely and would contaminate the product. The distillate obtained below 212° F. is agitated with carbonate of potassium, and the oily liquid which separates is very slowly heated in a clean retort to 204·8° F., then the receiver is changed and the distillate collected as before, until the thermometer reaches 212° F. That which comes over between the two temperatures is pure nitrite of amyl. It is essential to this process that in every case the heating be very gradual. (*Am. Journ. of Pharm.*, 1871, p. 148.) Prof. Maisch also attempted to produce nitrite of amyl by Redwood's process (*Am. Journ. of Pharm.*, 1867, p. 330) for the production of nitrous ether, substituting amylic for ethylic alcohol. He found that the reactions occurred with such excessive violence as to render the preparation of the drug in this way impracticable. Subsequently, however, Mr. Alfred Tanner pointed out (*Pharm. Journ. and Trans.*, Nov. 1871, also *Am. Journ. of Pharm.*, 1872, p. 21) that Prof. Maisch used a nearly anhydrous amylic alcohol, and that the reactions are equally violent with ethylic alcohol of similar strength. He finds no difficulty when the fousel oil is diluted with water, and prefers the process, especially for the production of the drug upon a small scale. Having introduced the purified amylic alcohol into a tubulated retort containing copper wire, he adds one-tenth of its bulk of strong sulphuric acid, and then the same quantity of nitric acid, previously diluted with an equal bulk of water, and heats gently to 145·4° F. At this temperature the reaction commences, and goes on very manageably, until a bulk about equal to double the quantity of nitric acid collects in the receiver. The chemical movement now ceases, and the temperature, which has risen to near 212° F., begins to fall. More dilute nitric acid is added, and the process carried out as before. These actions are repeated until the amylic alcohol is exhausted, which is known by the appearance of red fumes in the retort. The whole product is washed with caustic soda, to remove hydrocyanic and other acids, and rectified over the carbonate of potassium, to get rid of moisture. The portion which distils over between 203° F. and 212° F. is medicinally pure nitrite of amyl.

Physiological Action. Owing to its excessive volatility and the ease with which it is absorbed, nitrite of amyl acts with great quickness upon the organism. As early as 1859 Guthrie investigated, to some extent, its physiological action; but the attention of the profession was really first directed to the drug by the researches of Dr. Richardson, of London, in 1865. Since this time elaborate studies of its physiological action have been made by various investigators. Want of space forbids more than a summarizing of them in this book; for a full account the reader is referred to Dr. H. C. Wood's Treatise on Therapeutics. When inhaled in doses of from 5 to 10 drops, nitrite of amyl produces in man violent flushing of the face, accompanied with a feeling as though the head would burst, and a very excessive action of the heart. Along with these symptoms, after a larger quantity, there is a sense of suffocation, and more or less marked muscular weakness. As no case of serious poisoning from nitrite of amyl has occurred in man, for a further knowledge of its action we are dependent upon the study made on the lower animals. In dogs, rabbits, cats, &c., it induces effects similar to those occurring in man, followed, after large doses, by violently hurried, panting respiration, progressive loss of muscular power and of reflex activity, and finally death from failure of respiration, sensation and consciousness being preserved to the last. Although the frequency of the pulse may be increased, the force of the circulation is always diminished. This decrease of the arterial pressure is in great measure due to a dilatation of the capillaries. The vaso-motor palsy appears to be chiefly produced by a direct action upon the coats of the capillaries, but may in part be caused by an influence exerted upon the vaso-motor centres. The cause of the acceleration of the pulse has not been made out, but there is some evidence for the belief that the rise is due to a depressing action upon the inhibitory cardiac nerves.

The diminution of voluntary movements and of reflex action are chiefly owing to a powerful depressing influence exerted upon the spinal centres, although the drug does act to some extent upon both motor nerve and muscle, lowering their functional activity. Upon the perceptive and conscious portions of the nervous system nitrite of amyl has almost no influence, so that, as already stated, both consciousness and sensation are preserved in poisoning by it almost to the close.

After toxic doses the animal temperature falls to a most remarkable degree. Very small doses produce in man a slight ($\frac{1}{2}$° F.) temporary increase of the bodily heat, prob-

ably caused by the vascular dilatation. The vapours of nitrite of amyl outside of the body have a very extraordinary power of checking oxidation, and the results of numerous experiments seem to show that in the body the drug lessens very decidedly the chemical interchanges. With the exception of the decrease of temperature, the general symptoms produced by the poison do not seem to be due to this lowered oxidation, but to a direct influence exerted upon the various tissues.

Locally applied the nitrite of amyl causes a progressive loss of power in every highly organized tissue; this may end in a total loss of function, but even after this recovery is possible, provided the poison be withdrawn sufficiently early.

Therapeutic Action. The chief indication for the employment of nitrite of amyl is to relax spasm, either of the vaso-motor muscular fibres or of the voluntary or involuntary muscles. A disease, probably associated with vaso-motor spasm, but whose pathology is not established, in which experience has demonstrated the extreme value of nitrite of amyl, is angina pectoris. Immediate and great relief is nearly always afforded, whether the heart pain is or is not connected with organic cardiac disease. So far as experience goes, the cautious use of the remedy is safe, even when there is severe organic cardiac disease. In these cases it should always be administered by inhalation. Experience has also justified the use of the drug in many spasmodic diseases. In asthma the relief is often immediate; in convulsions occurring after labor the nitrite affords quiet, but its employment is dangerous, on account of its tendency to produce uterine relaxation and consequently flooding. In spasmodic dysmenorrhœa good may be expected from its use; in tetanus it will frequently temporarily arrest the spasm and aid other remedies in obtaining recovery; in strychnia poisoning, in hysterical convulsions, indeed, in almost any convulsive disorder, much is to be expected from its employment. The convulsive stage of the ordinary epileptic paroxysm is so short that the nitrite is usually not available; when, however, there is a marked epileptic stasis and the patient passes from one convulsion to another, the drug may be used with benefit. In those cases in which there is an aura of sufficient length, the epileptic attacks may be arrested by the patient carrying in the pocket a tightly-corked homœopathic phial containing five or ten drops of the remedy, and as soon as the aura commences, inhaling deeply from the opened mouth of the bottle.

Nitrite of amyl is generally administered by inhalation, usually in doses of from three to five drops, although much larger quantities have been given without bad results. The rule is to commence with three drops on a handkerchief held close to the nose, and then to gradually increase *pro re nata*. The handkerchief should always be withdrawn so soon as the face flushes or the heart begins to become excited, as the effects always increase for some time, even if no more be inhaled. The drug may also be given by the mouth, in doses of three to five drops, on sugar or dissolved in alcohol. H. C. W.

ANACAHUITE WOOD. Under this name, in the year 1860, considerable quantities of a peculiar wood were imported from Tampico, in Mexico, into Germany, where for a short time it attracted great attention as a supposed remedy in phthisis. The circumstance that the wood was destitute of taste and smell naturally suggested that it could possess little remedial power; and frequent trials of it in consumptive affections have ended in failure; so that the wood is likely to be forgotten almost as speedily as brought into temporary notoriety. In the mean time, the question of its botanical origin attracted the attention of pharmacologists; and the question has been at length determined by the importation of a living specimen of the tree into Germany, which partially flowered in the botanical garden of Göttingen. This, with dried specimens received from Mexico, enabled the botanists to decide that the wood was the product of the *Cordia Boissieri* of Alphonse De Candolle. (See *Pharm. Journ.*, Dec. 1862, p. 272, where the plant is figured.) W.

ANACARDIUM OCCIDENTALE. Linn. *Cassuvium pomiferum.* Lam. *Cashew-nut.* A small and elegant tree, growing in the West Indies, and other parts of tropical America. A gum exudes from the bark, which bears some resemblance to gum arabic, but is only in part soluble in water, and consists of true gum and bassorin. It is the *gomme d'acajou* of the French writers. The fruit is a fleshy, pear-shaped receptacle, supporting at its summit a hard, shining, ash-coloured, kidney-shaped nut, an inch or more in length, and three-quarters of an inch broad, consisting of two shells, with a black juice between them, and of a sweet oily kernel. The receptacle is red or yellow, and of an agreeable subacid flavour with some astringency. It is edible, and affords a juice which has been recommended in uterine complaints and dropsy. This juice is converted by fermentation into a vinous liquor, which yields a spirit by distillation, used in making punch, and said to be powerfully diuretic. The nuts are well known under the name of *cashew-nuts*. The black juice, contained between their outer and inner shell, is extremely acrid and corrosive, producing, when applied to the skin, severe inflammation, followed by blisters or desquamation. It has been examined chemically by Stoedeler, who found in it two peculiar principles, one having acid properties, which he calls *anacardic acid*, and the other a yellow, oleaginous liquid, named *cardol*. (See *Journ. de Pharm.*, 3e sér., xiii. 459.) The juice is used in the West Indies for the cure of corns, warts, ringworms, and obstinate ulcers, and is said to be sometimes applied to the face

by females, in order to remove the cuticle, and produce a fresher and more youthful aspect. In a case of external poisoning which came under our notice, in a lady who was exposed to the fumes of the nut while roasting, the face was so much swollen that for some time not a feature was discernible. A similar case, occurring in a boy who had cut open one of the nuts, eaten a small portion raw, and by handling it had spread the juice over different parts of the body, is recorded by Dr. Monkur in the *N. J. Med. Reporter* (April, 1855, p. 187). The tongue, face, neck, hands, forearms, scrotum, &c. were red and enormously swollen, and very painful. The tincture of iodine was found useful as a local application to the parts affected. The kernel has a sweet, agreeable taste, and is eaten like chestnuts, either raw or roasted. It is also used as an ingredient of puddings, &c., and forms an excellent chocolate when ground with cocoa. By age it becomes rancid. The black juice of the nut, and a milky juice which flows from the tree by incision, are sometimes used for marking linen, upon which they leave a nearly indelible brown or black stain. W.

ANAGALLIS ARVENSIS. *Scarlet Pimpernel.* An annual plant, growing in Europe and this country, with small, delicate, procumbent stems, furnished with opposite branches, opposite ovate leaves, and small scarlet flowers, which are supported upon axillary, solitary peduncles, and appear in June and July. It has little smell, but a bitterish, somewhat acrid taste. The ancients esteemed it a counter-poison, and in modern times it has been used as a preventive of hydrophobia; but at present no faith is placed in its alexipharmic powers. It is, nevertheless, not wholly inactive; as Orfila found three drachms of an extract prepared from it sufficient to destroy a dog, with marks of inflammation of the bowels. It has been recommended as a local application to old and ill-conditioned ulcers, and has been given internally in visceral obstructions, consumption, dropsy, epilepsy, mania, &c. But too little is known of its precise properties, to authorize its indiscriminate employment in these complaints. Mr. J. A. Heintzelman obtained a small quantity of volatile oil from the dried herb, and found it of a strong peculiar odour, a pungent and somewhat acrid taste, and the sp. gr. 0·987. Four drops of it produced intense headache and nausea, which continued for 24 hours, with pains throughout the body. Another species, considered by Linnæus as a variety of A. arvensis, is *A. cærulea*, distinguished by its blue flowers. The medical properties of the two, so far as is known, are the same. W.

ANCHUSA OFFICINALIS. *Bugloss.* This species of Anchusa is a native of Europe, and unknown in the United States. It is a biennial plant, from one to three feet high, and was formerly much esteemed as a medicine. The root, leaves, and flowers were officinal. These are inodorous and nearly tasteless. The root is mucilaginous and slightly sweetish, and the flowers very feebly bitter. The plant has no claim whatever to the credit, formerly attached to it, of possessing cordial and exhilarating properties. It was used by the ancients in hypochondriacal affections; but, as it was given in wine, the elevation of spirits was probably due to the vehicle. In France, the *Anchusa Italica*, which is there known as *buglosse*, is employed for the same purposes and in the same manner as Borago officinalis. (See *Borago officinalis* in *Part* III.) W.

ANDROMEDA ARBOREA. *Sorrel-tree.* A beautiful indigenous tree, growing in the valleys of the Alleghanies, from Pennsylvania to Florida. The leaves have a pleasant acid taste, which has given rise to the common name of the tree. They are used by hunters to allay thirst, and form in decoction a grateful refrigerant drink in fevers. The other species of Andromeda are shrubs, and some of them ornamental. Dr. Barton, in his "Collections," states that a decoction of *A. Mariana* is employed in the Southern States, as a wash in a disagreeable ulceration of the feet to which the negroes are liable. The powder upon the leaves and buds of *A. speciosa* is said to be a powerful errhine. The oil of *Andromeda Leschenaultii*, a native of India, was found by Mr. J. Broughton to be methyl-salicylic acid, almost identical with Canadian oil of wintergreen. He produced salicylic and finally carbolic acid from it. (*Pharm. Journ. and Trans.*, Oct. 1871, p. 281.) W.

ANEMONE PRATENSIS. *Meadow Anemone.* This plant enjoyed at one time considerable credit from the recommendation of Störck, who believed that he found it useful in amaurosis and other complaints of the eye, in secondary syphilis, and in cutaneous eruptions. Dr. J. de Ramm found it also very useful in hooping-cough. *A. Pulsatilla* (*pulsatilla*), an analogous species, has been employed for similar purposes; and favourable reports have been made of its efficacy in obstinate diseases of the skin, and in hooping-cough. It has been supposed also to possess emmenagogue properties, and to exert an alterative influence over the mucous membranes; rendering it useful in ophthalmia, in catarrhal inflammation of the nostrils, throat, and respiratory passages, and in similar conditions of the alimentary canal and urinary organs. The preparation employed by Störck was an extract of the herbaceous part of the plant, which was given in the dose of one or two grains daily, gradually increased to twenty grains or more. The dried herb, and a tincture and distilled water of the plant were used; the dose of the powder being two or three grains, of the tincture half a fluidrachm, and of the water two or three drachms. In large doses it was found frequently to produce nausea and vomiting, or

griping and looseness of the bowels, and sometimes acted as a diuretic. It is, we believe, a favourite remedy with the homœopathists. For a more particular account of the uses of pulsatilla, the reader is referred to an article by Dr. J. C. Peters, of N. York, in the *Bost. Med. and Surg. Journ.* (Aug. 29, 1867, p. 77). The species of Anemone above mentioned are European plants, and are not cultivated in this country. We have several native species. One of them, *A. nemorosa*, which is common to Europe and the United States, is said to act as a poison to cattle, producing bloody urine and convulsions. It is stated also to have proved, when applied to the head, a speedy cure for tinea capitis. Most of the species are, in the recent state, acrid and rubefacient, resembling in this respect other Ranunculaceæ. They contain a peculiar crystallizable principle, named *anemonin*, convertible into *anemonic acid* by the action of alkalies. (*Ann. der Pharm.*, xxxii. 276.) It is deposited by water distilled from the fresh herb upon standing, and resembles camphor. According to J. Müller, it is formed by a metamorphosis of the acrid matters which are distilled with the water. (*Pharm. Cent. Blatt*, Sept. 11, 1850, p. 618.) M. Dobraschinky obtains it by a method founded on its solubility in chloroform. The distilled water of Anemone pratensis is agitated with one-tenth of this liquid, with which it is continued in contact for some hours; the liquid on standing separates into two layers, the heavier of which, containing the chloroformic solution, is distilled. The chloroform passes, and the residue, constituting one-eighth of the solution, is treated with strong alcohol, heated, and set aside to crystallize. Anemonin separates in handsome crystals having all the properties of that very poisonous alkaloid. (*Journ. de Pharm.*, 4e sér., i. 319.) The *A. Ludoviciana*, an American species, growing in Minnesota and other parts beyond the Mississippi, has been employed with supposed advantage by Dr. W. H. Miller, of St. Paul, in chronic diseases of the eyes, in cutaneous eruptions, and syphilitic affections. Mr. A. W. Miller, having submitted the plant to chemical examination, succeeded in obtaining anemonin from it. (*Am. Journ. of Pharm.*, July, 1862, p. 300.) Mr. F. E. Miller has found the principle in abundance and that it has an acid reaction. (*Am. Journ. of Pharm.*, xlv. 299.) W.

ANGELICA. In various editions the U. S. Pharmacopœia has recognised our indigenous species *Angelica atropurpurea*, and also *Angelica Archangelica*, a native of Europe. But at the last revision both were dismissed. *Angelica atropurpurea*, sometimes called *masterwort*, has a perennial purplish root, and a smooth herbaceous stem, the dark colour of which has given rise to its specific name. The leaves are ternate, and supported by very large inflated petioles. The partitions of the leaf are nearly quinate, with ovate, acute, deeply serrate, somewhat lobed leaflets, of which the three terminal are confluent. The flowers are greenish-white. The purple angelica extends throughout the United States from Canada to Carolina, growing in meadows and marshy woods, and flowering in June and July. It is smaller than *A. Archangelica*, with a less succulent stem. The whole plant was formerly officinal. It has a strong odour, and a warm aromatic taste. The juice of the recent root is acrid, and is said to be poisonous; but the acrimony is dissipated by drying. The medical virtues of the plant are similar to those of the garden angelica of Europe, for which it has been proposed as a substitute. It is, however, little employed. An infusion is occasionally used in flatulent colic, and we are told that the stems are sometimes candied by the country people.

Angelica Archangelica. Garden Angelica has a long, thick, fleshy, biennial root, furnished with many fibres, and sending up annually a hollow, jointed, round, channeled, smooth, purplish stem, which rises five feet or more in height, and divides into numerous branches. The leaves, which stand upon round fistulous footstalks, are very large, doubly pinnate, with ovate-lanceolate, pointed, acutely serrate leaflets, the terminal being three-lobed. The flowers are small, greenish-white, and disposed in very large, many-rayed terminal umbels, composed of numerous dense, hemispherical umbellets. This plant is a native of the north of Europe, and is found in the high mountainous regions in the southern section of that continent, as in Switzerland and among the Pyrenees. It is cultivated in various parts of Europe, and may be occasionally met with in the gardens of this country. It flowers during the summer. The whole plant has a fragrant odour and aromatic properties; but the root and fruit only were officinal. 1. The *root* should be dug up in the autumn of the first year, as it is then least liable to become mouldy and worm-eaten. It is spindle-shaped, an inch or more thick at top, and beset with long descending radicles. The fresh root has a yellowish-gray epidermis, a fleshy yellow parenchyma, and when wounded yields a honey-coloured juice, having all the aromatic properties of the plant. The dried root is grayish-brown and much wrinkled externally, whitish and spongy within, and breaks with a starchy fracture, exhibiting shining resinous points. It is very apt to be attacked by worms, and is said to keep best, in the state of powder, in full and well-closed vessels. The smell is strong and fragrant, and the taste at first sweetish, afterwards warm, aromatic, bitterish, and somewhat musky. These properties are extracted by alcohol, and less perfectly by water. The constituents of the root, according to the younger Buchner, are volatile oil, a volatile acid which he calls *angelicic acid*, a wax-like substance, a crystallizable sub-resin, a brittle amorphous resin, a bitter principle, tannic acid, malic acid, sugar, starch, albumen, pectic acid, fibrin, and various salts. Five hundred parts yield nearly

four parts of volatile oil. 2. The *seeds*, as the fruit is commonly called, are two or three lines long, oval, obtuse or somewhat notched at the ends, flat, with a longitudinal furrow on one side, convex with three angular ridges on the other. They are ash-coloured, and have the smell and taste of the root. They are said to keep well.

Garden angelica is an elegant aromatic tonic, but is little employed in the United States. The Laplanders, in whose country it flourishes, esteem it highly as a condiment and medicine. In Europe, the stems are frequently made into a preserve, and used in desserts in order to excite the stomach. The dose of the root or seeds is from thirty grains to a drachm. W.

ANGRÆCUM FRAGRANS. This is an orchidaceous plant, indigenous in the Isle of Bourbon and Mauritius, where the leaves have been long used, under the name of *faham*, for the same purposes as Chinese tea, to which they are preferred by the natives of these islands. They have a somewhat pungent aromatic taste, and a strong and highly agreeable odour, scenting the whole apartment with a delicious perfume. Given in infusion, they appear to have an effect on the system somewhat similar to that of Chinese tea, and have recently been introduced into Paris, as a rival of that popular beverage. The drink is made by putting the leaves and stalks, in the proportion of 15 grains to a teacupful, into cold water, boiling for about ten minutes, and then pouring into a closed vessel, and sweetening it when used. (*Am. Journ. of Pharm.*, Sept. 1866, p. 441.) W.

ANILIN. *Aniline. Anilia.* This is an organic alkaloid obtained from coal tar. It was first discovered by Unverdorben, in 1826, among the products of the dry distillation of indigo, and was named by him *crystalline*. Fritzshe, who obtained it afterwards from indigo by another process, seems to have been the first to give it the name of anilin. In 1837 Runge obtained three volatile principles from coal tar, which he named *kinol*, *leucol*, and *pyrrhol*. Of these, kinol was afterwards found by Hoffmann to be identical with anilin, and leucol has been ascertained to be the same as quinolin (cincholin). Nitrobenzole has also been made to yield anilin by various processes; and this and coal tar are its chief practical sources. When coal tar is distilled, a set of the more volatile principles first come over, and, when condensed in the liquid form, constitute the *light oil of tar*. This includes benzole. Afterwards, another set come over, heavier, and with a higher boiling point, and these are all embraced under the name of the *heavy oil of tar*. Among these are anilin, quinolin, creasote, phenol, &c. After these follow other substances having when condensed a buttery consistence, among which are paraffin, &c. The heavy oil comes over between the temperatures of 300° and 450° F. At a higher heat than about 480° F. anilin is no longer found among the results of distillation. Hoffmann procures anilin in the following manner. The heavy oil already referred to is agitated with muriatic acid, and set aside for 12 or 14 hours. The liquid separates into an oily and an acid layer. The latter is separated and agitated with another portion of oil, though not to full saturation. The acid liquid containing the alkaloids in the form of muriates, having been filtered to separate all the oil, is mixed with an excess of lime and distilled. A milky liquid comes over containing the alkaloids, and anilin among them. These are again saturated with diluted muriatic acid, and the solution, after being concentrated by a water-bath, is treated with a slight excess of soda or potassa. The bases then set free float on the surface of the liquid, and, having been removed by a pipette, are rectified by distillation. The distillate which first comes over, at a heat short of 400° to 420° F., is anilin sufficiently pure for commercial purposes. Beyond the latter heat it is principally quinolin that comes over. To get anilin chemically pure, oxalic acid in alcoholic solution is added to the impure alkaloid. Oxalate of anilin is thrown down as a mass of white crystals. This is washed with alcohol, pressed, and then dissolved in water with a little alcohol, from which the oxalate crystallizes on concentration. The oxalate is decomposed by a caustic alkali, and the anilin, thus set free, is distilled once more. Water first comes over, then water with some anilin, and lastly pure anilin. (See *Am. Journ. of Pharm.*, Jan. and March, 1861, pp. 39 and 129, for the abstract of a paper by M. E. Kopp, abridged from the *Moniteur Scientifique*, t. ii. liv. 86.) For the mode of preparing anilin from nitrobenzole, the reader is referred to a paper by Prof. Procter in the *Am. Journ. of Pharm.*, July, 1862, p. 296; also to a memoir by MM. Depoully, translated in the *Chem. News*, Oct. 5, 1866, p. 157.

Properties. Pure anilin is a thin colourless fluid, of an oily appearance; but as found in the shops it is generally more or less coloured, and sometimes of a deep reddish-brown. It has a peculiar not disagreeable odour, and a pungent, aromatic, burning taste, and the sp. gr. 1·020 (*Hoffmann*), 1·028 (*Fritzshe*). It is not solidified at —4° F., boils at 360°, and its vapours are condensed unchanged. It is slightly soluble in water. Though possessed of strong basic powers, it does not restore the colour of reddened litmus, nor does it redden turmeric. It changes, however, the violet colour of dahlias to green. With the acids it forms soluble and readily crystallizable salts. It is inflammable, and absorbs oxygen from the air, becoming at first yellowish, afterwards reddish, and ultimately brown. A characteristic property is that it produces instantly a deep-blue or purple colour when brought into contact with chlorinated lime or other hypochlorite. Dr. Letheby has described a very delicate test for this alkaloid. If a drop of a very weak solution of the sulphate be placed on a piece of clean platinum foil, and touched with

the negative pole of a galvanic battery, the solution acquires a bluish, then a violet, and ultimately a pink colour. (*Pharm. Journ.*, Sept. 1862, p. 128.) It consists of carbon, hydrogen, and nitrogen; its formula being $C_{12}H_7N$. The chief value of anilin at present is for the colouring matters derived from it. Beautiful reds, purples, yellows, and blues, and various other tints are obtained from it, some of them truly magnificent. (See *Am. Journ. of Sci. and Arts*, May, 1863, p. 417; *Am. Journ. of Pharm.*, 1875, p. 126; *Journ. de Pharm.*, Janv. 1870, p. 21; Août, 1875, p. 120; *Chem. News*, June 6, 1873, p. 275.) An anilin black has also been obtained, but by a process somewhat different from that used for the other colours. (*Chem. News*, Feb. 10, 1865, p. 65.) Some of these colours are advantageously used in the preparation of inks. For the mode of making from them inks of different hues, even a black indelible ink, the reader is referred to the *Am. Journ. of Pharm.*, July, 1868, pp. 332 and 335. Anilin colours have been advantageously employed by Dr. J. J. Woodward, U. S. A., in histological researches; as they have the property of permanently colouring the cells and cell-derivatives of animal structures, without affecting the other constituents. For general use, he prefers the anilin red, and dissolves it in dilute acetic acid, or sometimes in water. (*Am. Journ. of Med. Sci.*, Jan. 1865, p. 106.) Böttger uses anilin red in detecting cotton in any fabric with which it is mixed. He dips a portion of the texture in an alcoholic solution of this colouring matter, then washes it with water till the washings are colourless, and puts it into a watery solution of ammonia. If cotton be present, its threads will be deprived of colour, while the linen will continue of a bright rose colour. (See *Am. Journ. of Pharm.*, Jan. 1866, p. 86.)

Medical Properties and Uses. Anilin is said by Wöhler and Frerichs to have no poisonous action on dogs. This is, however contradicted by the experiments of Dr. Letheby, who found that from 20 to 60 drops given to dogs and cats caused a rapid loss of respiratory powers, passing into coma, and ending in death. (*Guy's Hosp. Reports*, A. D. 1864, p. 198.) Some experiments have been made which show that it has a deleterious influence on leeches and frogs, and young rabbits were killed by it. A case is on record in which a workman having been exposed strongly to the vapours of anilin, in consequence of a vessel containing it having broken and spilled the contents over his person, was seized with symptoms of great prostration, from which, however, he recovered under stimulating treatment. (*Med. Times and Gaz.*, June 7, 1862.) Several other instances have since occurred, in which persons inhaling the vapour of anilin in the process of manufacture have been seriously affected; the prominent symptoms being violent attacks of neuralgia, heaviness in the head, giddiness, and apparent prostration, sometimes confining the workmen to bed for days; but in all instances recovery took place, leaving, so far as appears, no serious evil behind; showing that the action of the poison is directed mainly, if not exclusively, to the nervous system. (*B. and F. Med.-chir. Review*, April, 1866, p. 539.) It would seem, however, from the experiments of Dr. Letheby, that the salts of anilin are destitute of the poisonous properties of the pure alkaloid; though a change of colour is sometimes produced by them; a patient who had taken a considerable quantity of the sulphate having his skin, nails, and gums stained yellow. The colour, however, disappeared in a few days. (*Journ. de Pharm.*, 4e sér., iii. 397.) Some of the anilin colours, or those derived from substances belonging to the same series, used in dyeing, are said to have a violently irritant effect upon the skin to which the fabric dyed with them may be brought into contact; and, in some instances, constitutional effects seem to have been induced. These are, however, probably due to the anilin being contaminated with arsenic, which is used in its manufacture. (*Am. Journ. of Pharm.*, 1875, p. 210; *Med. Times and Gaz.*, Jan. 1870, p. 46.) For further observations on this point, see the article on *coralline*, in the present part of the *Dispensatory*. Dr. Turnbull, of Liverpool, has employed the sulphate remedially, and speaks favourably of its effects in chorea. A remarkable effect which he found it to produce was a transient blueness of the skin and lips, which he ascribed to the oxidation of anilin in the blood. (*Pharm. Journ.*, Nov. 1861, p. 284.) In some instances headache and symptoms of general depression were experienced, which, however, disappeared without leaving any unpleasant effect. The sulphate is made by simply saturating the alkaloid with the acid. Prof. Procter gives the following formula. Take 500 grains of pure anilin, 250 grains of sulphuric acid, and 4 fluidounces of distilled water. Mix the acid and water, add the anilin, and agitate till a thick mass is formed, and the odour of anilin is lost. Wash this with strong alcohol till the acid and colouring matter are removed, press the salt in bibulous paper, and dry it in the dark. (*Am. Journ. of Pharm.*, July, 1862, p. 298.) The salt is liable to be decomposed, and to change colour when exposed to air and light. Water at 60° dissolves about 6 per cent. It is only sparingly soluble in cold, but freely in hot absolute alcohol. It is more soluble in diluted alcohol, and insoluble in ether. The limits of the dose have not been satisfactorily determined. It has been given in the dose of three-fourths of a grain gradually increased to four or even seven grains, without any derangement of the functions, except the change of colour above referred to; but how far the latter dose may be exceeded with impunity has not been ascertained. (*Ann. de Thérap.*, 1864, p. 101.) From trials which have been made of the remedy by Drs. Fraser and

Davis, it has been inferred that the sulphate is much less powerful than the free alkaloid; and it is even stated that, while anilin itself is a powerful poison, the sulphate has little effect on the system. (*Pharm. Journ.*, Sept. 1863, p. 133.) Since the statements here made, the sulphate of anilin has been used in chorea and epilepsy with varying success. After failure in several cases of chorea, Dr. Fraser treated the disease successfully in two cases of a rather unpromising character, giving 5 grains of the sulphate three times a day. About half an hour after the medicine was taken, the mucous membrane of the mouth, and the nails became of a mauve colour, which increased for about two hours, and then disappeared. The patients complained more or less of headache and giddiness in the course of the treatment. In one of them 200 grains of the medicine were taken in about three weeks. (*Med. Times and Gaz.*, Aug. 1865, p. 142.) Dr. Filiberti, of Lyons, gives the sulphate with encouraging results in chorea and epilepsy. Beginning with a grain and one-half daily in two doses, he increases by the same amount daily till the dose reaches 15 grains, when he diminishes it in the same proportion till reduced to from 3 to 7 grains daily, which is continued. (*Ann. de Thérap.*, 1865, p. 124; from *Gaz. Méd. de Lyon.*)* W.

ANIMÉ. *Gum Animé.* The substance known at present by the name of animé is a resin supposed to be derived from the *Hymenæa Courbaril*, a tree of South America; though this origin is denied by Hayne. According to Dr. W. Hamilton, the resin exudes from wounds in the bark, and is found also underneath the surface of the ground, between the principal roots. (*Pharm. Journ.*, vi. 522.) It is in small, irregular pieces, of a pale lemon-yellow colour, sometimes inclining to reddish, more or less transparent, covered with a whitish powder, brittle, and pulverizable, with a shining fracture, a weak but agreeable odour, and a mild, resinous taste. It softens in the mouth, adheres to the fingers when in powder, and readily melts with heat, diffusing its agreeable odour in an increased degree. It consists of two resins, one soluble, the other insoluble in cold alcohol, and of a small proportion of volatile oil. There is a variety of a darker colour, less transparent, and with small cavities in the interior; in other respects resembling the preceding. Another variety is the East Indian, supposed to be derived from *Vateria Indica;* but this never reaches us as a distinct article of commerce. Animé formerly entered into the composition of various ointments and plasters; but is now used only as incense, or in the preparation of varnishes. The Brazilians are said to employ it internally in diseases of the lungs. W.

ANNOTTA. *Orleana.* The colouring substance called *annotta*, *arnotta*, or *roucou*, is the reddish pulp surrounding the seeds in the fruit of *Bixa Orellana*, a middling-sized tree, growing in Guiana, and other parts of South America. For a paper on the cultivation of this tree and the mode of preparing the annotta, by Mr. Th. Peckolt, see *Am. Journ. of Pharm.* (July, 1859, p. 360). The pulp is separated by bruising the fruit, mixing it with water, then straining through a sieve, and allowing the liquid to stand till the undissolved portion subsides. The water is then poured off, and the mass which remains, having been sufficiently dried, is formed into flat cakes or cylindrical rolls, and sent into the market. Another mode is to bruise the seeds, mix them with water, and allow the mixture to ferment. The colouring matter is deposited during the fermentation, after which it is removed and dried. In commerce there are two kinds of annotta, the Spanish or Brazilian, and French; the former coming in baskets from Brazil, the latter in casks from French Guiana. The French, which is also called *flag annotta*, has a disagreeable smell, probably from having been prepared by the fermenting process; but is superior, as a dye-stuff, to the Spanish, which is without any disagreeable odour. Annotta is of a brownish-red colour, usually rather soft, but hard and brittle when dry, of a dull fracture, of a sweetish peculiar odour, and a rough, saline, bitterish taste. It is inflammable, but does not melt with heat. It softens in water, to which it imparts a yellow colour, but does not dissolve. Alcohol, ether, the oils, and alkaline solutions dissolve the greater part of it. It contains a peculiar crystallizable colouring principle, to which M. Preisser, its discoverer, gave the name of *bixin*. (See *Journ. de Pharm.*, 3e sér., v. 258.) For a method of obtaining this principle, see *Journ. de Pharm.*, Janv. 1875, p. 78. The chief uses to which annotta is applied are for dyeing silk and cotton orange-yellow, and for colouring cheese. The colour, however, which it imparts to cloth, is fugitive. It has been given internally as a medicine; but is not now used, and probably exercises little influence upon the system. In pharmacy it is used to colour plasters, and has occasionally been substituted for saffron. It is said to be sometimes largely adulterated; and red ochre, powdered bricks, colcothar, farinaceous substances, chalk, sulphate of calcium, turmeric, &c., have been employed for the purpose. The mineral substances, if present, will be left behind when the annotta is burned. (See, in reference to its adulteration, *Pharm. Journ.*, xv. 199, 299, and 323.) W.

ANTENARIA MARGARITACEA. This is one of our indigenous plants which are known commonly by the name of *life-everlasting*. It is an herbaceous plant, a foot or two in height, and grows everywhere in the U. States northward of N. Carolina. For a description of the plant, see Gray's Manual of Botany (p. 229). The flowers are

* For an article upon the methods of detecting anilin in the body, see *Journ. de Pharm.*, 4e sér., xix. 341, 417.

of a pearly whiteness, and slightly fragrant. The leaves are the part used, having the credit, with the "eclectics," of being somewhat astringent and expectorant. W.

ANTHRAKOKALI. This preparation, introduced by Dr. Polya, is of two kinds, the simple and the sulphuretted. The *simple anthrakokali* is formed by adding 160 parts of porphyrized mineral coal to 192 parts of a concentrated and boiling solution of caustic potassa, contained in an iron vessel, the whole being well stirred together. When the mixture is completed, the vessel is taken from the fire, and the stirring continued until the whole is converted into a homogeneous black powder. The *sulphuretted anthrakokali* is prepared in a similar manner, 16 parts of sulphur being mixed with the mineral coal before it is added to the caustic potassa solution. Dr. Polya recommends these preparations, both internally and externally, in scrofula, chronic rheumatism, rheumatic tumours of the joints, and certain herpetic affections. The dose is a grain and a half three or four times a day, mixed with two or three times its weight of powdered liquorice root. For external use, sixteen grains may be rubbed with an ounce of lard to form an ointment, to be used by friction night and morning. B.

ANTHRISCUS CEREFOLIUM. De Cand. *Chærophyllum sativum.* Lam. *Scandix Cerefolium.* Linn. *Chervil.* An annual European plant, cultivated in gardens as a pot-herb, and supposed by some to possess remedial powers. It has a strong agreeable odour, especially when rubbed, and a pungent, slightly bitterish taste. These properties it owes to a volatile oil, which may be separated by distillation with water. It is said to be deobstruent, diuretic, and emmenagogue, and has been recommended by different authors in consumption, scrofula, dropsy, cutaneous and scorbutic affections, and as an external application to swollen breasts, bruises, and other local complaints or injuries. It is, however, very feeble, and is more used as an addition to broths than as a medicine. W.

ANTIMONIATED HYDROGEN. This is a gaseous substance, and, being taken by inhalation, is prepared at the moment of administration. A drachm of pure antimony and twice the quantity of pure zinc formed into an alloy, and a drachm of tartar emetic or chloride of antimony, are mixed, and introduced into a bottle with a large tubulure; and from time to time, as the gas is wanted for inhalation, from half a drachm to a drachm of muriatic acid is added, of which the whole quantity must not exceed about eight drachms. Muriatic acid gas is evolved at the same time with the antimoniated hydrogen; and to prevent the inhalation of the former, a sponge wet with an alkaline solution is made to close the respiratory orifices. This arrests the acid gas, but allows the other to pass into the lungs. The patient is to breathe the atmosphere impregnated in this manner for five minutes every hour. Besides, the bottle may be left unstopped in the mean time, so that the air of the chamber may become more or less affected. It is asserted that few therapeutical agents are more powerful than this in pneumonia and capillary bronchitis with fever. The gas is inodorous and unirritating, and the respiration is in no degree oppressed. The pulse diminishes in frequency and force, without nausea or vomiting; the expectoration is facilitated and increased; and a cure is effected more quickly than by any other known method of treatment. Such are the statements made by M. J. Hannon, an abstract of which may be seen in *Bouchardat's Annuaire* (1860, p. 143). A method of preparing pure antimoniated hydrogen, with the figure of an instrument for that purpose, by Mr. W. L. Scott, will be found described in the *Med. Times and Gaz.* (Octob. 1865, p. 402). W.

ANTIRRHINUM LINARIA. Linn. *Linaria Vulgaris.* (Lindley.) *Common Toadflax.* This is a perennial herbaceous plant, from one to two feet high, with numerous narrow linear leaves, and a terminal crowded spike of large yellow flowers. It is a native of Europe, but has been introduced into this country, and now grows in great abundance along the roadsides, through the Middle States. It is readily distinguishable by the shape of its leaf, and its conspicuous yellow flowers, which appear in succession from June to October. The herb is the part used. It should be collected when in flower, dried quickly, and kept excluded from the air. When fresh it has a peculiar, heavy, rather disagreeable odour, which is in a great measure dissipated by drying. The taste is herbaceous, weakly saline, bitter, and slightly acrid. This plant is said to be diuretic and cathartic, and has been used in dropsy, jaundice, and cutaneous eruptions. It is most conveniently employed in infusion. The fresh plant is sometimes applied, in the shape of poultice or fomentation, to hemorrhoidal tumours; and an ointment made from the flowers has been employed for the same purpose, and also locally in diseases of the skin. The flowers are used in Germany for dyeing yellow. W.

AQUA BINELLI. An Italian nostrum, named after a physician of Turin, which at one time enjoyed great reputation in Europe as a styptic; but has been proved to possess very little efficacy. It is a transparent liquid, with little taste, and an empyreumatic odour, and, after the discovery of creasote, was conjectured to contain a small proportion of that principle. It is now out of use. A recipe for its preparation is given in the *Annuaire de Thérapeutique*, 1843, p. 227. W.

AQUILEGIA VULGARIS. *Columbine.* A perennial herbaceous plant, indigenous in Europe, but cultivated in our gardens as an ornamental flower. All parts of it have

been medicinally employed. The root, leaves, and flowers have a disagreeable odour, and a bitterish, acrid taste. The seeds are small, black, shining, inodorous, and of an oleaginous sweetish taste, followed by a sense of acrimony. Columbine has been considered diuretic, diaphoretic, and antiscorbutic, and has been employed in jaundice, in smallpox to promote the eruption, in scurvy, and externally as a vulnerary. It is not used at present, and is even suspected to possess dangerous properties, like most other Ranunculaceæ. W.

ARECA NUT. *Betel Nut.* This is the product of *Areca Catechu*, an East India tree belonging to the family of palms. The fruit, which is about the size and shape of a small egg, and of an orange-yellow colour, contains the nut embedded in a fibrous, fleshy envelope, and invested with a brittle shell which adheres to the exterior flesh. The kernel, which is the betel-nut of commerce, is of a roundish conical shape, rather larger than a chestnut, externally of a deep-brown diversified with a fawn colour, so as to present a reticular appearance, internally brownish-red with whitish veins, very hard, of a feeble odour when broken, and of an astringent, somewhat acrid taste. It abounds in tannin, and contains also gallic acid, a fixed oil, gum, a little volatile oil, lignin, and various saline substances. It yields its astringency to water; and, in some parts of Hindostan, an extract is prepared from it having the appearance and properties of catechu. Immense quantities of the nut are consumed in the East, mixed with the leaves of the Piper Betel, and with lime, forming the masticatory so well known by the name of *Betel*. The red colour which this mixture imparts to the saliva and the excrements is owing to the areca nut, which is also powerfully astringent, and, by its internal use, tends to counteract the relaxation of bowels to which the heat of the climate so strongly predisposes. The nut is used, in this country, almost exclusively in the preparation of tooth powder, for which purpose it is first reduced by heat to the state of charcoal. The superiority of this form of charcoal over that from other sources is probably owing to its hardness. The nut has been used successfully in Great Britain, by Dr. Edwin Morris, in the treatment of the tapeworm, in doses of from four to six drachms. (See *Am. Journ. of Med. Sci.*, April, 1862, p. 496.) In India the fresh *grated* nut is used for the same purpose, a teaspoonful being given after twelve hours' fasting. (*Pharm. Journ. and Trans.*, Feb. 1874, p. 649.) W.

ARGEMONE MEXICANA. *Prickly Poppy.* An annual plant, belonging to the Papaveraceæ, growing in our Southern and Western States, Mexico, the West Indies, Brazil, and in many parts of Africa and Southern Asia. According to Dr. E. Bonavia, it grows abundantly about Lucknow, in Hindostan. (*Pharm. Journ.*, Nov. 1866, p. 297.) It has an erect, somewhat glaucous, bristly stem, with alternate sessile leaves, sinuated and prickly at the angles, and usually marked with white spots. The flowers are solitary, yellow or white, with two or three prickly deciduous sepals, four or six large petals, about twenty stamens, and four to six reflected stigmas. The whole plant abounds in a milky, viscid juice, which becomes yellow on exposure to the air. The plant was submitted to chemical examination by M. Charbonnier, who obtained from it a minute quantity of an alkaloid, which gave evidence to tests of being very similar to morphia, if not identical with it, as it is believed to be by its discoverer. (*Journ. de Pharm.*, Mai, 1868, p. 352.) From the statements of different authors, it may be inferred that the plant is emetic and purgative, and possesses also narcotic properties. The juice, which is acrid, has been used internally in obstinate cutaneous eruptions, and as a local application to warts and chancres, and in diseases of the eyes. The flowers are stated by De Candolle to have been employed as a soporific. But the seeds are most esteemed. They are small, round, black, and roughish. In the dose of two drachms, infused in a pint of water, they are said to act as an emetic. In smaller doses they are purgative. An oil may be obtained from them by expression, which has the cathartic property of the seeds, and, according to M. Lepine, might be advantageously used in the arts. (*Journ. de Pharm.*, Juillet, 1861, p. 16.) It may be separated by means of sulphuret of carbon, and, thus procured, it is described by M. Charbonnier as of a light-yellow colour, limpid, transparent, retaining its fluidity at 41° F., of a somewhat nauseous odour, and of a slightly acrid taste, which, however, are not disagreeable. It is a drying oil, and is entirely soluble in 5 or 6 measures of alcohol at 90°. It is thought applicable to various purposes in the arts, especially to painting; and the cultivation of the plant with a view to its production is suggested as a promising enterprise. M. Charbonnier found it gently cathartic in the dose of 15 to 25 drops, and emeto-cathartic in larger doses. (*Journ. de Pharm.*, Mai, 1868, p. 348.) According to Dr. W. Hamilton, the seeds unite an anodyne and soporific with the cathartic property; and, in the hands of Dr. Affleck, of Jamaica, have proved useful in flatulent colic, given in emulsion, in the dose of about eight grains, repeated every half hour till three doses were taken. The pain was relieved, and the bowels opened. (*Pharm. Journ.*, xiii. 642.) Dr. Bonavia also found it useful in colic with constipation, and, following a practice common in Upper India, applied it very successfully, as a local remedy, in a troublesome cutaneous affection about the waist, called the *dhad*, which is apt to occur in those regions. W.

ARUM. The root or cormus of *Arum maculatum* is occasionally used as a medicine

in Europe, and formerly held a place in the Dublin Pharmacopœia. Its properties closely resemble those of our *A. triphyllum*, which, until the last edition, was recognised by our Pharmacopœia. Its constituents, according to Enz, are a neuter acrid volatile principle soluble in ether, starch, gum, mucilage, sugar, lignin, albumen, saponin, fixed oil, resin, and phosphate of calcium; the fresh cormus containing 58·4 per cent. of water, 5·2 of lignin, and 27·2 of starch. (See *Am. Journ. of Pharm.*, xxxi. 352.) In overdoses it is capable of producing fatal effects, through the violent inflammation caused by it in the mouth, fauces, œsophagus, and stomach. A fatal case, occurring in a child three years old, is recorded in the *Annuaire de Thérapeutique* (A. D. 1862, p. 16), in which, besides the effects mentioned, profound torpor occurred at the end of three hours, followed by intense febrile reaction, and subsequent prostration. It is no doubt the acrid volatile principle to which these effects are to be ascribed. The root of *A. esculentum*, which abounds in starch, is much used by the natives of the Sandwich and other islands of the Pacific, as an article of food, having been previously deprived of its acrimony by heat.

Arum triphyllum. Wild. *Sp. Plant.* iv. 480; Bigelow, *Am. Med. Bot.* i. 52. The *dragon-root*, *Indian turnip*, or *wake-robin*, as this plant is variously called, has a perennial root or cormus, which, early in spring, sends up a large, ovate, acuminate, variously coloured spathe, convoluted at bottom, flattened and bent over at top like a hood, and supported by an erect, round, green or purplish scape. Within the spathe is a club-shaped spadix, green, purple, black, or variegated, rounded at the end, and contracted near the base, where it is surrounded by the stamens or germs in the diœcious plants, and by both in the monœcious, the female organs being below the male. The spathe and upper portions of the spadix gradually decay, while the germs are converted into a compact bunch of shining scarlet berries. The leaves, usually one or two in number, and upon long sheathing footstalks, are composed of three ovate acuminate leaflets, paler on their under than their upper surface, and becoming glaucous as the plant advances. There are three varieties of this species, distinguished by the colour of the spathe, which, in one is green, in another dark-purple, and in a third white. The plant is a native of North and South America, and is common in all parts of the United States, growing in damp woods, in swamps, along ditches, and in other moist shady places. All parts of it are highly acrid, but the root only was officinal. This is roundish, flattened, an inch or two in diameter, covered with a brown, loose, wrinkled, epidermis, and internally white, fleshy, and solid. In the recent state, it has a peculiar odour, and is violently acrid, producing, when chewed, an insupportable burning and biting sensation in the mouth and throat, which continues for a long time, and leaves an unpleasant soreness behind. According to Dr. Bigelow, its action does not readily extend through the cuticle, as the bruised root may lie upon the skin till it becomes dry, without producing pain or redness. The acrid principle is extremely volatile, and is entirely driven off by heat. It is not imparted to water, alcohol, or olive oil, but is probably soluble in ether, as may be inferred from the experiments of Enz, before referred to, on *A. maculatum*. The root loses nearly all its acrimony by drying, and in a short time becomes quite inert. It was found by Mr. D. S. Jones, besides the acrid principle, and from 10 to 17 per cent. of starch, to contain albumen, gum, sugar, extractive, lignin, and salts of potassa and lime. (*Am. Journ. of Pharm.*, xv. 83.) The starch may be obtained from it as white and delicate as from the potato. In Europe, the dried root of *A. maculatum* is said sometimes to be employed by the country people, in periods of great scarcity, as a substitute for bread; and an amylaceous substance is prepared from it, in small quantities, in the Isle of Portland, on the south coast of England, and called *Portland arrow-root*, or *Portland sago*. The Indian turnip may be preserved fresh for a year, if buried in sand.

Arum in its recent state is a powerful local irritant, possessing the property of stimulating the secretions, particularly those of the skin and lungs. It has been advantageously given in asthma, pertussis, chronic catarrh, chronic rheumatism, and various affections connected with a cachectic state of the system. As immediately taken from the ground, it is too acrid for use. The recently dried root, which retains a portion of the acrimony, but not sufficient to prevent its convenient administration, is usually preferred. It may be given in the dose of ten grains, mixed with gum arabic, sugar, and water, in the form of emulsion, repeated two or three times a day, and gradually increased to half a drachm or more. The powder, made into a paste with honey or syrup, and placed in small quantities upon the tongue, so as to be gradually diffused over the mouth and throat, is said to have proved useful in the aphthous sore-mouth of children. W.

ARSENIATE OF AMMONIUM. *Ammonii Arsenias.* This salt is obtained in crystals by saturating a concentrated solution of arsenic acid with ammonia or carbonate of ammonium, and allowing it to evaporate spontaneously. It has been used with advantage by Biett in several inveterate diseases of the skin. It is administered in solution, formed by dissolving a grain of the salt in a fluidounce of distilled water. Of this the dose is from twenty to twenty-five drops, given in divided portions in the course of the day, and gradually increased. B.

ARSENIATE OF ANTIMONY. This is a heavy snow-white powder, containing 56 per cent. oxide of antimony, and 44 per cent. arsenic acid. It is stated that it is used

in Russia in doses of 0·0012 gramme four times a day. (*Am. Journ. of Pharm.*, xliv. 301.) H. C. W.

ARSENIC ACID. *Acidum Arsenicum.* This acid is described at *page* 152. It has similar therapeutic effects to those of arsenious acid, but is more poisonous. The dose is the twentieth of a grain, given in aqueous solution. B.

ASARABACCA. This is the product of *Asarum Europæum*, an herbaceous perennial plant, growing in Europe, between 37° and 60° north latitude, in woods and shady places, and flowering in May. All parts of the plant are acrid. The leaves were specially directed by the London College, when the plant was recognised as officinal; but the whole plant, including the root, stem, leaves, and flowers, is usually kept in the shops. The root is about as thick as a goose-quill, of a grayish colour, quadrangular, knotted and twisted, and sometimes furnished with radicles at each joint. It has a smell analogous to that of pepper, an acrid taste, and affords a grayish powder. The leaves, which have long footstalks, are kidney-shaped, entire, somewhat hairy, of a shining deep-green colour when fresh, nearly inodorous, with a taste slightly aromatic, bitter, acrid, and nauseous. Their powder is yellowish-green. Both parts rapidly lose their activity by keeping, and ultimately become inert. Geiger, however, asserts that they keep well if perfectly dry. Their virtues are imparted to alcohol and water, but are dissipated by decoction. According to MM. Feneulle and Lassaigne, the root contains a concrete volatile oil, a very acrid fixed oil, a yellow substance analogous to *cytisin*, starch, albumen, mucilage, citric acid, and saline matters. The latest analysis is by Gräger, who found in the *root* a liquid volatile oil, two concrete volatile substances called respectively *asarum camphor* or *asarone*, and *asarite*, a peculiar bitter principle called *asarin*, tannin, extractive, resin, starch, gluten, albumen, lignin, citric acid, and various salts; in the *leaves*, asarin, tannin, extractive, chlorophyll, albumen, citric acid, and lignin. The active principles appear to be the volatile oil, which is lighter than water, glutinous, yellow, of an acrid and burning taste, and a smell like that of valerian, and the asarin, which is soluble in alcohol and very bitter, and is probably the same as the *cytisin* of Feneulle and Lassaigne. (See *Cytisus Laburnum*, in *Part* III.) The root and leaves of asarabacca, either fresh or carefully dried, are powerfully emetic and cathartic, and were formerly much used in Europe with a view to these effects. The dose is from thirty grains to a drachm. But as an emetic they have been entirely superseded by ipecacuanha; and they are now used chiefly, if not exclusively, as an errhine. One or two grains of the powdered root, snuffed up the nostrils, produce much irritation, and a copious flow of mucus, which is said to continue sometimes for several days. The leaves are milder, and generally preferred. They should be used in the quantity of three or four grains, repeated every night until the desired effect is experienced. They have been strongly recommended in headache, chronic ophthalmia, and rheumatic and paralytic affections of the face, mouth, and throat; and are in great repute in Russia, as a remedy for the deranged state of health consequent on habits of intoxication. W.

ASCLEPIAS CURASSAVICA. *Bastard Ipecacuanha. Redhead. Blood Weed.* This is a pretty species of Asclepias, from one to three feet high, and bearing umbels of bright red flowers. It is a native of the West Indies, abounding especially in Nevis and St. Kitts, where it is considerably used as a medicine. Both the root and expressed juice are emetic, the former in the dose of one or two scruples, the latter in that of a fluid-ounce or more. They are also cathartic in somewhat smaller doses; and the expressed juice, made into a syrup with sugar, has been strongly recommended as a remedy in worms. The medicine, however, is somewhat uncertain in its operation. According to Dr. W. Hamilton, the plant may also be usefully employed in arresting hemorrhages, and in obstinate gonorrhœa, in which it has been found very efficient by Dr. Barham. (See *Am. Journ. of Pharm.*, xix. 19.) W.

ASPARAGUS OFFICINALIS. *Asparagus.* This well-known garden vegetable is a native of Europe. It is perennial and herbaceous. The *root*, which is inodorous, and of a weak, sweetish taste, was formerly used as a diuretic, aperient, and purifier of the blood; and it is stated to be still employed to a considerable extent in France. It is given in the form of decoction, made in the proportion of one or two ounces of the root to a quart of water. Hayne asserts that, in the dried state, it is wholly inert. In the *berries* H. Reinsch has found a large proportion of glucose and a yellowish-red colouring matter, *Spargine*. (*Am. Journ. of Pharm.*, xlii. 371.) The *young shoots* are much used as food. Before being boiled they have a disagreeable taste; and their juice was found by Robiquet and Vauquelin to contain a peculiar crystallizable principle, called *asparagin*. (See *page* 103.) This has been thought not to exert any special influence on the system; but Dr. Allen Dedrick, of New Orleans, has found it to be sedative to the circulation, eight grains of it having reduced his own pulse from 72 to 56 in the minute, while, at the same time, brief frontal headache, a sense of fulness of the eyes, and a feeling of muscular weakness were experienced. The effect on the pulse was perceived at the end of five minutes, was at its height in an hour, and continued so for half an hour, when it gradually subsided. The pulse was also rendered intermittent. (*N. O. Med. and Surg. Journ.*, xi. 198.) Asparagin is said to be obtained with facility

by the process of dialysis. If the thick viscid mucilage of the marshmallow (*Althæa officinalis*) be put into a dialyser, with distilled water outside, the asparagin passes into the water, and may be obtained in crystals by evaporating the solution. (See *Pharm. Journ.*, May, 1862, p. 572.) It might probably be obtained in the same way from an infusion of asparagus.

The sprouts themselves are not without effect; as the urine acquires a disagreeable odour very soon after they have been eaten. They have been accused of producing irritation, with a morbid flow of mucus, of the urinary passages. (*Ann. de Thérap.*, 1861, p. 107.) They are considered by some writers as diuretic, aperient, and deobstruent, and as constituting a very wholesome and useful article of diet, early in the spring, when vegetables are scarce. Broussais thought that they were sedative to the heart, and recommended them especially in hypertrophy and other diseases of that organ attended with excessive action, and without phlogosis of the stomach. M. Gendrin, however, after much experience with asparagus, affirms that he never knew it to exercise the slightest influence over the heart, and ascribes its palliative effects, in diseases of that organ, to a diuretic action. He found it, in all the cases in which he administered it, to increase the quantity of urine, which, in some instances, was quintupled. The most convenient forms for exhibition are those of syrup and extract, prepared from the shoots. The former may be given in the dose of one or two fluidounces, the latter of half a drachm or a drachm. The syrup may be made by adding a sufficient quantity of sugar to the expressed juice of the shoots, previously deprived of its albumen by exposure to heat and by filtration; the extract, by evaporating the same juice to the consistence of a pilular mass. Dr. S. J. Jefferson, of England, has employed a tincture of asparagus for 16 years with great benefit, as an adjuvant of other diuretics. He prepares the tincture either by macerating 5 ounces of the dried tops in 2 pints of proof spirit; or by taking 5 pounds of the fresh tops, expressing the juice, evaporating it to a pint, straining, and adding a pint of rectified spirit. He gives from half a drachm to two drachms with each dose of the diuretic employed. (*Am. Journ. of Med. Sci.*, N. S., xxx. 490; from the *Assoc. Med. Journ.*) The *berries* are capable of undergoing the vinous fermentation, and affording alcohol by distillation. In their unripe state they possess the same properties as the shoots, and probably in a much higher degree. We have employed a syrup prepared from them, with apparent advantage, in a case of diseased heart. The seeds have been tried as a substitute for coffee, which, when treated in the same way, they are said to resemble in flavour. (See *Boston Med. and Surg. Journ.*, July 19, 1854.) W.

ASPLENIUM FILIX FŒMINA. R. Brown. *Female Fern.* This is the *Polypodium Filix fœmina* of Linn., the *Aspidium Filix Fœmina* of Swartz, and the *Athyrium Filix fœmina* of Roth. It has a root analogous in character to that of the male fern (*Aspidium Filix mas*), and has been supposed to possess similar vermifuge properties. At present, however, it is not used. The vulgar name of *female fern* is also given to the *Pteris aquilina*, or *common brake*, which is said by some authors to have the property of destroying the tapeworm. The leaves of two species of Asplenium, *A. Trichomanes*, or *common spleenwort*, and *A. Adiantum-nigrum*, or *black spleenwort*, are mucilaginous, and have been used as substitutes for the *maidenhairs* (*Adiantum Capillus Veneris* and *A. Pedatum*) as pectorals, though destitute of the aromatic flavour which is their chief recommendation. W.

ASTER PUNICEUS. (*Gray's Manual*, p. 195.) This species of Aster is a very common indigenous plant, growing from three to six feet high, in low swampy places. The rootlets are said to be aromatic, bitterish, and astringent, and have been employed in domestic and irregular practice as a stimulating diaphoretic, in rheumatic and catarrhal affections. Other species also of Aster have attracted attention for supposed remedial powers. W.

ATHEROSPERMA MOSCHATA. *Australian Sassafras.* The bark of this tree contains a volatile oil which is obtained by distillation, and has some reputation in Australia as a remedy. It is said to be diaphoretic, diuretic, and sedative to the heart. The dose is a drop every 6 or 8 hours. An alkaloid called *athero-spermin* has been extracted from the bark by M. Zeyer, of Munich. (*Pharm. Journ.*, April, 1863, p. 447.) W.

ATOMIZERS. *Pulverizers. Nebulizers.* These are instruments by which liquid substances, which cannot be wholly volatilized, as saline solutions for example, can be brought into a state of minute division, as in spray, whereby they may be introduced into the air-passages, and by inhalation into the lungs. Various soluble substances can thus be brought into contact with these surfaces in a diseased state, often with great advantage, which cannot otherwise be conveniently applied. The instruments are of various forms, but consist essentially of two tubes open at both ends, with a capillary opening at one end; and joined together so that they shall be perpendicular to each other with their capillary points in contact. One tube is perpendicular, and, when the instrument is in action, is inserted at its larger extremity into a vessel containing the liquid to be atomized; the other is horizontal. Through the latter a current of air is forced, which, on escaping at the capillary opening, carries with it a portion of the air in the orifice of the perpendicular tube, so that, to avoid a vacuum, the liquid is forced

up by the atmospheric pressure, and mixes with the current of air as it escapes. It is thus minutely divided, and, accompanying the expanding current, may be received in the mouth or nostrils, and made to impinge on any part of these cavities or of the fauces, or be conveyed by inhalation into the lungs. The further consideration of this subject belongs rather to therapeutics than to pharmacology; and, for a description of different varieties of these instruments, the reader is referred to my work on the Practice of Medicine (6th ed., vol. i. p. 949), and to essays on the subject by Dr. J. M. Da Costa, Dr. J. Solis Cohen, both of Philadelphia, and by Dr. Ephraim Cutter, of Boston. For convenience of reference it may be proper to present here, in a tabular form, the most important substances used in this way, and the proportion to the fluid menstruum which each one should bear. For such a list I am indebted, in large part, to the essay of Dr. Da Costa above referred to. The number given opposite to each name represents the number of grains or of minims in which the substance named should be dissolved in a fluidounce of water.

Alum	10 to 30 grs.	Iron, sulphate of	1 to 2 grs.
Ammonium, chloride of	10 to 20 grs.	Lead, acetate of	2 to 5 grs.
Arsenic (solution of arsenite of potassa)	1 to 20 mins.	Lime-water	60 to 120 mins
Chloride of Sodium	5 to 20 grs.	Mercury, corrosive chloride of	$\frac{1}{4}$ to 1 gr.
Chlorinated Soda, solution of	30 to 60 mins.	Morphia, solution of sulphate of	$\frac{1}{14}$ to $\frac{1}{8}$ gr.
Conium, fluid extract of	3 to 8 mins.	Opium, tincture of	2 to 12 mins.
Copper, sulphate of	1 to 3 grs.	" watery extract of	$\frac{1}{4}$ to $\frac{1}{2}$ gr.
Hemp, tincture of	5 to 10 mins.	Silver, nitrate of	1 to 10 grs.
Hyoscyamus, fluid extract of	3 to 10 mins.	Tannin	1 to 20 grs.
Iodine, compound solution of	2 to 15 mins.	Tar-water	60 to 120 mins
Iron, perchloride of	$\frac{1}{8}$ to 2 grs.	Turpentine, oil of	1 to 2 mins.
Iron, solution of subsulphate of	8 to 16 mins.	Zinc, sulphate of	1 to 6 grs.

In general a substance may be used in this way of the strength in which it would be applied to the mucous membranes. W.

AZEDERACH INDICA. *Nim Tree.* The interior bitter bark of this tree is extensively used in India as a febrifuge and tonic, sometimes in the form of powder, more usually in that of decoction. The roots are said to have vermifuge properties, and the seeds yield an oil largely used for lighting purposes and sometimes as a medicine. The bark has been chemically examined by Mr. J. Broughton, Government Quinologist, who found in it a bitter resin and a crystalline fat. (*Pharm. Journ. and Trans.*, June, 1873, p. 992.) H. C. W.

BALATA. This is the dried milky juice of the Sapota Muelleri or Bully Tree, a native of Guiana. It is an oxidized carbo-hydrogen, contains a little resin, and is said to be midway between caoutchouc and india-rubber in its physical properties. (*Am. Journ. of Pharm.*, xlii. 178.) H. C. W.

BALM OF GILEAD. *Balsam of Gilead. Balsamum Gileadense. Baume de la Mecque.* Fr. The genuine balm of Gilead is the resinous juice of the *Amyris Gileadensis* of Linn., the *Balsamodendron Gileadense* of Kunth, a small evergreen tree, growing on the Asiatic and African shores of the Red Sea. It was in high repute with the ancients, and still retains its value in the estimation of the Eastern nations, among whom it is employed both as a medicine and cosmetic. In Western Europe and in this country, it is seldom found in a state of purity, and its use has been entirely abandoned. It is described as a turbid, whitish, thick, gray, odorous liquid, becoming solid by exposure. It possesses no medical properties which do not exist in other balsamic or terebinthinate juices. It was formerly known by the name of *opobalsamum;* while the dried twigs of the tree were called *xylobalsamum*, and the dried fruit, *carpobalsamum.* W.

BALSAM OF SULPHUR. This name was formerly given to a substance resulting from the reaction of sulphur upon olive oil at a high temperature. It was directed in the old Edinburgh Pharmacopœia, under the name of *Oleum Sulphuratum;* but was discharged at the last revision. The directions of the College were to boil *eight parts* of olive oil and *one part* of sublimed sulphur together, with a gentle fire, in a large iron pot, stirring them constantly till they united. The iron pot was directed to be large enough to hold three times the quantity of the materials employed; as the mixture might otherwise boil over. As the vapours which rose were apt to take fire, a lid was to be at hand to cover the pot, and thus extinguish the flame if necessary. Sulphur is soluble to a considerable extent in heated oil, from which, if the solution be saturated, it is deposited in a crystalline state on cooling. But it is not a mere solution which this process was intended to effect. The oil was partly decomposed, and the resulting preparation was an extremely fetid, acrid, viscid, reddish-brown fluid. In order that it might be obtained, it was necessary to heat the oil to the boiling point. *Sulphurated oil*, or *balsam of sulphur*, was formerly thought useful in chronic catarrh, consumption, and other pectoral complaints; but inconvenience arose from its acrid properties, and its internal use was aban-

doned. It is said to be sometimes applied as a stimulant to foul ulcers. The dose is from five to thirty drops. W.

BALSAMUM TRANQUILANS. *Baume Tranquille.* This is a preparation of some note, directed by the French Codex, and consisting essentially of olive oil holding in solution the active matters of certain narcotic and aromatic plants. The fresh plants are boiled with the oil until all their water is driven off; the oil is then expressed and poured upon the dried plants properly comminuted; and the mixture, having been allowed to stand for a month, is strained, and the oil decanted. The preparation is used by friction as an anodyne in local pains. A formula for it is contained in the *Am. Journ. of Pharm.* (Jan. 1862, p. 22), and in the *Journ. de Pharm.* (Août, 1862, p. 121). W.

BAPTISIA TINCTORIA. *Sophora tinctoria.* Linn. *Podalyria tinctoria.* Michaux. *Wild Indigo.* This is an indigenous perennial plant, found throughout the United States, growing abundantly in woods and dry barren uplands. It is from one to three feet high, with a smooth, very branching stem, small, ternate, cuneate-obovate, bluish-green leaves, and yellow flowers, which appear in July and August, and, like the whole plant, become black when dried. The root, which is the part most highly recommended, is of a dark brown colour, of a slight peculiar odour in the dried state, and of a nauseous, bitter somewhat acrid taste. Its virtues appear to reside chiefly in the cortical portion. Mr B. L. Smedley thought that he had found in it a peculiar alkaloid. (*Am. Journ. of Pharm.*, July, 1862, p. 311.) Mr. Jno. A. Weaver has shown this to be a salt of lime. (*Am. Journ. of Pharm.*, xliii. 251.) In large doses, it is said to operate violently as an emetic and cathartic; in smaller, to produce only a mild laxative effect. It is said to have proved useful in scarlatina, typhus fever, and in that state of system which attends gangrene or mortification. Dr. Thacher spoke highly of its efficacy as an external application to obstinate and painful ulcers; and Dr. Comstock, of Rhode Island, found it extremely useful, both as an internal and external remedy, in threatened or existing mortification. By the latter physician it was given in decoction, made in the proportion of an ounce of the root to a pint of water, of which half a fluidounce was administered every four or eight hours, any tendency to operate on the bowels being checked with laudanum. Dr. Stevens, of Ceres, Pennsylvania, has employed a decoction of the root advantageously in epidemic dysentery. (*N. Y. Journ. of Med.*, iv. 358.) It may be used externally in the form of decoction or cataplasm. The stem and leaves possess the same virtues as the root, though in a less degree. A pale-blue colouring substance has been prepared from the plant as a substitute for indigo, but is greatly inferior. Another species, *B. Alba*, or *prairie indigo*, which is abundant in our N. W. prairies, is said to have similar properties, and to be sometimes used as a substitute for *B. tinctoria.* W.

BARBADOES NUTS. *Purging Nuts. Physic Nuts.* These are the seeds of the *Curcas purgans* of Adanson (*Jatropha Curcas* of Linnæus), growing in Brazil, the West Indies, and on the western coast of Africa. The fruit is a three-celled capsule, containing one seed in each cell, and is about the size of a walnut. The seeds are blackish, oval, about eight lines long, flat on one side, convex on the other; and the two sides present a slight longitudinal prominence. They yielded to Soubeiran fixed oil, an acrid resin, sugar, gum, a fatty acid, gluten, a free acid, and salts. The oil may be separated by expression. When fresh it is without smell or colour, but becomes yellowish and slightly odorous by time. When cold it deposits a white substance, which is probably margarin. Alcohol does not readily dissolve it. Some call it *jatropha oil.* For an account of the chemical properties of this oil, see the *Chemical Gazette* (Dec. 15, 1854, p. 469). From three to five of the *seeds*, slightly roasted and deprived of their envelope, operate actively as a cathartic, and not unfrequently produce nausea and vomiting, with a sense of burning in the stomach. The *oil* purges in the dose of twelve or fifteen drops, and is analogous in its action to croton oil, though less powerful. The cake left after the expression of the oil is an acrid emeto-cathartic, operating in the dose of a few grains. Either of these substances may produce serious consequences in overdoses. The leaves of the plants are rubefacient, and the juice is said to have been usefully employed as a local remedy in piles.

The seeds of *Curcas multifidus* (*Jatropha multifida*, Linn.) have similar properties, and yield a similar oil. This species also grows in Brazil and the West Indies. *Jatropha urens* must be excessively poisonous, as accidental contact of the wrist of a gardener in Kew with a young plant, produced such symptoms that for five minutes the man was thought to be dead. (*Pharm. Journ. and Trans.*, April, 1872, p. 863.) W.

BASSORA GUM. The plant which yields this substance is unknown. It came into commerce originally from the neighbourhood of Bassora, on the Gulf of Persia; but is often found mixed with gum brought from other countries, and is probably not the product of one plant exclusively. It is in irregular pieces, of various sizes, never very large, white or yellow, intermediate in the degree of its transparency between gum-arabic and tragacanth, inodorous, tasteless, and possessed of the property of yielding a slight sound when broken under the teeth. But a small portion of it is soluble in water, whether hot or cold. The remainder swells up considerably, though less than tragacanth, and does not, like that substance, form a gelatinous mass, as it consists of independent granules which have little cohesion. The soluble portion is pure gum or *arabin*, and,

according to M. Guérin, constitutes 11·2 per cent. The insoluble portion consists of a peculiar principle called *bassorin*, associated with a small proportion of saline substances, which yield, when the gum is burnt, 5·6 per cent. of ashes. The gum is useless both in medicine and pharmacy, and is described here only as containing a principle which enters into the composition of several medicinal substances.

Bassorin is insoluble in water, alcohol, and ether, but softens and swells up in hot or cold water. Diluted nitric and muriatic acids, with the aid of heat, dissolve it almost entirely. The acidulous solution, concentrated by evaporation, and treated with alcohol, lets fall a flocculent precipitate which has all the characters of pure gum, into which the bassorin appears to have been converted by the action of the acid. This does not, however, constitute more than a tenth part of the bassorin dissolved. By gradually evaporating the alcoholic acidulous solution, a thick, bitterish liquid is obtained, which exhales a strong odour of ammonia when treated with potassa. Strong nitric acid converts bassorin into mucic and oxalic acids; and, treated with sulphuric acid, it yields a sweet crystalline substance which is incapable of the vinous fermentation. (Guérin.) Vauquelin was the first to call attention to this principle, upon which he conferred its present name, from having first observed it in the Bassora gum. Bucholz afterwards discovered the same, or a closely analogous principle, in tragacanth; and John, a principle which was supposed to be the same in the gum of the cherry-tree. Hence it has sometimes been called *tragacanthin* and *cerasin*. M. Guérin, however, has demonstrated that the insoluble principle of the cherry gum is essentially different from bassorin. Berzelius considered the latter as belonging to the class of substances which he associated under the name of mucilage, and of which the mucilages of flaxseed and quince seed are examples. (See *Linum*, Part I.) W.

BDELLIUM. This name has been given to two different gum-resins, distinguished as *Indian* and *African bdellium*. Dr. Royle was informed that the former was obtained from the *Amyris Commiphora* of Roxburgh, growing in India and Madagascar. The latter is said to be the product of *Heudelotia Africana*, which grows in Senegal. Bdellium sometimes comes mixed with gum arabic and gum senegal. It is either in small roundish pieces, of a reddish colour, semi-transparent, and brittle, with a wax-like fracture, or in large irregular lumps, of a dark brownish-red colour, less transparent, somewhat tenacious, and adhering to the teeth when chewed. It has an odour and taste like those of myrrh, but weaker. It is infusible and inflammable, diffusing while it burns a balsamic odour. According to Pelletier, it consists of 59 per cent. of resin, 9·2 of gum, 30·6 of bassorin, and 1·2 of volatile oil, including loss. In medical properties it is analogous to myrrh, and was formerly used for the same purposes; but it is now scarcely ever given internally. In Europe, it is still occasionally employed as an ingredient of plasters. The dose is from ten to forty grains. W.

BEDEGUAR. *Fungus Rosarum*. An excrescence upon the *sweetbriar* or *eglantine*, and other species of *Rosa*, produced by the puncture of insects, especially by one or more species of *Cynips*. It is of irregular shape, usually roundish, about an inch in diameter, with numerous cells internally, in each of which is the larva of an insect. It has little smell, and a slightly astringent taste. Though formerly considered diuretic, anthelmintic, and lithontriptic, and employed as a remedy for toothache, it has fallen into disuse. It was given in doses of from ten to forty grains. W.

BENZOATE OF LITHIUM. *Lithii Benzoas*. This salt, which occurs in glistening pearly scales, of a cool, sweetish taste, may be prepared by adding benzoic acid to a solution of carbonate of lithium. For details, see *Am. Journ. of Pharm.*, xlvii. 113. It has been strongly recommended as a remedy for gout, especially when combined with iron. (*Edin. Med. Journ.*, Jan. 1875.) H. C. W.

BENZOATE OF SODIUM. *Sodii Benzoas*. This salt has been employed by MM Socquet and Bonjean, in conjunction with silicate of soda and other substances, as remedy in gout and rheumatism, for the purpose of eliminating uric acid. It is prepared by saturating a solution of benzoic acid with a solution of carbonate of sodium. For the complicated formula proposed, including colchicum and aconite, see *Am. Journ. of Pharm.* (July, 1857, p. 314). B.

BENZOIN ODORIFERUM. Nees. *Laurus Benzoin*. Linn. *Spice-wood. Spice-bush. Fever-bush*. An indigenous shrub, from four to ten feet high, growing in moist, shady places, in all parts of the United States. Its flowers appear early in spring, long before the leaves, and are succeeded by small clusters of oval berries, which, when ripe, in the latter part of September, are of a shining crimson colour. All parts of the shrub have a spicy, agreeable flavour, which is strongest in the bark and berries. The small branches are sometimes used as a gently stimulating aromatic, in the form of infusion or decoction. They are said to be employed in this way by the country people as a vermifuge, and an agreeable drink in low fevers; and the bark has been used in intermittents. The berries, dried and powdered, were sometimes substituted, during the revolutionary war, for allspice. According to Dr. Drake, it is used as a stimulant. The colourless fragrant oil of the berries has been examined by Mr. J. Morris Jones and found to belong to the cinnamyl series. (*Am. Journ. of Pharm.*, xlv. 300; *Ibid.*, xlvii. 246.) W.

BENZOLE. *Benzen. Benzene. Phene. Hydruret of Phenyl.* This substance must not be confounded with a commercial article sometimes sold as *benzin*, which is a mixture of various carbohydrogens of light sp. gr., obtained in the distillation of coal-gas tar and petroleum. (See *Am. Journ. of Pharm.*, July, 1861, p. 367.) Originally the two names benzole and benzin were applied to the one substance, but after the discovery of petroleum it was soon found that the coal tar produced artificially was quite different from that obtained from petroleum. Little by little in the United States it has become the custom to call the liquid obtained by the fractional distillation of petroleum having the sp. gr. 62° to 65° Baumé *benzin*. The two substances are essentially different, although resembling one another in their solvent powers. Benzole is a definite carbohydrogen of fixed constitution. Benzin a complex body of varying constitution. Benzole can be frozen; benzin has never yet been consolidated. Benzole can be converted into nitro-benzole, and by further treatment into anilin colours. Benzin cannot. According to Pusch, it can be distinguished from benzin by dissolving iodine in it, benzole forming a violet red, and benzin a raspberry-coloured solution. (*Am. Journ. of Pharm.*, xlvii. 268.)

Benzole was originally obtained by distilling benzoic acid with lime. It was afterwards discovered by Faraday as a constituent of coal-gas tar. This tar, when distilled, furnishes *coal-naphtha* (the commercial benzine above referred to), a complex substance, containing a number of carbohydrogens, among which is benzole. Upon distilling this naphtha from a metallic still, surmounted by an open vessel filled with water, and containing a worm terminating in a refrigerated receiver, the benzole will pass over and condense in the receiver; while the other substances associated with it, having higher boiling points, will condense in the worm, and fall back into the still. The benzole is then purified by distillation at a heat between 176° and 194°, and by subjecting the product to a new distillation from one-fourth of its volume of sulphuric acid. A method of obtaining it pure is described by Mr. A. H. Church, consisting in the dry distillation of a compound made by treating the ordinary benzole of commerce with fuming sulphuric acid, then adding carbonate of ammonium, evaporating the whole to dryness, and exhausting the residue with alcohol. The alcoholic solution is distilled to dryness, and the remaining mass distilled at a higher heat. The distillate is washed with solution of potassa, and then rectified from caustic potassa. The product is perfectly pure benzole. (See *Am. Journ. of Pharm.*, March, 1860, p. 144.) M. E. Kopp purifies benzole by taking advantage of its high congealing point. He exposes the impure mixture containing it to a degree of cold sufficient to solidify it (5° F.), presses the congealed mass to separate the liquid carbohydrogens, allows it to become fluid, then again freezes and presses it, and thus obtains it almost entirely pure. The mixed fluids treated in this way he obtains by decomposing the heavier tar oils by a high degree of heat. (*Chem. News*, May 14, 1864, p. 229.)

Prof. Calvert, of Manchester, purifies coal-naphtha, so as to render it a sufficiently pure benzole to be usefully applied to the purpose of removing fatty and oily matters from animal and vegetable substances, by subjecting it to the action of sulphuric acid, added in small quantities, so long as coloration is produced, then washing it with pure water, and afterwards subjecting it to distillation in an ordinary still. The sulphuric acid destroys the less volatile carbohydrogens present, which interfere with the solvent power of the benzole.

In consequence of the great volatility and extreme inflammability of benzole and its attendant carbohydrogens, much care is necessary both in their preparation and subsequent use to avoid any possible exposure to flame. Very serious results have taken place from want of caution in this respect.

Benzole is a colourless oleaginous liquid, possessing an agreeable odour. Its sp. gr. is 0·85, congealing point 32°, and boiling point 176°. Its formula is $C_{12}H_6$. Its powers as a solvent are very extensive. Among the substances soluble in it are sulphur, phosphorus, and iodine. It dissolves quinia, but not cinchonia, with which it forms a bulky gelatinous mass. Morphia and strychnia are sparingly soluble. Its solvent power over some of the organic alkalies led Mr. John Williams, of London, to employ it in extracting them from the vegetables in which they are found; and he succeeded in obtaining them in several instances on a small scale. In this way he extracted quinia, quinidia, and amorphous quinia, together, from cinchona bark, but not cinchonia. In like manner he separated strychnia and brucia from nux vomica, and handsome crystals of cantharidin from cantharides. Mr. Williams supposes that benzole might form a good test of the value of Peruvian barks. Benzole is also a solvent of many of the resins, of mastic, camphor, wax, fatty and oily substances, essential oils, caoutchouc, and gutta-percha. The last two substances may be obtained, without alteration of properties, in tough sheets of any desired tenuity, by spreading their benzole solutions on glass or other polished surface, and allowing the solvent to evaporate. The same solutions, brushed over the skin, form artificial cuticles, which have been found useful as coverings to wounds and burns. The vapour of benzole, when inhaled, acts as an anæsthetic. As benzole is often mixed, sometimes in but small proportion, with other hydrocarbons associated with it in coal tar and petroleum, it becomes desirable to be able to detect it in such an association. The following method, originating with M. Scharlommer, is

based on the conversion of this carbohydrogen into anilin, and that into one of the characteristic colours derived from it. That part of the mixture which volatilizes at 150° C. (302° F.) is operated on. This is treated with fuming nitric acid, which, if benzole be present, gives rise to a nitrobenzole with its bitter-almond odour. The nitrobenzole is then converted by the action of granulated tin and muriatic acid into anilin, which is isolated by distilling the product with potassa. The anilin floats on the top of the liquid that passes. A little of this gives with hypochlorite of sodium a fine purple colour; and a drop of it will yield the beautiful colour of rosanilin, if heated with a little bichloride of mercury. (*Journ. de Pharm.*, 4e sér., ii. 177.) In relation to benzole, see the paper of C. B. Mansfield, in the *Chem. Gaz.* (No. 159, p. 224), from which many of the facts of this article have been taken. A case is on record showing that, taken internally in a considerable quantity, it has a decided narcotic action, apparently intermediate between that of ardent spirit and opium. Swallowed accidentally, to the amount probably of one or two fluidounces, it produced vertigo with a sensation as of intoxication, followed by sleep for two hours, from which the patient awoke with a gay delirium, attended with bursts of laughter, and some impediment of speech, continuing for four hours. The pulse was slightly quickened, the surface warm, and the expression of face animated. Sleep then came on, from which the patient awoke next day, still feeling some dizziness. The breath had a strong smell of benzole. (See *Journ. de Pharm.*, Mars, 1861, p. 222.)

M. Reynal, of the Veterinary School at Alfort, has long been in the habit of destroying parasites in domestic animals by benzole, and proposes its employment in the parasitic diseases of man. It has the advantage of not affecting the skin. For this purpose a mixture may be used, consisting of 10 parts of benzole, 5 of soap, and 85 of water. B.

M. Dragendorff proposes further to utilize benzole by substituting it for amylic alcohol in the search for strychnia and brucia, which it dissolves more freely, without affecting the sense of smell so strongly. The sulphates of these alkaloids, however, are insoluble in benzole. (*Journ. de Pharm.*, 4e sér., v. 473.) Petroleum benzine has also been proposed as a substitute for ether in making oleoresins, but has been objected to by Prof. Maisch. (*Am. Journ. of Pharm.*, xliv. 208.)

Prof. Moslor proposes benzole as a remedy in trichiniasis. It is among the most powerful anthelmintics, and will no doubt destroy all the trichinæ remaining in the alimentary canal; and there is hope that it may be able to follow the parasite fatally into the muscles. After some encouraging results with the lower animals, he tried it in several cases of the disease as it prevailed at Quedlinburg early in 1864. He gave the antidote in the following manner. Two drachms of benzole, and an ounce, each, of liquorice juice (solution of the extract) and mucilage of gum arabic, were mixed with four ounces of peppermint-water; and a tablespoonful of the mixture well shaken was given every hour or two. The medicine was easily taken and well borne; and many of the patients found themselves relieved under the treatment. Dr. Rudolff gave as much as two drachms daily, continued from four to six days. No bad effects showed themselves, even in cases when the fever was high. But the ultimate result is not stated. If necessary, larger doses of the medicine could probably be used without danger; at any rate, it would seem to be very promising as a prophylactic if taken soon after the ingestion of the infected meat. (*Boston Med. and Surg. Journ.*, vol. lxxi. p. 381.) W.

Nitrobenzole. Benzole, by the action of fuming nitric acid, is converted into *nitrobenzole*, also called *nitrobenzule* and *nitrobenzide*, having the formula $C_{12}H_5,NO_4$. The product, after having been washed with water, forms an oily, yellowish, intensely sweet liquid, with an odour like that of oil of bitter almonds. Its density is 1·209, and boiling point 415°. Latterly it has become of commercial importance under the name of *artificial oil of bitter almonds*, being employed in confectionery, for scenting soaps, and for flavouring articles of diet. Nitrobenzole may be viewed as benzole, in which one eq. of hydrogen is replaced by one of hyponitric acid. For some observations on nitrobenzole, especially for a test of it by Prof. Maisch, see *Part* I. page 614. Dr. F. Mahla, of Chicago, considers the commercial nitrobenzole as a different compound from the proper chemical article, which he has found to have an odour between that of cinnamon and of bitter almond oils, but more closely analogous to the former. (*Am. Journ. of Pharm.*, May, 1859, p. 202.) B.

A very interesting paper by Mr. H. Letheby, on the physiological and toxicological properties of nitrobenzole, is contained in the *Pharmaceutical Journal* (Sept. 1863, p. 130). In manufactories, where the fluid is prepared, the workmen are often affected with headache and sleepiness from exposure to the vapour which escapes; but the effects are quickly relieved by fresh air and a mild stimulant. Two fatal cases are, however, recorded, one from the inhalation of the vapour, proceeding from the poison spilled upon the person of the individual affected, the other from the accidental swallowing of a small portion. The effects were the same. For some time there was no feeling of discomfort; but gradually symptoms of stupor came on, with flushed face, ending in profound coma, in which state the patients died, about nine hours from the time of taking the poison, the coma having come on in four hours. The brain was found congested, the heart full, and the blood black and fluid. Chemical examination detected both nitrobenzole and anilin in the blood, showing that the former had been converted into the latter. Mr. Letheby

also made experiments with the poison on domestic animals, and obtained some extraordinary results. From 30 to 60 drops were given by the mouth to cats and dogs. There was rarely vomiting or other sign of gastric irritation. Two classes of effects were observed, either rapid coma, or a slow occurrence of palsy and coma after a period of apparent inaction of the poison. Even in the rapidly comatose cases, paralytic symptoms were noticed in the earlier stage. The time varied in these cases from 25 minutes to 12 hours between the exhibition of the poison and death. In the slower cases there was no visible effect for hours and sometimes for days. Suddenly, however, the animal would be attacked with vomiting, followed by convulsions, which, on their subsidence, left more or less paralysis, first of the hinder and then of the fore limbs. After this the animal generally lay for days, more or less conscious, with now and then epileptic attacks, and at length died of exhaustion or gradually recovered. The time from the exhibition of the poison to the first epileptic fit was from 19 to 72 hours, in most cases about two days, and to the period of death was from 4 to 9 days. This apparent inaction of the poison at first is very extraordinary, almost justifying the belief in those cases of poisoning said to have occurred in ancient times, in which the substance given exerted no effect till a considerable time after it was exhibited. The explanation is that the nitrobenzole undergoes changes in the system into a more violent poison, and as anilin is found after death, this may be the real agent. In the guinea pig, but not in the dog, Dr. Ewald has found nitrobenzole to produce glycosuria. (*Philad. Med. Times*, iv. 312.)

Notwithstanding these statements of Mr. Letheby, we find it positively asserted by M. Collas that nitrobenzole is not poisonous; as M. Lassaigne had made numerous trials with it on dogs, to which he had given from one to two drachms without other effect than to perfume their evacuations. (*Ann. de Thérap.*, 1861, p. 35.) There can be no doubt, however, of the substantial correctness of the assertions of Mr. Letheby. Nitrobenzole is a violent poison. According to Caspar, after death prussic acid and nitrobenzole poisoning may be distinguished by the permanence of the odour of the latter substance when the body is left open. For an elaborate article on the toxicology of nitrobenzole, see *Journ. de Pharm.*, 1875, pp. 375, 455. W.

BETAIN. This is a new alkaloid which M. C. Sheibler claims to have discovered in the juice of the sugar beet. (*Am. Journ. of Pharm.*, xli. 559.) H. C. W.

BETONICA OFFICINALIS. *Wood Betony.* A perennial European herb, belonging to the labiate plants. It has a pleasant but feeble odour, and a warm, somewhat astringent, and bitterish taste. By the ancients it was much esteemed, and employed in numerous diseases; but it is at present little used. It is slightly warming and corroborant, but is inferior in this respect to many other plants of the same family. The root has been considered emetic and purgative. W.

BETULA ALBA. *Common European Birch.* Various parts of this tree have been applied to medical uses. The young shoots and leaves secrete a resinous substance, having acid properties, which, combined with soda, is said to produce the effects of a tonic laxative. (*Journ. de Pharm.*, xxvi. 208.) The *inner bark*, which is bitterish and astringent, has been employed in intermittent fever. The epidermis is separable into thin layers, which may be employed as a substitute for paper, and are applied to various economical uses. The bark contains a peculiar principle, called *betulin*, which is ranked among the subresins. When the bark is distilled, it yields an empyreumatic oil, having the peculiar odour of Russia leather, in the preparation of which it is employed. This oil has been found very useful as a local application in chronic eczema. The *leaves*, which have a peculiar, aromatic, agreeable odour, and a bitter taste, have been employed, in the form of infusion, in gout, rheumatism, dropsy, and cutaneous diseases. The same complaints, particularly dropsy, are said to have been successfully treated by enveloping the body in the fresh leaves, which thus applied excite perspiration. When the stem of the tree is wounded, a saccharine *juice* flows out, which is considered useful in complaints of the kidneys and bladder, and is susceptible, with yeast, of the vinous fermentation. A beer, wine, spirit, and vinegar are prepared from it, and used in some parts of Europe.

Of the American species of birch, *Betula lenta*, variously called *sweet birch*, *black birch*, *cherry birch*, and *mountain mahogany*, is remarkable for the aromatic flavour of its bark and leaves, which have the odour and taste of Gaultheria procumbens, and are sometimes used in infusion, as an agreeable, gently stimulant, and diaphoretic drink. An oil is obtained by distillation from the bark, which has been proved by Prof. Procter to be identical with oil of gaultheria. As in the case of the oil of bitter almonds, this oil does not pre-exist in the dried bark of the birch, but is formed by reaction between water and a neuter principle in the bark, analogous to amygdalin, to which Prof. Procter has given the name of *gaultherin*. (*Am. Journ. of Pharm.*, xv. 243 and 246.) This species also affords a saccharine liquor, which, indeed, appears to be common to all the birches. The bark of *B. papyracea* is employed by the Northern Indians for making canoes; and thin layers of the epidermis are placed inside of boots to prevent the access of moisture. W.

BEZOAR. This name has been given to concretions formed in the stomach or intestines of animals, which were formerly thought to possess extraordinary medical virtues. Many varieties have been noticed; but they were all arranged in two classes, the *oriental bezoar* (*lapis bezoar orientalis*), and *western bezoar* (*lapis bezoar occidentalis*), of which the former was most esteemed. They have fallen into merited neglect. W.

BICARBONATE OF AMMONIUM. This salt has been brought into notice by Prof. Wm. Procter, in reference to its antacid properties. It is formed by exposure of the ordinary carbonate to the air, and is found in considerable quantities on the sides of casks in which that salt is imported, and less largely even in the bottles in which it is kept in the shops. The ordinary carbonate of ammonium, being in fact a sesquicarbonate, undergoes this change by giving off an equivalent of the monocarbonate. When pure, the bicarbonate of ammonium is white, having the same crystalline form as the bicarbonate of potassium, of a saline slightly ammoniacal taste, and a feeble odour of ammonia, ascribable to a very slow volatilization. On exposure to heat, it gives off carbonic acid. It is soluble in 8 parts of water at 60°, is nearly insoluble in officinal alcohol, but soluble in diluted alcohol; and its solution has an alkaline reaction with syrup of violets. It may be prepared by treating sesquicarbonate of ammonium with officinal alcohol, whereby the monocarbonate is dissolved, and the bicarbonate left. To render this still purer it should be washed with alcohol and dried. It is obtained as a crystalline precipitate by adding alcohol to a saturated solution of the ordinary carbonate; or by passing carbonic acid through the same solution. It may be used as an antacid in the same manner and the same doses as bicarbonate of sodium, being preferable to that salt when a slightly stimulant impression on the stomach is desired. It is due to Prof. Procter to state that this article has been taken, simply with verbal alteration, from his communication on the subject to the *Am. Journ. of Pharm.* (July, 1869, p. 294.) W.

BIDENS BIPINNATA. (*Gray's Manual*, p. 222.) *Spanish Needles.* An herbaceous indigenous plant, of which the root and seeds, as well as those of other species of the same genus, have a popular reputation as emmenagogue, and are given by the "eclectics" in laryngeal and bronchial diseases as expectorants. W.

BIRD-LIME. A viscid substance, existing in various plants, particularly in the bark of *Viscum album* and *Ilex aquifolium* or European holly, from the latter of which it is usually procured. The process for preparing it consists in boiling the middle bark for some hours in water, then separating it from the liquid, and placing it in proper vessels in a cool situation, where it is allowed to remain till it becomes viscous. It is then washed to separate impurities, and constitutes the substance in question. Bird-lime thus prepared is greenish, tenacious, glutinous, bitterish, and of an odour analogous to that of flaxseed oil. Exposed to the air in thin layers it becomes dry, brown, and pulverizable, but reacquires its viscidity upon the addition of water. It is a complex body, but is thought to owe its characteristic properties to a proximate principle, identical with that which exudes spontaneously from certain plants, and is called *glu* by the French chemists. This principle is without odour or taste, extremely adhesive, fusible by heat, inflammable, insoluble in water, nearly insoluble in alcohol, but dissolved freely by ether and oil of turpentine. According to M. Macaire, it is insoluble in the fixed oils, either hot or cold; a property which distinguishes it from the resins. M. Macaire proposes for it the name of *viscin*. (*Journ. de Pharm.*, xx. 18.) Bird-lime is so tenacious that it may be employed to catch small birds, which, when they alight on a stick thickly covered with it, are unable to escape. W.

BISTORT. This is the root of *Polygonum Bistorta*, a perennial herbaceous plant, growing in Europe and the North of Asia. The root is cylindrical, somewhat flattened, about as thick as the little finger, marked with annular or transverse wrinkles, furnished with numerous fibres, and folded or bent upon itself, so as to give it the tortuous appearance from which its name was derived. When dried, it is solid, brittle, of a deep-brown colour externally, reddish within, inodorous, and of a rough, astringent taste. It contains much tannin, some gallic acid and gum, and a large proportion of starch. It resembles the other vegetable astringents in medical properties, and is applicable to the same complaints; but is less efficient than catechu or kino, and in this country is seldom used. It may be employed in powder, decoction, or extract. The dose of the powder is 20 or 30 grains.

Besides the bistort, some other plants belonging to the genus Polygonum have been used as medicines. Among those are *P. aviculare*, or *knot grass*, a mild astringent, formerly employed as a vulnerary and styptic; *P. Persicaria* (Persicaria mitis), of a feebly astringent saline taste, and at one time considered antiseptic; and *P. Hydropiper* or water-pepper (Persicaria urens), the leaves of which have a burning and biting taste, inflame the skin when rubbed upon it, and are esteemed diuretic, and have been used with asserted success in amenorrhœa and other uterine disorders. Its irritant and also medicinal properties are due to an acid, *polygonic acid*, discovered by C. J. Rademaker. (*Am. Journ. of Pharm.*, xliii. 490.) The *water-pepper* or *smart-weed* of this country—*P. punctatum* (Elliott), *P. hydropiperoides* (Michaux)—which grows abundantly in moist places, possesses properties similar to those of the European water-pepper, and is occa-

sionally used as a detergent in chronic ulcers, and internally in gravel. Dr. Eberle very strongly recommended it in amenorrhœa, in which complaint he found no other remedy equally effectual. He gave a fluidrachm of the saturated tincture of the plant, or from four to six grains of the extract, three or four times a day. He found it to produce a warmth and peculiar tingling sensation throughout the system, with slight aching pains in the hips and loins, and a sense of weight and tension within the pelvis. (*Eberle's Mat. Med.*, 4th ed., i. 441.) Dr. Wilcox, of Elmira, New York, has found advantage from a decoction of the dried leaves, made in the proportion of an ounce to the pint, and applied locally, in mercurial salivation, and the sore-mouth of nursing women. (*Am. Journ. of Med. Sci.*, N.S., xvi. 248.) *P. Fagopyrum* is common *buckwheat*. The leaves of this plant have been found by Mr. Ed. Schunck to contain a crystallizable colouring principle, identical with the *rutin* or *rutic acid* previously discovered by Weiss in the leaves of the common rue, and probably with the *ilixanthin* of Moldenhaus, existing in the leaves of Ilex aquifolium or common holly. Buckwheat leaves yielded to Mr. Schunck somewhat more than one part of rutin in a thousand. (*Chem. Gaz.*, No. 399, p. 201.)

W.

BISULPHATE OF POTASSIUM. *Potassii Bisulphas.* This salt, though formerly officinal in the Ed. and Dub. Pharmacopœias, has been omitted in the British. The following are the formulas of the two Colleges. "Take of the residuum of the preparation of pure Nitric Acid *two pounds;* Sulphuric Acid (commercial) *seven fluidounces and one fluidrachm* [Imperial meas.]; boiling Water *six pints* [Imp. meas.]. Dissolve the salt in the Water, add the Acid, concentrate the solution, and set it aside to cool and form crystals." (*Ed.*) "Take of Sulphate of Potash, in powder, *three ounces* [avoirdupois]; Pure Sulphuric Acid *one fluidounce* [Imperial measure]. Place the Acid and Salt in a small porcelain capsule, and to this apply a heat capable of liquefying its contents, and which should be continued until acid vapours cease to be given off. The Bisulphate, which concretes as it cools, should be reduced to a fine powder, and preserved in a well-stopped bottle." (*Dub.*)

In explaining the Edinburgh formula, it is only necessary to recall to the reader's attention a part of the explanations given under the head of *Acidum Nitricum*, in *Part* I. It is there stated that, for the decomposition of nitre on the small scale for the purpose of obtaining nitric acid, it is necessary to use two eqs. of sulphuric acid to one of the salt. Consequently, the salt which remains after the distillation of nitric acid is really a bisulphate, and would seem only to require to be dissolved, and the solution filtered and duly evaporated, in order to obtain the salts in crystals. But Mr. Phillips states that, when bisulphate of potassium is dissolved in water, and the solution is allowed to crystallize, some sulphate and much sesquisulphate are obtained instead of bisulphate, owing to the water retaining a part of the excess of acid in solution. This result is prevented by the sulphuric acid directed to be added, and, consequently, the real bisulphate is obtained in crystals. In the *Dublin* process, sulphate of potassium is mixed with more sulphuric acid than is necessary to convert it into bisulphate, and the mixture is exposed to a liquefying heat, which is continued so long as acid vapours are given off. The portion of acid, more than sufficient to form a bisulphate, is thus driven off; so that the saline matter left is the salt under consideration, which, after concreting, is reduced to fine powder.

Properties, &c. Bisulphate of potassium is a white salt, having the form of a right rhombic prism, so flattened as to be tabular, and a bitter and extremely acid taste. It is soluble in twice its weight of cold, and in less than its weight of boiling water. Alcohol does not dissolve it, but, when added to an aqueous solution, precipitates the neutral sulphate. Exposed to the air, it effloresces slightly on the surface, and when moderately heated readily melts, and runs like oil. At a red heat it loses water and the excess of acid, and is reduced to the neutral sulphate. From its excess of acid, it acts precisely as an acid on the carbonates, causing them to effervesce. It is incompatible with alkalies, earths, and their carbonates, with many of the metals, and most oxides. This salt was formerly called *sal enixum*. It consists of two eqs. of sulphuric acid 80, one of potassa 47·2, and two of water 18 = 145·2.

Medical Properties and Uses. Bisulphate of potassium unites the properties of an aperient and tonic, and may be given in constipation with languid appetite, such as often occurs in convalescence. Dr. Paris states that it forms a grateful adjunct to rhubarb. It answers, also, according to Dr. Barker, for preparing an aperient effervescing draught at little expense. Equal weights, a drachm for instance, of the bisulphate and of carbonate of sodium, may be dissolved separately, each in two fluidounces of water, then mixed, and taken in the state of effervescence. The dose of the bisulphate is one or two drachms.

B.

BISULPHURET OF CARBON. *Bisulphide of Carbon. Sulphuret of Carbon. Sulphide of Carbon. Carburet of Sulphur.* This compound is formed by passing the vapour of sulphur over charcoal, heated to redness in a porcelain tube. Prepared on the large scale, the charcoal may be heated in a cast-iron cylinder, as recommended by M. Chandelon. According to M. Millon, it is purified by first washing it repeatedly in distilled water, then putting it upon quicklime in a large retort, and, after a contact of 24 hours, distilling

it from the lime. More recently corrosive sublimate has been used in its purification. (*Journ. de Pharm.*, 4e sér., xi. 232.) The vapours are received in a vessel containing a large quantity of pure copper turnings. It is a transparent, colourless, exceedingly volatile liquid, having a pungent, somewhat aromatic taste, and, as found in commerce, a very fetid smell. But when purified in the manner above directed, if not perhaps very agreeable to the smell, it is much less disagreeable than as ordinarily found, and is employed by MM. Millon and Commaile for extracting the sweetest perfume of flowers. (*Journ. de Pharm.*, Nov. 1868, p. 361.) It is soluble in alcohol. On exposure to sunlight for a considerable time, it becomes somewhat yellow, owing to a partial decomposition; and traces of formic acid and sesquisulphide of carbon have been noticed in the results. (O. Loew, *Am. Journ. of Sci.*, Nov. 1868.) Its sp. gr. is 1·272. Like carbonic acid it may be frozen by its own evaporation. The solid bisulphide melts at 9° F., and has the appearance of male cauliflower. (*Cosmos*, March, 1870.) In composition it is a bisulphuret. Taken internally, it acts as a diffusible stimulant, accelerating the pulse, augmenting the animal heat, and exciting the secretions of the skin, kidneys, and genital organs. It has been employed in obstinate rheumatic and arthritic affections, paralysis, and cutaneous eruptions, and more recently as a resolvent in indolent tumours. It is used both internally and externally. For exhibition in gout and rheumatism, Dr. Otto, of Copenhagen, employed an alcoholic solution, in the proportion of two drachms to the fluidounce, of which four drops were given every two hours. At the same time the affected parts were rubbed with a liniment, made by dissolving the bisulphuret in the same proportion in olive oil. Dr. Krymer applied it successfully to an indolent tumour by allowing forty or fifty drops to fall upon it three times a day. In this case it may be supposed to have acted by the cold produced. He also succeeded in reducing several strangulated hernias, by applying some drops of the bisulphuret to the hernial tumour. Dr. Turnbull found the vapour useful in the resolution of indurated lymphatic glands. It is applied by means of a bottle with a proper sized mouth, containing a fluidrachm of the bisulphuret, imbibed by a piece of sponge. The skin over the gland is first well moistened with water. He employed the vapour also with benefit in deafness, when dependent on want of nervous energy, and a deficiency of wax. For this purpose, the bottle containing the bisulphuret is made with a neck to fit the meatus, and, being applied to the ear, is held there until considerable warmth is produced. Dr. Geo. Kennion. of Harrogate, has employed it in a similar manner with happy effect, in nervous headache, the mouth of the bottle being previously applied to the temple or behind the ear. (*Bost. Med. & Surg. Journ.*, Oct. 1, 1868, p. 143; from the *British Med. Journ.*) Dr. C. G. Page, of Boston, has used the vapour with advantage for the alleviation of local pains. Mr. James Schiel, of St. Louis, Mo., recommends the bisulphuret, mixed with an equal measure of alcohol, in neuralgia of the face, toothache, and similar affections. The mixture, poured upon some raw cotton, is to be rubbed vigorously on the part affected for five or six seconds. (*St. Louis Med. and Surg. Journ.*, Jan. 1857.) M. Guillaumet recommends it very highly as a local application to chronic ulcers. (*Med. Times and Gaz.*, i., 1875, p. 310.)

Bisulphuret of carbon possesses diversified solvent powers, and is extensively used in the arts, the demand for it having made it a cheap product. It is said to render wood very sonorous, and an excellent conductor of electricity. (*Am. Journ. of Pharm.*, xlii. 461.) Mr. Alexander Parkes, of Birmingham, claims the credit of having first produced it largely for manufacturing purposes. (*Chem. News*, June 21, 1867, p. 321.) Among other substances, it readily dissolves sulphur, phosphorus, bromine, and iodine. The solution of phosphorus is a powerful deoxidizing agent. (*Journ. de Pharm.*, 4e sér., iv. 464.) According to M. A. Vogel, it dissolves eighteen times its weight of phosphorus without losing its fluidity. (*Ibid.*, Mars, 1869, p. 237.) It has been proposed by M. Lepage, of Gisors, for extracting the fixed oils of nutmegs, bay berries, and croton seeds. M. Deiss, of Paris, employs it for extracting the fat of bones. (See *page* 684.) In India-rubber manufactories, it is used as a solvent of the caoutchouc. The extensive employment of it in this way has shown that air, loaded with its vapour, is poisonous. According to M. Delpech, the workmen exposed to the fumes of the bisulphuret are affected with headache, vertigo, and over-excitement of the nervous system, as evinced by voluble talking, incoherent singing, or immoderate laughter, or sometimes by weeping; and a continuance of the exposure is apt to cause at length a state of cachexia, characterized by general weakness, loss of sexual appetite, dulness of sight and hearing, and impairment of memory. M. S. Cloëz has made with it experiments on some of the smaller animals, as rats and rabbits, which were confined under a bell-glass with some cotton saturated with the bisulphuret. In a few moments the animal exhibited signs of its action in great excitement, followed by retarded movements, with some convulsive shocks, then fell on its side and died in five minutes from the beginning. Congestion of the lungs and of the cavities of the heart, without any cerebral lesion, while the right auricle continued to contract two hours after apparent death, were the phenomena observed on dissection. (*Lancet*, Sept. 1866, p. 267.)

Protosulphuret of carbon (CS) was discovered in May, 1857, by M. E. Baudrimont, of Paris. It is conveniently obtained by passing the vapour of the bisulphuret over spongy

platinum, or over pumice heated to redness. It is a colourless gas, a little heavier than carbonic acid, having an odour like that of the bisulphuret. It burns with a blue flame, producing carbonic acid, sulphurous acid, and sulphur. By water it is decomposed, so as to form carbonic oxide and sulphuretted hydrogen. When breathed it appears to act as an anæsthetic. B.

BLACK WAX. This appears to be a product of animal life, which has found its way in very small quantities to England from India and the Pacific Islands. (*Pharm. Journ. and Trans.*, 2d ser., x. 11, 219.) H. C. W.

BLOOD OF BULLOCKS. As long ago as 1852 Prof. Samuel Jackson, of this city, employed as a tonic the blood of bullocks carefully dried in vacuo, giving 5 to 10 grains of it as a dose. Recently it has been used considerably in Europe, and even drinking fresh bullock's blood has come to some extent into fashion. There is no reason for believing that dried blood is more valuable than more usual ferruginous tonics, if, indeed, it be of equal value. H. C. W.

BOLDO. This plant is an Alpine evergreen shrub, frequenting the meadows of the Andes, in Chili, where its yellowish-green fruit is eaten, its bark used in tanning, and its wood in charcoal making. It is the Peumus Boldo of Molina (1782). The leaves, which contain a large amount of an aromatic volatile oil in especial cells, are the parts used in medicine. They are entire, reddish-brown when dry, coriaceous, with a prominent midrib, and very numerous small glands upon their surface. A peculiar alkaloid, *Boldine*, has been found in them by MM. Bourgoise and Verne (*Journ. de Pharm.*, 4e sér., xvi. 191). In France the remedy has been employed as a tonic, especially in cases in which there existed chronic hepatic torpor. (*Pharm. Journ. and Trans.*, Nov., 1874, p. 405.) Fifty centigrammes of a tincture, made by macerating 100 parts of the drug in 500 parts of alcohol, are given at a dose, and increased gradually. Large doses are apt to vomit. H. C. W.

BOLE ARMENIAN. The term *bolus* or *bole* was formerly applied to various forms of argillaceous earth, differing in colour, or place of origin. Such were the *Armenian*, *Lemnian*, and *French boles*, and the *red* and *white boles*. Some of these substances were so highly valued as to be formed into small masses and impressed with a seal, and hence received the name of *terræ sigillatæ*. They were all similar in effect, though the small proportion of oxide of iron contained in the coloured boles may have given them greater activity. The only one at present kept in the shops is that called *bole Armenian*, from its resemblance to the substance originally brought from Armenia. It is prepared, by trituration and elutriation, from certain native earths existing in different parts of Europe. It is in pieces of various sizes, reddish, soft, and unctuous, adhesive to the tongue, and capable of forming a paste with water. It consists chiefly of alumina and silica, coloured with oxide of iron. The boles were formerly employed as absorbents and astringents, and were undoubtedly useful in some cases of acidity of the stomach and relaxed bowels. Bole Armenian is used chiefly as a colouring ingredient in tooth powders. W.

BORAGO OFFICINALIS. *Borage.* This is an annual, hairy, succulent European plant, one or two feet high, with fine blue flowers, on account of which it is sometimes cultivated in our gardens. All parts of it abound in mucilage, and the stem and leaves contain nitrate of potassium with other salts. To these constituents the plant owes all its virtues. It is much used in France. An infusion of the leaves and flowers, sweetened with honey or syrup, is employed as a demulcent, refrigerant, and gently diaphoretic drink in catarrhal affections, rheumatism, diseases of the skin, &c. The expressed juice of the stem and leaves is also given in the dose of from two to four ounces. The flowers are sometimes applied externally as an emollient. A distilled water, extract, and syrup were formerly used, but have fallen into neglect. Borage is scarcely known in this country as a medicinal plant. W.

BORATE OF AMMONIUM. *Biborate of Ammonium.* By dissolving boracic acid in excess in heated water of ammonia, and allowing the solution to cool slowly, biborate of ammonium is obtained in crystals. These are rhombic octahedrons, with truncated summits, and often truncated edges, and are semitransparent. The taste of the salt is alkaline, and it has an alkaline reaction. On exposure, it effloresces, losing ammonia, and becoming in time the quadriborate. It is soluble in about twelve parts of water. (*Gmelin*, ii. 435.) Attention has recently been called to this salt by M. Beeker, who has used it in cases of stone in the bladder and renal colic, and, as he believes, almost constantly with an amelioration of the symptoms. Under its influence the urine becomes loaded with uric acid and the earthy phosphates. It is said also to be an excellent remedy in chronic catarrh of the bladder. It is believed by M. Beeker to be the *ludus* of Paracelsus, which had a great reputation in the treatment of urinary calculi. It may be given in the dose of from 10 to 20 grains every hour, in water sweetened with liquorice. (*Ann. de Thérap.*, 1867, p. 94; from *Journ. de Thérap. Med.-chir.*, Sept. 1, 1866.) W.

BRAZIL NUTS. *Cream Nuts.* These are edible nuts imported from Brazil, and sometimes employed in making cream syrups for giving flavour to carbonic acid water. In Brazil an expressed oil is obtained from them, which is said to be used for burning,

making ointments, and adulterating copaiba. Dr. Edward Donnelly, of Philadelphia, states, in a communication to the American Pharmaceutical Association (*Proceedings*, 1858, p. 327), that the nuts are the product of the *Bertholletia excelsa* (Humboldt and Bonpland), a large and beautiful tree, growing over extensive regions in South America. The leaf and fruit are figured in the work just referred to. B. Corenwinder has found in the kernel of the nut 65·60 per cent. of oil, and 15·31 per cent. of nitrogenous matter. (*Pharm. Journ. and Trans.*, Aug. 1873, p. 86.) W.

BRAZIL WOOD. A red dye-wood, the product of different species of Cæsalpina, growing in the West Indies and South America. Two varieties are known in commerce: —1. The proper Brazil wood, said to be derived from *Cæsalpina echinata*, and sometimes called *Pernambuco* or *Fernambuco wood*, from the province of Brazil where it is collected; 2. the *brasiletto*, produced by *C. Brasiliensis* and *C. Crista*, which grow in Jamaica and other parts of the West Indies. The former is the most highly valued. The *sappan* or *sampfen wood* may be referred to the same head, being obtained from the *Cæsalpina sappan*, and possessing properties analogous to those of the brasiletto. The *Nicaragua* or *peach wood* is also analogous to the brasiletto, and is said by Bancroft to be derived from a species of Cæsalpina. It is produced in the East Indies. Brazil wood is nearly inodorous, has a slightly sweetish taste, stains the saliva red, and imparts its colouring matter to water. It was formerly used in medicine; but has been abandoned as inert. In pharmacy it serves to colour tinctures, &c.; but its chief use is in dyeing. A red lake is prepared from it, and it is an ingredient in a red ink. Its dyeing properties are owing to a crystallizable colouring principle, named *bresilen* or *brasilin*. This, as usually obtained, is of a sulphur-yellow colour, which it preserves in the dark, but soon loses in the sunlight, to which it is remarkably sensitive, changing to a reddish hue after a few minutes' exposure, and undergoing a similar alteration in diffused daylight, though more slowly. The principle should, therefore, be kept in perfectly opaque vessels. It is now stated that when absolutely pure it is colourless, and becomes red on exposure to the air. It is sparingly soluble in water, yielding a sweet and almost colorless solution which is not changed by acids, but is deeply reddened by alkalies. In alcohol and ether it is somewhat more soluble than in water, giving a light-yellow solution. The colourless watery solution soon becomes reddish in the air, afterwards yellowish-red, in which condition the solution acquires the curious property of phosphorescing in a golden-yellow light. (C. F. Schönbein, *Neues Repertor.*, A.D. 1868, vol. xvii., part vii., p. 390.) M. E. Koff gives for it the formula $C_{44}H_{18}O_{14}$. For the method of preparing it, see his paper in the *Journ. de Pharm.*, 4e sér., xix. 88. W.

BROMAL. (C_2HBr_3O.) This substance resembles chloral in its chemical properties, like it existing as an oily colourless liquid, or when united with water or alcohol, as a crystalline hydrate or alcoholate. It boils at about 212° F., and distils without decomposition. It is prepared by adding, little by little, 3 to 4 parts of bromine to refrigerated alcohol. After fifteen hours of contact the mixture is distilled. The bromine and other very volatile products come over first, and afterwards, at a temperature of 160° to 180° C., the bromal, with an oily substance insoluble in water. Water being added, the hydrate of bromal (C_2HBr_3O,H_2O) is formed. By the action of an alkali, bromoform is produced from the hydrate of bromal. Its physiological action has been investigated by Dr. S. Steinauer. (*Virchow's Archiv*, May 19, 1870.) In frogs it produces at first great restlessness, followed by sleep of moderate intensity, accompanied by an almost complete analgesia. In warm-blooded animals similar symptoms were developed. Dyspnœa was usually very marked, and death sometimes occurred in convulsions. The cardiac ventricles after death were relaxed or tetanized, according as the dose had been large or small. Dr. Steinauer believes the succession of signs are due to the first action being that of the bromal, and the subsequent, that of bromoform and nascent bromides generated in the blood from the bromal hydrate. Dr. Steinauer administered the drug to several patients, in doses of three grains at bedtime, with the effect of relieving pain or producing sleep. In epileptics it seemed to avert the paroxysms. H. C. W.

BROMIDE OF CADMIUM. This salt is not used in medicine, but a recent case of severe poisoning by it (*Boston Med. and Surg. Journ.*, Oct. 1876) makes allusion to it here necessary. The symptoms were those of violent irritant poisoning. H. C. W.

BROMIDE OF CALCIUM. This is prepared by M. Boedecker by first forming a bromide of sulphur by the addition of 20 parts of the flowers of sulphur to 240 parts of bromine; this is added to a milk of lime containing 140 parts of fresh lime. The sulphate and bromide of calcium are formed and are readily separated. (*Journ. de Pharm.*, 4e sér., viii. 463.) Mr. Jas. R. Mercein puts five ounces of bromine and two and a half pints of water in a half gallon specie jar, passes a stream of sulphuretted hydrogen through the bromine until it is all taken up, filters, drives off excess of sulphuretted hydrogen by heat, distils the solution of hydrobromic acid thus obtained until four-fifths have passed over, saturates this with excess of precipitated carbonate of calcium, filters and evaporates. (*Am. Journ. of Pharm.*, xliv. 100.) Mr. Macdonald (*Ibid.*, 1873) employs the following method. Dissolve 4 ounces of bromide of ammonium in a pint of water. Put in a flask and bring to the boiling point. Keep boiling, and add milk of lime

(made from *pure* calcined lime) in small quantities, until ammoniacal vapours cease to be evolved. The operator can easily tell when this point has been reached, by the sense of smell. Filter the solution, evaporate to a syrupy consistency, remove from the fire, and stir until cold. Bromide of calcium as it occurs in the shop is a granular salt of a hot, somewhat saline taste. It is freely soluble in twice its weight of water. It has been used in medicine for the same purposes as bromide of potassium. Its action upon animals has been investigated by Dr. Guttmann. (*Phila. Med. Times*, iv. 361.) He found it to be only one-third or one-fourth the strength of the potassium salt, and to be wanting in the action which is exerted by that salt upon the heart. It has been somewhat extensively used as an adjuvant to bromide of potassium in epilepsy. The dose is half to two drachms. H. C. W.

BROMIDE OF CERIUM. This salt is prepared by Mr. Charles Bullock by calcining the oxalate in a porcelain capsule until it becomes converted into the yellowish-brown sesquioxide, dissolving this in hydrochloric acid, precipitating with carbonate of sodium, dissolving in hydrobromic acid, and evaporating at a low temperature to dryness. As thus prepared the salt is of a light chocolate colour, and of a very styptic sweetish taste, soluble in 95 per cent. alcohol, partially soluble in water. (*Am. Journ. of Pharm.*, xliii. 345.) H. C. W.

BROMIDE OF IRON. *Ferri Bromidum.* This bromide is obtained by heating gently, in thirty parts of water, two parts of bromine, and one of iron filings. When the liquid has become greenish, it is filtered and evaporated to dryness in an iron vessel; and the dry mass, again dissolved and evaporated to dryness, furnishes the bromide. Bromide of iron is a brick-red, deliquescent salt, very soluble, and extremely styptic. For medical employment it should be in aqueous solution, protected by sugar. Mr. Dillwyn Parrish has proposed the following formula. Take of bromine *two hundred grains;* iron filings *eighty-five grains;* distilled water *four and a half fluidounces;* sugar *three ounces.* Make a solution in the manner directed for preparing solution of iodide of iron. (*Med. Exam.*, vii. 162.) For other formulas, see *Pharm. Journ. and Trans.*, 3d ser., v. 67, 162. This solution is deemed tonic and alterative. It has been used with advantage by Dr. E. Gillespie, of Brady's Bend, Pa., in tetter, scrofulous tumours, inflammation of the glands both acute and chronic, erysipelas, and amenorrhœa. In tumours and erysipelas, Dr. Gillespie, besides giving the solution internally, applies it to the parts affected, by means of a feather, two or three times a day. Dr. David Alter, of Freeport, Pa., has employed it with seeming benefit in phthisis and other tuberculous diseases. It has also been found useful in bronchocele. The dose of Mr. Parrish's solution is twenty drops, three times a day, gradually increased until its effects are manifested. Bromide of iron is formed as the first step of the process for preparing the officinal bromide of potassium. B.

BROMIDE OF LITHIUM. This whitish salt occurs in a powder, more or less aggregated in an irregular crystalline manner. It was first employed in medicine by Dr. Gibbs, but was especially brought into notice by Dr. S. Weir Mitchell. It is said to resemble the bromide of potassium in its action, but to be more decidedly hypnotic. H. C. W.

BROMIDE OF SODIUM. This salt, according to M. Castelhaz, is best made by transforming bromine into bromide of ammonium, separating any iodine present as iodide by crystallization from the mother-waters, and decomposing the bromide of ammonium with carbonate of sodium. The solution should be evaporated by heat. (*Am. Journ. of Pharm.*, xlii. 509.) As it occurs in the shops it is a white, granular salt of a warm, saline taste. It is freely soluble in water, and has been used to some extent in the place of bromide of potassium. It does not, however, exert as powerful sedative influence as that salt. The dose is twenty grains to a drachm. H. C. W.

BROMIDE OF ZINC. This salt has been proposed on theoretical grounds as an antispasmodic by Dr. L. S. Joynes. In a single case of hysteria it was given in doses of about 2 grains with asserted good effects. It was made by a direct combination of its elements. (*Am. Journ. of Pharm.*, xlv. 366.) H. C. W.

BROMIDES OF THE ALKALOIDS. These have been proposed as medicinal agents, but are devoid of any advantages. If called for, they may be made by precipitating bromide of barium by the sulphate of the alkaloid as suggested by Mr. Geo. Macdonald. (*Am. Journ. of Pharm.*, 1873.) H. C. W.

BROMIDES OF MERCURY. The *protobromide* is formed by adding bromide of potassium to nitrate of protoxide of mercury. It falls as a white curdy precipitate. The *bibromide* may be obtained by digesting the protobromide in water containing bromine. Mr. A. E. Ebert prepares it by reaction between bromide of potassium and officinal solution of nitrate of mercury. For the particulars of the process see a paper by Mr. Ebert in the *Am. Journ. of Pharm.*, March, 1867, p. 107. It is in the form of colourless crystals, soluble in water and alcohol. Exposed to heat it melts and sublimes. These bromides are analogous in composition and medical properties to the corresponding iodides of mercury. The protobromide is given in the dose of a grain daily, gradually increased. The bibromide, like corrosive sublimate, is an irritant poison, and may be administered

in doses of the sixteenth of a grain, gradually increased to the fourth, either in the form of pill, or in ethereal solution made by dissolving a grain in a fluidrachm of ether. B.

BROMINATED CAMPHOR. ($C_{20}H_5BrO_2$.) *Monobromated Camphor. Monobromate of Camphor.* This substance was discovered in 1861 by Th. Swarts, who prepared it by heating bibromide of camphor in a sealed tube to 100° C. It may also be made by heating for three hours in a sealed tube, with the water-bath, bromine and camphor in the proper chemical proportions. The crystalline mass is washed with water, recrystallized from alcohol after treatment with animal charcoal, washed with an alcoholic solution of potassa, then with much water, and finally recrystallized from a mixture of alcohol and ether. It is very easy to prepare the monobromide on a small scale in this way. There is, however, at all times a very great pressure upon the inside of the tube, and the attempt to practice the method upon a large scale is very apt to result in shattering the tubes. This has led to numerous experiments as to the best method of preparing the drug. The reader will find an account of these in Prof. Maisch's paper. (*Am. Journ. of Pharm.*, xliv. 340.) Want of space prevents our detailing them. Prof. Maisch finally elaborated a method of producing the drug by heating bromine and camphor together in an open retort. For the details of this process, see *Am. Journ. of Pharm.*, xliv. 342.

Monobromated camphor crystallizes from alcohol in thin, white, or colourless prisms or needles; from petroleum benzine in long, flat, transparent hard prisms, or, when rapidly crystallized, in shiny scales. It is permanent in the air, insoluble in water, freely soluble in alcohol and ether, soluble in less than its own weight of hot petroleum benzine. Its odour is somewhat camphoraceous, its taste camphoraceous, terebinthinate, and peculiar. It fuses at 170° F., boils with partial decomposition at 325° F. It was first proposed as a medicine by Professor Deneffe, and has been used by various practitioners as a nervous sedative in delirium tremens, hysteria, convulsive irritation of teething, sleeplessness, &c. According to the experiments of Dr. Bourneville (*Le Progrès Médicale*, 1874) and of Dr. Lawson (*The Practitioner*, Aug. 1874), it produces in mammals muscular weakness, passing into paralysis, very decided progressive reduction of temperature, decrease in the respiration rate, sleep passing into stupor, and finally death. Dr. Bourneville states that the vessels of the ear and eyelids in the rabbit are contracted. The dose is five grains given in emulsion, and repeated in an hour if necessary.

H. C. W.

BRYONY. *White Bryony.* This is the root of *Bryonia alba*, or white bryony, a perennial, climbing, herbaceous plant, growing in thickets and hedges in different parts of Europe. It bears rough, heart-shaped, five-lobed leaves, small yellow monœcious flowers, arranged in racemes, and roundish black berries about the size of a pea. Another species called *B. dioica*, with diœcious flowers and red berries, bears so close a resemblance in character and properties to the preceding, that it is considered by some botanists merely a variety. The roots of both plants are gathered for use. When fresh they are spindle-shaped, sometimes branched, a foot or two in length, as thick as the arm, or even thicker, externally yellowish-gray and circularly wrinkled, within white, succulent, and fleshy, of a nauseous odour, which is lost in great measure by drying, and of a bitter, acrid, very disagreeable taste. The peasants are said sometimes to hollow out the top of the root, and to employ the juice which collects in the cavity as a drastic purge. (*Mérat et De Lens.*) The berries are also purgative, and are used in dyeing.

As kept in the shops, the root is in circular transverse slices, externally yellowish-gray and longitudinally wrinkled, internally of a whitish colour, becoming darker by age, concentrically striated, light, brittle, and readily pulverizable, yielding a whitish powder. Besides a peculiar bitter principle called *bryonin*, the root contains starch in considerable proportion, gum, resin, sugar, a concrete oil, albumen, and various salts. It yields its active properties to water. *Bryonin* may be obtained by mixing the powdered root with one-sixth of its weight of purified animal charcoal, in fine powder, putting the mixture into a percolator, already containing a quantity of animal charcoal equal to that mixed with the bryony, and then percolating successively with strong alcohol, diluted alcohol, and sufficient water to displace the alcoholic liquid. The tincture thus obtained yields the bryonin by spontaneous evaporation. This is extremely bitter, soluble in water and alcohol, insoluble in ether, unaltered by the alkalies, and dissolved by sulphuric acid, with the production of a blue colour. It purges actively in the dose of two grains. (*Am. Journ. of Pharm.*, xxviii.; from *Repert. de Pharm.*, Nov. 1855.) When treated with acids bryonin is resolved into sugar and two peculiar substances, one soluble in ether, called *bryoretin*, the other insoluble in that liquid, and named *hydrobryoretin*. It is therefore a glucoside. (G. F. Walz. See *Am. Journ. of Pharm.*, May, 1859, p. 251.)

Bryony is an active hydragogue cathartic, in large doses sometimes emetic, and disposed, if too largely administered, to occasion inflammation of the alimentary mucous membrane. A fatal case is recorded by Mr. Wm. Herapath, in which narcotic symptoms with vomiting and purging were produced in a woman by an overdose of bryony with jalap, ending in death in thirty-six hours. On dissection, the brain was found con-

gested, the heart empty, and the gastric and intestinal mucous membrane inflamed. (*Pharm. Journ.*, April, 1858, p. 542.) The recent root is highly irritant, and is said, when bruised and applied to the skin, to be capable of producing vesication. The medicine was well known to the ancients, and has been employed by modern physicians; but is now nearly superseded by jalap, which is more certain, and less liable to lose its strength by age. The dose of the powdered root is from a scruple to a drachm. W.

BUXUS SEMPERVIRENS. *Box.* This evergreen shrub is too well known to require description. Though much cultivated in this country as an ornamental plant, it is a native of Europe and Western Asia. The wood is considered diaphoretic in its native countries, and is used in decoction in rheumatism, secondary syphilis, &c. The leaves, which have a peculiar odour and a bitter and disagreeable taste, are said to be purgative in the dose of a drachm. A volatile oil distilled from the wood has been given in epilepsy. A tincture formerly enjoyed some reputation as an antiperiodic. (*Mérat et De Lens.*) In 1860 it was determined by Walz that *buxine*, an alkaloid which had been discovered in the leaves of this tree, was identical with the bebeerin of the bebeeru or nectandra bark. (See *page* 599; also *Pharm. Journ.*, Oct. 1869, p. 194.) W.

BYTTERA FEBRIFUGA. *Bitter Ash.* The name *Byttera febrifuga* was given by M. Bélanger to a tree growing in Martinico, in the West Indies, the wood of which has tonic properties closely analogous to those of quassia. It appears to be one of the Simarubaceæ; but differs from the plants of the genus Simaruba of De Candolle, in having hermaphrodite flowers, resembling in this respect the Quassia of that author. A bitter principle has been separated from the wood by M. Gerardias, which is closely analogous if not identical with quassin, the active principle of quassia. The wood has long been used in the West Indies in the cure of intermittents, and probably has all the remedial properties of the simple bitters. (*Journ. de Pharm.*, xxxi. 110.) It seems, however, at present to be admitted that this Byttera of M. Bélanger is really the Quassia excelsa of Linn., the Simaruba excelsa of De Candolle, from which quassia is generally obtained (*Ann. de Thérap.*, 1858, p. 190); and a specimen of the wood of this supposed Byttera, said to be from the Island of Guadeloupe or Martinique, which the author had an opportunity of seeing at the Palais d'Industrie in Paris, certainly bore a very close resemblance to the billets of quassia. W.

CABBAGE-TREE BARK. The bark of *Andira inermis* (De Cand.), *Geoffroya inermis* (Wild.), figured in Woodville's Medical Botany, p. 416, t. 151. This is a leguminous tree, with a stem rising to a considerable height, branched towards the top, and covered with a smooth gray bark. The leaves are pinnate, consisting of six or seven pairs of ovate-lanceolate, pointed, veined, smooth, petiolate leaflets, with an odd one at the end. The flowers are rose-coloured, and in terminal panicles, with very short pedicels. The tree is a native of Jamaica and other West India Islands. The bark, which is the part used, is in long pieces, thick, fibrous, externally of a brownish-ash colour, scaly, and covered with lichens, internally yellowish, of a resinous fracture, a disagreeable smell, and a sweetish, mucilaginous, bitterish taste. Its powder resembles that of jalap. Huttenschmidt obtained from it a crystallizable, very bitter substance, having the composition and neutralizing properties of the vegetable alkaloids, and named it *jamaicina*. Two grains of it produced violent purging in pigeons.

Theodore Peckolt says of the wood of the tree, which he calls *Andira anthelmintica*, that the workmen engaged in sawing it are apt to be affected with inflammation of the eyes, constriction of the throat, excessive thirst, a bitter, burning taste, a troublesome itching over the body, and sometimes eruptions on the skin. By treating a concentrated decoction of the wood with hydrate of lime, filtering after 48 hours, evaporating to the consistence of syrup, and exhausting the residue with alcohol, Peckolt obtained a yellowish-brown colouring matter which he called *andirin*, and which may prove serviceable in painting. He also obtained a peculiar resin by treating the wood with alcohol, filtering, distilling off most of the alcohol, and then precipitating by water. The resin is inodorous, of a bitter, acrid taste, soluble in alcohol, and but partially soluble in ether. This resin, and peculiarly the portion soluble in ether, is the ingredient which gives its irritating properties to the sawdust. (*Chem. Cent. Blatt*, Nov. 17, 1858 p. 813.)

On the continent of Europe, the bark of *Andira retusa* (*Geoffroya Surinamensis*), which grows in Surinam, has also been used. It is considered more powerfully vermifuge, and less liable to produce injurious effects. It has a grayish epidermis, beneath which it is reddish-brown, laminated, compact, and very tenacious, and, when cut transversely, exhibits a shining and variegated surface. In the dried state it is inodorous, but has an austere bitter taste. The powder is of a pale-cinnamon colour.

Cabbage-tree bark is cathartic, and, in large doses, apt to occasion vomiting, fever, and delirium. It is said that these effects are more liable to result if cold water is drunk during its operation, and are relieved by the use of warm water, castor oil, or a vegetable acid. In the West Indies it is esteemed a powerful vermifuge, and is much employed for expelling lumbrici; but it is dangerous if incautiously administered, and instances of death from its use have occurred. It is almost unknown in this country, and does not

enter into our officinal catalogues. The usual form of administration is that of decoction, though the medicine is also given in powder, syrup, and extract. The dose of the powder is from a scruple to half a drachm, of the extract three grains, of the decoction two fluidounces. W.

CABBAGE LEAVES. The leaves of our ordinary cabbage have been highly praised by Dr. Blanc (*New Remedies*, 1873, p. 407) as a stimulant application to foul and indolent ulcers. H. C. W.

CACAO CERUM. An elegant dressing for the hair is sometimes called for in the shops under this name. The following formula is suggested by Mr. T. S. Glenn. Take of oleum theobromæ, sixteen ounces; oleum ricini, ninety-six ounces; oleum bergamii, six drachms; oleum limonis, one and a half ounces; oleum citronellæ, one and a half drachms; oleum lavandulæ, four drachms; spiritus coloniensis 95 per cent., sixty-four ounces. Melt the oil of theobroma, warm the castor oil, and mix. Dissolve the essential oils in the cologne spirit. Fill the bottles two-thirds full with the first mixture, and fill the remainder of bottle with the perfumed spirit. H. C. W.

CACTUS GRANDIFLORA. *Night-blooming Cereus.* This well-known flowering plant has recently been introduced into therapeutics. Dr. Rubini has used with success, in functional palpitations of the heart, a tincture made of four ounces of the fresh stems and flowers and a pint of alcohol of 95°, by macerating for a month, and filtering. He gives from one to five drops three times a day. (*N. Y. Med. Record*, Sept. 1868, 299.) W.

CAHINCA. This medicine attracted at one time considerable attention. The name of *cahinca* or *cainca* was adopted from the language of the Brazilian Indians. The Portuguese of Brazil call the medicine *raiz pretta* or black root. When first noticed in Europe, it was supposed to be derived from the *Chiococca racemosa* of Linnæus, which was known to botanists as an inhabitant of the West Indies. But Martius, in his "Specimen Materiæ Medicæ Brasiliensis," describes two other species of Chiococca, *C. anguifuga* and *C. densifolia*, which afford roots having the properties of the root ascribed to *C. racemosa;* and, as the medicine was brought from Brazil, there seemed to be good reason for referring it to one or both of the plants named by that botanist. A. Richard, however, received from Brazil specimens of *C. racemosa* as the cahinca plant.

A specimen brought into this market consisted of cylindrical pieces, varying in size from the thickness of a straw to that of the little finger, somewhat bent or contorted, slightly wrinkled longitudinally, with occasional small asperities, internally ligneous, externally covered with a thin, brittle, reddish-brown bark, having a light-brown or brownish ash-coloured epidermis. The cortical portion, which was of a resinous character, had a bitter disagreeable taste, somewhat acrid and astringent; the ligneous part was quite tasteless. The virtues of the root reside almost exclusively in its bark. They are extracted by water and alcohol. Cahinca has been analyzed by several chemists. Four distinct principles were discovered in it by Pelletier and Caventou:—1. a crystallizable bitter substance, believed to be the active principle, and called *cahincic acid;* 2. a green fatty matter of a nauseous odour; 3. a yellow colouring matter; and 4. a coloured viscid substance. Rochleder and Hlasiwetz found also caffeotannic acid. By these chemists a tincture, obtained by boiling the bark in alcohol, was precipitated first with a spirituous solution of acetate of lead, and afterwards, having been previously filtered, with the tribasic acetate of lead. The first precipitate consisted chiefly of caffeotannate and a portion of cahincate of lead, the second of cahincate of lead exclusively. To obtain the caffeotannic acid separate, the first precipitate was treated with sulphuretted hydrogen, and afterwards with neutral acetate of lead, and in like manner several times, until at length a pure caffeotannate of lead remained, which, on decomposition, yielded an acid identical with the tannic acid of coffee. The cahincic acid was obtained by treating the second precipitate with sulphuretted hydrogen, and concentrating the resulting liquid. The chemist last mentioned gave as its formula $C_{16}H_{13}O_7$. (*Chem. Gaz.*, ix. 121.) Cahincic acid is white, without smell, of a taste at first scarcely perceptible, but afterwards extremely bitter and slightly astringent, of difficult solubility in water, but readily soluble in alcohol, permanent in the air, and unaltered at 212°. It reddens vegetable blues, and unites with the alkalies, but does not form crystallizable salts. It is thought to exist in the root as subcahincate of calcium.

Medical Properties. Cahinca is tonic, diuretic, purgative, and emetic. In moderate doses it gently excites the circulation, increases the discharge of urine, and produces evacuations from the bowels; but is rather slow in its operation. It may be made to act also as a diaphoretic, by keeping the skin warm, using warm drinks, and counteracting its purgative tendency. In some patients it occasions nausea and griping, and in very large doses always acts powerfully both as an emetic and cathartic. In Brazil it has long been used by the natives as a remedy for the bites of serpents; and its Indian name is said to have been derived from this property. According to Martius, the bark of the fresh root is rubbed with water till the latter becomes charged with all its active matters; and the liquid, while yet turbid, is taken in such quantities as to produce the most violent vomiting and purging, preceded by severe spasmodic pains. Patrick Brown speaks of the root of *C. racemosa* as very useful in obstinate rheumatism. But the virtues of cahinca

in dropsy, though well known in Brazil, were first made known to the European public in the year 1826, by M. Langsdorf, Russian Consul at Rio Janeiro. Achille Richard afterwards published a few observations in relation to it in the *Journ. de Chimie Médicale;* and its properties were subsequently investigated by numerous practitioners. M. François, of Paris, contributed more than any other physician to its reputation. It was considered by him superior to all other remedies in dropsy. But general experience has not confirmed the partial estimate of Dr. François; and, having been found at least equally uncertain with other diuretics, the medicine is now little used. It was employed in substance, decoction, extract, and tincture. The powdered bark of the root was given as a diuretic and purgative, in a dose varying from a scruple to a drachm; but the aqueous or spirituous extract was preferred. The dose of either of these is from ten to twenty grains. Dr. François recommended that, in the treatment of dropsy, a sufficient quantity should be given at once to produce a decided impression, which should afterwards be maintained by smaller doses, repeated three or four times a day. W.

CALAMINA. *Calamine. Lapis Calaminaris.* Calamine is introduced into this part of the Dispensatory, because dismissed from the Pharmacopœias. The term *calamine* is applied by mineralogists indiscriminately to two minerals, scarcely distinguishable by their external characters, the *carbonate* and *silicate* of zinc. The term, however, in the pharmaceutical sense refers to the native *carbonate* only. The silicate is sometimes called *electric calamine.* Calamine is found in the United States, but more abundantly in Germany and England. It usually occurs in compact or earthy masses, or concretions, of a dull appearance, readily scratched by the knife, and breaking with an earthy fracture; but sometimes it is found crystallized. Its colour is very variable; being, in different specimens, grayish, grayish-yellow, reddish-rellow, and, when very impure, brown or brownish-yellow. Its sp. gr. varies from 3·4 to 4·4. Before the blowpipe it does not melt, but becomes yellow and sublimes. When of good quality, it is almost entirely soluble in the dilute mineral acids; and, unless it has been previously calcined, emits a few bubbles of carbonic acid. If soluble in sulphuric acid, it can contain but little carbonate of calcium, and no sulphate of barium. Ammonia, added to the sulphuric solution, throws down the oxide of zinc, mixed with the subsulphate, and takes it up again when added in excess. If copper be present the ammonia will give rise to a blue colour; if iron, the alkali will throw down the sesquioxide, not soluble in an excess of the precipitant. The officinal calamine is distinguished from the electric calamine, which is a silicate of zinc, by dissolving in warm nitric acid without gelatinizing, and by not being rendered electric by heat.

Impurities. According to Mr. Robert Brett, calamine, as sold in the English shops, is frequently a spurious mixture containing only traces of zinc. He analyzed six specimens, and found them to contain from 78 to 87·5 per cent. of sulphate of barium, the rest consisting of sesquioxide of iron, carbonate of calcium, sulphate (sulphuret) of lead, and mere traces of zinc. When acted on by muriatic acid, the spurious calamine, in powder, evolved sulphuretted hydrogen, and was only in small part dissolved, the great bulk of it remaining behind as sulphate of barium. (*Amer. Journ. of Pharm.*, ix. 173.) The results of Mr. Brett have been confirmed by Dr. R. D. Thomson, Mr. D. Murdock, and Mr. E. Moore. Dr. Thomson thinks the spurious calamine is made of sulphate of barium and chalk, coloured with Armenian bole. The late Mr. Jacob Bell, of London, held the more probable opinion that it is the native sulphate of barium, deriving its colour from iron, which is a mineral having some resemblance to calamine. Mr. Midgley, indeed, states that the miners in England distinguish two calamines, *brass calamine*, which is sold to the makers of brass, and *baryta calamine*, which is really the native amorphous sulphate of barium, and which is furnished to the druggists in the place of the genuine native carbonate of zinc. Even the genuine calamine of the shops is impure, usually containing iron and copper, and various earthy matters. That which has been calcined, to render it more readily pulverized, contains little or no carbonic acid. In view of these facts, the revisers of the U. S. Pharmacopœia of 1850 deemed it proper to introduce, as a new officinal, the *pure* carbonate of zinc, obtained by precipitation. (See *Zinci Carbonas Præcipitata.*) The crystallized variety is anhydrous, and consists of one eq. of carbonic acid 22, and one of protoxide of zinc 40·3 = 62·3. The compact and earthy varieties are said to contain one eq. of water.

Prepared Calamine. Calamina Præparata. Calamine must be impalpable before being used in medicine. In this state it forms *prepared calamine*, which, though but recently an officinal preparation, has shared the fate of its original, and been discarded from the Pharmacopœias. The following is the U. S. formula of 1850. "Take of Calamine *a convenient quantity.* Heat it to redness, and afterwards pulverize it; then reduce it to a very fine powder in the manner directed for Prepared Chalk." (*U. S.*) The object of this process is to bring the native carbonate of zinc, or calamine, to the state of an impalpable powder. It is first calcined, to render it more readily pulverizable, and then levigated and elutriated. During the calcination, water and more or less carbonic acid are driven off; so that little else remains than the oxide of zinc, and the earthy impurities originally existing in the mineral. Calamine, as sold in England, is almost always spurious, consisting wholly or principally of native sulphate of barium, coloured with

sesquioxide of iron. The same remark applies to the calamine in the shops of the United States. Of six samples analyzed by Mr. F. Bringhurst, of Wilmington, Del., five were totally devoid of zinc, and the sixth contained only 2 per cent. of the oxide. (*Am. Journ. of Pharm.*, July, 1857.) Prepared calamine is in the form of a pinkish or flesh-coloured powder, of an earthy appearance. Sometimes it is made up into small masses. It is used only as an external application, being employed as a mild astringent and exsiccant in excoriations and superficial ulcerations. For this purpose it is usually dusted on the part, and hence the necessity for its being in very fine powder. It is often employed in the form of cerate. The evidence being conclusive that the powder almost universally sold as prepared calamine is a spurious article, consisting chiefly of sulphate of barium, whatever therapeutic effects it may have exerted, must be attributed to that salt. B.

From a recent communication by Mr. R. H. Davis to the *Pharm. Journ. and Trans.* (Oct. 1866, p. 207) it appears, as the result of an examination of numerous specimens of calamine, obtained from different shops in Great Britain, that a great improvement has taken place in the character of this drug, and that greater reliance may now be placed on it as found in the market, than was the case a few years past. W.

CALENDULA OFFICINALIS. *Marigold.* This well-known garden plant was formerly much employed in medicine. It has a peculiar, rather disagreeable odour, which is lost by drying, and a bitter, rough, saline taste. Among its constituents is a peculiar principle, called *calendulin*, discovered by Geiger most abundantly in the flowers, and considered by Berzelius as analogous to bassorin, though soluble in alcohol. The plant was thought antispasmodic, sudorific, deobstruent, and emmenagogue, and was given in low forms of fever, scrofula, jaundice, amenorrhœa, &c. Both the leaves and flowers were used; but the latter were preferred, and were usually administered in the recent state, in the form of tea. An extract was also prepared, and employed in cancerous and other ulcers, sick stomach, &c. At present marigold is very seldom used in regular practice; but, in a communication from Dr. Ab. Livezey, of Philadelphia, to the *Med. and Surg. Reporter* (Aug. 1, 1868, p. 85), the author states that he habitually uses a strong tincture of the flowers, probably saturated, as an application to incised and lacerated wounds and contusions, and has invariably found it to exercise a peculiar curative influence, preventing inflammation and suppuration, and promoting the healing of the wounds when the parts were brought into contact. W.

CALLITRICHE VERNA. (*Gray's Manual*, p. 384.) *Water Starwort.* This is a small, herbaceous, indigenous water-plant, growing in shallow streams, ditches, or ponds, with a long stem under water, and leaves floating on the surface. This and several other species of the same genus are supposed to have diuretic properties, and are given in decoction in dropsical affections and complaints of the urinary organs. W.

CALOTROPIS GIGANTEA. Brown. *Asclepias gigantea.* Linn. Under the name of *madar* or *mudar*, a medicine has been employed in the East Indies, with great asserted advantage. It is the bark of the root of a species of Calotropis, generally considered as *C. gigantea*, but asserted by Dr. Casanova to be a distinct species, and named by him *C. Madarii Indico-orientalis*. *C. gigantea* is a native of Hindostan, and has been introduced into the West Indies, where it is now naturalized. The bark, as employed, is without epidermis, of a whitish colour, nearly or quite inodorous, and of a bitter somewhat nauseous taste. It appears to have the general properties of many other acrid medicines; in small doses, increasing the secretions, and in larger, producing nausea and vomiting. According to Dr. Casanova, who published an essay upon the subject at Calcutta, it is especially directed to the skin, the capillaries and absorbents of which it stimulates to increased action. It is chiefly recommended as a remedy in the obstinate cutaneous diseases of tropical climates, such as elephantiasis and leprosy. It has been employed also in syphilis, dropsy, rheumatism, and hectic fever; and Mr. J. J. Durant states that he has found it an excellent substitute for ipecacuanha in acute dysentery, giving it in the same dose. (*Am. Journ. of Med. Sci.*, Oct. 1866, p. 526; from *India Med. Gaz.*, May, 1866.) It is given in substance in the dose of from three to twelve grains, three times a day, and gradually increased till it affects the system. The plant has of late years been applied to various economical purposes in India, independently of its medical use. The most important of these is the manufacture of cords, ropes, &c. from the fibres of its branches, which are said to possess many of the properties of flax, and to be applicable to the making of cloth. (*Chem. News*, No. 167, p. 76.) W.

CAM WOOD. A red dye-wood, procured from the *Baphia nitida* of De Candolle, a leguminous tree, growing on the Western Coast of Africa. The wood is usually kept in the shops in the ground state. It yields its colouring matter scarcely at all to cold water, slightly to boiling water, and readily to alcohol and alkaline solutions. This colouring matter is thought to be identical with santalin. W.

CANARY SEED. The seeds of *Phalaris Canariensis*, an annual plant belonging to the grasses, originally from the Canary Islands, but now growing wild in Europe and the United States, and cultivated in many places. The seeds are ovate, somewhat compressed, about two lines long, shining, and of a light yellowish-gray colour externally, and brownish within. Their chief constituent is starch. They were formerly esteemed

medicinal, but are now used only for emollient cataplasms. They are nutritive, and their meal is said to be mixed, in some places, with wheat flour, and made into bread. They are used as food for Canary birds. W.

CAOUTCHOUC. *Gum Elastic. Indian Rubber.* Many lactescent plants belonging to the natural orders *Artocarpeæ*, *Apocynaceæ*, and *Euphorbiaceæ*, and growing in hot countries, yield products analogous to caoutchouc; but the great bulk of that found in general commerce is the concrete juice of different species of Siphonia, especially the *Siphonia Cahuchu* of Schreber and Willdenow, identical with *Siphonia elastica* of Persoon, the *Jatropha elastica* of the younger Linnæus, and the *Hevea Guianensis* of Aublet. Some India-rubber is now imported to Europe from India and the Malayan Archipelago; this is the product of the *Ficus elastica*. A small amount is also yielded to commerce by climbing plants of the West Coast of Africa. The *Siphonia elastica*, the great source of caoutchouc, is a large tree, growing in Brazil, Guiana, and Central America (*Journ. of Phil. Col. of Pharm.*, iii. 292; *Journ. de Pharm.*, 4e sér., xv. 256); but the product is brought chiefly from the port of Para, in Brazil. On being wounded, the tree emits a milky juice, which concretes on exposure, and constitutes the substance in question. Caoutchouc comes to us in large flat pieces, or moulded into various shapes. The latter are formed by applying successive layers of the juice upon moulds of clay, which are broken and removed when the coating has attained a sufficient thickness and consistence. In the drying of these layers they are exposed to smoke, which gives to the concrete mass a blackish colour. The juice, when it concretes by exposure to the air, assumes on the outer surface a yellowish-brown colour, while the mass remains white or yellowish-white within. It is said that a little alum facilitates the coagulation, while ammonia retards it; so that a little of the latter may be advantageously added, when it is desired to keep the milky juice in the liquid state. (R. Spruce, *Pharm. Journ.*, xv. 118.) The recent juice contains, according to Faraday, 1·9 per cent. of vegetable albumen, traces of wax, 7·13 per cent. of a bitter azotized substance soluble in water and alcohol, 2·9 of a substance soluble in water but insoluble in alcohol, 56·37 of water with a little free acid, and only 31·7 of the pure elastic principle to which chemists have given the name of caoutchouc. Besides these principles the concrete juice, as it reaches us, generally contains soot derived from the smoke used in drying it. *Pure caoutchouc* is nearly colourless, and in thin layers transparent. It is highly elastic, lighter than water, without taste and smell, fusible at about 248°, remaining unctuous and adhesive upon cooling, inflammable at a higher temperature, insoluble in water, alcohol, the weak acids, and alkaline solutions, soluble in ether when entirely freed from alcohol, soluble also in chloroform and most of the fixed and volatile oils, though, in the latter, at the expense of its elasticity. It is said, however, that the oils of lavender and sassafras dissolve it without change, and that, when precipitated by alcohol from its solution in cajeput oil, it is still elastic. But its best solvents, for practical purposes, are coal-naphtha or benzine, the empyreumatic oil obtained by distilling caoutchouc itself, and pure oil of turpentine. According to Dr. Bolley, the best method of effecting its solution, for the preparation of a varnish, is first to digest it, cut in small pieces, in bisulphuret of carbon, which converts it into a jelly, and then to treat this jelly with benzine. A larger proportion is thus taken up than by any other method. (See *Am. Journ. of Pharm.*, Sept. 1862, p. 414.) Caoutchouc is not affected by atmospheric air, chlorine, muriatic or sulphurous acid gas, or ammonia. It consists, according to Faraday, of 87·2 parts of carbon, and 12·8 of hydrogen. The unpleasant odour acquired by caoutchouc, through its property of absorbing gases, which almost unfits it sometimes for purposes to which it is otherwise applicable, may be obviated by exposing it to the still greater power of absorption possessed by charcoal. For the method of applying charcoal for the purpose, the reader is referred to the *Amer. Journ. of Pharm.* (May, 1867, p. 236).

By the action of sulphur caoutchouc acquires properties which greatly increase its value in the arts. It becomes of a black colour and horny consistence, preserves its elasticity under the influence both of heat and cold, is compressible with great difficulty, and resists the ordinary solvents, such as petroleum and oil of turpentine. In this state it is said to be *vulcanized*. The discovery of the process of *vulcanization* is ascribed to Mr. Charles Goodyear, of New York. (*Chem. Gaz.*, x. 193.) It consists in submitting caoutchouc in thin sheets to the action of a mixture, composed of 40 parts of bisulphuret of carbon and 1 of chloride of sulphur. For fuller details the reader is referred to the *Journ. de Pharm.* (3e sér., xvii. 205). But the same object may be effected in other methods. When thin layers of caoutchouc are immersed for two or three hours in melted sulphur at the heat of 240° F., they are penetrated by the sulphur, but undergo no change of properties. If now heated in an inert medium to a temperature of from 275° to 320°, a chemical reaction takes place, and the vulcanized product is obtained. The same result takes place if the caoutchouc be first pounded with from 12 to 20 per cent. of finely powdered sulphur, and then heated to the temperature requisite for vulcanization. In either case, a portion of uncombined sulphur remains mechanically mixed with the vulcanized caoutchouc, from which it may be separated by various solvents, such as solutions of caustic soda or potassa, bisulphuret of carbon, oil of turpentine, anhydrous ether, &c. The *desulphurated* product thus obtained, while exempt from

the disadvantages arising from the reaction of free sulphur, is more porous than before. (*Ibid.*, xxi. 366.) Another mode of vulcanization, proposed by Mr. Humphrey, is based on the property of dissolving chloride of sulphur possessed by petroleum, which is substituted for sulphuret of carbon. It is necessary that the petroleum should be perfectly freed from water, by which the chloride of sulphur is immediately decomposed. This is effected by agitating the petroleum of commerce long and energetically with one-tenth of concentrated sulphuric acid; after which, the acid being allowed to subside, the petroleum is decanted, and treated with 200 to 250 grammes (about half a pound) of powdered quicklime for each hectolitre (26·4 gallons), with a little peroxide of manganese. The liquid, being now distilled, is fit for the vulcanization of the caoutchouc. According to the *Chemist*, there is no economy in the substitution of petroleum for the sulphuret of carbon; but the new process has a great advantage in regard to the health of the workmen, and the facility of the work. (*Ibid.*, 4e sér., ii. 386.)

Caoutchouc is used for erasing pencil marks; in the formation of flexible tubes and corks for the laboratory, and of catheters, bougies, pessaries, dilators, and other instruments for surgical purposes; in the melted state, as a luting to the joints of chemical apparatus; in the shape of thin layers, for covering the mouths of bottles, and for other purposes in which the exclusion of air and moisture is requisite; in the manufacture of water-proof cloth; as a varnish, and for numerous other purposes, to which its elasticity, and the resistance which it offers to the ordinary solvents, and to other powerful chemical agents, peculiarly adapt it. It is now, however, asserted that caoutchouc, whether vulcanized or not, is unfit for effecting the junction of apparatus, when it is necessary to obtain gases quite pure; as it admits the escape of a portion of the gas and the entrance of the air, according to the law of diffusion established by Prof. Graham. The inconvenience, however, may be remedied by covering the caoutchouc with a coating of asphaltum dissolved in tar. (*Journ. de Pharm.*, 4e sér., iv. 157.) Bands of caoutchouc have, by their elasticity, been found useful in the reduction of dislocations. (*Br. and F. Med.-chir. Rev.*, Jan. 1867, p. 264.) Still another surgical use of the vulcanized caoutchouc is for plates to fill clefts and vacancies in the palate, etc. (*Ed. Med. Journ.*, Aug. 1867, p. 176.) It may be brought to the state of thin layers, by softening the small flasks of it in ether containing alcohol, or boiling them in water for fifteen minutes, and then distending them by means of air forced into them; and the same end may be attained by spreading its naphtha or ethereal solution upon a smooth surface, and allowing the solvent to evaporate. Tubes of caoutchouc may be made from its solution, or from the juice imported in the liquid state. A *court-plaster* prepared with caoutchouc has been considerably used, and from its impermeability by moisture is sometimes valuable. (See *Am. Journ. of Pharm.*, xv. 38.) A convenient sticking-plaster may be prepared by spreading the liquid caoutchouc, by a stiff brush, upon calico, soft leather, or thin sheets of vulcanized Indian rubber as found in the shops. Small thin pieces of caoutchouc may be very advantageously employed to suppress hemorrhage from leech-bites, &c., by first softening one surface of the piece by a taper, and when cool applying it firmly over the bleeding point. The cavity of a decayed tooth may be lined with caoutchouc, so as to prevent the access of air, and thus relieve pain, by fastening a piece firmly around the end of a rod, liquefying the surface by heat, then introducing it with pressure into the cavity, and again withdrawing it. The milky juice obtained from the plant, and prevented from coagulating in the bottle by a little solution of ammonia, has been recommended as a local application in cutaneous eruptions, burns, erysipelas, &c., in which it proves useful by concreting, and forming an elastic covering, impermeable to moisture and the air. A solution of caoutchouc in chloroform is used for the same purpose; the menstruum evaporating quickly and leaving a thin layer of the elastic substance on the surface. An excellent glue may be made by dissolving, with the aid of heat and agitation, 3 parts of caoutchouc in 30 of naphtha, and adding 64 parts of finely-powdered shellac. It may be obtained in sheets by pouring it when hot on plates of metal. (*Am. Journ. of Pharm.*, March, 1867, p. 185.) Caoutchouc has been given internally in phthisis, in the dose of one or two grains, gradually increased. W.

CAOUTCHOUC, ARTIFICIAL. Prof. Lonnenschein has discovered that an elastic mass resembling caoutchouc may be obtained by combining tungstate of sodium with certain organic substances. If tungstic acid or tungstate of sodium be added to a solution of glue and afterwards muriatic acid, a compound of tungstic acid glue is precipitated, which is so elastic at 85° to 105° F. that it can be drawn out into very thin fibres. On cooling the mass becomes very solid and brittle. (*Am. Journ. of Pharm.*, xliii. 471.) H. C. W.

CAOUTCHOUC, MINERAL. Large tracts of ground in Australia are said to be covered by this substance, in many places to a foot in depth. It is stated to resemble caoutchouc closely and not to be of a petroleum nature. It has not been determined whether it is of mineral or vegetable origin. (*Pharm. Journ. and Trans.*, 3d ser., ii. 763.) H. C. W.

CAPPARIS SPINOSA. *Caper-bush.* A low, trailing shrub, growing in the South of Europe and North of Africa. The buds or unexpanded flowers, treated with salt and

vinegar, form a highly esteemed pickle, which has an acid, burning taste, and is considered useful in scurvy. The dried bark of the root was formerly officinal. It is in pieces partially or wholly quilled, about one-third of an inch in mean diameter, transversely wrinkled, grayish externally, whitish within, inodorous, and of a bitterish, somewhat acrid, and aromatic taste. It is considered diuretic, and was formerly employed in obstructions of the liver and spleen, amenorrhœa, and chronic rheumatism. W.

CARAMANIA GUM. Under this name a large quantity of a peculiar product was a few years since brought into this market for sale, a specimen of which, kindly sent us by Mr. B. R. Smith, we have had the opportunity of examining. No history of its origin came with it, but, judging from its name and character, we have little doubt that it is identical with the Caramania gum, noticed under the head of tragacanth, as one of the substances used in the adulteration of that drug. It is in pieces differing in size from that of a small pea to that of a Spanish chestnut, of various shapes, sometimes irregularly spherical, sometimes elongated, often bent or somewhat contorted, occasionally appearing as if several smaller pieces had adhered longitudinally, smoothish on the surface, generally pale, but in some pieces brown, and in most of a faint reddish hue, and translucent in all. The gum is very hard yet brittle, without smell, nearly tasteless, and very gradually softening when held in the mouth. At our request, Professor Procter subjected a portion to examination, and found it, when macerated in cold water, gradually to swell up like tragacanth, and like it, to give up a part of its substance to water, but less than tragacanth. After four or five days it ceased to swell, and the bulky hydrated masses formed appeared like clouded calf's feet jelly, and with little cohesiveness, in this respect resembling Bassora gum. The dissolved portion was mucilaginous but not thick. It was precipitated by subacetate of lead, but less decidedly than arabin. Oxalate of ammonium caused a white precipitate, indicating the presence of lime. It was not coagulated by borax or sesquichloride of iron, nor was it precipitated by alcohol in flakes like arabin. The undissolved portion, boiled with diluted sulphuric acid, was broken down, assuming a syrupy consistence, and yielded to Trommer's test evidence of the presence of glucose, which must have been formed under the influence of the acid, as the first watery solution contained none. Prof. Procter failed to find any signs of lead on the surface, so that the statement made by Mr. Maltass in relation to the Caramania gum used to adulterate tragacanth is not applicable to this. But there was no reason to expect it, as this was offered in the market under its own and not a false name. It is very obviously the concrete exuded juice of a tree, but the particular plant which yields it is unknown. So far as examined, it corresponds to a considerable extent with Bassora gum; and, as it probably comes from Caramania, a province in the eastern part of Asia Minor, it is not impossible that the two are of the same origin, the Bassora gum being carried down to the Persian Gulf.* W.

CARANNA. *Gum Caranna.* A resinous substance, in pieces of a blackish-gray colour, externally dark-brown, internally somewhat shining and translucent, brittle and pulverizable when dry, but, in the recent state, soft and adhesive like pitch, easily fusible, of an agreeable balsamic odour when heated, and of bitterish resinous taste. (*Geiger.*) It is said to be derived from the *Amyris Caranna* of Humboldt, a tree growing in Mexico and South America. Geiger refers it also to *Bursera gummifera* of the West India Islands; but the resin obtained from this tree is described by the French writers under the name of *resine de Gomart*, or *resine de chibou*, or *cachibou*, and is said to bear a close resemblance to the resin *tacamahac*. It is probable that in different parts of South America the name Caranna is applied to the products of different trees. (*Am. Journ. of Pharm.*, xli. 233.) W.

CARBAZOTIC ACID. *Picric Acid. Nitropicric Acid.* This acid is obtained by the action of nitric acid on indigo, silk, and other substances. It may be cheaply prepared from coal-tar creasote (impure phenylic or carbolic acid), or from Australian gum. It is in pale-yellow shining scales, soluble in water, to which it gives a strong yellow colour and very bitter taste. Its salts crystallize readily, and explode when heated. The potassa salt is so sparingly soluble, that an alcoholic solution of the acid may be used as a test for this alkali. Its formula is $C_{12}(H_2 3NO_4)O + HO$; being phenylic acid, with three eqs. of hydrogen replaced by three of hyponitric acid. It is largely used in dyeing; producing magnificent yellow colours, and, in connection with indigo or Prussian blue, different shades of green. The salts which picric or carbazotic acid forms with potassa and soda, are yellow and bitter; and it is in this state that the acid is often used in dyeing. It should be understood, however, that these salts are capable of exploding violently at elevated temperatures or from a severe blow; and very fatal consequences occurred from such an explosion of a large quantity of picrate of potassium, in one of the

* After the article upon Caramania gum had been sent to the press, a specimen was shown us, labeled *false tragacanth*, which had been kept for many years in a materia medica cabinet, and had probably been separated from a parcel of adulterated tragacanth, and which so closely resembled the gum described in the text, that we have no doubt of their identity in character and origin. According to Mr. Maltass, Caramania gum is used in the adulteration of tragacanth to the extent, in different varieties, of from 25 to 100 per cent. (*Pharm. Journ.*, xv. 20.)—*Note to the thirteenth edition.*

magazines of Paris, in March, 1869. (*Journ. de Pharm.*, Avril, 1869, p. 247.) According to Mr. Galippe, picric acid affords one of the most sensitive known tests for albumen. He uses a saturated aqueous solution, putting it first into a test tube and dropping in the suspected urine. If albumen be present a white line forms at the junction. (*Edinb. Med. Journ.*, Aug. 1873, p. 178.)

From the therapeutic trials, made with carbazotic acid, it is inferred to be tonic and astringent. In large doses it is poisonous; 10 grains of it having been sufficient to kill a dog in less than two hours. (*Taylor on Poisons*, p. 793.) It was first used in intermittent fever by Dr. Bell, of Manchester, who thought it might be employed as a cheap substitute for quinia. Its salts are preferred to the free acid, which is apt to cause cramps of the stomach; and those most approved are the *carbazotates of ammonium and iron.* Dr. T. Moffat cured several cases of cephalalgia by the iron salt, and cases of intermittent fever and anæmia by the ammonia salt. Mr. Alfred Aspland has given an ample trial to the acid and the salt of ammonia, and confirms the statements previously made of their efficacy, having found them especially useful in intermittent fever, and applicable to all cases in which quinia is indicated. (*Med. Times and Gaz.*, Sept. 1862, p. 289.) Other observers have obtained similar results, but Dr. W. Erb failed entirely in an extensive trial of the drug in malarial disease. (*Das Pikrinsaure*, Würzburg, 1865.) The dose of either of the salts administered in pills, is from a quarter to half a grain, three times a day. Mr. Aspland began with a grain three times a day, and increased to 4 grains for a dose. A curious effect of these salts, first observed by Dr. Moffat, is to produce, in many cases, a temporary yellowness of the skin and conjunctiva, as in jaundice. The effect is generally induced when about 15 grains of the acid have been taken. The urine also becomes orange-coloured. The colour disappears in two or three weeks after ceasing to use the medicine.

Carbazotate of iron may be prepared by digesting pure crystallized carbazotic acid with an excess of recently precipitated sesquioxide of iron and water at a gentle heat, till the acid has disappeared, filtering, and evaporating the filtrate at a temperature not exceeding 212°. Thus prepared it is amorphous, reddish-brown in mass, lighter-coloured in powder, of an astringent and intensely bitter and persistent taste, and readily soluble in water. On account of its bitterness, it is best given in pill. (See *Am. Journ. of Pharm.*, March, 1863, p. 169.) B.

CARBONIC OXIDE. Dr. Ozanam has proposed this gas as an anæsthetic; his opinion of its fitness being founded on twenty-five experiments on rabbits, and five on man; but his results show it to be dangerous, on account of the sudden manner in which it sometimes acts, and its supposed advantages are problematical. (See *B. and F. Medico-chir. Rev.*, Am. ed., July, 1857, p. 176.) B.

CARBURET OF IRON. *Ferri Carburetum. Plumbago. Black Lead.* This substance has been used both internally and externally in cutaneous affections. For medicinal use it is reduced to very fine powder, and purified by being boiled in water, and digested with dilute nitromuriatic acid. The dose is from five to fifteen grains or more, three or four times a day, given in the form of powder or pill. The ointment is made by mixing from two to six drachms with an ounce of lard. B.

CARDAMINE PRATENSIS. *Cuckoo-flower.* This is a perennial herbaceous plant, with a simple, smooth, erect stem, about a foot in height. The leaves are pinnate; the radical, composed of roundish irregularly toothed leaflets, those of the stem alternate, with leaflets which become narrower, more entire, and pointed as they ascend. The flowers are purplish-white or rose-coloured, and terminate the stem in a raceme approaching the character of a corymb. The plant is a native of Europe, and is found in the northern parts of our continent, about Hudson's Bay. It is a very handsome plant, abounding in moist meadows, which it adorns with its flowers in the months of April and May. The leaves are bitterish, and slightly pungent, resembling in some measure those of water-cresses, and like them supposed to be possessed of antiscorbutic properties. In Europe they are sometimes added to salads. The flowers have the same taste as the leaves, and, when fresh, a somewhat pungent odour. When dried they become inodorous and nearly insipid. They formerly possessed the reputation of being diuretic, and, since the publication of a paper by Sir George Baker, more than half a century ago, have been occasionally used as an antispasmodic in various nervous diseases, such as chorea and spasmodic asthma, in which they were successfully employed by that physician. They produce, however, little obvious effect upon the system, and are not employed in this country. W.

CARNALITE. This native mineral is found in Stassfurt, Prussia, in enormous quantities, and is at present very extensively used in the preparation of potassium salts. It is a double chloride of magnesium and potassium, associated with rock salt. (See *Pharm. Journ. and Trans.*, March, 1872, p. 787.) H. C. W.

CARNAULIA ROOT. This root, which has recently been thrown into commerce, is the product of Corypha cerifera, a wax palm of Brazil. The root is several feet in length, about three-eighths of an inch thick, with a thick friable cortex of a mixed grayish and reddish brown colour. (*Am. Journ. of Pharm.*, Aug. 1875, p. 349.) Mr. E. L. Cleaver

found in it tannic acid, an acrid resinous body, a red colouring matter, and minute portion of volatile oil and of an alkaloid. (*Pharm. Journ. and Trans.*, June, 1875, p. 965.) It is said to resemble sarsaparilla in its action. H. C. W.

CARUBA DI GUIDEN. Under this name are largely used, for the relief of asthma, certain gall-like bodies, formed on various species of Pistacia (especially P. terebinthina), as the result of the stings of an hemipterous insect. According to Ignaz Hoffmann, they are used by smoking and fumigation. For this purpose they are coarsely pulverized and burnt in the bowl of a pipe, or in a dish, with some arrangement by which the fumes may be inhaled. Preparations should be made beforehand, so that the smoke may be inhaled at the commencement of the attack. They appear to act by exciting free secretion, probably through the turpentine with which they are saturated. They are also said to be very useful in other lung affections besides asthma, even in chronic organic diseases. (*Schmidt's Jahrbücher*, Jan. 1872.) H. C. W.

CARYA. *Hickory. Juglans.* Linn. Several species of the genus Carya, of Nuttall, separated by that botanist from the *Juglans* of Linnæus, grow within the limits of the United States, of which *C. olivæformis* bears the *pecan-nut* of the South-West, *C. alba*, the fruit so well known by the name of *shell-bark*, derived probably from the ragged state of the bark of the stem, *C. sulcata*, another variety of shell-bark, and *C. tomentosa*, the common thick-shelled hickory-nut. Other indigenous species are *C. amara*, *C. glabra*, and *C. microcarpa*. The leaves of most if not all of these trees are somewhat aromatic and astringent, and the bark astringent and bitter; and both no doubt possess medical virtues. Attention was called to them by Mr. Frederick Stearns, of Detroit, in a paper on the medical plants of Michigan, read before the American Pharmaceutical Association, and published in their *Proceedings* (1859, p. 249). Mr. Stearns bases his opinion of the probable virtues of these products upon a communication made to him by Mr. Caffinbury, of the same State, who had found great advantage from chewing the inner bark of the hickory in dyspepsia, and had used a tincture made from the same bark with great success in the treatment of intermittent fever. The use of the remedy had extended in his neighbourhood, and many employ it habitually in the same complaint, some of whom very wisely prefer the infusion to the tincture, as it has been found equally effectual. W.

CASTANEA PUMILA. *Chinquapin.* This held a place in the secondary catalogue of our Pharmacopœia, until the late revision, when it was discarded. It is the bark of *Castanea pumila*, or chinquapin, of our Atlantic States. We present here the short account of it formerly contained in the first part of this work. The genus Castanea belongs to Monœcia Polyandria of the Linnæan system, and to the natural order Cupuliferæ, with the following generic character:—"MALE. *Ament* naked. *Calyx* none. *Corolla* five-petaled. *Stamens* ten to twenty. FEMALE. *Calyx* five or six leaved, muricate. *Corolla* none. *Germs* three. *Stigmas* pencil formed. *Nuts* three, included in the echinated calyx." (*Willd.*)—The chinquapin is a shrub or small tree, which, in the Middle States, rarely much exceeds seven or eight feet in height, but, in the Carolinas, Georgia, and Louisiana, sometimes attains an elevation of thirty or forty feet, with a diameter of trunk equal to twelve or fifteen inches. The leaves are oblong, acute, mucronately serrate, and distinguished from those of the chestnut, which belongs to the same genus, by their whitish and downy under surface. The barren flowers are grouped upon axillary peduncles, three or four inches long; the fertile aments are similarly disposed, but less conspicuous. The fruit is spherical, covered with short prickles, and encloses a brown nut, which is sweet and edible, but differs from the chestnut in being much smaller, and convex on both sides. The tree extends from the banks of the Delaware southward to the Gulf of Mexico, and south-westward to the Mississippi. It is most abundant in the southern portions of this tract of country. The bark is the part used. It is astringent and tonic, and has been employed in the cure of intermittents. W.

CATALPA BIGNONIOIDES. (*Walt.*) *Bignonia Catalpa.* Linn. *Catalpa-tree*, or *Catawba-tree.* This is a beautiful indigenous flowering tree, occasionally cultivated for ornamental purposes. It is reputed to be poisonous. The seeds have been employed by several practitioners of continental Europe in asthma. Mr. Eugene O. Rau obtained from them a bitter crystalline principle, the exact nature of which was not determined. (*Am. Journ. of Pharm.*, xlii. 204.) M. Automarchi recommends a decoction, made by boiling twelve ounces of water with three or four ounces of the seeds down to six ounces, the whole to be given morning and night; but, if there be any foundation for the prevalent opinion as to the poisonous character of the tree, this might be a hazardous dose; and it would be advisable, in any one who might be disposed to imitate the practice, to begin with much smaller doses, and to increase until the effects of the medicine on the system are ascertained. W.

CAULOPHYLLUM THALICTROIDES. (*Michaux.*) *Leontice thalictroides.* Linn. *Blue Cohosh. Pappoose Root.* (*Gray's Manual*, p. 20.) An indigenous, perennial, herbaceous plant, with matted, knotty rhizomas, from which rises a single, smooth stem, about two feet high, naked till near the summit, where it sends out a large triternately compound leaf, and ending in a small raceme or panicle of greenish-yellow flowers at the

base of which is often a smaller biternate leaf. The whole plant when young, as well as the seeds, which are about as large as peas, is glaucous. It is the only known species of the genus. It is found in most parts of the United States, growing in moist rich woods. The root is the part used. This has a sweetish, pungent taste, and yields its virtues to water and alcohol. It is deemed especially emmenagogue, and is thought also to promote the contractions of the uterus, for which purpose, we learn, it is much employed by the "eclectic" practitioners, who consider it also possessed of diaphoretic and various other remedial properties. It is given in decoction, infusion, or tincture; the first two being made in the proportion of an ounce to a pint of water, the last of four ounces to a pint of spirit. The dose of the decoction or infusion is one or two fluidounces, of the tincture one or two fluidrachms. W.

CEANOTHUS AMERICANUS. *New Jersey Tea. Red-root.* A small indigenous shrub, growing throughout the United States. The root is astringent, and imparts a red colour to water. It is said to be useful in syphilitic complaints, in which it is given in the form of decoction, made with two drachms of the root to a pint of water. Schoepf states that it is purgative. The leaves were used during the revolutionary war as a substitute for tea. Dr. Hubbard recommends a strong infusion of the dried leaves and seeds, as a local application in aphthous affections of the mouth and fauces, and the sorethroat of scarlatina, and as an internal remedy in dysentery. (*Boston Med. and Surg. Journ.*, Sept. 30, 1835.) W.

CEDRON. The seeds of a tree growing in New Granada and Central America, and described by M. Planchon under the name of *Simaba Cedron*, in the *London Journ. of Botany* (v. 566), from specimens sent by Mr. Wm. Purdie, curator of the Botanical Garden at Trinidad, to Sir Wm. J. Hooker. Mr. Purdie had received the first intimation of the value of this medicine from Dr. Cespedes, a physician of Bogota. The first account of it, however, which reached Europe appears to have been that of Dr. Luigi Rotellini, a physician of St. Domingo, who had previously resided in New Granada. It was published in an Italian journal so early as the year 1846. In France it appears to have been made known through M. Jamord, who received information of its effects from M. Herran, Chargé d'Affaires in France of the Republic of Costa Rica. The fullest account that we have seen of the plant and its product is from the pen of Sir Wm. J. Hooker. (See *Pharm. Journ.*, Jan. 1851, x. 344.)

Simaba Cedron belongs to the natural family of Simarubaceæ. It is a small tree, with an erect stem, not exceeding six inches in diameter, branching at top in an umbellate form, with large, glabrous, pinnate leaves, and pale-brown flowers, in long, branching racemes. The fruit is a large, solitary drupe, containing a single seed. The whole plant appears to be impregnated with a bitter principle, but it is the seed only that is used. A specimen of the dried fruit was kindly sent to the author from Cartago, in Costa Rica, by Dr. Guier, formerly of Philadelphia. It is light, of a yellowish-ash colour, flattish-ovate, with one edge convex and the other nearly straight, the convex outline terminating at each end in an obtuse point, of which that at the apex is most prominent. It is about two inches long, and sixteen lines in its greatest breadth. Within, the seed is loose and movable. The seed itself is about an inch and a half long, ten lines broad, and half an inch thick. It is convex on one side, flat or slightly concave on the other, and presents an oval scar near one extremity of the flat surface. It is hard and compact, but may be readily cut with a knife.

Cedron seed is inodorous, but of a pure and intensely bitter taste, not unlike that of quassia. It yields its virtues to water and alcohol. M. Lowry obtained from it a crystalline substance, intensely bitter, freely soluble in boiling water, and neutral to test paper, which he supposes to be the active principle, and proposes to make *cedrin*. He obtained it by first exhausting the cedron with ether, then treating it with alcohol, and crystallizing from the tincture. (*Journ. de Pharm.*, xix. 335.)

This medicine has long had great reputation in New Granada and Central America, as a remedy for the bite of serpents, being mentioned in the *History of the Buccaneers*, published in 1699, as useful for this purpose; and such continues to be the confidence of the natives in its virtues, that they have no fears of the poisonous bite of these reptiles, if provided with the antidote. It is also highly esteemed for the prevention of hydrophobia, and in the treatment of intermittent fever, spasm of the stomach and bowels, and dyspeptic affections. Dr. Guier informed us that he had seen it once apparently successful in curing the bite of a poisonous serpent, and had used it effectually in cholera morbus, colic, and neuralgia of the face. In the hands of Dr. J. B. Thompson, of London, it has proved useful in gout. (*Med. Times and Gaz.*, April, 1852.) Dr. S. S. Purple, of New York, has found it promptly effectual in a number of cases of intermittent fever, and believes it to possess valuable antiperiodic properties. (*N. Y. Journ. of Med.*, N. S., xiii. 173.) To us the medicine appears to be closely analogous to quassia, with which it is botanically allied. The dose used in Central America is one or two grains. M. Herran states that he had employed the remedy in eight cases of poisoning, and that his mode of using it was to administer five or six grains with a spoonful of brandy; and to dress the bite with the tincture. He had rarely occasion to repeat the dose to effect a cure.

Dr. Rotellini says that it is poisonous in overdoses, and has occasioned death in the quantity of twenty-five or thirty grains. A vinegar has been prepared in London by macerating for seven days two scruples of the cedron in an ounce of distilled vinegar. The dose is from twenty minims to a fluidrachm. (*Pharm. Journ.*, xii. 63.) From the statements of Dr. Purple, it appears that the doses above stated are too small, and that, from any ordinary quantity, no fear of injurious consequences need be entertained. He gave from ten to thirty grains every four hours, and states that though, in very large doses, it may produce griping and diarrhœa, these effects are easily controlled. W.

CELASTRUS SCANDENS. *Climbing Staff-tree.* A climbing indigenous shrub, growing from Canada to Carolina, and said to possess emetic, diaphoretic, and narcotic properties. The bark is the part employed. It has been used in chronic affections of the liver and secondary syphilis. For a full description of the plant, see Darlington's *Flora Cestrica*, p. 149. Other species of Celastrus, growing in various parts of the world, have been employed in medicine, though with little reputation. W.

CENTAUREA BENEDICTA. *Blessed Thistle. Carduus benedictus. Cnicus benedictus.* (De Cand.) This is an annual herbaceous plant, the stem of which is about two feet high, branching towards the top, and furnished with long, elliptical, rough leaves, irregularly toothed, barbed with sharp points at their edges, of a bright-green colour on their upper surface, and whitish on the under. The lower leaves are deeply sinuated, and stand on footstalks; the upper are sessile, and in some measure decurrent. The flowers are yellow, and surrounded by an involucre of ten leaves, of which the five exterior are largest. The calyx is oval, woolly, and composed of several imbricated scales, terminated by rigid, pinnate, spinous points. The plant is a native of the South of Europe, and is cultivated in gardens in other parts of the world. It has become naturalized in the United States. The period of flowering is June, when its medicinal virtues are in greatest perfection. The leaves are the officinal portion. They should be gathered when the plant is in flower, quickly dried, and kept in a dry place. The herb has a feeble, unpleasant odour, and an intensely bitter taste, more disagreeable in the fresh than the dried plant. Water and alcohol extract its virtues. The infusion with cold water is a grateful bitter; the decoction is nauseous, and offensive to the stomach. The bitterness remains in the extract. The active constituents are volatile oil, and a peculiar principle for which the name of *cnicin* has been proposed. This is crystallizable, inodorous, very bitter, neither acid nor alkaline, scarcely soluble in cold water, more soluble in boiling water, and soluble in all proportions in alcohol. It consists of carbon, hydrogen, and oxygen, and is analogous to salicin in composition. In the dose of 4 or 5 grains, it is said often to vomit, and in that of 8 grains, to be useful in intermittent fevers. (*Ann. de Thérap.*, 1843, p. 206.) The blessed thistle may be so administered as to prove tonic, diaphoretic, or emetic. The cold infusion, made with half an ounce of the leaves to a pint of water, has been employed as a mild tonic in debility of the stomach. A stronger infusion, taken warm while the patient is confined to bed, produces copious perspiration. A still stronger infusion or decoction, taken in large draughts, provokes vomiting, and has been used to assist the operation of emetics. The herb, however, is at present little employed, as all its beneficial effects may be obtained from chamomile. The dose of the powder as a tonic is from a scruple to a drachm, that of the infusion two fluidounces.

Attention has recently been called to another species, *Carduus or Cnicus marianus*, which was of old used for the same purpose as the C. benedictus, under the impression that its seeds have valuable hæmostatic properties. Rademacher is stated to have found a decoction of the seeds of great use in hemorrhages, particularly when connected with diseased liver or spleen. Dr. Lobach considers no other remedy so efficacious in uterine hemorrhage and melæna. He has also found it useful in amenorrhœa when connected with derangement of the portal circulation. He gives the seeds in decoction, made in the proportion of two ounces to the pint of water, of which the dose is a tablespoonful every hour. (See *Am. Journ. of Med. Sci.*, April, 1859, p. 537.) W.

CENTAURY. *Common European Centaury. Centaurium.* This long-used remedy, which held a place in the Edinburgh Pharmacopœia even to its latest edition, has been omitted in the British Pharmacopœia. It consists of the herb, and more especially of the flowering heads of *Erythræa Centaurium* (Persoon), *Chironia Centaurium* (Willd. *Sp. Plant.* i. 1068.) It is a small, annual herbaceous plant, rising about a foot in height, with a branching stem, which divides above into a dichotomous panicle, and bears opposite, sessile, ovate-lanceolate, smooth, and obtusely pointed leaves. The flowers are of a beautiful rose colour, standing without peduncles in the axils of the stems, with their calyx about half as long as the tube of the corolla. The plant grows wild in most parts of Europe, adorning the woods and pastures, towards the close of summer, with its delicate flowers.

The herb, though without odour, has a strong bitter taste, which it imparts to water and alcohol. The flowering summits are the officinal part. We have seen no satisfactory analysis of this plant. Among its constituents is a bitter extractive matter, for which the name of *centaurin* has been proposed. But it can scarcely be considered as a pure

proximate principle. The fresh herb yields by distillation an odorous watery product, of sharp taste (*Geiger*, ii. 482), in which M. Méhu, a French pharmaceutist, has detected valerianic acid. The same chemist claims to have discovered a peculiar colourless crystallizable, non-nitrogenous substance, which he names *erythrocentaurin*. He obtained it by exhausting the tops with water, evaporating a portion of the water, allowing the residue to stand, separating the precipitated matter or apotheme, adding alcohol to the remaining liquid which now deposited a bitter substance, and, after the separation of this by decantation, evaporating the liquid to the consistence of syrup, and treating the residue with ether. The ethereal solution, upon evaporation, yielded the erythrocentaurin in crystals. These are needle-shaped, soluble in the ordinary menstrua, and possessed of the remarkable property of being strongly reddened by exposure to solar light, and reacquiring their colourless character upon being again dissolved and crystallized. The bitter substance before mentioned may be separated by menstrua into two portions, one soft and the other dry, the former of which it is that gives its strong smell to the distilled water. Besides these principles, M. Méhu found also in centaury a *wax-like substance*, and saline matter. (*Journ. de Pharm.*, xliii. 38.)

Medical Properties and Uses. The common centaury of Europe has tonic properties very closely resembling those of gentian, with which it is associated in the same natural family. It is employed on the other side of the Atlantic in dyspeptic complaints, and formerly had considerable reputation in the treatment of fever. It was one of the ingredients of the *Portland powder*. In the United States it has been superseded by *Sabbatia angularis*, or American centaury. The dose of the powder is from thirty grains to a drachm. Another species of Erythræa (*E. Chilensis*) possesses similar properties, and is employed to a considerable extent in Chili as a mild tonic. An elaborate account of it may be seen in the *Journal de Pharmacie* (3e sér., xxv. 434). The *E. acaulis*, which grows in great abundance in the territory of French Algiers, where it borders on the Sahara, yields a root, which, under the name of *rejagnou*, is much employed by the natives for dyeing yellow. (*Ibid.*, 4e sér., v. 87.) W.

CEPHALANTHUS OCCIDENTALIS. *Button-bush.* (*Gray's Manual*, p. 172.) A common indigenous shrub, which received both its generic title and common name from the arrangement of its flowers in dense spherical heads (*χεφαλή*, head, and *ἄνθος*, flower). It prefers moist places, as along streams or on the borders of swamps. Its bark is bitter, is said to be laxative as well as tonic, and has been given in periodical fevers, in decoction or infusion. In a chemical examination of it, Mr. E. M. Hattan found a crystallizable fluorescent acid, a bitter uncrystallizable principle, a principle resembling saponin, tannin, two resins, fatty matter, gum, glucose, and starch. (*Am. Journ. of Pharm.*, xlvi. 314.) W.

CERESIN. Under this name has been introduced into commerce, as a substitute for wax, a substance which closely resembles white beeswax, but which, according to Prof. Jos. P. Remington, is one of the paraffins. (See *Am. Journ. of Pharm.*, xlv. 11.) H. C. W.

CHELIDONIUM MAJUS. *Celandine.* A perennial herbaceous plant, growing wild in this country, about old houses and in rocky places; supposed to have been introduced from Europe, where it is indigenous. It is one or two feet high, bears pinnate leaves and small peduncled umbels of yellow flowers, and, when wounded, emits a yellow, opaque juice. The whole plant is used. It has a faint unpleasant odour, and a bitter, acrid, durable taste, which is stronger in the roots than in the leaves. The odour is nearly lost by drying, but the taste remains. The yellow juice is bitter and exceedingly acrid, and when applied to the skin produces inflammation and even vesication. The plant, analyzed by MM. Chevallier and Lassaigne, afforded a bitter resinous substance of a deep-yellow colour; a kind of gum-resin of an orange-yellow colour, and bitter, nauseous taste; mucilage; albumen; and various saline substances, besides free malic acid and silica. Dr. Probst, of Heidelberg, afterwards found in it a peculiar acid denominated *chelidonic acid;* two alkaline principles, one of which forms neutral salts with the acids, and is called *chelerythrin* (*chelerythria*) in consequence of the intense redness of its salts, the other unites with but does not neutralize the acids, and is named *chelidonin* (*chelidonia*); and lastly a neuter, crystallizable, bitter principle, which from its yellow colour he calls *chelidoxanthin*. Chelerythrin appears to be an acrid narcotic poison. (*Annal. der Pharm.*, xxix. 113.) It has been shown by Dr. James Schiels, of St. Louis, to be identical with *sanguinarina*, and may be prepared in the same manner. (See *Sanguinaria*. Part I.) Zwenger has lately isolated another acid, which he names *chelidoninic acid*. (See a paper by Prof. J. M. Maisch, in the *Am. Journ. of Pharm.*, Jan. 1861, p. 7.)

Celandine is an acrid purgative, possessed also of diuretic, and perhaps diaphoretic and expectorant properties. In overdoses it produces unpleasant effects, and is by some considered poisonous. By the ancients it was much esteemed as a remedy in jaundice; and it has been found useful in the same complaint by some modern physicians. It was the chief ingredient of the old *decoctum ad ictericos* of the Edinburgh Pharmacopœia. It has been given also in other complaints, especially those of a scrofulous character,

affecting the mesenteric and lymphatic glands, the skin, and the eyes. The yellow juice is often applied to corns and warts, which it destroys by stimulating them beyond their vital powers, and is said to be very useful in eczema, urticaria, and other itching eruptions. The fresh herb is also applied locally about the pelvis, with asserted benefit, in amenorrhœa, and is much used in the South of Europe as a vulnerary. The dose of the dried root or herb is from thirty grains to a drachm, that of the fresh root one or two drachms, and the same quantity may be given in infusion. The watery extract and expressed juice have also been employed. The dose of the former is from five to ten grains, of the latter from ten to twenty drops, to be gradually increased. W.

CHELONE GLABRA. *Snake-head. Turtle-head.* (*Gray's Manual*, p. 285.) This is a very common indigenous, perennial, herbaceous plant, a foot or two in height, readily distinguished by its conspicuous closely clustered flowers, the shape of which, from their resemblance to the head of a snake or tortoise, has given origin both to the common and scientific names of the plant. It prefers low wet places. The leaves have a bitter taste, and are said to be tonic and aperient, with a supposed peculiar action on the liver. The decoction, made in the proportion of two ounces of the fresh herb to the pint, may be given in the dose of one or two fluidounces. W.

CHELTENHAM SALT, ARTIFICIAL. Several artificial mixtures have been prepared, professing to be exact imitations of the saline ingredients in the chalybeate Cheltenham water; but the only ones which appear worthy of confidence are those prepared by Robert Alsop, chemist, of London, and W. Hodgson, jun., druggist, of this city. The composition of the natural Cheltenham chalybeate is given at *page* 143. The imitation of Mr. Alsop, as analyzed by Dr. Faraday, contains the same solid and gaseous constituents as the natural water, except the sulphate of calcium, which is very properly omitted; and in the same proportions precisely, with the exception that there is about twice as much free carbonic acid in the artificial preparation. The iron is present in the state of protoxide, and is immediately dissolved by the free carbonic acid, upon adding a sufficient quantity of water. The carbonic acid probably exists in a free state in a dry mixture; as there is no obvious agent present to cause it to be disengaged in the mere act of solution.

Mr. Alsop's artificial mixture is in the form of a powder, nearly white, possessing a saline and slightly ferruginous taste. It forms a good combination, in which the aperient property of the salts present is combined with the tonic virtue of the iron. It is considered to be useful in glandular obstructions, especially of the liver, and in scrofulous affections, attended with feeble digestion, sluggish bowels, and pallidness of skin. It is employed, also, with advantage in sick headache, habitual costiveness, and hemorrhoids. The dose is a teaspoonful, quickly dissolved by brisk stirring in half a pint of cold water, and swallowed immediately, before the iron has time to separate in an insoluble state. This quantity may be taken in the morning, fasting, and repeated once or twice after an interval of twenty minutes, or in the course of the day. To obtain its full tonic and alterative effects, it should be persevered with for a month or six weeks. The artificial Cheltenham salt of Mr. Hodgson is identical with that of Mr. Alsop, and may be used with entire confidence for all the purposes to which the latter is applied. B.

CHIONANTHUS VIRGINICA. *Fringe Tree.* In the bark of this indigenous plant Mr. R. S. Justice has found *saponin.* (*Am. Journ. of Pharm.*, xlvii. 195.) H. C. W.

CHLORIDE OF ALUMINIUM. This substance, which has been proposed, and to some extent used, in England as a disinfectant, may be prepared by double decomposition between sulphate of aluminium and chloride of calcium in solution; the resulting sulphate of calcium being separated by filtration and the chloride obtained in crystals by evaporation at a very gentle heat. Under the name of *chloralum* and *chloralum powders* various mixtures have been put upon the market, all containing more or less of the chloride of aluminium. (*Am. Journ. of Pharm.*, xliv. 398.) They appear to be feeble and uncertain disinfectants. H. C. W.

CHLORIDE OF ARSENIC, SOLUTION OF. *Liquor Arsenici Chloridi. De Valangin's Arsenical Solution.* The following formula was given for this preparation in the late London Pharmacopœia. "Take of Arsenious Acid, broken into small pieces, *half a drachm;* Hydrochloric Acid *a fluidrachm and a half* [Imperial measure]; Distilled Water *a pint* [Imp. meas.]. Boil the Arsenious Acid with the Hydrochloric Acid, mixed with a fluidounce [Imp. meas.] of the Water, until it is dissolved; then add sufficient Water to make the solution accurately fill the measure of a pint [Imp. meas.]." This is an imitation of De Valangin's arsenical solution, called by the inventor, who was a practitioner in London, *solutio solventis mineralis.* It was originally made by subliming three parts of arsenious acid with eight of common salt, and dissolving the product in a determinate quantity of dilute muriatic acid. The sublimation directed by De Valangin with common salt had no effect on the arsenious acid; and, accordingly, his preparation may be considered to have been a solution of arsenious acid in muriatic acid, becoming terchloride of arsenic by the mutual decomposition of the acids. In the London formula thirty grains of arsenious acid were dissolved in twenty Imperial fluidounces of the menstruum, that being the measure to which the preparation is ultimately brought.

Hence each fluidounce contains a quantity of terchloride equivalent to a grain and a half of arsenious acid. Terchloride of arsenic is a colourless anhydrous liquid of the sp. gr. 2·18. It is strongly acid to litmus, completely soluble in alcohol and ether, and possesses the power of dissolving a considerable proportion of arsenious acid. (Dr. Penny and Mr. W. Wallace, *Philos. Mag.*, xli. 365.)

Medical Properties. This arsenical solution has considerable reputation in London as an alterative. It is chiefly employed in the treatment of chorea and lepra vulgaris. Dr. Farre, of London, states, as the result of his observation, that it effectually cures the worst forms of chorea. (Pereira, *Mat. Med.*, 3d ed., p. 670.) The late Dr. Pereira, who used this solution on numerous occasions, found it efficacious in the treatment of chorea and lepra, but was not convinced of its superiority to Fowler's solution. It is said to be less apt to disturb the stomach; but it must be recollected that De Valangin's solution is only three-eighths as strong as that of Fowler, and yet is not given in a larger dose. The average dose is five drops three times a day. Dr. Farre begins with three drops three times a day, increasing one drop each day, until the dose reaches ten drops three times daily. Whenever the stomach becomes disordered, the medicine should be suspended; and when renewed, it must be given in the original dose. Dr. Fuller, of London, praises this solution as a remedy in rheumatic gout, if the urine be clear and of low sp. gr. In such cases he gives it in the large dose of from ten to twenty drops, either alone or combined with cinchona. If mineral acids are indicated, muriatic acid is added. B.

This article was omitted in the original British Pharmacopœia, but was subsequently introduced in a modified form into both it and the U. S. Pharmacopœia. (See *Liquor Arsenici Hydrochloricus*, in *Part* II. of this work.) The present British preparation has nearly three times the strength of the Liquor Arsenici Chloridi of the late London Pharmacopœia. W.

CHLORIDE OF BROMINE. *Brominii Chloridum.* This chloride is prepared by passing chlorine gas through bromine, and condensing the vapours which form by a freezing mixture. It is a reddish-yellow, very mobile and volatile liquid, emitting dark yellow fumes, which have a very powerful odour, and cause a flow of tears. Its taste is hot and unpleasant. Chloride of bromine is used by Prof. Landolfi, of Naples, in the treatment of cancer and malignant tumours, both internally and as an ingredient in his caustic. For the composition of the caustic, and his formula for administering the chloride of bromine, see *page* 184, and the article on *Zinci Chloridum* in *Part* II. B.

CHLORIDE OF MAGNESIUM. *Magnesii Chloridum. Muriate of Magnesia.* When a concentrated solution of this salt is evaporated to dryness, it is partially decomposed into magnesia and muriatic acid, the latter being evolved. By a careful evaporation, stopping it so soon as the vapour begins to redden litmus paper, the chloride may be obtained in the state of a fused hydrate, having the composition MgCl,6HO. (Casaseca, *Chem. Gaz.*, Oct. 15, 1853, p. 384.) The physiological action of this bitter and very deliquescent salt is the subject of a memoir by Dr. Lebert. He finds it to act mildly and favourably as a purgative, producing a flow of bile, and an increase of appetite. On account of its extreme deliquescence, he recommends it in the liquid form, prepared by dissolving the salt in its weight of water. Of this solution he gives an ounce sufficiently diluted to an adult, and half an ounce to a child from 10 to 14 years of age. (*Arch. Gén.*, 4e sér., iii. 448.) B.

CHLORIDE OF MERCURETHYL. ($C_4H_5H_9Cl$.) This has been proposed as a substitute for corrosive sublimate, but is not at all likely to come into use. For an account of it and its method of preparation, see *Am. Journ. of Pharm.*, xlv. 337. H. C. W.

CHLORIDE OF MERCURY AND QUINIA. *Hydrargyri et Quiniæ Chloridum.* This compound has been prepared by Mr. McDermott, of Dublin, by uniting chemically corrosive sublimate with quinia. The corrosive sublimate was found to be reduced to the state of calomel; and, hence, it may be inferred that half the chlorine of the former united with the quinia. This preparation has been found useful in the treatment of obstinate skin diseases, given in the dose of a grain two or three times a day. B.

CHLORIDE OF POTASSA, SOLUTION OF. *Liquor Potassæ Chlorinatæ. Javelle's Water. Eau de Javelle.* This is prepared from carbonate of potassium precisely as the solution of chlorinated soda from carbonate of sodium, and probably has an analogous composition. (See *Liquor Sodæ Chlorinatæ.*) It is employed for taking out fruit stains, &c. from linen. B.

CHLORIDE OF SILVER. *Argenti Chloridum.* This has been already referred to as being inevitably formed when nitrate of silver is given internally. (See *page* 1090.) It is readily prepared by adding a solution of common salt to one of nitrate of silver, as long as it produces a precipitate. As first thrown down it is a white, curdy substance, but it soon becomes discoloured when exposed to the light. It is decomposed by solutions of the caustic alkalies, which convert it into oxide, but not by their carbonates. After the formation of the oxide in this way, the addition of sugar reduces it, and revives the silver. (*Levol.*) Chloride of silver has been used, rubbed on the tongue, in syphilis, and internally in epilepsy, chronic dysentery and diarrhœa, and other diseases in which nitrate of

silver has been given. The dose is from one to three grains or more, four or five times a day. Dr. Perry administered it at the Philadelphia Hospital, Blockley, in chronic dysentery, with the immediate effect of diminishing the number of stools. The crystallized *ammonio-chloride of silver* has been given in syphilitic affections, in the dose of the fourteenth of a grain. It is formed by saturating solution of ammonia, by the aid of heat, with chloride of silver, and allowing the liquid to cool in a stopped bottle. It crystallizes in cubes, and is very liable to decomposition. B.

CHLORIDE OF TIN. This chloride, which may be made by heating tin and muriatic acid together, has recently been recommended by M. Mallez, for local application in cases of gonorrhœa and purulent discharges from the vagina, as having a direct curative agency in these affections. He injects daily, in divided portions, a solution containing half a drachm of the salt in three fluidounces of distilled water. He has employed the same solution with complete success in a case of obstinate purulent otitis, which had resisted all the aurists. (*Ann. de Thérap.*, 1868, p. 175.) W.

CHLORINATED ANÆSTHETIC COMPOUNDS. By the mutual action of chlorine and olefiant gas, an oily liquid is obtained, discovered by the associated Dutch chemists, and called *Dutch liquid*. The empirical formula of this compound is $C_4H_4Cl_2$, which makes it the *bichloride of ethylen;* the rational formula is C_4H_3Cl,HCl. When it is acted on by an alcoholic solution of potassa, muriatic acid is separated by the formation of chloride of potassium, and a compound represented by C_4H_3Cl is set free. By the action of additional chlorine the Dutch liquid is susceptible of having each equivalent of hydrogen successively replaced by one of chlorine, forming four new compounds; namely, $C_4H_2Cl_2,HCl$ — C_4HCl_3,HCl — C_4Cl_4,HCl — C_4Cl_6. The last compound here is evidently a 6–4 chloride of carbon; and the others are called by Regnault, in allusion to the replacing chlorine, without noting the disappearing hydrogen, monochlorinated, bichlorinated, and trichlorinated Dutch liquid. The Dutch liquid has been tried as an anæsthetic by Prof. Simpson and Mr. Nunnely. Prof. Simpson was not satisfied with its effects; but Mr. Nunnely, having administered it frequently in practice, found it perfectly agreeable in every respect. Its use, he alleges, is not attended by the troublesome excitement produced by ether, or by the tendency to collapse caused by chloroform. Two forms of Dutch liquid have been recently experimented with by Dr. Aran, of Paris; and one of them furnished satisfactory clinical results. The liquid which gave favourable results has been ascertained by Mialhe and Flourens to be the monochlorinated Dutch liquid; but its cost proved to be too high to allow of its general use as a therapeutic agent. In consequence of this objection to the monochlorinated liquid, Mialhe and Flourens were induced to search for a substitute in the corresponding compound of a parallel series of ethers, formed by the action of chlorine on muriatic ether. When muriatic ether (C_4H_5Cl) is acted on by successive portions of chlorine, the hydrogen is replaced by the latter, equivalent for equivalent, and there are formed the five following compounds: $C_4H_4Cl_2$ — $C_4H_3Cl_3$ — $C_4H_2Cl_4$ — C_4HCl_5 — C_4Cl_6. Of this series, the first member is isomeric with the Dutch liquid; the second, third, and fourth with the mono- bi- and trichlorinated Dutch liquid, and the fifth is the 6–4 chloride of carbon, the terminating compound of the other series. The first member, though identical with the Dutch liquid in elementary composition, and having a vapour of the same density, has, nevertheless, a lower boiling point, and is different in chemical properties. Thus, it is not decomposed by an alcoholic solution of potassa, as the Dutch liquid is, and is not acted on by potassium, while the Dutch liquid is immediately attacked by it. These facts show that the atomic constitution of these two substances must be different. In like manner the second, third, and fourth members of this series are different in chemical properties from their isomeric representatives in the Dutch liquid series. In denoting the different degrees of chlorination of the muriatic ether series, Regnault indicates merely (as in the Dutch liquid series) the number of eqs. of chlorine supposed to replace hydrogen. Accordingly, he calls the first member of the series monochlorinated muriatic ether, corresponding to the Dutch liquid; and the second, third, and fourth, bi-tri- and quadrichlorinated muriatic ethers, corresponding to the mono- bi- and trichlorinated Dutch liquids. This confusion of nomenclature arises from the fact that the replacement by chlorine sets out from five eqs. of hydrogen in the muriatic ether series, and from four eqs. in the Dutch liquid series.

From the explanations above given, it will be understood that the compound of the muriatic ether series, corresponding to the monochlorinated Dutch liquid, is the bichlorinated muriatic ether. This compound proved too volatile to act advantageously as a local anæsthetic. The tri- and quadrichlorinated ethers are denser and less volatile, and acted more favourably. The conclusion arrived at by Mialhe and Flourens appears to be that the four chlorinated muriatic ethers all possess anæsthetic properties; and, as it would be difficult to separate them, they propose the use of the mixed ethers, consisting principally of the tri- and quadrichlorinated compounds, as an anæsthetic, under the indefinite name of chlorinated muriatic ether.

Chlorinated muriatic ether (*chlorinated chlorohydric ether*) is a colourless, very mobile, neuter liquid, having an aromatic ethereal odour, and hot, saccharine taste. It is sparingly soluble in water, but readily soluble in alcohol, ether, and most of the fixed and volatile

oils. It is not inflammable, in which respect it agrees with chloroform. Being a mixture of different liquids, its sp gr. is not uniform. Its boiling point varies from 230° to 266°. According to the experiments of Flourens, it has a similar action to chloroform, the most important of the chlorinated anæsthetics. (See *Chloroformum.*) Its local action is that of a powerful sedative. (B. Cucuel, *Ann. de Thérap.*, 1853, 102.) B.

Within a very short time various other chlorinated compounds have been brought forward as having anæsthetic virtues, of which those most deserving of attention are probably the *bichloride of methyl*, *bichloride of carbon*, and *chloride of ethylin*. It will be more convenient to consider these under the general name at the head of this article, than to scatter them here and there, according to the position of their titles in an alphabetical catalogue.

Bichloride of Methylen. *Chloromethyl.* This was introduced into notice by Dr. B. W. Richardson, of London. It may be prepared by exposing to sunshine, in a glass globe, chlorine and gaseous chloride of methyl. The globe is provided with two lateral apertures for the admission of the gases, and below with an open neck, which communicates with one of the tubulures of a Woulfe's bottle, of which the other tubulure communicates by a bent tube with a second Woulfe's bottle, and this by another bent tube with a flask. The second bottle is surrounded with ice, and the flask immersed in a freezing mixture, to condense the volatile products. The bichloride condenses in the flask in a pure state, while the contents of the two Woulfe's bottles consist chiefly of chloroform. (*Gmelin*, vii. 288.)

The chloride of methyl may be made for the purpose by heating together 1 part of wood-spirit, 2 parts of common salt, and 3 of sulphuric acid, and collecting the evolved gas over water, which retains the impurities. Chloride of methyl is a colourless gas, having an ethereal odour and a sweet taste. (*Gmelin.*) Dr. Richardson found it to possess anæsthetic properties, but to be less manageable than the bichloride of methylen.

Bichloride of methylen is a colourless liquid, of an odour analogous to that of chloroform, of the sp. gr. 1·344, and the boiling point 88° F. The density of its vapour is 3·012 (*Gmelin*), 2·937 (*Richardson*). It consists of one eq. of methylen and two of chlorine, and its formula is C_2H_2,Cl_2. In its preparation, chlorine appears to take one eq. of hydrogen from the chloride of methyl and to give it an eq. of chlorine; thus converting C_2H_3Cl (chloride of methyl) into $C_2H_2Cl_2$ (bichloride of methylen). The vapour of the bichloride does not, like that of chloroform, extinguish the flame of a taper, but itself takes fire, burning with a brilliant flame, and yielding, as the result of its combustion, carbonic and muriatic acids. Bichloride of methylen mixes readily with absolute ether, and, as the boiling points of the two approach nearly, they volatilize evenly and equably. It is neutral to test paper; and an acid reaction in any specimen would be an evidence of the presence of muriatic acid, and should preclude its use as a respiratory anæsthetic. To prevent the generation of the acid, the liquid should be kept carefully secluded from the sunlight.

Dr. Richardson, in his experiments with animals, found it, when inhaled, to produce insensibility without previous excitement, and the insensibility, when produced, continues longer without an additional administration than that caused by other anæsthetics. Like the others, it may be made to destroy life; but it has this advantage over them, that, after death, the muscular irritability remains longer; and consequently the chances are greater of a restoration of the vital functions by the means employed. The condition in which the heart and lungs are left after death from it is favourable to resuscitation. On the whole, Dr. Richardson gives, as the result of his experiments both with the inferior animals and man, the following conclusions. 1. The bichloride produces as deep insensibility as chloroform. 2. Its action is rather more rapid; but more is required to produce the desired effect, in the proportion of about six to four. 3. It produces a less prolonged second degree of narcotism than other anæsthetics. 4. The narcotism, when induced, is very prolonged, and may be reproduced with great ease. 5. It acts equably through the nervous centres of respiration and circulation; producing no break in the natural relation between these functions. 6. It rapidly escapes from the system, so that recovery is sudden when it begins. 7. It sometimes, like ether and chloroform, causes vomiting. 8. When it kills, it is by equally paralyzing the circulation and respiration. 9. It interferes with muscular irritability less, probably, than any other anæsthetic. 10. It combines with ether and chloroform in all proportions. It has been tried in several cases of severe surgical operations, and with results thus far altogether satisfactory. The quantity used averaged about a drachm every five minutes. (Dr. B. W. Richardson, *Med. Times and Gaz.*, Oct. and Nov. 1867, pp. 423 and 479.)

Under the recommendation of Dr. Richardson, the bichloride has been used by several others, with satisfactory results. Dr. A. Russell Strachan, of New York, has published an account of his experience with it in the *Medical Record* (March 2, 1868, p. 22). Trying it first on himself, he inhaled it from lint upon which about a drachm had been poured, and at once began to experience pleasant and extremely composing sensations, soon followed by an "irresistible tendency to somnolence," without any of the disagreeable sensations in the head usually attendant on the inhalation of ether and chloroform. Feeling that he would soon be beyond his own control, he poured about three drachms

more of the liquid on the lint, and continued to inhale until entirely unconscious. About half an hour from the beginning, he suddenly reacquired consciousness, feeling perfectly well and fit to attend to his affairs. There was no nausea, oppression, or other unpleasant feeling; and nothing remained to remind him of the experiment but a somewhat disagreeable flavour in the mouth and throat. Encouraged by the results of this trial, he used the anæsthetic afterwards in one surgical and in one obstetrical case with complete success; the patients having been speedily narcotized, in one instance in three minutes, afterwards kept insensible as long as was needful, and in the end suddenly awaking, with nothing but comfortable sensations. In the surgical case two drachms were at first administered on a folded napkin, four minutes afterwards another drachm, and, in the course of the operation, which lasted nearly three-quarters of an hour, somewhat more than an ounce and a half. In the obstetrical case a drachm and a half of the bichloride was sufficient to produce unconsciousness in three minutes; which was afterwards maintained without difficulty, so far as was necessary, until the birth of the child.

The anæsthetic has since been used successfully by various English surgeons, also in Germany and this country. In the convenience of its administration, bichloride of methylen enjoys at least an equal superiority with chloroform over ether; but experience has shown the fallaciousness of the first estimates of its safety, as several deaths have been produced by it. (See *British Med. Journ.*, Oct. 1869; *Dublin Quarterly Journ.*, Aug. 1870; *Pharm. Journ. and Trans.*, April, 1871, p. 875.) Even the mixture of bichloride of methylen and absolute ether, which Dr. Richardson has introduced under the name of *methylen ether* (*Med. Times and Gaz.*, ii. 1872; i. 1873), has caused death. (*Philada. Med. Times*, iii. 718; *Med. Times and Gaz.*, July, 1873.)

The bichloride of methylen may be used in the dose of from ten to thirty minims, or be given in dilute spirit. (*Lancet*, ut supra.)

Bichloride of Carbon. *Tetrachloride of Carbon. Chlorocarbon.* The substance to which these several names have been attached, though discovered by Regnault so early as 1839, did not come into general notice until December, 1865, when it was suggested as an anæsthetic by Prof. Simpson, of Edinburgh, in a paper published in the *Med. Times and Gaz.* (Dec. 1865). It appears, however, that it had been previously used as an anæsthetic by Dr. A. E. Sansom and Dr. John Harley, who experimented with it in 1864, and recorded their experience in Dr. Sansom's work on Chloroform, published in May, 1865. (*B. and F. Med.-chir. Rev.*, Oct. 1867, p. 551.) To procure it, dry chlorine is passed first through a bottle containing sulphuret of carbon, and then through a porcelain tube, filled with pieces of porcelain, and kept at a bright-red heat. The vapours are condensed in a cooled receiver, forming a yellowish-red liquid, which is a mixture of bichloride of carbon, and chloride of sulphur. The chloride of sulphur is removed by slowly adding the liquid to an excess of ley of potash or milk of lime; the mixture being set aside, and agitated from time to time till the sulphur compound is decomposed, and then distilled. Bichloride of carbon passes over, sometimes mixed with a portion of sulphuret of carbon which has escaped decomposition, but which may be separated by occasionally bringing the mixture into contact with ley of potash. There are other modes of preparing it, which will be found in *Gmelin's Handbook* (vii. 356). By one of these, chloroform is made to yield it by the substitution of an eq. of chlorine for one of hydrogen; thus C_2H,Cl_3 (chloroform) becomes C_2Cl_4 (bichloride of carbon).

Bichloride of carbon is a transparent colourless liquid, of the sp. gr. 1·599 (Regnault), boiling at 172° F., with a vapour density 5·33, and an agreeable aromatic flavour. In composition it is a bichloride (C_2Cl_4 or $C_2Cl_2Cl_2$); but, according to the new notation, which doubles the weight of carbon, it is a tetrachloride (CCl_4 or CCl_2Cl_2). Sir J. Y. Simpson, to obviate this uncertainty of nomenclature, proposes *Chlorocarbon* as a medical or pharmaceutical title, sufficiently expressive without ambiguity.

Effects and Uses. Dr. P. Smith describes its effects as follows. About half a drachm on a handkerchief was inhaled. The vapours had an agreeable odour, not unlike that of the quince; a sense of coolness in the fauces was experienced similar to that caused by oil of peppermint; and this was followed by a feeling of warmth on the surface of the body generally. A feeling of calmness and comfort succeeded, which continued until the end of the day; and the sleep at night was sounder than usual. Similar effects were afterwards obtained in greater degree upon a repetition of the experiment with an increased dose. Rapid anæsthetic effects were produced, followed, in about two minutes, by calm sleep, and in about a minute longer, by a complete return of consciousness. The bichloride was then tried on animals, with the result, in small doses, of causing entire loss of power and consciousness, from which they soon recovered entirely; but larger doses occasioned death; the animal becoming first unconscious, then gradually ceasing to respire, and dying in eight minutes. The heart was not felt to beat after the breath had ceased. Similar experiments were performed by Dr. John Harley with essentially similar results. From numerous trials afterwards made on human subjects in various morbid conditions, the conclusion was arrived at, that the bichloride of carbon may be usefully employed, by inhalation, for the relief of pain, especially headache, tic douloureux, toothache, the sufferings of dysmenorrhœa, &c., that it will be a valuable agent for mitigating the pains of labour, and that its local use may prove serviceable for

similar purposes. In the majority of instances there was no supervening nausea or vomiting; and no unpleasant effect on the skin or mucous membrane. It is pleasanter to inhale than chloroform, and produces anæsthesia with less previous muscular spasm. Though slower in escaping from the system, yet its effects on perception are more evanescent, and consciousness usually returns in a few moments after the cessation of inhalation. Pain, however, and voluntary muscular power, may be suspended without the complete loss of consciousness. Like all anæsthetics, it may destroy life if recklessly used. (*Lancet*, June 1, 8, and 29, 1867, pp. 661, 692, and 791.)

Sir J. Y. Simpson says, of this anæsthetic, that the effects of its vapour approach nearer to those of chloroform than any other similar agent. Its primary effects are very analogous to those of chloroform, but it takes a longer time to produce the same degree of anæsthesia, and generally longer to recover from it. Its depressing influence, however, on the heart, he observes, is far greater, and, consequently, its employment far more dangerous. It is less irritant to the skin, and, therefore, may sometimes be preferable as a local anæsthetic. The injection of its vapour into the rectum is also less irritating. Its vapour, applied to the eye by sprinkling a few drops on the hand, is one of the most effectual means of relieving some forms of conjunctivitis, ulceration of the cornea, photophobia, &c. Injected subcutaneously, in the dose of 10 to 20 drops, it relieved pains in the walls of the chest and abdomen, without subsequent nausea. Internally, Sir James tried it only in small doses in gastrodynia, in which it had the same effects as chloroform. (*Med. Times and Gaz.*, Dec. 1865, p. 651.) W.

CHLORIDE OF ETHYLIDINE. ($C_2H_4Cl_2$.) This substance, which has recently been brought forward in Germany as a new anæsthetic, is in reality the same as the *Chloride of Ethyl*, which was employed as long back as 1851 by Dr. Snow, of England, as an anæsthetic. It is an oily fluid of a pleasant odour, which boils at 136° F., has a specific gravity at 60° F. of 1·174, and a vapour density of 38, taking hydrogen as a unit. It appears to be a quick, prompt anæsthetic, but has not been used with sufficient frequency to determine its safety. It is prepared by acting upon aldehyd with the pentachloride of phosphorus; and is especially liable to impurity. Indeed, Dr. Snow abandoned its use on account of the difficulty of getting it pure. H. C. W.

CHLORINATED MAGNESIA, SOLUTION OF. Mr. Robert E. Fairthorne has suggested this solution as a substitute for solution of chlorinated soda or chlorinated lime, in cases in which, whether internally or externally, the influence of the chlorine is especially required, and in which the irritant or corrosive quality of the soda or lime might be contraindicated. He proposes the following formula. "Dissolve eight ounces of sulphate of magnesia in two pints of water. Triturate in a mortar four ounces and one drachm of chlorinated lime with an equal amount of the same fluid. Mix the solution, and agitate occasionally. After standing twelve hours, pour off the supernatant liquid." Mr. Fairthorne found that each ounce of the solution contains somewhat less than nine grains of magnesia. (*Am. Journ. of Pharm.*, Jan. 1868, p. 70.) W.

CHROME. *Chromium.* As it has been customary, in this work, to notice more or less fully the metals of which one or more compounds are officinal, even though the metal may not hold the same position, it is proper to give a brief notice in this place of the metal chrome, of which two compounds, chromic acid and bichromate of potassium, are contained in the Materia Medica Catalogue of our Pharmacopœia. Chrome was discovered by Vaquelin in 1797. Its most common ore is the chromite of iron, consisting of protoxide of iron and sesquioxide of chromium. This is not an abundant mineral; and one of the most copious sources of it is in the chrome mines of south-eastern Pennsylvania. Chrome is obtained by igniting its oxide intensely in contact with charcoal. It is a brittle metal, of a grayish-white colour like platinum, with some lustre, and very hard, so that it scratches glass. Its sp. gr. is 5·9, equivalent 26·3, and symbol Cr. It does not change by exposure to the air, and is with difficulty attacked by the acids. It forms with oxygen five compounds: 1. the protoxide (CrO), 2. the sesquioxide (Cr_2O_3), 3. chromic acid (CrO_3). Of the two others, one may be considered as a compound of the protoxide and sesquioxide (CrO,Cr_2O_3), and the other, called *perchromic acid*, is said to consist of two eqs. of chrome and seven of oxygen (Cr_2O_7). Chrome combines with chlorine in two proportions, forming the protochloride and sesquichloride. The chief value of chrome in the arts is as the source of bichromate of potassium, extensively used in dyeing and valuable for the facility with which it parts with oxygen, and as the base of certain beautiful pigments. W.

CHROME YELLOW. This is the neutral chromate of lead, prepared by precipitating a solution of the nitrate of lead with chromate of potassium. It is of a beautiful lemon-yellow colour. The subchromate of lead, consisting of one eq. of acid and two eqs. of base, is of a red colour, and is sometimes used as a pigment. *Chrome green* is a mixture of chrome yellow and Prussian blue. The chromates are sometimes adulterated with the sulphate of lead. M. Duviller (*Journ. de Pharm.*, Août, 1873, p. 114) detects this by heating one part of the suspected pigment with a mixture of 2 to 3 parts nitric acid, sp. gr. 1·420, one to two parts of water, and one-fourth part of alcohol. The chromate is all dissolved, but any sulphate present remains unaffected. W.

CICHORIUM INTYBUS. *Chicory. Succory.* A perennial herbaceous plant, indigenous in Europe, but naturalized in this country, where it grows in fields, and in roads along the fences, in neighbourhoods which have been long settled. It is one or two feet high, with large, compound, beautifully blue flowers, which appear in July and August, and serve to distinguish the plant at first sight. The whole plant has a bitter taste, without acrimony, or any very peculiar flavour. The taste is strongest in the root, and weakest in the flowers. The leaves, when young and tender, are said to be sometimes eaten as salad in Europe. Succory is gently tonic without being irritating, and is considered by some authors as aperient and deobstruent. It is said to be useful, if freely taken, in hepatic congestion, jaundice, and other visceral obstructions in the early stages; and is affirmed to have done good even in pulmonary consumption. The usual form of administration is that of decoction, which is prepared by boiling one or two ounces of the root, or a handful of the herb, in a pint of water. The root, dried and roasted, is much used in certain parts of Europe as a substitute for coffee, and is said also to be mixed fraudulently with ground coffee for sale. In preparing it for coffee, Dausse recommends that the dried root should be cut into rather large and equal pieces, which are to be roasted until they lose 140 out of 500 parts. The pieces are then easily ground in a mill, and afford a yellowish-brown powder. (*Pharm. Cent. Blatt*, Oct. 1850, p. 688.) The plant is now largely cultivated both in England and on the Continent, to supply the demand for its root, which has grown out of its use for admixture with coffee, or as a substitute. In France alone the annual consumption is said to be 16 millions of pounds. (*Pharm. Journ.*, Aug. 1860, p. 125.) An instrument by means of which it may readily be detected when used to adulterate coffee, will be found described and figured in the *Pharmaceutical Journal* (Sept. 1867, p. 141). Mr. J. R. Leebody gives (*Chem. News*, Nov. 1874, p. 243) the following method of estimating the percentage of chicory in adulterated coffee. "Take one gramme of the unknown mixture and one gramme of a standard mixture of equal parts chicory and coffee, and remove all the colouring matter from each sample by repeated extraction with boiling water. Make the cooled extract from each up to the same volume (actual volume of no consequence, about 700 c.c. a convenient amount), and filter off a portion for the assay. Put 50 c.c. of the filtered extract from the unknown mixture in a Nessler cylinder, and determine by trial how many c.c. of the extract from the standard mixture, together with sufficient distilled water to make up to 50 c.c., will give the same colour. Let a c.c. be required, then, assuming the tinctorial power of chicory to be m times that of coffee the percentage (x) of chicory in the sample is given by the formulæ: $x = a\frac{m+1}{m-1} - \frac{100}{m-1}$." The *garden endive* is a species of Cichorium, denominated *C. Endivia.* W.

CICUTA VIROSA. *Water Hemlock. Cowbane.* A perennial, umbelliferous European plant, growing on the borders of pools and streams. It is very poisonous, proving fatal to most animals which feed upon it, though said to be eaten with impunity by goats and sheep. Several instances are on record of children who have died from eating the root by mistake for parsnep. It operates as an acrid narcotic, producing inflammation of the stomach, together with symptoms which indicate cerebral disturbance, such as vertigo, intoxication, and convulsions. Infusion of galls is recommended as an antidote, but should not be relied on to the exclusion of emetics. When the plant vomits, as it frequently does, fatal effects are less apt to ensue. It is said to be less poisonous dried than fresh; and it has been inferred that the active principle is volatile. But the volatile oil, obtained by distillation, was found by Simon, of Berlin, not to be poisonous. Indeed, from the experiments of M. Julius Trapp, of St. Petersburg, it appears to be identical with the volatile oil of cummin seeds (*Cuminum Cyminum*), which rank among the aromatics. (*Chem. Central Blatt*, June 9, 1858, p. 414.) On the other hand, the alcoholic extract of the dried root operated as a violent poison upon animals. (*Annal. der Pharm.*, xxxi. 258.) At present the plant is never used internally, having been superseded by *Conium maculatum.* Externally it is sometimes employed as an anodyne poultice in local pains, particularly those of a rheumatic or gouty nature.

Cicuta maculata, or *American water hemlock*, which grows in meadows and on the borders of streams throughout the United States, is closely analogous, in botanical character and in effects, to the European species. In several instances, children have been fatally poisoned by eating its root. This consists of several oblong, fleshy tubers, sometimes as long as the finger, spreading out from the base of the stem, and having a smell and taste not unlike those of parsnep. Until recently it has not been used in medicine; but we are told in Mr. Stearns' account of the medical plants of Michigan, that Dr. Norton, of Minnesota, highly recommends it as a specific in nervous and sick headache. (*Proceed. of Am. Pharm. Assoc.*, 1858, p. 253.) For a full account of the plant, see *Bigelow's Medical Botany* (i. 125). The seeds have been analyzed by Mr. J. E. Young, who found in them albumen, tannic acid, gum, fixed oil, resin, volatile oil, chlorophyll, colouring matter, a peculiar acid, and an organic alkaloid supposed to be identical with *conia.* (*Am. Journ. of Pharm.*, xxvii. 294.)

In cases of poisoning by either of these species of Cicuta, vomiting should be induced

as speedily as possible, and maintained till the stomach is thoroughly evacuated, after which the system must be supported. W.

CITRATE OF IRON AND BISMUTH. A solution of this so-called salt has been proposed as a remedy in dyspepsia. It is made by dissolving citrate of bismuth in a watery solution of ammonia, and adding the ammonio-citrate of iron. It is a mere mixture of the substances. (*Am. Journ. of Pharm.*, xliv. 246.) H. C. W.

CITRATE OF IRON AND MAGNESIUM. *Ferri et Magnesii Citras.* This double salt was introduced to the notice of the profession by M. Van der Corput. It is made by dissolving *two ounces* of freshly precipitated hydrated oxide of iron in a moderately heated solution of *three ounces* of citric acid, and saturating the liquor with carbonate of magnesium. The solution, after filtration, is evaporated by means of a water-bath to a syrupy consistence, and spread on glass to dry in scales. The quantity of carbonate required is nearly an ounce. Three and a quarter ounces of sulphate of iron will furnish by decomposition the necessary hydrated oxide for three ounces of the acid. (See formula for *Ferri Oxidum Hydratum.*) This salt is in transparent, greenish-yellow scales, having a slightly ferruginous, somewhat acid taste. It is very soluble in water, but insoluble in alcohol and ether. It may be given in doses of from five to ten grains, in the form of solution, syrup, or pill. See the remarks of Prof. Procter on this preparation, contained in the *American Journal of Pharmacy* (Oct. 1850, p. 315). B.

CITRATE OF SODIUM. *Sodii Citras.* This salt may be formed by saturating a solution of citric acid with bicarbonate of sodium, evaporating the liquid, and setting it aside to crystallize. It is a white salt, crystallized in six-sided pyramids, and having a saline taste without any bitterness. Citrate of sodium has been proposed by M. Guichon, of Lyons, as a pleasant purgative, having properties similar to those of citrate of magnesium, and, though possessing a taste more decidedly saline than the latter, having the advantages of cheapness, and of a constant solubility, which permits it to be associated with other medicinal preparations. M. Dannecy recommends it in diabetes, in daily doses of from half a drachm to a drachm. (*Bulletin Gén. de Thérap.*, Avril 15, 1866.) The dose, as a cathartic, is from ten to fourteen drachms, given in simple aqueous solution, or acidulated with citric acid and sweetened. B.

CIVET. *Zibethum.* This is an odorous substance, obtained from two animals of the genus Viverra; *V. Civetta* or civet cat of Africa, and the *V. Zibetha*, which inhabits the East Indies. It is secreted into a cavity opening between the anus and external genitals, and is collected from animals confined for the purpose. It is semi-liquid, unctuous, yellowish, becoming brown and thicker by exposure to the air, of a very strong, peculiar odour, similar to that of musk, though less agreeable and less diffusible, and of a bitterish, subacrid, disagreeable fatty taste. When heated it becomes quite fluid, and at a higher temperature takes fire, and burns with a clear flame, leaving little residue. It is insoluble in water, and only slightly soluble in ether and cold alcohol; but heated alcohol dissolves it almost entirely, depositing it again upon cooling. It contains, among other ingredients, a volatile oil, fat, and free ammonia. In medicine it was formerly employed as a stimulant and antispasmodic, like castor and musk; but is now used exclusively as a perfume. W.

CLEMATIS ERECTA. *Upright Virgin's Bower.* A perennial European plant. The leaves and flowers have an acrid, burning taste. When bruised in a mortar they irritate the eyes and throat, giving rise to a flow of tears and to coughing; and applied to the skin they produce inflammation and vesication. Hence the name of *flammula Jovis*, by which the plant was known in older pharmacy. The acrimony is greatly diminished by drying. Störck found this species of Clematis useful in secondary syphilis, cancerous and other foul ulcers, and severe headaches. He gave it internally, and at the same time applied the powdered leaves to the surface of the sore. It acted as a diuretic and diaphoretic. Two or three drachms of the leaves were infused in a pint of water, of which he administered four ounces three times a day. He also employed an extract, in the dose of a grain or two in the course of a day. At present the plant is little used; but the seeds have lately been given by M. Sauveur, in the form of infusion, in two cases of Bright's disease, which appeared to be cured, or at least greatly relieved by the remedy, acting powerfully as a diuretic. (*Ann. de Thérap.*, 1866, p. 130.)

Other species of Clematis have the same acrid properties. Among these are *C. Flammula* or *sweet-scented virgin's bower*, which, though a native of Europe, is cultivated in our gardens, *C. Vitalba* or *traveller's joy*, also a native of Europe, and several indigenous species, of which *C. Virginica* or *common virgin's bower*, *C. Viorna* or *leather flower*, and *C. crispa* have been particularly cited by authors as proper substitutes for the C. erecta used by Störck. All these are climbing plants. C. Vitalba has been used in Europe with success in the cure of itch. For this purpose the roots and stems, bruised, and boiled for a short time to diminish their acrimony, were infused in boiling oil, which, thus impregnated, was applied to the skin several times a day. Twelve or fifteen applications were usually sufficient. M. Gaube has found in this species an alkaloid, which he names *clematine*, and which forms with sulphuric acid a salt crystallizable in six-sided needles;

and, besides this, an acrid volatile oil analogous to mezereon in its properties, tannic acid, mucilaginous substances, and earthy salts in small proportion. (*Journ. de Pharm.*, Août, 1869, p. 122.) W.

COAL TAR. When bituminous coal is subjected to dry distillation, besides the incondensible gases which serve for lighting, and the charcoal left behind as *coke*, which is a valuable fuel, there are formed, through the reactions between the disengaged principles of the coal, numerous other products, necessarily more or less varying in character and amount, not only according to the kind of coal used, but also with the varying circumstances of the decomposing process. Most of these newly-formed bodies, all of which are volatile, are condensed into a dark thick liquid or semi-liquid substance called coal tar. Formerly this was considered as refuse matter, and the most embarrassing problem for the manufacturer was how to get rid of it most conveniently. But science and industry have combined to wrest from this seemingly useless mass many substances of great value in the arts, and several which have entered into the catalogue of remedies. In an excellent paper by M. E. Kopp, an abridgment of which is published in the *American Journal of Pharmacy* (1861, Jan., March, and May, pp. 39, 129, and 245), a general view is given of the constituents of coal tar, to which we wish to acknowledge our indebtedness for most of the statements which follow. Our purpose is to give a condensed view of these substances, and when found of importance in their therapeutical relations, to treat of them more fully, should they not have been already commented on under distinct heads. When coal tar is submitted to distillation and rectification, it yields the following products in variable proportion. They may be arranged in the three divisions of solids, liquids, and gases.

1. *Solids.* Carbon, naphthalin, paranaphthalin or anthracein, paraffin, chrysene, and pyrene.

2. *Liquids.* These may be subdivided into acid, neutral, and basic substances. The *acids* are rosolic, brunolic, carbolic or phenic, acetic, and butyric. The *neutral bodies* are water, essence of tar, light oil of tar, heavy oil of tar, benzole, tuluole, cumole, cymole, propyl, butyl, amyl, caproyl, hexylene, and heptylene. The *bases* are ammonia, methylamin, ethylamin, anilin, quinolin, picolin, toluidin, lutidin, cumidin, pyrrhol, and phætin.

3. *Gases.* Hydrogen, carburetted hydrogen, bicarburetted hydrogen, various other carbohydrogens, carbonic oxide, sulphuret of carbon, carbonic acid, hydrosulphuric acid, and hydrocyanic acid.

Since the appearance of M. Kopp's paper, M. Berthelot has been investigating the constituents of coal tar, and has succeeded in determining among them some which had been only conjectured to be present in it, as *styroline* and the *hydruret of naphthaline;* others of which the existence has been disputed, as *cymene* and *anthracene;* and others again previously unknown, as *fluorene* and *acénaphtène*, the last of which is of peculiar interest chemically, in consequence of its artificial production by the union of naphthaline and ethylene. (*Journ. de Pharm.*, Nov. 1867, p. 338; also Dec. p. 440.) Valuable researches have also been made in this field by Mr. C. R. Warren, which are contained in the *Memoirs of the American Academy* (N. S., ix. 135), and in the *Amer. Journ. of Sci. and Arts* (A. D. 1865, vol. xl. p. 89); to these, and to a résumé in the *Chemical News*, Oct. 16, 1874, p. 180, the reader is referred, as we have not space here to do justice to the subject.

Of the above substances a considerable number have not yet been individually applied to any important practical purpose. Some are so well known to the reader as to require no further notice. The remainder we shall endeavour to consider more or less fully as their novelty and importance may seem to demand.

Before submitting the tar to distillation, it is to be freed as far as possible from the ammonia it may contain, which is mixed up with the mass in impure watery solution, chiefly probably as the carbonate. For this purpose it is heated to a point between 170° and 212° F., by which it is rendered more liquid, so that the water holding the ammonia in solution can be drawn off. This impure ammoniacal liquid is afterwards treated with sulphuric acid, by which the sulphate of ammonium is obtained, and this, by sublimation with chloride of sodium, yields chloride of ammonium; and from this source almost exclusively the market is at present supplied with the different ammoniacal compounds.

Having been thus freed from ammonia, the tar is next distilled at a relatively low temperature, which is most conveniently regulated by means of steam. The object is to obtain first the lighter liquids, of which the boiling point is comparatively low. The heat employed should not exceed 390° F.; and, when the sp. gr. of the condensed products reaches 0·850, the process is suspended. The product of this first distillation is very complex, containing, among other substances, three carbohydrogens of special interest to the physician; viz., *benzole* ($C_{12}H_6$), which has already been treated of, *amyl* ($C_{10}H_{11}$), the radical of fusel oil or amylic alcohol, also before considered, and *propyl* (C_6H_7), the radical of the alkaloid *propylamia*, of which we propose to treat in the following pages. This lighter oil is known as *light oil of tar* or *coal naphtha*. It is purified by first agitating it with 5 per cent. of concentrated sulphuric acid, allowing it to rest

for a day or two in order that the acid and impurities may subside, then washing it with water, and afterwards with 2 per cent. of a solution of caustic soda of the sp. gr. 1·382, to separate adhering acid, and finally distilling with a current of steam. Thus purified, it has the sp. gr. 0·815 to 0·820, and is not unfrequently sold under the name of *benzine*, which it would be well to restrict to this product, reserving the name of *benzole* for the pure carbohydrogen. Benzine is used for various purposes in the arts, generally connected with its great solvent power.

When the distillation of the tar is suspended, the steam is withdrawn, and, the heat being increased to between 390° and 410° F., the distillation recommences; and the mixed oils that now come over and condense have a sp. gr. from 0·880 to 0·885, instead of 0·850, the sp. gr. of the lighter oil. This heavier product is distinguished by the name of the *heavy oil of tar*. It contains the acids and organic bases already enumerated, from which it is freed by treatment with sulphuric acid and one of the fixed alkalies and redistillation, in the same manner as above described for the light oil, using 10 per cent. of sulphuric acid instead of 5, and 6 per cent. of solution of soda instead of 2. The heavy oil thus purified is used as lamp oil, and is very largely consumed. Before distillation this oil has a disagreeable sulphurous odour, owing to the decomposition of the sulphuric acid used in purifying it, from which it is freed by shaking it with solution of sulphate of iron before distillation, or, after distillation, with addition of caustic soda to the sulphate. A blackish deposit of sulphuret of iron takes place, and the oil loses its odour. (*Kopp.*)

The solid or semi-solid mass, which forms out of the last products of the distillation upon cooling, is also complex; but consists largely of the two concrete bodies, naphthalin and paraffin, the proportion of each of which to the other varies according to the kind of coal used, and to the degree of heat employed. According to Mr. Joseph Taylor, the product of naphthalin is very great when the coal has been decomposed at a high temperature. He states that it is easily obtained from the latter portions of the light oil, which, if collected separately and set aside, become semi-solid on cooling. This concrete mass is pressed to separate the liquid portion, and may be purified by crystallization from naphtha or sublimation. *Paraffin*, according to the same authority, exists in small quantity in coal tar, being destroyed by the high temperature necessary in decomposing the coal in the manufacture of gas. (*Pharm. Journ.*, Jan. 1861, p. 364.) M. Kopp, on the contrary, states that the tar from Boghead coals is rich in paraffin. (*Am. Journ. of Pharm.*, Jan. 1861, p. 41.) When the last products of distillation cool, this separates as a buttery mass, while naphthalin, under similar circumstances, assumes a crystalline character. The paraffin and the heavy oil which drains from it, and which is called *paraffin oil*, are purified in the same manner as the lighter and heavier oils above referred to by sulphuric acid, which, however, is sometimes aided by oxidizing agents, such as bichromate of potassium, peroxide of manganese, or permanganate of potassium, and subsequent washing with solution of caustic soda. After this the paraffin is either redistilled, or purified by a second treatment with sulphuric acid and washing. It is now mixed with 1 per cent. of stearic acid, which, on the addition of the caustic soda, forms a soap which, when the paraffin is melted, envelops the impurities, and separates in flocculi, leaving the paraffin pure. *Paraffin* having been already described under the head of *Creasotum*, in *Part* I. (*page* 355), requires no further consideration here; and *naphthalin* will be considered in its proper alphabetical position in the present part of this work. It may be worth mentioning that death has occurred in a woman in consequence of swallowing paraffin oil largely. (*Pharm. Journ.*, July, 1865, p. 38.)

The acid and alkaline washings resulting from the purifying processes to which the oils have been subjected contain all the acids and alkaloids already mentioned as among the products of the distillation of coal tar. It has become important to obtain these separate, as some of them have recently acquired great value in the arts as the source of colouring substances used in dyeing, and others are employed as medicines. M. Kopp proposes the following method of obtaining them. Collect separately the acid and the alkaline liquors, determine how much of the latter would suffice to neutralize a given portion of the former, then mix the alkaline solution with twice the quantity of acid sufficient to saturate it. If the mixture be quickly made a heat will be generated near to the boiling point; and a concentrated solution of bisulphate of sodium will be formed, holding in solution the bisulphates of the organic alkaloids, while the carbolic acid and creasote will separate in the form of a brown oil. If this be removed and distilled, a light neutral oil will first pass, and then the creasote and carbolic acid nearly pure; and it is probably this mixture or some one like it that is now improperly sold in the market under the name of creasote. The acid solution, being now allowed to cool, deposits bisulphate of sodium in crystals. The portion of acid solution, not used to saturate the alkaline, may now be added, the mixture heated to 150° or 180° F., chalk or lime added short of complete saturation, and the liquor concentrated. After the deposit of sulphate of calcium has been separated, the concentrated solution of the acid sulphates is to be mixed with an excess of quicklime, and distilled from an iron retort. Sulphate of calcium is left behind, and the liberated alkaloids pass over and condense with water. If the water be sufficient to hold them in solution, muriatic acid is to be added to saturation, and the liquor evaporated, first over the naked fire, but towards the close upon a

water-bath, nearly to dryness. The muriates thus formed are mixed with an excess of lime and distilled, and an oily liquid is thus obtained, consisting chiefly of the alkaloids, anilin (anilia), quinolin (quinolia), and toluidin (toluidia), sufficiently pure to be used in preparing the various colouring substances, which constitute all their value in the arts. Of the different products resulting from the above process, all that are used in medicine, namely *creasote*, *carbolic acid*, and *anilin*, have been treated of under distinct heads in this work, to which the reader is referred. (See *Acidum Carbolicum* and *Creasotum*, in *Part* I., and *Anilin*, in *Part* III.)

This is not the place to treat of the methods in which the several beautiful and magnificent colours are prepared from anilin and the other coal-tar alkaloids; as the subject belongs exclusively to the arts. It will be sufficient to refer to the fine *anilin violet*, produced by reaction with bichromate of potassium; the magnificent purple called *fuchsin* or *magenta*, resulting from the reaction between anilin and chloride of tin; and the splendid *anilin red* obtained by treating the same alkaloid with bichloride of mercury or perchloride of tin. Yellows, greens, and various other tints are prepared either with anilin or the other coal-tar alkaloids, which appear to share its wonderful colouring powers.

The residue of coal tar left after its distillation, commonly called *pitch*, has also been applied to various useful purposes; being mixed with coal dust or small fragments of coal, otherwise useless, to fit them for fuel; or used as a paint to wood in order to preserve it; or employed in the preparation of what are called asphaltum pavements and for covering roofs. (*Taylor.*)

Coal tar itself has been ascertained to answer admirably well, in certain instances, the purposes of a disinfectant. MM. Corne and Demeaux prepared a mixture of coal tar and plaster of Paris, in the proportion of from one to three parts of the former to one hundred of the latter, which, having been submitted for trial to a committee of the Academy of Sciences of Paris, was reported on favourably by the committee, of which M. Velpeau was at the head. The mixture should be made of the best modelling plaster, and should have a gray colour after the ingredients have been well rubbed together. It is in the form of powder, and may be applied on lint, or mixed with cataplasms, or sprinkled thickly on ulcerated surfaces. It is applicable to fetid, sloughing, or gangrenous ulcers, to offensive suppurating surfaces, sanious wounds, &c., and may be used also to correct disagreeable odours, in autopsies, about the beds of dirty patients, and wherever there are fetid discharges. (*Journ. de Pharm.*, Oct. 1859, p. 296.) It may sometimes be advisable to employ coal tar for the same purpose in the liquid form, made by emulsionizing it; but this cannot be effected, as in the case of wood tar, by means of the carbonated alkalies. It is asserted by M. Jeannel that the only known means of obtaining this result, up to the time at which he wrote (A. D. 1866), was by the use of a tincture of the soap bark (bark of *Quillaya saponaria*), as proposed by M. Lebœuf. This tincture is prepared for the purpose by digesting, for some days, one part of the bark finely bruised with four parts of alcohol of 90°. The emulsion is made by digesting ten parts of coal tar with twelve of the tincture. It makes a stable mixture with water. (*Journ. de Pharm.*, 4e sér., iv. 285.) W.

COBALT BLUE. This beautiful pigment is a compound of oxide of cobalt and alumina, obtained by precipitating the mixed solutions of a salt of alumina and of cobalt by means of an alkali, and washing, drying, and strongly calcining the precipitate. (*Berzelius.*) The cobalt blue of Thenard is made by heating together the hydrated subphosphate of cobalt and hydrate of alumina. It is used in painting. An oxide of cobalt, prepared by precipitating the chloride with potassa, has been employed in rheumatism. It is emetic in the dose of 10 or 20 grains. The salts of the metal are irritant poisons. W.

COBWEB. *Spiders' Web. Tela Araneæ.* The genus *Aranea* of Linn. has been divided by subsequent naturalists into several genera, of which the *Tegeneria* of Walkenaer is the one that includes the medicinal species of spider. The *T. domestica* of Europe, and *T. medicinalis* of this country (Henz, *Journ. Acad. of Nat. Sci.*, ii. 53), are the particular species which have attracted most attention. They inhabit cellars, barns, and other dark places, and are of a brown or blackish colour. It is affirmed that the web of the field spider is inefficacious, while that collected in the cellars of houses, &c. has extraordinary medical virtues. Several authors speak in very decided terms of its powers as a febrifuge and antispasmodic. According to Dr. Robert Jackson, it is superior even to bark and arsenic in the cure of intermittents, and is, moreover, highly useful in various spasmodic and nervous diseases, controlling and tranquillizing irregular nervous action, exhilarating the spirits, and disposing to sleep, without producing any of the narcotic effects of opium on the brain. Among the complaints in which it has been found useful, besides intermittent fever, are periodical headache, hectic fever, asthma, hysteria, and nervous irritations attended with morbid vigilance and irregular muscular action. Dr. J. Donaldson, of Madras, India, has recently found it remarkably successful in fever, considering it sometimes preferable to quinia. (*Lancet*, Feb. 16, 1867, p. 212.) It will be observed that these are, for the most part, affections over which the imagination has

much control. The dose of spiders' web is five or six grains, to be given in the form of pill, and repeated every three or four hours. Dr. Jackson states that its influence is not in proportion to the quantity administered, and that he obtained the same effects from ten as from twenty grains. This might well be, if the supposition be allowed that its chief operation is through the imagination. Spiders' web has also been used, with asserted advantage, as a styptic in wounds, and a healing application to superficial ulcers. In the *Dental Cosmos* (Nov. 1866), Mr. A. Robertson, of Wheeling, Va., records a case, in which hemorrhage from the socket of an extracted tooth, after resisting the most energetic styptics, yielded immediately to spiders' web stuffed into the socket. (*Am. Journ. of Pharm.*, Jan. 1867, p. 67.) Spiders themselves were formerly employed in the treatment of intermittent fever, and this application of the web is not of recent origin

W.

COCCULUS. *Cocculus Indicus.* Having been dismissed from the British Pharmacopœia, this substance is inserted here in accordance with our usual custom. The plant which produces cocculus Indicus was embraced by Linnæus, with several others, under the title of *Menispermum Cocculus.* These were referred by De Candolle to a new genus, denominated *Cocculus.* From this the particular species under consideration has been separated by Wight and Arnott, and erected into a distinct genus with the name of *Anamirta.*

The genus Anamirta belongs to *Diœcia Dodecandria* of the sexual system, and to the natural order *Menispermaceæ.* The following is the *generic character.* Flowers diœcious. *Calyx* of six sepals in a double series, with two close-pressed bracteoles. *Corolla* none. MALE. *Stamens* united into a central column dilated at the apex. *Anthers* numerous, covering the whole globose apex of the column. FEMALE. *Flowers* unknown. *Drupes* one to three, one-celled, one-seeded. *Seed* globose, deeply excavated at the hilum. *Albumen* fleshy. *Cotyledons* very thin, diverging. (*Wight and Arnott.*)

Anamirta Cocculus. Wight and Arnott, *Flor. Penins. Ind. Orient.* i. 446; Lindley, *Flor. Med.* 371.—*Menispermum Cocculus.* Linn.—*Cocculus suberosus.* De Cand. *Prodrom.* i. 97. This is the only species. It is a climbing shrub, with a suberose or corky bark; thick, coriaceous, smooth, shining, roundish or cordate leaves, sometimes truncate at the base; and the flowers in lateral compound racemes. It is a native of the Malabar Coast, and of Eastern Insular and Continental India. The fruit is the officinal portion.

This plant was proved to be the source of cocculus Indicus by Roxburgh, who raised it from genuine seeds which he had received from Malabar. It is believed that other allied plants, bearing similar fruit, contribute to furnish the drug; and the *Cocculus Plukenetii* of Malabar, and *C. lacunosus* of Celebes and the Moluccas, are particularly designated by authors. It was known to the Arabian physicians, and for a long time was imported into Europe from the Levant, from which circumstance it was called *cocculus Levanticus.* It is now brought exclusively from the East Indies.

Properties, &c. Cocculus Indicus, as found in the shops, is roundish, somewhat kidney-shaped, about as large as a pea; having a thin, dry, blackish, wrinkled exterior coat, within which is a ligneous bivalvular shell, enclosing a whitish, oily, very bitter kernel. It is without smell, but has an intensely and permanently bitter taste. It bears some resemblance to the bay berry, but is not quite so large, and may be distinguished by the fact, that in the cocculus Indicus the kernel never wholly fills the shell. When the fruit is kept long, the shell is sometimes almost empty. The Edinburgh College directed that "the kernels should fill at least two-thirds of the fruit." M. Boullay discovered in the seeds a peculiar bitter principle which he denominated *picrotoxin.* This is white, crystallizable in quadrangular prisms, soluble in 25 parts of boiling and 150 of cold water (*Glover*), and very soluble in alcohol and ether, but insoluble in the oils. Its composition is $C_{12}H_7O_5$ (*Pelletier and Couerbe*), or $C_{20}H_{12}O_8$, according to Gmelin, who considers it as isomeric with cantharidin. (*Handbook*, xiv. 475.) According to M. Blas, its solutions have a decidedly acid reaction, and potassa renders it soluble in water. (*Journ. de Pharm.*, 4e sér., xvi. 215.) M. Boenhuke-Reech has found that it forms with ammonia a very unstable compound. (*Journ. de Pharm.*, 4e sér., xix. 465.) It is poisonous, and, given to strong dogs in the quantity of from five to ten grains, produces death, preceded by convulsions, which, according to Dr. R. M. Glover, are very similar in character to those produced by Flourens by section of the corpora quadrigemina and cerebellum; being attended with backward and rotary movements and tetanic spasms. It also greatly increases the animal heat. (*Ed. Monthly Journ. of Med. Sci.*, N. S., iii. 303.) To procure it, the watery extract of the seeds is triturated with pure magnesia, and then treated with hot alcohol, which dissolves the picrotoxin, and yields it upon evaporation. In this state, however, it is impure. To obtain it colourless it must be again dissolved in alcohol, and treated with animal charcoal. After filtration and due evaporation, it is deposited in the crystalline form. Besides picrotoxin, cocculus Indicus contains a large proportion of fixed oil, and other substances of less interest. The active principle above described is said to reside exclusively in the kernel. In the shell MM. Pelletier and Couerbe discovered two distinct principles; one alkaline and named *menispermin* (menispermia), the other identical with it in composition, but distinguishable by its want of alkalinity, its volatility, and its solubility and crystalline form, and denominated *para-*

menispermin. They found also in the shell a new acid, which they called *hypopicrotoxic.* The picrotoxin of M. Boullay they believed to possess acid properties, and proposed for it the name of *picrotoxic acid.* (*Journ. de Pharm.*, xx. 122.) In Europe, picrotoxin is said to be added to malt liquors, in order to give them bitterness and intoxicating properties; although the practice is forbidden by the law, in England, under heavy penalties.

Gunckel proposes the following mode of detecting and separating picrotoxin from liquids containing it, founded on the facts, that it is soluble in dilute acids though not combining with them, and that ether extracts it from its acidulous solutions, but not from those in water or alcohol, even with the presence of potassa. The substance suspected to contain it, having been brought to the consistence of paste, is to be digested with alcohol and a little tartaric acid, the liquid separated, the alcohol evaporated, the residue diluted with a little water and then treated with ether, and, finally, the ethereal solution submitted to evaporation in a watch-glass. Picrotoxin, if present, is deposited, recognisable by its feathery crystallization, its bitter taste, and the property of reducing the tartrate of copper and potassium. If strychnia, which perhaps resembles it most closely in its effects, should have been present, it would be left behind in the acidulated solution. (*Journ. de Pharm.*, Juillet, 1858, p. 78; from *Archiv. der Pharm.*, xciv. 14.) In the instance of adulterated malt liquor, in consequence of the resin of hops it contains, it might be expedient first to evaporate the liquor to dryness, and prepare a watery extract of the residue, and then to proceed as stated.

Mr. J. W. Langley proposes, as a means of detection, the oxidation of picrotoxin. When to a little of this substance, mixed with nitrate of potassium in a watch-glass, a drop of sulphuric acid is added, no observable reaction takes place; but, if a very strong solution of caustic potassa or soda be now added, a bright reddish-yellow colour is produced, which is highly characteristic. A very minute quantity may thus be detected. Mr. Langley, however, thinks it extremely probable that this phenomenon is owing to a minute quantity of some nitrogenous principle strongly attached to the picrotoxin; for, if this principle be purified by combining it in solution with potassa, and then precipitating it with an acid, it does not answer the test. (*Am. Journ. of Sci. and Arts*, July, 1862, p. 109.)

Medical Properties, &c. Cocculus Indicus acts in the manner of the acrid narcotic poisons, but is never given internally. In India it is used to stupefy fishes in order that they may be caught; and it has been applied to the same purpose in Europe and this country. It is asserted that the fish thus taken are not poisonous. The powdered fruit, mixed with oil, is employed in the East Indies as a local application in obstinate cutaneous affections. An ointment made with the powder has been used in tinea capitis, and to destroy vermin in the hair. Picrotoxin has been successfully substituted by Dr. Jeager for the drug itself. Rubbed up with lard in the proportion of ten grains to the ounce, it usually effected cures of tinea capitis in less than a month. A case is recorded by W. B. Thompson, of New York, in which death in a child six years old, preceded by tetanic spasms, and extremely contracted pupil, resulted from the application of a strong tincture of the fruit to the scalp. (*Med. Exam.*, N. S., viii. 227.) It should be used with great caution when the surface is abraded. Mr. J. Crichton Browne has found that picrotoxin and chloral are, within certain limits, antagonistic. (*New Remedies*, Oct. 1875.)

Fluid Extract of Cocculus Indicus is a convenient form for external use. Prof. Procter prepares it by moistening a moderately coarse powder, obtained from 16 troyounces of the fruit, with 6 ounces of a menstruum composed of two parts of alcohol and one of water; packing the mixture, after two hours, in a conical percolator; pouring upon it a similar menstruum till twelve fluidounces have passed; digesting the coatings, from which the powder was sifted, in two pints of diluted alcohol; pouring the whole, when cool, into the percolator; after the liquid has disappeared, pouring on diluted alcohol until two pints of filtered liquor are obtained; evaporating this to four fluidounces; mixing the residue with the reserved tincture; and, after 24 hours, filtering through paper. (*Am. Journ. of Pharm.*, March, 1863, p. 112.) W.

COCHLEARIA OFFICINALIS. *Common Scurvy-grass.* This is an annual or biennial plant, sending up early in the spring a tuft of radical leaves, which are heart-shaped, roundish, of a deep shining-green colour, and supported on long footstalks. The leaves of the stem are alternate, oblong, somewhat sinuate, the lower petiolate, the upper sessile. The stem is erect, branched, angular, six or eight inches high, and bears, at the extremity of the branches, numerous white cruciform peduncled flowers in thick clusters. The fruit is a roundish two-celled pod, containing numerous seeds. The whole plant is smooth and succulent. It is a native of the northern countries of Europe, where, as well as in the United States, it is occasionally cultivated in gardens. The whole herb is officinal. It has, when fresh, a pungent, unpleasant odour if bruised, and a warm, acrid, bitter taste. These properties are lost by drying. They are imparted to water and alcohol by maceration, are retained by the expressed juice, and probably depend on a peculiar volatile oil, which is separable in very small quantity by distillation with water. Dr. Geiseler has shown that, when the dried herb is mixed with water and a little myrosin (see *Sinapis*), the taste and smell of the fresh plant are developed; proving that,

as in black mustard, the volatile oil is produced by reaction between a fixed principle in the plant and water, under the influence of myrosin acting as a ferment. (*Chem. Cent. Blatt*, Feb. 20, 1856, p. 124.) The oil was at one time supposed to be identical with the oil of mustard, but M. Geiseler has shown it to have a different composition; its formula being $C_8H_5O_2S$, which is oil of garlic plus one eq. of oxygen. (See *Am. Journ. of Pharm.*, Sept. 1859, p. 416.) The boiling point also differs, being, according to Dr. A. W. Hoffmann, about 160° C.; while that of mustard is 147° C. (*Chem. News*, June 1, 1869, p. 286.) According to the later researches of Dr. Hoffmann it is, however, a mustard oil of the butylic series, having the formula $C_5H_9NC = C_4H_9CS,N$. Dr. Hoffmann has also made it synthetically.

Common scurvy-grass is gently stimulant, aperient, and diuretic. It is highly celebrated as a remedy in sea-scurvy, and has been recommended in chronic obstructions of the viscera, and certain forms of chronic rheumatism. The fresh plant may be eaten as a salad, or used in the form of infusion in water or wine, or of the expressed juice. Alcohol and water are impregnated with its virtues by distillation; and the distilled spirit has been found useful in paralysis, in the dose of thirty drops several times a day. The expressed juice may be used as a local application in scorbutic affections of the gums. W.

COCO-NUT OIL. *Cocoa-nut Oil. Cocoa-nut Butter.* This must not be confounded with the fixed oil of the chocolate nut, which is often called *cocoa-butter*, and which has been described in *Part* I. The substance here considered is the fixed oil of the coco-nut, which is the fruit of a species of palm, denominated botanically *Cocos nucifera*, and universally known by the name of *coco-nut tree*, or, as it is frequently spelled, *cocoa-nut tree*. The oil is obtained either by expression or decoction. It is of a fine white colour, of the consistence of lard at ordinary temperatures, becoming solid, like suet, between 40° and 50°, and liquid at about 80°, of a bland taste, and a peculiar, not disagreeable odour. It is readily dissolved by alcohol. According to Brandes, it consists mainly of a peculiar fatty principle, called *cocin*, which yields *cocinic acid* by saponification. (*Journ. de Pharm.*, xxiv. 652.) It has since been found to contain several solid and volatile acids, as caproic, caprylic, capric, and pichuric acids. (*Ibid.*, 3e sér., xv. 69.)

This oil has been used for various purposes in medicine and pharmacy. Dr. Theophilus Thomson has found it to possess virtues similar to those of cod-liver oil, and has used it with advantage in consumption. In some instances it appeared to arrest the progress of phthisis as decisively as that oil, over which it has the advantages of being cheaper, more palatable, and less apt to produce nausea. (*Clin. Lect. on Pulmonary Consumption*, Am. ed., p. 128.) Dr. J. H. Warren, of Boston, gives similar testimony in its favour. (*Bost. Med. and Surg. Journ.*, lii. 377.) In Germany it has been used in pharmacy, to a considerable extent, as a substitute for lard, to which, according to Pettenkofer, it is preferable on account of its less tendency to rancidity, its more ready absorption when rubbed on the surface of the body, and its less liability to produce chemical changes in the substances with which it is associated. Thus, the ointment of iodide of potassium, when made with lard, becomes yellow in a few days; while, if made with coco-nut oil, it remains unchanged for two months or more. Vegetable substances also keep better in ointment prepared with this oil than with lard. Besides, it takes up one-third more water, which is a useful quality, when it is desirable to apply saline solutions externally. To prepare it for use, nothing more is ordinarily necessary than to melt it at a moderate heat, and strain it through linen. If coloured, it may be digested with powdered animal charcoal, and subsequently filtered through paper. (*Am. Journ. of Pharm.*, xxix. 331; from *Buchner's Repertorium*, 1856, 485–8.) Coco-nut oil has been used in the manufacture of soap; but we are told that the soap acquires a very offensive odour when long kept. A preparation has been shown to us, said to be the liquid part of coco-nut oil, prepared in London, and, under the name of *coco-olein*, used, instead of the oil itself, as a substitute for cod-liver oil. The dose of this, as well as of the oil, is half a fluidounce three times a day. If the oil is used, it may be readily brought to the liquid state by a gentle heat. W.

CŒLOCLINE POLYCARPA (Alphonse De Candolle). *Unona polycarpa* (De Cand.). *Berberin Tree. Yellow-dye Tree of Soudan.* This is a small tree, growing in Soudan, Sierra Leone, and other parts of Western Africa, the bark of which has come into notice, through the researches of Dr. Wm. F. Daniell, who has described both the tree and its bark. (*Pharmaceutical Journal*, Feb. 1857, p. 398.) When wounded the tree exudes a juice which produces a yellow stain upon linen, that cannot be washed out. The epidermis of the bark is greenish-gray, interrupted by occasional blackish patches; the inner layers are of a golden yellow, and very fibrous, so that they can be separated in riband-like bands. The bark is moderately but disagreeably bitter, and stains the saliva yellow. Water extracts its colour and bitterness. Dr. Stenhouse has ascertained that it contains *berberina*. The bark is much used in Africa for dyeing yellow. In Sierra Leone it is employed topically, with asserted advantage, in the treatment of obstinate ulcers, being applied both in the state of powder and in decoction. W.

COLLINSONIA CANADENSIS. *Horse-weed. Horse-balm. Richweed. Heal-all. Stone-root. Knot-root.* An indigenous plant, with a perennial, knotty root, and an herbaceous simple stem, about two feet high, furnished with two or three pairs of broad cordate-ovate, smooth leaves, and terminating in a pannicle of yellow flowers in branched racemes. The flowers are diandrous and monogynous, with a labiate calyx and corolla, the latter of which has the lower lip fringed. The plant grows in woods from Canada to the Carolinas, and flowers from July to September. The whole plant has a strong disagreeable odour, and a warm pungent taste. It is considered tonic, astringent, diaphoretic, and diuretic; and the root, in substance, is said to irritate the stomach, and produce vomiting, even in small doses. The plant is used in numerous complaints in domestic practice. It is preferred in the fresh state, as the active principle is volatile. A decoction of the fresh root is said to have been used with advantage in catarrh of the bladder, leucorrhœa, gravel, dropsy, and other complaints; and the leaves are applied by the country people, in the form of cataplasm or fomentation, to wounds, bruises, and sores, and in cases of internal abdominal pains. W.

COLUTEA ARBORESCENS. *Bladder Senna.* A shrub growing spontaneously in the southern and eastern parts of Europe, and cultivated in gardens as an ornamental plant. Its leaves are pinnate, consisting of from three to five pairs of leaflets, with an odd one at the end. The leaflets are obovate, slightly emarginate, smooth, and of a deep-green colour on the upper surface, grayish-green and somewhat pubescent beneath. The flowers are yellow, and the fruit vesicular, whence the plant derived its vulgar name. The leaflets are purgative, and, in some parts of Europe, are used as a substitute for senna, which is said to be sometimes adulterated with them. Bladder senna is comparatively very feeble. It is administered in infusion or decoction, of which the dose is about half a pint, containing the virtues of from one to three ounces of the leaves. W.

COLZA OIL. This is an oil expressed from the seeds of the *Brassica campestris*, or field cabbage, a cruciferous plant which grows wild through the greater part of Europe, and is largely cultivated in France and Germany, where the fields, at its period of flowering, are beautiful with its bright-yellow blossoms. It is cultivated for the sake of the oil, obtained by expression from its seeds, which is largely used in the arts, though, in consequence of its unpleasant taste, unfitted for the table. W.

COMPTONIA ASPLENIFOLIA. *Sweet Fern.* A shrubby, indigenous plant, named from the resemblance of its leaves to the *spleenwort fern*, and belonging to the Linnæan class and order *Monœcia Triandria*. It grows in thin sandy or stony woods, from New England to Virginia. All parts of it possess a resinous spicy odour, which is increased when the plant is rubbed. Mr. R. T. Chiles has found in it tannic and gallic acid, volatile oil, extractive, gum, resin, and a substance resembling saponin. (*Am. Journ. of Pharm.*, xlv. 306.) It is said to be tonic and astringent, and to be occasionally used in domestic practice as a remedy in diarrhœa, and various other complaints. It is employed in the form of decoction. W.

CONIOSELENIUM CANADENSE. *Hemlock Parsley.* (*Gray's Manual*, p. 154.) This plant grows in swamps in the northern parts of the United States and in Canada. It has recently come into notice as one of a combination of native plants, recommended as having peculiar efficacy in dysentery, by Mr. Wm. Kerr. After experimenting with a great variety of medicines, officinal and non-officinal, in this complaint, Mr. Kerr believed that he had hit on a combination having special powers in its cure; and other practitioners in Canada joined with him in recommending it from their own experience. The constituents of this compound are four officinal medicines, opium, stramonium, dulcamara, and digitalis, and three non-officinal, *Sium lineare*, *Cicuta maculata*, and *Conioselenium Canadense*. (*Edin. Med. Journ.*, June, 1865, p. 1106.) The parts of the plant used, and the mode of preparing them, are not mentioned in the paper; and the preparation would scarcely have been noticed here, except that attention is called to a new medicine, Conioselenium Canadense, which may possibly possess useful remedial properties, and is worthy of being further investigated. W.

CONTRAYERVA. *Contrayerva.* This is the root of Dorstenia Contrayerva, and formerly held a place in the secondary catalogue of the U. S. Pharmacopœia, but has now ceased to be officinal. The plant belongs to Tetrandria Monogynia of the Linnæan system, and to the natural order Urticaceæ. The following is its generic character:—"*Receptacle* common, one-leafed, fleshy, in which solitary *seeds* are nestled." (*Willd.*) This plant has a perennial, fusiform, branching, rough, compact root or rhizome, which sends up several leaves of an irregular shape, about four inches in length, lobed, serrated, pointed, and placed upon long radical foot-stalks, which are winged towards the leaves. The scapes or flower-stems are also radical, rise several inches in height, and support irregular quadrangular receptacles, which contain male and female flowers, the former having two stamens, the latter a single style. The capsule, when ripe, possesses an elastic power, by which the seeds are thrown out with considerable force. The plant grows in Mexico, the West Indies, and Peru. The root (rhizome) is the officinal portion. According to Pereira, however, the contrayerva of the shops is the product of D. Brasiliensis, and is brought from Brazil. The term contrayerba, in the language of the Spanish

Americans, signifies *counterpoison* or *antidote*, and was applied to this root under the impression that it had the property of counteracting all kinds of poison. The probability is that the root sold as *contrayerva* is derived from several species of Dorstenia, among which, besides *D. Contrayerva*, two others are mentioned by Dr. Houston, *D. Houstonia* and *D. Drakena*, the former growing near Campeachy, the latter near Vera Cruz. It is referred by Dr. Martius also to *D. Brasiliensis*, growing in Jamaica, Trinidad, and Brazil. D. Contrayerva was the only one recognised in the Pharmacopœia.

Properties. The root, as found in our shops, is oblong, an inch or two in length, of varying thickness, very hard, rough, and solid, of a reddish-brown colour externally, and pale within; and has numerous, long, slender, yellowish fibres attached to its inferior part. The odour is aromatic; the taste, warm, slightly bitterish, and pungent. The fibres have less taste and smell than the tuberous portion. The sensible properties are extracted by alcohol and boiling water. The decoction is highly mucilaginous. The tincture reddens infusion of litmus, and lets fall a precipitate on the addition of water. The root, so far as we know, has not yet been analyzed, but contains starch and a volatile oil. Contrayerva is a stimulant tonic and diaphoretic, and has been given in low states of fever, malignant eruptive diseases, some forms of dysentery and diarrhœa, and other diseases requiring gentle stimulation. It is very seldom used in this country. The dose of the powdered root is about half a drachm. W.

CONVALLARIA MAJALIS. *Lily of the Valley.* This charming little garden flower is a native of Europe, and is found growing wild in the United States, upon the highest mountains of Virginia and Carolina. The *flowers* have a strong, delightful odour, which is in a great measure lost by drying. Their taste is nauseous, bitter, and acrid. G. F. Walz has found in the herb and root two peculiar principles, one crystalline and acrid, which he calls *convallarin*, the other amorphous and bitter, and named *convallamarin*. For the mode of preparing them the reader is referred to the *Am. Journ. of Pharm.* (Nov. 1859, p. 577.) Convallarin is in colourless rectangular prisms, scarcely soluble in water, but sufficiently so to render the solution acrid, and to cause it when shaken to foam like soap and water. It is easily dissolved by alcohol. Its composition is represented by the formula $C_{34}H_{31}O_{11}$. It is a glucoside. Convallamarin is a white powder, very bitter and afterwards sweetish, soluble in water and alcohol, but not in ether. This also is a glucoside. Its composition is $C_{46}H_{44}O_{24}$. Taken internally the flowers are said to be emetic and cathartic, and their extract purges actively in the dose of half a drachm. They were formerly used in epilepsy and against worms. At present they are employed only as a sternutatory, for which purpose they are dried and reduced to a coarse powder. The *root*, which is also bitter, has similar purgative properties, and, reduced to powder, is said to be sternutatory. From the analysis of Mr. Walz, it is probable that the virtues reside in the whole plant, and that it combines emetic and cathartic with tonic properties. The effects on the system of the two principles above mentioned have been investigated by Dr. H. Marme, of Germany, with the following results. *Convallarin*, in doses of 3 or 4 grains, acts as a purgative, without observable inconvenience to the animals acted on; *convallamarin*, even in small doses, produces active vomiting, whether given by the mouth or injected into the subcutaneous tissue, or directly into the veins. The latter principle acts especially on the heart, at first diminishing the number of its pulsations, and afterwards rendering them more frequent and irregular, and causing death in a few minutes after the introduction of the poison. The heart appears to be paralyzed, and cannot be excited after death. The principle acts on the heart through the vagi nerves, and resembles digitalis in its mode of operation. From 6 to 8 milligrammes caused death, when injected into the cervical vein in rabbits, 15 to 20 in dogs. (*N. Y. Med. Journ.*, Nov. 1867, p. 166; *Schmidt's Jahrbuch*, 1867, v. 166.) W.

CONVALLARIA POLYGONATUM. Linn. *Polygonatum uniflorum.* Desfontaines.—*Solomon's Seal.* A perennial, herbaceous, European plant, the root of which is horizontal, jointed, white, and marked, at short intervals, with small circular impressions, which bear a remote resemblance to those made by a seal, and have served to give a name to the plant. The root is inodorous, and of a sweetish mucilaginous taste, followed by a slight degree of bitterness and acrimony. It is said to be emetic. In former times it was used externally in bruises, especially those about the eyes, in tumours, wounds, and cutaneous eruptions, and was highly esteemed as a cosmetic. At present it is not employed, though recommended by Hermann as a good remedy in gout and rheumatism. The berries and flowers are said to be acrid and poisonous. *C. multiflora* (*Polygonatum multiflorum*, Desf.), which grows both in this country and Europe, is analogous to the preceding in properties. Dr. John H. Rauch found two fluidounces of a decoction, made by boiling two ounces of the root in a pint of milk, to produce nausea, a cathartic effect, and either diaphoresis or diuresis. He used it advantageously as an internal remedy in piles, and externally in the form of decoction, in the affection of the skin resulting from the poisonous exhalations of certain plants. (*Inaugural Essay*, March, 1849.) W.

CONVOLVULUS PANDURATUS. *Wild Potato.* Under this name, the root of *Convolvulus panduratus* was formerly recognised in the secondary list of the U. S. Pharma-

copœia, from which, however, it was dismissed at the recent revision. The wild potato plant (for a figure of which see *Barton's Med. Bot.* i. 249) has a perennial root, and a round, purplish, procumbent or climbing stem, which twines around neighbouring objects, and grows sometimes twelve feet in length. The leaves, which stand alternately on long petioles, are broad, heart-shaped at the base, entire or lobed on the sides like a guitar or violin, somewhat acuminate, deep-green on the upper surface, and paler beneath. The flowers are in fascicles, upon long axillary peduncles. The calyx is smooth and awnless; the corolla, tubular, campanulate, very large, white at the border, but purplish-red at the base. The plant is indigenous, growing throughout the United States in sandy fields and along fences, and flowering from June to August. A variety with double flowers is cultivated in the gardens for the sake of ornament. The root, which was the officinal part, is very large, two or three feet in length, about three inches thick, branched at the bottom, externally of a brownish-yellow colour, and full of longitudinal fissures, internally whitish and milky, and of a somewhat acrid taste. The wild potato is feebly cathartic, and has been proposed as a substitute for jalap, but is scarcely used. It is thought also to be diuretic, and has been employed, with supposed advantage, in strangury and calculous complaints. Dr. G. M. Maclean considers it one of the best diuretics he has used, when given in infusion. (*N. Y. Journ. of Med.*, x. 375.) Forty grains of the dried root are said to purge gently. W.

COPAL. A resinous substance, brought from the East Indies, South America, and the eastern and western coasts of Africa, but most abundantly from the first mentioned source. It is the concrete juice of different trees, and is furnished by exudation. The East India copal has been ascribed to the *Vateria Indica* of Linn., the *Elæocarpus copaliferus* of Retzius; and the Brazilian, by Martius and Hayne, probably with justice, to different species of *Hymenæa*. There is some reason to believe that the East India copal is also the product of a Hymenæa; at least a specimen of this resin was collected by M. Perottet from the *Hymenæa verrucosa*, which he found growing in the Isle of Bourbon. This tree is a native of Madagascar, and probably of the neighbouring parts of Africa; and M. Perottet was informed that the copal of India is taken thither by the Arabs of Muscat, who obtain it from the east coast of Africa. (*Journ. de Pharm.*, 3e sér., i. 406.) It is stated by Mr. James Vaughan, who was stationed as army surgeon at Aden in Arabia, that copal is taken to that port from the African coast opposite the island of Zanzibar, where it is said to be dug up from the earth. (*Pharm. Journ.*, xii. 385.) Col. Playfair, British Consul at Zanzibar, has sent to the Kew Museum specimens of the bark of a tree, with the resin *in situ*, and specimens of the collected resin, and of the fruit of the tree, which leave little doubt that the Zanzibar copal is obtained from the *Hymenæa Mozambicensis*. On the same authority it is stated that the value of the copal exported from Zanzibar in the year 1863–4, amounted to 163,353 dollars, of which 5000 dollars' worth was sent to the United States. (*Am. Journ. of Pharm.*, May, 1866, p. 255; from *Lond. Pharm. Journ.*) In a later communication from Dr. John Kirk, dated Zanzibar, March 20, 1865, it is stated that the smooth copal, exported from that region, is obtained from the *Trachylobium Mozambicense*, Kl., a small tree or bush, distinguished by its rounded head of glossy leaves, with groups of white flowers at the ends of the branches. The trunk and limbs are covered with a clear resinous exudation, portions of which, after solidifying, drop to the ground and are collected, while other portions are broken from the tree. This kind of resin is always smooth, and is exported to India. Another variety, with an indented goose-flesh surface, known in the English market as *animé*, is dug from the earth, and, though the product of forests now extinct, originated probably from the same tree, as specimens of the recent gum, which had dropped from the tree, and been some time buried in the sand, present similar surface marking, and in other respects exhibit similar physical properties. (*Pharm. Journ.*, May, 1869, p. 654.) In papers contained in the *Pharm. Journ.* (xvi. 369 and 423), Dr. W. F. Daniell has given an account of several varieties of copal produced on the coast and interior parts of Western Africa, from Sierra Leone to Angola and Benguella, and exported in large quantities. Those from Sierra Leone, which are most highly valued for their superior hardness and transparency, are said by Dr. Daniell to be derived from the *Guibourtia copallifera* of Bennett, a large tree, growing preferably in mountainous regions, and very nearly related, botanically, to the Hymenææ, which produce copal in other regions. The drug is mostly collected, not from the tree itself, but from the beds and borders of streams, into which it is washed down, during the rains, from the hillsides, in the soil of which it had been deposited. Copal varies in appearance and properties as procured from different sources. It is in roundish, irregular, or flattish pieces, often rough over the surface, probably from the impression of sand in its soft state, colourless, yellowish, or brownish-yellow, more or less transparent, very hard, with a shining, conchoidal fracture, inodorous and tasteless, of a sp. gr. varying from 1·045 to 1·139, insoluble in alcohol, soluble in ether and slightly so in oil of turpentine. Some varieties unite with alcohol, if suspended in its vapour while boiling. By heat it melts and is partially decomposed, becoming thereby soluble in alcohol and oil of turpentine. It is not a proximate principle, but consists of various resins united in different proportions. The East India or African copal is described by Mr. Schindler as of a globular form, softer and more trans-

parent than the other varieties, with a surface always clear, and having an agreeable smell when heated. It is readily and freely dissolved by the oils of turpentine and rosemary when pure, but not by these fluids when rendered resinous by age. It is more readily fusible than the others, and makes the best varnish. The West India copal is in flat pieces, seldom weighing more than three ounces, rarely containing insects, very hard, of a rough appearance, of a yellowish colour, and without smell or taste. It is much less readily dissolved by oil of turpentine than the East India variety, swells, but does not dissolve in oil of rosemary, and is slightly soluble in absolute alcohol. A third kind, probably also American, is in convex or concave pieces, about a pound in weight, often containing insects and other impurities. In solubility it resembles the last mentioned variety, in fusibility is intermediate between it and the East Indian, and is altogether inferior. (*Pharm. Journ.*, Aug. 1850.) The *African or Sierra Leone copal* is described by Dr. Daniell as occurring "in small round tears, or irregular conical and smooth nodulated masses, seldom exceeding in size an ordinary duck egg. They are covered, to a greater or less extent, by a peculiar white efflorescence, which increases by age. Their colour graduates from a pale-green to a lemon or dull-yellow." (*Ibid.*, xvi. 369.) Dr. Welwitsch, in "Notes and Observations on the subject of copal, made during his travels in West Africa," states that this drug is mostly found in sandy soil, in the hilly districts, along the whole coast of Angola, where its prevalence coincides with that of *Adansonia digitata*. It is dug from the earth, or found in spots where it has been collected by the washing of the rains, or laid bare by earth-falls; and the quantity annually collected in this region, and exported from Benguella, from 1850 to 1860, was 1,600,000 pounds. The surface, like that described by Dr. Daniell, is covered with a whitish earthy crust, sometimes exhibiting veins or network, probably produced by attrition in their conveyance by floods from their original site. (*Am. Journ. of Pharm.*, Sept. 1866, p. 439; from *Gardener's Chronicle.*) *Crude* and *scraped* copal are also known in the market; the former of a dull opaque appearance externally, the latter much clearer and more transparent, in consequence of being deprived of its outer coat. The process of *scraping* is said to consist in the removal of the exterior portion by means of an alkaline solution, which readily dissolves copal. This resin is used chiefly in making varnishes. For a paper by M. H. Violette on the preparation of copal varnish, see the *American Journal of Pharmacy* (March, 1863, p. 140). M. Violette states that certain varieties of copal used for varnish, which are not naturally soluble in ether, oil of turpentine, benzine, petroleum, &c., become soluble in these menstrua, whether cold or hot, by being heated in close vessels to the temperature of 350° to 400°, and thus yield excellent varnishes without loss of matter; and the same resin, heated as above with one-third of linseed oil and three-fourths of oil of turpentine, gives directly a clear, limpid, slightly yellowish varnish, fit for the most delicate uses. (*Journ. de Pharm.*, 4e sér., iv. 284.) W.

COPPER, BLACK OXIDE OF. This is the protoxide of copper, CuO, obtained most conveniently by heating to redness the nitrate. This oxide, in the form of ointment, made by mixing four parts with thirty of lard, has been used in frictions, practised twice a day, for the removal of chronic indurations of the glands. (Hoppe, *Ann. de Thérap.*, 1855, p. 251.) B.

CORAL. A substance found at the bottom of the Mediterranean and other seas, formerly considered as a plant, but now universally admitted to belong to the animal kingdom. The *red coral* (*Corallium rubrum* of Lamarck, *Isis nobilis* of Linn.) is in the form of a small shrub, a foot or two in height, with a stem sometimes an inch or two in thickness, fixed to the rock by an expansion of the base, divided above into branches, and covered with a pulpy membrane, which is properly the living part, and which is removed when the coral is collected. The central portion is extremely hard, of various shades of red, susceptible of a brilliant polish, longitudinally striated, and formed of concentric layers, which are rendered obvious by calcination. Its chief constituent is carbonate of calcium, which is coloured by oxide of iron, and united, as in similar calcareous products, with more or less animal matter. It was formerly highly esteemed as a remedy, but is in no respect superior to prepared oyster-shell, or other form of carbonate of calcium, derived from the animal kingdom. It was employed in fine powder, or in different preparations, such as troches, syrups, conserves, &c. At present it is valued chiefly as an ornament. W.

CORALLINE. *Pœonin.* A colouring or dyeing material, derived from *rosolic acid*, which is itself derived from *carbolic* or *phenic acid*, by its oxidation. It is formed by exposing together rosolic acid and ammonia to a heat of 300° F. A solid substance is thus obtained, in scales of a peony redness, with reflected green or dull-yellow rays, almost insoluble in water, soluble in alcohol and the fixed oils, and having all the characters of an amide acid. Dr. Ambrose Tardieu, having met with some extraordinary cases of a severe vesicular eruption upon the feet, attended with violent inflammation and swelling, and with general febrile symptoms; and having been disposed to ascribe the affection to the poisonous properties of the colouring matter contained in a red silk, out of which socks, slippers, stockings, &c., worn by the sufferers, had been made, resolved to determine the accuracy of his impressions by experiment. He first satisfied

himself that the suspected material contained no mineral substance, and then, aided by a chemist, M. Z. Roussin, proceeded to search for some organic principle to which the effects might be traced. The red silk socks, to which the eruption in the first case that occurred to him was ascribed, were first treated by water in different states; cold, hot, feebly acidulated, and alkaline; but yielded nothing to the menstruum. They were then immersed in boiling alcohol of 85°, which quickly dissolved the red colouring matter. By evaporating the alcoholic solution thus made, an extract was obtained, which, on being injected in alcoholic solution into the areolar tissue of a dog, rabbit, and frog, produced death in all, in the frog in 4 hours, in the dog after 36 hours, and the rabbit later; the two latter animals having been copiously and almost incessantly purged. The colouring matter was thus shown to be very poisonous. To determine whether the poisonous colouring material was coralline, as they suspected, some of this substance was obtained from M. Persoz. Three varieties of coralline were presented: one pure, the other the coralline red of commerce, and the third coralline yellow. It was with the pure coralline that they operated. An alcoholic solution was injected into animals as before, with the same result. A dog was killed by 20 centigrammes (about 3 grains), a rabbit by half the quantity, and a frog by 5 centigrammes, or less than a grain. In the dog and rabbit, there was violent purgation, with intense fever and progressive prostration, and the leg of the side in which the injection had been made was very painful. After death the neighbourhood of the wound was found suppurating, the stomach sound, and the intestines distended, with signs of violent inflammation of the mucous membrane; the liver presented evidences of fatty degeneration; and the lungs appeared as if dyed by the colouring matter, exhibiting a very beautiful scarlet hue throughout their whole extent, and over their whole surface. M. Roussin succeeded in extracting a portion of the colouring matter from the lungs and liver, and dyeing with it a skein of silk. These experiments are very interesting in a medico-legal point of view; as coralline might be readily detected in this way, if at any time, accidentally or otherwise, the cause of fatal results. Hitherto the effects on the human subject have been confined to the painful cutaneous affection, which has been so satisfactorily traced to contact of the skin with the silk fabrics dyed with it; but, even in these cases, there were serious constitutional symptoms, as fever, headache, giddiness, and nausea, which probably proceeded in part from the absorption of the poison. (*Journ. de Pharm.*, Avril, 1869, p. 262.)

From a late communication by M. Tardieu, it appears that coralline is not the only colouring material capable of producing local poisoning; as red socks or stockings dyed with anilin red have given rise to accidents. These two colours may be distinguished in tissues. *Anilin red* disappears very rapidly by contact with ammonia; but the colour reappears by the addition of an acid, or by the evaporation of the alkali. *Coralline red* is not dissolved by cold water, yields a slight colour to boiling water, but rapidly disappears from the tissue under the action of boiling alcohol. Alkalies brighten the colour without changing it; acids precipitate the colouring matter in yellow flakes. (*Ibid.*, Mai, 1869, p. 371.) Other cases of local poisoning from the wearing next the skin of silks dyed with coralline, or other similar matter, have been recorded in the journals, among which may be mentioned two described in the *Med. Times and Gaz.* (April, 1869, p. 421). There is, however, much reason for believing that pure coralline is not poisonous, but that the symptoms have been produced by arsenic or other contaminating substances. (See *Pharm. Journ. and Trans.*, 2d ser., xi. 360; also, *New York Med. Journ.*, Feb. 1870, p. 559; *New Remedies*, i. 288.) W.

CORALLORHIZA ODONTORHIZA. (*Gray's Manual*, p. 453.) *Coral-root.* This is a leafless herb, sending up from a coral-like rhizome, a simple scape or flower-stem, from 6 to 16 inches high, furnished with sheaths instead of leaves, of a light-brown or purplish colour, and bearing small, greenish-brown flowers in a long spike. The plant grows throughout the United States east of the Mississippi. It is supposed by some to be parasitic, attaching itself to the roots of trees, and nourished from them. The root or rhizome is the part used. It is much branched and toothed, and of a brown colour, and from its resemblance to coral in appearance gave name to the plant. It has a strong peculiar odour, and an astringent bitterish taste. It holds a high place in the Materia Medica of the "eclectics," being considered by them as an energetic diaphoretic, and, as it is destitute of general stimulant properties, is given in fevers and inflammatory affections. It is administered in powder, in the dose of thirty grains, every two hours. W.

CORIARIA MYRTIFOLIA. *Redoul*, Fr. This is a shrub indigenous in the South of France, and growing also wild in Spain, Italy, and Barbary. It is sometimes cultivated in gardens on account of its handsome foliage. The leaves, which are used for dyeing black, were at one time employed to a considerable extent in France in the adulteration of senna. The fruit, resembling berries in form, are black, and about the size of a pea. Both these and the leaves are poisonous in large doses, and several instances of death are on record from eating the fruit. They are supposed to act as a narcotic, as a child under their influence appeared, half an hour after taking them, as if in a state

of drunkenness, with loss of speech, foaming at the mouth, livid face, and convulsive movements, and died at the end of 17 hours. The stomach upon examination showed scarcely any signs of phlogosis. (*Mérat et de Lens.*) M. Riban has discovered in the fruit a peculiar principle, on which he believes their poisonous properties depend, and to which he has given the name of *coriamyrtin*. This is in the form of white crystals, inodorous, excessively bitter, and extremely poisonous. It is but slightly soluble in water hot or cold, but freely so in alcohol, ether, chloroform, and benzole. Its composition is represented by the formula $C_{40}H_{28}O_{16}$. It ranks with the glucosides. About three grains of it killed a dog, first vomiting, then causing severe convulsions, and death in an hour and a quarter. M. Riban obtained it by treating the juice of the fresh or an infusion of the dried fruit and leaves first with acetate of lead, then with sulphuretted hydrogen to throw down the lead, concentrating the filtered liquid to a syrupy consistence, and agitating this with ether, which extracted the poison, and yielded it on evaporation. (*Journ. de Pharm.*, Juin, 1864, p. 487.)

Toot-poison. In New Zealand a poisonous plant, known as the *toot-plant*, has proved very destructive to the domestic animals of the settlers. Dr. W. Lauder Lindsay, in a journey through New Zealand, had an opportunity of examining the plant and its effects. He found it to be the *Coriaria ruscifolia* of Linnæus (*C. sarmentosa*, Forst.), and in its action on the system to be an irritant narcotic. For an elaborate account of the *toot-plant*, and its poisonous effects, the reader is referred to papers by Dr. Lindsay in the *British and Foreign Medico-chirurgical Review* (July, 1865, p. 153, and Octob. 1868, p. 465). From these it appears that more than one species of Coriaria inhabit New Zealand; *C. thymifolia*, and *C. angustissima*, besides the *ruscifolia;* though Dr. Lindsay appears to think that the two former may be merely varieties of the third; as the species of the genus are very variable; and the three indigenous in New Zealand pass into each other by gradations. It is not only cattle that are poisoned by the plant; but not unfrequently also children, who are apt to eat the fruit, and occasionally even an adult. The cattle are probably in general poisoned by eating the young shoots. It has been conjectured that the same narcotic principle found in C. myrtifolia (*coriamyrtin*) is that which renders the New Zealand species poisonous. Mr. W. S. Key has found an oil in it, to which he attributes the poisonous qualities. (*Chem. News*, 1870, xxii. 315.) The prominent symptoms of the poisoning in man are giddiness, stupor, and coma with or without delirium or convulsions. Occasionally the delirium resembles that of alcoholic intoxication, in other instances approaches that of acute mania, and is attended with violent muscular action. The loss of memory is one of the characters of convalescence. W.

CORK. *Suber*, Lat. *Liege*, Fr. The great use made of this substance by the apothecary will justify a brief notice of it here. Though in general ascribed exclusively to the *Quercus Suber*, a large oak growing in Spain, the South of France, North of Italy, Algeria, and some of the Mediterranean islands, it is said by M. Cassimer de Candolle to be obtained also for commercial purposes from another species, the *Q. occidentalis*, growing in the Southwest of France and in Portugal. It consists of the exterior layers of the bark beneath the epidermis, which acquire in these species an extraordinary development, becoming thick, and of that peculiar spongy consistence which characterizes cork. The tree begins to yield cork when fifteen or sixteen years old, and every six or eight years furnishes a fresh supply, even for a century and a half, before it perishes; that interval of time being required for the renewal of the suberose layers by the living portions of the bark beneath. There are four constituent layers of the bark, the epidermis, within this the cork, next the cellular envelope, and lastly the liber which lies upon the wood. Each of these increases year by year; but the cork thus naturally produced is not valued. The commercial product is obtained by an artificial process. The exterior layers are removed, and the liber exposed. In the interior of this, at a variable distance from the surface, a layer of the proper cork is now formed, apparently by a change in the substance of the liber, the outer portions of which perish, while annually a new layer is added to the cork already existing, until it acquires a thickness which will justify its removal. Incisions are made in such a way that the cork is removed in large concave plates, which are then flattened under pressure, and dried very slowly. From ordinary accounts, it might be supposed that the cork-tree was very common in Spain; but in a long journey through that country from the North to the extreme South, the author had no opportunity of seeing the trees from which the cork was obtained except in the Eastern Pyrenees, where it appeared to be abundant.

In selecting cork for use, those parts should be preferred which are soft and of uniform consistence; and in the choice of the larger plates those should be selected which are thick, flexible, elastic, and finely porous, and of a reddish colour. (*Guibourt.*) Cork consists mainly of a peculiar proximate principle analogous to lignin, but differing from it in this respect, that, when treated with nitric acid, it yields a peculiar acid, which has been denominated the *suberic acid*. According to M. Chevreul, who has analyzed cork, it contains, besides the principle mentioned, a little volatile oil and acetic acid which it yields by distillation; a yellow colouring substance, an astringent principle, an animalized substance, gallic acid, another acid, gallate of iron and calcium, all of which it yields

to water; a wax-like crystallizable matter, a soft resin, and two other undetermined bodies, which were extracted by alcohol after the cork had been exhausted by water; altogether constituting about 30 per cent., while the characteristic ingredient mentioned, which may be called *suberin*, amounts to 70 per cent.

M. Stanislaus Martin has called attention in France to the use of refuse corks in Paris, where they are collected by the scavengers, and sold to persons whose business it is to revive them; recutting such as are of unsuitable shape, filling up the vacuities with mastic, and covering them over with some powder which may give them a fresh and proper appearance. In consequence of the high price of cork, those which are thus prepared over again are said to be used in the bottling of beverages. Mr. J. B. Moon has found (*Am. Journ. of Pharm.*, xlvii. 467) that old corks may be regenerated by allowing them to soak for 24 hours in hot water, washing well several times, allowing to stand for a few hours in a mixture of one part of muriatic acid and fifteen parts of hot water, and finally washing well in pure water. It is easy to conceive that a cork at one time used to enclose arsenical or other deadly solution may become saturated with the poison, and afterwards impart enough of it to another liquid, if not to produce dangerous effects on the health, at least to give to tests evidence of its presence, and thus lead to serious suspicions. No cork, therefore, which has been used in a bottle containing a poisonous substance should be used a second time. W.

CORTEX CARYOPHYLLATA. *Cassia Caryophyllata. Clove Bark.* These names have been given to a bark, brought from the West Indies, and derived from a tree belonging to the family of Myrtaceæ, supposed to be the *Myrtus acris* of Schwartz. It is usually in cylinders from one to two feet long by an inch in diameter, composed of numerous separate pieces rolled around one another, having a dark-brown colour, a pungent taste, and an odour similar to that of cloves. It is sometimes in fragments, of a similar colour, taste, and smell, but softer and lighter, and supposed to be derived from older branches. A similar bark is said to be derived from the *Myrtus caryophyllata* of Linn., which grows in Ceylon. The clove bark has aromatic properties not unlike those of the spice from which it derived its name; but it is much inferior, and is not used in this country. Some authors have confounded with it a different bark, produced in the Moluccas, and known by the Indian name of culilawan. (See *Culilawan.*) W.

CORYDALIS FORMOSA. (*Pursh.*) *Turkey Corn. Turkey Pea.* This pretty little indigenous plant, growing in the Middle and Western States, is one of those employed by the practitioners calling themselves eclectics, and is highly esteemed by them. The root is the part used. It is a small roundish tuber, having a slight peculiar smell, and a bitterish somewhat pungent and persistent taste. It is said to yield its active properties to water and alcohol. According to Mr. W. T. Wenzell, who examined the root chemically, and made it the subject of an inaugural essay presented to the Philadelphia College of Pharmacy, it contains an alkaloid denominated *corydalia*, fumaric acid, bitter extractive, and acrid resin with volatile oil, a tasteless resin, brown colouring matter, starch, albumen, arabin, bassorin, cellulose, and various inorganic salts. The alkaloid was obtained by making a hydro-alcoholic tincture, distilling off the alcohol, filtering, precipitating with ammonia in slight excess, washing the precipitate, treating it with boiling alcohol, evaporating the solution to dryness, treating the residue with dilute muriatic acid, precipitating with ammonia, dissolving the precipitate in boiling alcohol, concentrating the tincture, and allowing it to stand. The corydalia was deposited in crystals, and was purified by repeated solution in alcohol and crystallization. The crystals, which are slender four-sided prisms, are inodorous, tasteless, insoluble in water, soluble in alcohol, ether, and chloroform, reddened by nitric acid, and capable of forming soluble salts with the acids. It appears to be identical with the alkaloid found in European species of Corydalis. This has been examined by G. Leube, who gives, as the result of his analysis, the formula $C_{46}H_{29}NO_7$, as representing its composition.

The corydalin of the *Corydalis tuberosa*, of Europe, was discovered in 1826 by Wackenroder. Wicke obtains it from the tubers by heating their watery infusion acidulated with sulphuric acid to 120° F., precipitating with phospho-tungstate of sodium (made by treating metatungstate of sodium with sufficient phosphate of sodium to prevent turbidness from acids), washing the yellowish precipitate, then treating it, hot, with chalk rubbed up with water, evaporating by a water-bath, and exhausting with alcohol. The solution, after evaporation, deposits, on standing, a portion of the alkaloid in star-shaped prisms. It is soluble in alcohol, ether, chloroform, amylic alcohol, sulphuret of carbon, benzine, and oil of turpentine. The alcoholic solution has a bitter taste and alkaline reaction. Corydalin forms crystallizable salts with muriatic, acetic, and other acids. It is precipitated by tannic acid, and white by sulpho-cyanide of potassium, bichloride of mercury, iodide of potassium, and metatungstate of sodium, and yellow by picrate of sodium, chromate of potassium, iodohydrargyrate of potassium, and the chloride of gold and platinum. (*Journ. de Pharm.*, 4e sér., iii. 395.)

The root of C. formosa is supposed to be tonic, diuretic, and alterative, and is given in syphilitic, scrofulous, and cutaneous affections, in the dose of from ten to thirty grains. It is also used in the form of tincture and decoction. We are indebted for the above abstract of the properties and uses of this plant to the essay of Mr. Wenzell, above re-

ferred to, published in the *American Journal of Pharmacy* for May, 1855, p. 205. The "eclectics" use a preparation which they call *corydalin* or *corydalia* made by precipitating a tincture of the root with water, in the dose of half a grain or a grain. It is of course not the active principle, and therefore has no claim to the title; yet it no doubt contains more or less of the proper alkaloid. W.

CORYLUS ROSTRATA. *Beaked Hazel.* This is a small indigenous shrub, growing especially in mountainous districts. The nut is invested with a scaly involucre, projecting beyond it like a beak, and thickly covered with short spicula like those of Mucuna pruriens. These spicula have been employed by Dr. Heubener, of Bethlehem, Pennsylvania, as an anthelmintic, and found to be efficacious. They operate in the same way as cowhage, and may be administered in the same manner and dose. (See a communication by the late Mr. Duhamel, in the *Am. Journ. of Pharm.*, xiv. 280.) W.

COSMOLIN. Under this name has been introduced a proprietary substance, which from its extreme blandness and from its favourable consistence has gained general favor as an application in inflammations of the skin. It appears to be nothing more than an impure paraffin. Mr. A. W. Miller (*Am. Journ. of Pharm.*, xlv. 534) imitates it by mixing together one part of paraffin and three parts of the best so-called neutral oil. H. C. W.

COTYLEDON UMBILICUS. *Navel-wort. Penny-wort.* This is a perennial, herbaceous, succulent plant, belonging to the class and order Decandria Pentagynia, and the natural family of Crapulaceæ. It is about six inches high, with fleshy, peltate, crenate leaves, and a flower-stem bearing, in the form of a spike, pale-yellow, belt-shaped, pendulous flowers, which appear in June and July. The plant is a native of England, where it grows upon old walls and rocks, and dry sandy banks. It was first brought before the profession, as a remedy in epilepsy, by Mr. Thos. Salter, of Poole, who had found its expressed juice very efficient in that disease, and published the results of his observations in the *London Medical Gazette* for March, 1849 (page 367). In the following May, Dr. Joseph Bullar, of Southampton, communicated the results of his observations on the same subject to the *Prov. Med. and Surg. Journ.*, which were confirmatory of those of Mr. Salter. Since that period, other testimony has been advanced in favour of the remedy; among which is that of Dr. Graves, of Dublin, who considers it a valuable aid in the treatment of epilepsy, and states that it has long been known in Ireland as a popular remedy, not only in that disease, but in asthma. (*Dublin Quart. Journ. of Med. Sci.*, xiv. 264.) It is, however, proper to say that Dr. Ranking, of Norwich, England, in a letter published in the *Lond. Med. Times and Gaz.* for April, 1854 (page 328), declares that, so far as his experience goes, he considers the medicine utterly worthless, having employed it perseveringly in more than thirty cases of epilepsy, without the smallest benefit in a single instance.

The medicine is said to have no other observable effect than that of a gentle tonic to the nervous system. The part used is the expressed juice, which should be obtained when the leaves are most succulent, before the appearance of the flowers. An extract, and a fluid extract have also been employed. The juice has been given in doses varying from a fluidrachm to a fluidounce twice or three times a day, and should be long persevered with. The dose of the fluid extract is stated at a fluidrachm, that of the dry extract at five grains, to be increased if necessary.

The probability of medicinal inertness arising from the absence of any positive physical characters in this plant can now scarcely be urged against it. From the researches of M. Flétet, it appears to contain a principle analogous to propylamin, at one time thought to be identical with it, yet now admitted to be distinct, though isomeric with it; namely *trimethylamin*, which exists in it, combined with a yet unknown acid. When the powder of the plant is exposed to the air, it attracts moisture, and exhales a disagreeable smell strikingly analogous to that of fish; and an extract, treated with a fixed alkali, disengages, even in the cold, an odour, which, at first ammoniacal, soon acquires the fishy character referred to. The presence of this ammoniacal compound, concurrently with that of a salt of ammonia, together with a notable portion of nitre, is sufficient to prove that the plant is not entirely inert, as it has generally been thought to be. We might expect in it virtues somewhat analogous to those of ergot, which owes a similar odour to propylamin. Besides this salt of trimethylamin, which, with an ammoniacal salt, constitutes 2 parts in 1000 of the plant, it contains cellulose, starch, glucose, mucilage, chlorophyll, yellow colouring matter, a volatile oil smelling like sandarac, tannin, iron, and salts of potassa, soda, lime, and oxide of iron, with 0·9 per cent. of nitre, and 95 of water. (*Ann. de Thérap.*, 1865, p. 125.) With this account of the chemical character of the plant, we are prepared to receive without absolute incredulity, the statement of M. Fonssagrives, who, having employed this remedy in a large number of epileptic cases, declares that some have been cured, and in almost all there has been a very observable amelioration, evinced in a diminished frequency and intensity of the attacks. The whole treatment consists in the daily use of a tablespoonful of the juice, which is to be continued for a year at least. (*Ibid.*, 1868, p. 56; from *Gaz. Hebdomad.*) W.

COURT PLASTER. The following formula for preparing court plaster, so much used as a means of drawing small wounds together, was devised by Mr. Arthur S. Vende (*Am. Journ. of Pharm.*, xlv. 207). Take of Russia Isinglass ℥j; Water Oj; Alcohol f℥j; Glycerin fʒss. Soak the isinglass in the water for one day, then dissolve it by the aid of gentle heat, after which strain it and add the alcohol and glycerin. The mixture, being now ready for use, is spread on a fine quality of silk stretched on a frame, each successive coat being allowed to dry before applying the next. Heat should not be used in drying the plaster, as it is apt to drive the glycerin out, and leave the plaster streaked. By another formula. Take of Russia Isinglass ℥iss; Resin ʒxiv; Alcohol, Water, āā, q. s.; Glycerin ʒss. Beat the resin in a mortar until perfectly powdered, then dissolve it in alcohol q.s., and mix with the isinglass solution; strain, and add the glycerin. Court plaster made in this way is very adhesive, but not as handsome as when made by the previous formula. In another formula, gelatin is used instead of isinglass, and makes a very handsome plaster. Gelatin ℥iss; Water Oj; Glycerin f℥i. Soak the gelatin in the water for one day, then dissolve it by the aid of a gentle heat, and after it is dissolved add the glycerin. This mixture, if spread on coarse, heavy silk, makes a white and opaque plaster; while, if spread on thin and finer silk, the plaster will be nearly transparent and of a yellowish tint. H. C. W.

CRAB ORCHARD SALT. This is a mild, saline purgative, obtained by evaporating the waters of springs at Crab Orchard, Lincoln County, Kentucky. Its principal active ingredients are sulphates of magnesium, sodium, and potassium; it contains, also, a little iron and lithium. In its crude form it is not wholly soluble, and sometimes it is purified by dissolving and straining through flannel, and evaporating. As thus prepared, it is of a brilliant white, and as a purgative is about 20 per cent. stronger than the crude salt. It, however, lacks the tonic properties of the latter. The dose of it is from one to two teaspoonfuls. H. C. W.

CRABS' CLAWS. *Chelæ Cancrorum.* These, in a prepared state, were formerly included in the Edinburgh Pharmacopœia. Supposing them identical with the crust of the lobster, they consist, in the 100 parts, of 60 parts of carbonate and 14 of phosphate of calcium, with 26 of animal matter. They are prepared by levigation and elutriation, so as to bring them to a fine powder. They were formerly used as an absorbent and antacid; but the animal matter in their composition confers on them no peculiar virtues. They are given in the same dose with prepared chalk. B.

CRABSTONES. *Lapilli Cancrorum. Crabs' Eyes.* These are concretions found in the stomach, one on each side, of the European crawfish, at the time the animal is about to change its shell. They are most abundantly procured in the province of Astracan, in Asiatic Russia. The crawfish are bruised with wooden mallets and laid up in heaps to putrefy. The animal remains are then washed away, and the stones picked out. They are inodorous, insipid bodies, somewhat hemispherical in shape, of a whitish or reddish colour, hard and stony consistence, and laminated texture. They are very variable in size, weighing from one to twelve grains each. They effervesce with acids, and, without dissolving, become converted, owing to the animal matter which they contain, into a soft transparent mass, retaining the original shape of the stone. By this character they are distinguished from counterfeit stones, which are sometimes fabricated of chalk, mixed with mucilaginous substances. They consist of carbonate and phosphate of calcium, cemented together by animal matter. Crabstones have been used as an absorbent and antacid, given in the same dose with prepared chalk. They were prepared by being levigated in the usual manner; but they are now no longer officinal. B.

CRANBERRIES. These familiar berries, so well known as an article of diet, have recently come into notice as a source of citric acid. For a method of obtaining the acid from them, see *Journ. de Pharm.*, 4e sér., xviii. 439. H. C. W.

CROCUS OF ANTIMONY. *Saffron of Antimony.* This compound is formed during the deflagration of a mixture of equal weights of tersulphuret of antimony and nitrate of potassium, to which one-twelfth of muriatic acid has been added. The nitric acid of the nitre is decomposed, nitrogen and nitric oxide being given off, and, by furnishing oxygen to part of the tersulphuret, converts its constituents into sulphuric acid and teroxide of antimony. The sulphuric acid combines with the potassa of the nitre, to form sulphate of potassium; while the teroxide unites or mixes with the undecomposed tersulphuret to constitute the crocus. The muriatic acid prevents the formation of sulphuret of potassium and free potassa, by giving rise to chloride of potassium. The product of the deflagration is reduced to powder, washed with boiling water to separate sulphate of potassium and chloride of potassium, and then fused. When crocus of antimony is intended to be employed for making tartar emetic, it should not be fused; because it requires, for preparing this antimonial, to be reduced to a very fine powder, and the fused substance is pulverized with difficulty. The deflagrated mass, instead of being fused should be reduced to very fine powder, and washed with boiling water. In this state it more readily dissolves in the solution of cream of tartar. Fused crocus is in masses of a liver-brown colour. As obtained without fusion, it is a saffron-brown insoluble powder, containing about four-fifths of its weight of teroxide, the remaining fifth being tersulphuret. In the

London Pharmacopœia of 1836, the unfused crocus was adopted for preparing tartar emetic; but in the edition of 1851 it was abandoned, and the subsulphate of antimony substituted for it. B.

CUCUMBER OINTMENT. An emollient ointment, prepared from the common cucumber (fruit of *Cucumis sativus*), has been considerably employed in irritated states of the skin. The following is the mode of preparing it, recommended by Prof. Procter. Take of green cucumbers 7 pounds avoirdupois, pure lard 24 ounces, veal suet 15 ounces. Grate the washed cucumbers to a pulp, express, and strain the juice. Cut the suet into small pieces, heat it over a water-bath till the fat is melted out from the membrane; then add the lard, and, when melted, strain through muslin into an earthen vessel capable of holding a gallon, and stir until thickening commences, when one-third of the juice is to be added, and the whole beaten with a spatula till the odour has been almost wholly extracted. The portion which separates is to be decanted, and the remaining two-thirds of the juice are to be consecutively incorporated and decanted in the same manner. The jar is then closely covered and placed in a water-bath, until the fatty matter entirely separates from the juice. The green coagulum floating on the surface is now removed, and the jar put in a cool place that the ointment may solidify. The crude ointment is then separated from the watery liquid on which it floats, melted and strained, and placed in glass jars, which must be kept closely sealed. A layer of rose-water upon its surface will favour its preservation. A portion may be triturated with a little rose-water until white and creamy, and put into a separate jar for present use. (*Am. Journ. of Pharm.*, xxv. 409.)

M. Emile Mouchon prepares the ointment by obtaining the juice mixed with a little alcohol, and incorporating this with benzinated lard and stearin. He directs 16 parts of the cucumber to be reduced to a pulp, 1 part of alcohol of 36° B. to be added, and the mixture to be placed on the diaphragm of a percolator. Twenty-four hours afterwards 10 parts of the liquid are obtained of 19° B. Of this liquid 6 parts are to be incorporated with 37·5 parts of benzinated lard and 12·5 of stearin; the fatty matters having been previously melted together by means of a water-bath, and beaten vigorously on cooling. The liquid is to be added before the completion of the beating, which should then be continued until the whole becomes as light and white as possible. The benzoin and alcohol enable the ointment to keep a long time. (*Journ. de Pharm.*, Juillet, 1854, p. 41.) W.

CUCURBITA CITRULLUS. *Watermelon.* The seeds of the watermelon are employed, to a considerable extent, as a domestic remedy in strangury and other affections of the urinary passages. They have similar properties with the seeds of the other Cucurbitaceæ, of which four different kinds were formerly officinal under the name of the *greater cold seeds*—viz., those of the *Cucurbita Pepo* or pumpkin, the *Cucurbita Lagenaria* or gourd, the *Cucumis Melo* or muskmelon, and the *Cucumis sativus* or cucumber. These, when bruised and rubbed up with water, form an emulsion, which was formerly thought to possess considerable virtues, and was much used in catarrhal affections, disorders of the bowels and urinary passages, fever, &c.; but they have been superseded by other more agreeable demulcents. Watermelon seeds are also esteemed by some diuretic. They are given in infusion, made with one or two ounces of the bruised seeds to a pint of water, and taken *ad libitum*. The juice of the melon itself is undoubtedly diuretic, and might be very properly recommended as an adjuvant to other remedies in many cases of dropsy.

The pulp of the root of *Cucurbita Lagenaria*, or gourd, is said by Dr. Chapin to be a powerful and even drastic purgative, and to be used by the natives of the Sandwich Islands successfully in dropsy; though in the large quantities in which it is employed by them, it sometimes proves fatal through hypercatharsis. (See a paper by Dr. Luther H. Gulick, in the *N. Y. Journ. of Med.* for March, 1855, p. 203.) W.

CULILAWAN. *Cortex Culilaban.* An aromatic bark, produced by *Cinnamomum Culilawan* (*Laurus Culilawan*, Linn.), a tree of considerable size, growing in the Molucca Islands, Cochin-China, and other parts of the East. It is usually in flat or slightly rolled pieces, several inches long, an inch or more in breadth, and one or two lines thick. Sometimes the bark is thinner and more quilled, bearing considerable resemblance to cinnamon. The epidermis is for the most part removed, but when present is of a light brownish-gray colour, soft to the touch, and somewhat spongy. The colour of the bark itself is a dull dark cinnamon-brown, the odour highly fragrant, the taste agreeably aromatic, and not unlike that of cloves. The active constituent is a volatile oil, which may be separated by distillation. Culilawan has the medical properties common to the aromatics, but is scarcely used at present. W.

CUMIN SEED. CYMINUM, *Lond.* CUMINUM, *Ed.* Cumin seeds have been omitted in the British Pharmacopœia, and, having no place in our own, and consequently none in *Part* I. of this work, require a brief notice here. They are the fruit of the *Cuminum Cyminum*, an umbelliferous plant, belonging to Pentandria Digynia of the Linnæan system, with the following generic character. "*Fruit* ovate, striated. *Partial umbels* four. *Involucres* four-cleft." (*Willd.*) It is an annual plant, about six or eight inches

high, having a round, slender, branching stem, with numerous narrow, linear, pointed, smooth, grass-like leaves, of a deep-green colour. The flowers are white or purple, and disposed in numerous terminal umbels, which have very few rays, and are attended with general and partial involucres, consisting of three or four linear leaflets. The fruit consists of two oblong plano-convex half-fruits, commonly called seeds, united by their flat sides. The plant is a native of Egypt, but is cultivated for its fruit in Sicily, Malta, and other parts of Europe.

The cumin seeds of the shops are elliptical, flat on one side, convex, furrowed, and rough on the other, about one-sixth of an inch in length, and of a light-brown colour. Each has seven longitudinal ridges. Two seeds are sometimes united together as upon the plant. Their odour is peculiar, strong, and heavy; their taste warm, bitterish, aromatic, and disagreeable. They contain much essential oil, which is lighter than water, yellowish, and has the sensible properties of the seeds. It consists of two distinct oils, one a carbohydrogen, called *cymene* ($C_{20}H_{14}$), the other consisting of carbon, hydrogen, and oxygen ($C_{20}H_{12}O_2$), which may be regarded as *hydruret of cumyl* ($C_{20}H_{11}O_2,H$). (Gregory's *Organic Chemistry*, 4th ed., pp. 156 and 341.) Dumas, a long time since, obtained a cymene identical with that of oil of cumin seeds, by dehydrating camphor, and M. Paternó prepared it in a similar way from oil of turpentine. (*Journ. de Pharm.*, 4e sér., xx. 409.) In his discovery M. Paternó seems, however, to have been preceded by several chemists, Mr. C. R. A. Wright apparently having the priority. (*Am. Journ. of Pharm.*, xlvi. 117.) For details in regard to the question of priority and the method of preparing the cymene, the reader is referred to the papers just quoted, and to the *Am. Journ. of Pharm.*, xliv. 452. In medical properties cumin seeds resemble the other aromatic fruits of umbelliferous plants, but are more stimulating. They are seldom used in the United States, and appear to have been retained by the London College merely as an ingredient in a stimulant and discutient plaster (*Emplastrum Cymini*), now no longer officinal. The dose is from fifteen grains to half a drachm. W.

CUNDURANGO. *Condurango.* This drug some few years since attracted a great deal of attention as a remedy in cancerous disease, but further experience has demonstrated its uselessness. It appears, however, to be used largely in South America as an alterative in chronic syphilis, and merits a brief notice here. According to an official investigation (*A Report on the Origin and Therapeutic Properties of Cundurango.* By Dr. W. S. W. Ruschenberger, U. S. N., Washington, 1873) made by Passed Assistant Surgeon Jos. G. Ayers, U. S. N., there are at least ten different plants known in New Granada as condurango. For a description of them the reader is referred to the report of Dr. Ruschenberger. The variety which has been used in cancer is the *cundurango blanco.* The plant which yields it is a vine from ten to thirty feet in length, and from one to two inches in diameter. It is stated to belong to a previously undescribed genus of Asclepiadaceæ, and the name *Pseusmagenuetus Equatorium* has been proposed for it. The bark is prepared by pounding the stem with a mallet, to separate it, and then drying it in the sun. It is from one-sixteenth to one-sixth of an inch thick, with a smooth external surface of an ash-gray colour, diversified with greenish and blackish lichens. When dried on the stem the bark has a darker colour. Dr. Thos. Antisell (*Am. Journ. of Pharm.*, xliii. 289) found in it tannin, extractive matter, a yellow resin, to which he attributes whatever of virtue the plant may contain. Of the physiological action of cundurango blanco we have no definite knowledge. It is stated the roots and seeds will kill dogs. Dr. H. Chiriboga states that two or three drachms of it taken by himself in the form of decoction, produced considerable activity of the circulation, copious diaphoresis, increased secretion of urine, and even some vertigo and disturbance of vision. H. C. W.

CUNILA MARIANA. *American Dittany.* A small indigenous perennial herb, growing on dry, shady hills, from New England to Georgia, and flowering in June and July. The whole herb has a warm pungent taste, and a fragrant odour, dependent on an essential oil. By means of distillation with water, this oil has been separated by Mr. Philip Milleman, of Chicago, who describes it as of a reddish-amber colour, becoming light-yellow by exposure to light, of a delicate, fragrant odour, very similar to that of oil of monarda, of a warm, pungent taste, and of the sp. gr. 0·920. It is readily soluble in alcohol, ether, and chloroform. On spontaneous evaporation, it leaves a small crystalline residue. Iodine decomposes it, producing white vapours; by sulphuric acid it is reddened and decomposed, by nitric acid resinified, and by muriatic acid decolorized, though its colour returns on exposure. It is slightly rubefacient; in the dose of five or ten drops is carminative, and of 15 to 20 drops diaphoretic. The same author found in the dried herb tannic acid, a trace of glucose, gum, bitter extractive, resin, and salts of potassa, lime, magnesia, and iron. (*Am. Journ. of Pharm.*, Nov. 1866, p. 495.) American dittany is a gently stimulant aromatic, analogous to the mints, pennyroyal, &c. In warm infusion, it is popularly employed to excite perspiration in colds and slight fevers, to promote suppressed menstruation, to relieve flatulent colic, and for various other purposes to which the aromatic herbs are thought applicable. W.

CUTTLE-FISH BONE. *Os Sepiæ.* This is a calcareous body, situated underneath the skin, in the back of the *Sepia officinalis*, or *cuttle-fish*, which inhabits the seas of Eu-

rope, especially the Mediterranean, in the waters of which the bone is not unfrequently found floating. It is oblong-oval, from five to ten inches long, and from one and a half to three inches broad, somewhat convex on both sides, with thin edges, of a rather firm consistence upon the upper surface, very friable beneath, and composed of numerous layers, loosely connected, so as to give to the mass a porous consistence. It is lighter than water, of a white colour, a feeble odour of sea plants, and a saline taste. It contains, according to John, from 80 to 85 per cent. of carbonate of calcium, besides animal matter, a little common salt, and traces of magnesia. Reduced by levigation and elutriation to a fine powder, it may be given as an antacid like chalk or oyster-shell. It is sometimes used as an ingredient of tooth-powders. Small pieces of it are often put into bird-cages that the birds may rub their bills against them; and the powder is employed for polishing. Another product of the cuttle-fish is a blackish-brown liquor, secreted by a small gland into an oval pouch, communicating externally near the rectum by a a long excretory duct, through which the animal is said to have the power of ejecting it at will. This, when taken from the fish, is dried, and used in the preparation of the water colour called *sepia*. W.

CYANIDE OF ZINC. *Zinci Cyanidum. Cyanuret of Zinc.* This cyanide is precipitated as a white insoluble powder, by adding cautiously, until it ceases to produce a precipitate, a recently filtered solution of cyanide of potassium, obtained from the impure black cyanide, to a solution of sulphate of zinc. It is used in Germany as a substitute for hydrocyanic acid, and is said to be anthelmintic. It has been employed in epilepsy, chorea, and neuralgia, in several painful affections of the stomach, and in the colics attendant on difficult menstruation. The dose is a quarter of a grain, gradually increased to a grain and a half, given in mixture. It is included in the officinal list of the French Codex. B.

CYCLAMEN EUROPÆUM. *Pain de Porceau*, Fr. *Sow-bread.* This is an herbaceous perennial, stemless plant, indigenous in the South of Europe, and cultivated in gardens for the beauty of its purple flowers, with reflected petals. It belongs to *Pentandria Monogynia* of the Linnæan system, and to the natural order *Primulaceæ*. The root is globular, with many branched fibres, almost black without, and white within, inodorous, and when fresh, of a bitter, acrid, burning taste. By drying it loses much of its acrimony, and is said to be rendered edible by roasting. Hogs are said to root it up from the ground and to eat it with impunity; and hence its common French name. The root is a drastic cathartic, and is thought to have the power of producing abortion, for which purpose it is sometimes employed among the peasantry, who habitually use it as a cathartic. Sometimes, however, it has produced very serious effects, as inflammation of the alimentary canal, with bloody stools, cold sweats, and convulsive movements, which have even ended fatally. It is supposed to be capable of acting on the bowels when applied to the skin; and, in the form of ointment, is said to be rubbed on the surface of the abdomen in children for the expulsion of worms. (*Mérat et De Lens.*) The root probably owes its acrimony, if not all its medicinal properties, to an active principle, first discovered many years since by Saladin, and named by him *arthanitin*, and more recently by S. De Luca, who has given it the more appropriate name of *cyclamin*. It is white, amorphous, inodorous, and, when held a short time in the mouth, intensely acrid, extending its action even to the throat. With cold water it swells and becomes gelatinous, but is readily dissolved, and forms a solution which froths like soap and water, and is coagulated by a heat of about 150° F. Alcohol dissolves it with difficulty when cold, but freely when hot; it is soluble in glycerin with the aid of heat; and is insoluble in ether, chloroform, bisulphuret of carbon, and the essential oils. It contains no nitrogen; its formula being, according to an analysis by Dr. Klinger, $C_{28}H_{16}O_{12}$. Dr. T. W. C. Martius recommends the following method of preparing it. The tubers, collected in the autumn, dried and powdered, are mixed with animal charcoal, and exhausted at a boiling heat by alcohol of 0·825; the tincture is filtered, concentrated, and set aside for six or eight weeks, when the cyclamin is deposited. This should be washed on a filter with alcohol till it passes colourless; and if the filtrate be concentrated, and set aside, it will deposit a further quantity in a few weeks. The whole is then mixed with animal charcoal, and treated with boiling alcohol, which will slowly deposit the pure cyclamin on cooling. This principle was found by M. De Luca, by experiments on animals, to be poisonous, and he supposed it to resemble curari in its action, though less violent. (See *Am. Journ. of Pharm.*, Jan. 1858, p. 21, and March, 1860, p. 154.) The dose of the powdered root is said to be from 20 to 40 grains. W.

CYNANCHUM VINCETOXICUM. R. Brown. *Asclepias Vincetoxicum.* Linn. *White Swallow-wort. Vincetoxicum.* A perennial, herbaceous European plant, the root of which was formerly esteemed a counterpoison, and hence gave origin to the officinal name. It has a bitterish acrid taste, and, when fresh, a disagreeable odour, which is diminished by drying. Taken internally, especially in the recent state, it excites vomiting, and is capable, in larger quantities, of producing dangerous if not fatal inflammation of the stomach. Its former reputation as an alexipharmic was without foundation. It is said to be useful in cutaneous diseases, scrofula, etc., but is little employed. The

leaves of the plant also are emetic. Feneulle found in the root a peculiar principle analogous to emetin. W.

CYNARA SCOLYMUS. *Garden Artichoke.* This is a perennial plant, indigenous in the South of Europe, and cultivated in our gardens as a culinary vegetable. The flowers, constituting what are commonly called the *heads*, are the part used. The receptacle and the lower portion of the fleshy leaflets of the calyx are eaten, and the other parts rejected. When young, the heads are cut up raw and eaten as salad; when older, they are boiled, and dressed variously. The flowers are said to curdle milk, and the plant to yield a good yellow dye. The leaves and their expressed juice are very bitter, and have been thought to be actively diuretic. They have long had some reputation in the treatment of dropsies. Dr. Badely, of Chelmsford, England, recommends a tincture and extract, prepared from the leaves, in rheumatic, gouty, and neuralgic affections. He gives a drachm of the tincture, with five grains of the extract, three times a day, with or without other remedies, as circumstances seem to require. The leaves should be fresh and the preparations made from them quickly used. (*Lond. Lancet*, 1843, p. 556.) Dr. E. Copeman has also found the remedy of great value in rheumatism. (*Edinb. Med. Journ.*, xx. 958.) W.

CYNOGLOSSUM OFFICINALE. *Hound's Tongue.* A biennial plant, common both in Europe and this country, and named from the shape of its leaves. The leaves and root have been employed, but the latter has been generally preferred. The fresh plant has a disagreeable narcotic odour resembling that of mice, which is dissipated by drying. The taste is nauseous, bitterish, and mucilaginous. Different opinions as to its powers have been entertained, some considering it nearly inert, others as a dangerous poison. Dr. Diedülin, of St. Petersburg, Russia, affirms that an extract of this plant will paralyze the motor nerves in vertebrate animals; and J. Setschenow, of Gratz, states that, upon introducing a piece of the extract, about as large as the head of a pin, which he had received from Dr. Diedülin, into the dorsal lymph sac of each one of four frogs, he produced total paralysis of motion in from five to ten minutes; the heart continuing to beat, the irritability of the muscles continuing, and sensation remaining undisturbed. (See *Med. and Surg. Reporter*, Aug. 22, 1868, p. 153.) Hound's tongue has been used as a demulcent and sedative in coughs, catarrh, spitting of blood, dysentery, and diarrhœa; and has been applied externally in burns, ulcers, scrofulous tumours, and goitre. Should the plant be found really to possess the property assigned to it by Dr. Diedülin, it might be tried in tetanus with hope of benefit. The *pilulæ de cynoglosso*, which are officinal in some parts of Europe, though they contain the root of hound's tongue, owe their properties chiefly to opium. W.

CYTISUS LABURNUM. *Laburnum.* The laburnum is a small tree, indigenous in the higher mountains of Europe, and cultivated, throughout the civilized world, in gardens and pleasure grounds for the beauty of its flowers, which appear early in the spring in rich pendent yellow clusters. The young shoots and probably the leaves, indeed all parts of the plant, are purgative, and in excessive doses poisonous. Caventou found in the flowers an odorous fixed oil, gum, lignin, gallic acid, and traces of sulphate and chloride of calcium. MM. Chevallier and Lassaigne discovered in the seeds a peculiar principle, to which they gave the name of *cytisin*. This was a yellowish-white, neuter, amorphous, deliquescent, non-nitrogenous substance, of a bitter nauseous taste, soluble in water and weak alcohol, and insoluble in ether. In small doses it produced, in several animals of different species, vomiting, convulsions, and death; and eight grains taken by Chevallier himself caused threatening symptoms, which disappeared under the free use of lemonade. Five grains appeared equal to three of tartar emetic. (*Méret et De Lens.*) Dr. Th. Scott Gray found in laburnum three distinct principles, an acid which he named *laburnic*, and two other substances, both of them bitter and neuter, which he proposed to call *laburnin* and *cystinea*. These are contained in variable proportions in all parts of the plant, but most largely in the bark and seeds. As all of them are soluble in water, and only a portion in alcohol, the former is the proper menstruum for extracting the virtues of the plant. Dr. A. Husemann claims to have discovered a new alkaloid in laburnum, which he calls *cytisin*, and describes as a white, crystalline solid, of a bitter somewhat caustic taste, soluble in water and alcohol, but scarcely at all soluble in ether, chloroform, benzole, or sulphuret of carbon. It is strongly basic, and has the composition $O_{20}H_{27}N_3O$, of course quite different from the cytisin of MM. Chevallier and Lassaigne. (*Chem. News*, July 16, 1869, p. 36.) It is stated to be found also in arnica flowers. In reference to the physiological effects of laburnum, Dr. Gray found that, after a slight excitement of the nervous and circulatory systems, there was a diminution of the pulse and a disposition to sleep. Decided narcotic effects were produced, with a moderate increase of urine, and a tendency to increased action of the liver. Dr. Gray employed the preparations of the plant therapeutically, and thought them useful in bilious dyspepsia, with periodical vomiting and alternations of constipation and diarrhœa; in infantile vomiting; in allaying the cough in bronchitis, and the violence of the paroxysms of hooping-cough and asthma; in the vomiting of pregnancy; and, finally, given in large doses four times a day, in the treatment of prurigo; the decoction

being at the same time applied externally. (*Journ. de Pharm.*, Août, 1862, p. 160; from the *Ed. Med. Journ.*) Several cases of poisoning from laburnum seeds have been recorded. In a child about six years old, taken to the Cork Infirmary, the symptoms were giddiness and pain in the head, dryness and constriction of the throat, afterwards very painful sensations in the stomach, followed by nausea and vomiting, with rapid and fluttering pulse, laboured breathing, convulsive twitchings of the face, and wide dilatation of the pupils and insensibility to light. He recovered, however, under treatment. (J. Popham, *Dub. Quart. Journ.*, Feb. 1863, p. 248.) Another case is reported as having occurred at Canterbury, England, in which very similar symptoms resulted from the same cause, and with a similar result. (*Med. Times and Gaz.*, Sept. 13, 1862.) For still other cases see *Lancet*, Aug. 1870; *Philad. Med. Times*, Oct. 1875. W.

DAJAKSCH. *Arrow Poison of Borneo.* This poison, which is in the form of an extract, but apparently of unknown botanical origin, was made the subject of experimental investigation by Dr. P. M. Braidwood, who came to the following conclusions as to its physiological action. 1. It causes death by paralyzing the heart, which is proved by the fact that, after ligature of the heart, death occurs in the same manner and in about the same time as after taking this poison. 2. That the cessation of the heart's action results from paralysis of the cardiac ganglia of the great sympathetic. 3. That the other phenomena, such as paralysis of sensation and motion, are the natural results of paralysis of the heart. (*Edin. Med. Journ.*, Aug. 1864, p. 127.) It is not the same as the Java arrow poison, which is the product of the Upas Antiar, though this also destroys life by suspending the cardiac action. The Upas Antiar appears to act directly on the heart, the dajaksch through the sympathetic ganglia. (*Ibid.*, p. 133.) W.

DAMIANA. This is a remedy recently introduced from Mexico, and stated to be a powerful aphrodisiac useful in cases of sexual atony. It cannot be doubted but that very different substances have been sold under the one name. Mr. Wood (*Am. Journ. of Pharm.*, xlvii. 47) states that there are in the market at least three distinct drugs all claiming to be the genuine article. One of these has a smooth, dark-green, broadly lanceolate, dentate leaf, usually having six teeth on each side, heavy mid-rib, and ribs extending to the point of the teeth, from two to five lines in width and from six to twelve in length; the stem is red and woody, and the leaves give a minty flavour when chewed. The second variety has a light-green obovate, deeply toothed leaf, having three and occasionally four teeth on each side, with a heavy mid-rib, and branching ribs extending to the edge. The surface is rough, and both sides are covered with short hairs. It is from two to five lines in width and five to eight in length. Its flavour, when chewed, reminds of sage; the stem is very woody, and near the apex it is quite hairy. In the third variety the leaf is light-green, lanceolate, three teeth on each side, which terminate with hard, sharp points; it has a distinct mid-rib, and is rather indistinctly veined; is from one and a half to three lines in width and four to ten in length. It is quite thick and has a rough surface, with occasional black dots. To the naked eye the leaf appears to be covered with shining scales, which, under the glass, appear as minute resin-like globules. This is the only specimen accompanied by flowers. They are compound, with yellow florets and white pappus, the stem is woody with green epidermis, and covered with resinous secretion. One specimen submitted to Prof. I. T. Rothrock was undoubtedly the product of *Bigelovia veneta* Gray. Other specimens in the market are said to come from *Turnera aphrodisiaca*, and still other samples from a third plant. (*Med. and Surg. Reporter*, 1876, 182, 425.)

The published reports as to the value of the drug vary greatly, some having had great success with it, others finding it useless. An ounce of the leaves, either in the form of infusion or fluid extract, may be given daily. H. C. W.

DIANTHUS CARYOPHYLLUS. *Clove Pink.* The *clove pink* or *carnation* is too well known to require minute description. It is a perennial, herbaceous plant, belonging to the family of Caryophyllaceæ, and characterized as a species by its branching stem, its solitary flowers, the short ovate scales of its calyx, its very broad beardless petals, and its linear, subulate, channeled, glaucous leaves. Indigenous in Italy, it is everywhere cultivated in gardens for the beauty of its flowers, of which numerous varieties have been produced by horticulturists. Those are selected for medicinal use which have the deepest red colour, and the most aromatic odour. The petals should not be collected till the flower is fully blown, and should be employed in the recent state. They have a fragrant odour, thought to resemble that of the clove. Their taste is sweetish, slightly bitter, and somewhat astringent. Both water and alcohol extract their sensible properties, and they yield a fragrant essential oil by distillation. In Europe they are employed to impart colour and flavour to a *syrup*, which serves as a vehicle for other less pleasant medicines. According to the directions of the former Edinburgh Pharmacopœia, this was prepared by macerating one part of the flowers, without their claws, with four parts of boiling water for twelve hours, then filtering, and adding seven parts of sugar. W.

DIAPHORETIC ANTIMONY. *Antimonium Diaphoreticum. Potassii Biantimonias.* This compound is directed, in the French Codex, to be formed by deflagrating in a red-hot crucible, and keeping red-hot for half an hour, a mixture of pure antimony with

twice its weight of nitrate of potassium, both being in fine powder. The product is washed with water and dried, and forms the *washed diaphoretic antimony*. As thus prepared, M. Oscar Figuier has shown that it contains, besides antimonic acid, both teroxide of antimony and antimonious acid; the nitre not being in sufficient quantity completely to peroxidize the antimony. When, however, the antimony is deflagrated with three times its weight of nitre, and the matter is kept at a red heat for an hour and a half, the whole of the antimony is converted into antimonic acid; and, when the product is thoroughly exhausted by boiling water, the resulting solution contains a large quantity of neutral antimoniate of potassium, and the insoluble residue is impure biantimoniate. M. Figuier rejects this residue, which forms the diaphoretic antimony of the ordinary process, and obtains the preparation from the solution of the neutral antimoniate, by passing through it a stream of carbonic acid gas, which removes one eq. of potassa from two of the antimoniate, and throws down the biantimoniate in the form of a white powder. By this process he obtained a quantity of the preparation, equal to three-fourths of the weight of the materials employed. Diaphoretic antimony is a perfectly white powder. When properly prepared, as by the process of M. Figuier, it consists of two eqs. of antimonic acid, one of potassa, and six of water. The dose is two or three drachms. On account of its weak and variable nature, it has been generally laid aside in practice. B.

DICTAMUS ALBUS. *White Fraxinella. Bastard Dittany.* This is a perennial European plant, the root of which is bitter and aromatic, and has been used as an anthelmintic, emmenagogue, and stomachic tonic; though at present little employed in Europe, and not at all in this country. Störck gave it in intermittents, worms, amenorrhœa, hysteria, epilepsy, and other nervous diseases. The bark of the root is the most active part. The dose is from a scruple to a drachm. W.

DIERVILLA TRIFIDA. (Mœnch, *Gray's Manual*, p. 166.) *D. Canadensis.* (Muhl.) *Bush Honeysuckle.* A low, erect, indigenous shrub, growing especially in rocky places throughout the Northern States. The whole plant, including root, branches, and leaves, is supposed to be possessed of diuretic and astringent properties, which render it useful, given in the form of infusion, in diseases of the urinary passages. It is one of the eclectic remedies. W.

DIOSCOREA VILLOSA. (*Gray's Manual*, p. 480.) *Wild Yam-root. Colic-root.* An indigenous perennial creeper, with long, branching, contorted, fibrous, ligneous roots. It grows from Maine to Wisconsin, and southward also. The roots are used by the "eclectics," who consider them efficacious in bilious colic. They are administered in decoction and tincture; and a substance called improperly *dioscorein*, obtained by precipitating the tincture with water, is used for the same purpose in a dose of from one to four grains. W.

DIPPEL'S ANIMAL OIL. *Oleum Cornu Cervi.* This oil is obtained during the distillation of bones, in the processes for obtaining ammoniacal products on a large scale. The portion which first comes over is pale yellow; but, in the progress of the distillation, the distillate becomes gradually deeper coloured and thicker, and at last black and viscid. It is purified and rendered colourless by redistillation, a pyrogenous resin being left behind. Thus rectified it is a colourless liquid, very limpid and volatile, with a penetrating extremely fetid odour and burning taste. By repeating the distillation till a dark residuum is no longer left in the retort, it may be obtained free from fetor, and of an agreeable aromatic odour; and in this mode it is said to have been prepared by Dippel. Four or five distillations are necessary. (*Am. Journ. of Pharm.*, ix. 244.) The oil is soon altered by the action of air and light, becoming thick, yellow, brown and finally black. It has an alkaline reaction, and probably contains the various principles which have been discovered by Reichenbach in the products of the distillation of organic substances.

This oil was originally obtained from hartshorn, and was a product of the decomposition of the gelatinous tissue, the horn containing no fat. When obtained from bones, it is a product of the same tissue; as these are boiled with a large quantity of water, and dried, before they are submitted to destructive distillation. The oily product of this distillation, after rectification, forms the *bone-oil* of commerce. Bone-oil has a dark-brown almost black colour, with a greenish shade. It is perfectly opaque in the mass, but brown when viewed by transmitted light in a thin layer. Its sp. gr. is about 0·970. Its smell is peculiarly disagreeable and somewhat ammoniacal. A piece of fir-wood, moistened with muriatic acid, and held over the mouth of a vessel containing it, acquires a dark reddish-purple colour, characteristic of *pyrrol*. It contains several organic bases, such as *petinin*, *picolin*, &c., which have been examined by Dr. Thomas Anderson, of Scotland. (See his paper on the products of the distillation of animal substances, in the *Philos. Mag.*, 3d series, xxx. 174; and for a notice of picolin, see the note in *page* 706.)

Animal oil was formerly much used in medicine, but its repulsive odour and taste, as it is ordinarily prepared, have caused it to be almost entirely laid aside. It is given in the dose of a few drops, mixed with water, and acts as a stimulant and antispasmodic. Its presence in the spirit and salt of hartshorn gives to these preparations medicinal properties different from those of the pure spirit and of carbonate of ammonium. B.

DIRCA PALUSTRIS. *Leather Wood.* An indigenous shrub, usually very small, but sometimes attaining the height of five or six feet, growing in boggy woods, and other low wet places, in almost all parts of the United States. The berries, which are small, oval, and of an orange colour, are said to be narcotic and poisonous. The bark has attracted most attention. It is extremely tough, and of very difficult pulverization. In the fresh state it has a peculiar rather nauseous odour, and an unpleasant acrid taste, and when chewed excites a flow of saliva. It yields its acrimony completely to alcohol, but imperfectly to water even by decoction. In the dose of six or eight grains, the fresh bark produces violent vomiting, preceded by a sense of heat in the stomach, and often followed by purging. Applied to the skin it excites redness and ultimately vesicates; but its epigastric operation is very slow. It appears to be analogous in its properties to mezereon, to which it is botanically allied. W.

DITA. This is the bark of a tree, *Alstonia Scholaris*, R. Br. (*Echites Scholaris*, L.), belonging to the family of Apocynaceæ, and growing in the Philippine Islands. It occurs in pieces 3 to 6 inches long and 3 to 4 lines thick, sometimes flat, sometimes slightly curved; its internal surface is fibrous and of a brown sepia tint; its section has the colour of leather, and its external surface is of the same tint, with brown spots. It is compact, but readily pulverized; is without odour, and has a taste at first slight, afterwards decidedly bitter. M. Gruppe has extracted from it, by a process similar to that used in obtaining quinine, an uncrystallizable, hygroscopic, very bitter principle, to which he gives the name of *Ditaine*, and which has been used with asserted success as a substitute for quinine. (*Journ. de Pharm.*, 4e sér., xviii. 225; xix. 84; *Pharm. Journ. and Trans.*, Aug. 1875.) H. C. W.

DRAGON'S BLOOD. *Sanguis Draconis.* This is a resinous substance obtained from the fruit of several species of *Calamus*, especially *C. Rotang* and *C. Draco*, small palms, growing in Siam, the Molucca Islands, and other parts of the East Indies. On the surface of the fruit, when ripe, is an exudation, which is separated by rubbing, or shaking in a bag, or by exposure to the vapour of boiling water, or finally by decoction. The finest resin is procured by the two former methods. It comes in two forms: sometimes in small *oval masses*, of a size varying from that of a hazelnut to that of a walnut, covered with the leaves of the plant, and connected together in a row like beads in a necklace; sometimes in *cylindrical sticks*, eighteen inches long and from a quarter to half an inch in diameter, thickly covered with palm leaves, and bound round with slender strips of cane. In both these forms, it is of a dark reddish-brown colour, opaque, and readily pulverizable, affording a fine scarlet powder. It sometimes comes also in the form of a reddish powder, and in small irregular fragments or tears. An inferior kind, said to be obtained by boiling the fruit in water, is in *flat circular cakes*, two or three inches in diameter and half an inch thick. This also yields a fine red powder. A fourth variety, much inferior even to the last mentioned, is in *large disks*, from six to twelve inches in diameter, by an inch in thickness, mixed with various impurities, as pieces of the shell, stem, &c., and supposed to be derived from the fruit by decoction with expression. A substance known by the name of dragon's blood is derived by exudation from the trunk of *Dracæna Draco*, a large tree inhabiting the Canary Islands and the East Indies, and another from *Pterocarpus Draco*, a tree of the West Indies and South America, by incision into the bark. These last, however, are little known in commerce. According to Lieut. Wellstead, much dragon's blood is obtained in the island of Socotra, by spontaneous exudation from a large tree, growing at a considerable elevation on the mountains.

Dragon's blood is inodorous and tasteless, insoluble in water, but soluble in alcohol, ether, and the volatile and fixed oils, with which it forms red solutions. According to Herberger, it consists of 90·7 parts of a red resin, which he calls *draconin*, 2·0 of fixed oil, 3·0 of benzoic acid, 1·6 of oxalate of calcium, and 3·7 of phosphate of calcium. It was formerly employed in medicine as an astringent, but is nearly or quite inert, and is now never given internally. It is sometimes used to impart colour to plasters, but is valued chiefly as an ingredient of paints and varnishes. W.

DUTCH PINK. A yellow or brownish-yellow paint, consisting of clay, or a mixture of clay and chalk, or carbonate of calcium in the form of whiting, coloured by a decoction of woad, French berries, or birch leaves, with alum. W.

EMERY. A very hard mineral, the powder of which is capable of wearing down all other substances except the diamond. As existing in commerce, it is said to be derived chiefly from the island of Naxos, in the Grecian Archipelago; but, according to Landerer, it has been found also in Asia Minor and the Morea. Within a few years a new locality of emery has been discovered at Chester, Hampden County, Mass., where a vein of this valuable mineral exists, of an average width of four feet, and several miles in length. For details in reference to this subject, the reader is referred to a paper by Prof. J. Lawrence Smith, in the *American Journal of Sciences and Arts* (A.D. 1866, 2d ser., xlii. 83). Emery is pulverized by grinding it in a steel mill, and the powder is kept in the shops of different degrees of fineness. It is used for polishing metals and hard stones. The method, adopted in Smyrna, of ascertaining its purity, is to rub a plate of glass of known weight with a certain quantity of the suspected mineral until it ceases to have

any effect. The loss of weight in the glass is the measure of the value of the emery. (See *Am. Journ. of Pharm.*, March, 1862, p. 187.) W.

EPIGÆA REPENS. *Trailing Arbutus. Ground Laurel. May-flower.* This is a small trailing plant, with woody stems from six to eighteen inches long, entire, cordate-ovate leaves, and small, very fragrant flowers, which appear early in the spring. It is found in the woods, and affects the sides of hills with a northern exposure. Dr. Darlington states that the plant has been supposed to be injurious to cattle, when eaten by them. (*Flora Cestrica*, p. 259.) Mr. Jefferson Oxley has found in this plant arbutin, urson, evicolin, tannic and formic acids, and a principle allied to gallic acid. (*Am. Journ. of Pharm.*, xliv. 253.) The late Dr. Eli Ives, of New Haven, Connecticut, furnished us with the following account of its virtues and uses, founded on his own observation. "The Epigæa repens has been freely used for many years in diseases of the urinary organs, and of the pelvic viscera generally, particularly of irritated action, in those cases in which the uva ursi and buchu are indicated. The leaves and stems are prepared in the same manner, and administered in the same dose as the uva ursi. The Epigæa has given relief in some cases where the uva ursi and buchu have failed. May 4th, 1849." W.

EPILOBIUM ANGUSTIFOLIUM. (*Gray's Manual*, p. 130.) *Willow-herb.* There are several species of Epilobium, which have the common name of willow-herb from the resemblance of their leaves to the willow, and probably have nearly identical properties. They are all perennial and indigenous. The E. angustifolium is the largest of them, having a simple stem, from four to seven feet high. It is common in the Northern States, frequenting low, or newly-cleared grounds. It bears showy purple flowers, which appear in July and August. The leaves and roots are said to be demulcent, tonic, and astringent, and yield their virtues to water and alcohol. They are used by the "eclectics," generally and locally, in decoction, infusion, or cataplasm, in cases which call for the use of astringent remedies. W.

EQUISETUM HYEMALE. (*Gray's Manual*, p. 585.) *Horsetail. Scouring Rush.* An indigenous cryptogamous plant, with slender annual stems from a foot and a half to three feet high, growing abundantly in the Northern States, and preferring wet places, as the banks of streams, &c. The plant derives its name of scouring rush from its use in scouring, for which it is fitted by the siliceous character of the stems. It has the reputation of being diuretic, and is used sometimes in dropsical diseases and those of the urinary passages. The whole plant is employed, usually in the form of infusion. W.

ERECHTHITES HIERACIFOLIA. (*Gray's Manual*, p. 230.) *Fireweed.* An annual indigenous plant, growing in moist woods and recent clearings, and having a rank odour, though somewhat aromatic, which probably called attention to the plant in reference to its use in medicine. Its taste is bitterish, slightly acrid, and disagreeable. It yields these and what medical virtues it may possess to water. It has been especially recommended in dysentery. This plant is apt to infest the peppermint fields of Michigan; and its oil is said sometimes to deteriorate the oil of peppermint from that region. W.

ERODIUM CICUTARIUM. *Storksbill.* (*Gray's Manual*, p. 73.) An annual hairy plant, with spreading stems, pinnate leaves, and several-flowered peduncles, belonging to the family of *Balsaminaceæ*. and growing in the northern part of this country, especially on the banks of Oneida Lake, New York. It is highly recommended by Dr. W. Abbotts Smith in the treatment of dropsy. He uses it in the form of decoction, made by boiling two ounces of the dried bark with three pints of water down to two, then decanting and straining. (See *Am. Journ. of Med. Sci.*, Jan. 1865, p. 240.) W.

ERYNGIUM AQUATICUM. *Button Snakeroot.* The root of Eryngium aquaticum was formerly included in the Secondary Catalogue of the U. S. Pharmacopœia. The plant belongs to Pentandria Digynia of the Linnæan system, and to the natural order Apiaceæ or Umbelliferæ. The following is its generic character. "*Flowers* capitate. *Involucrum* many-leaved. Proper *calyx* five-parted, superior, persistent. *Corolla* of five petals. *Receptacle* foliaceous, segments acute or cuspidate. *Fruit* bipartite." (*Nuttall.*) The *button snakeroot* or *water eryngo* is an indigenous herbaceous plant, with a perennial tuberous root, and a stem two or three feet high, sometimes, according to Pursh, six feet, generally branching by forks, but trichotomous above. The leaves are very long, linear-lanceolate on the upper part of the stem, sword-shaped below, with bristly spines at distant intervals upon their margin. The floral leaves are lanceolate and dentate. The flowers are white or pale, and in globose heads, with the leaflets of the involucrum shorter than the head, and, like the scales of the receptacle, entire. This plant is found in low wet places, as far south as Virginia and N. Carolina. Its period of flowering is August. The root, which is the medicinal portion, has a bitter, pungent, aromatic taste, provoking, when chewed, a flow of saliva. It is diaphoretic, expectorant, in large doses occasionally emetic; and has been used by some physicians in decoction as a substitute for seneka. (*Bigelow.*) We are told in Barton's *Collections*, that it is nearly allied to the contrayerva of the shops. W.

ERYTHRONIUM AMERICANUM. (Muhl. *Catalogue*, 84; Bigelow, *Am. Med. Bot*, iii. 151.)—*E. lanceolatum.* (Pursh, p. 320.) The root and herb of this plant were

formerly included in the Secondary Catalogue of the U. S. Pharmacopœia. The plant belongs to Hexandria Monogynia of Linnæus, and to the natural order of Liliaceæ. The following is the generic character. "*Calyx* none. *Corolla* inferior, six-petaled; the three inner petals with a callous prominence on each edge near the base." (*Bigelow.*) This is an indigenous perennial bulbous plant, sometimes called, after the European species, *dog's tooth violet.* The bulb (cormus), which is brown externally, white and solid within, sends up a single naked slender flower-stem, and two smooth lanceolate, nearly equal leaves, sheathing at their base, with an obtuse callous point, and of a brownish-green colour diversified by numerous irregular spots. The flower is solitary, nodding, yellow, with oblong-lanceolate petals obtuse at the point, a club-shaped undivided style, and a three-lobed stigma. The Erythronium grows in woods and other shady places throughout the Northern and Middle States. It flowers in the latter part of April or early in May. All parts of it are active. In the dose of twenty or thirty grains, the recent bulb operates as an emetic. The leaves are said to be more powerful. The activity of the plant is diminished by drying. W.

ERYTHROXYLON COCA (Lamarck). *Coca.* This is a shrub growing wild in South America, and largely cultivated in Bolivia for the sake of its leaves, which are much used in that country as a masticatory. The plant, which is propagated from the seed in nurseries, begins to yield in eighteen months, and continues productive for half a century. The leaves, on being picked, are dried in the sun, and then packed in bags. They are known in South America by the name of *coca.* They were in general use among the natives of Peru at the time of the conquest, and have continued to be much employed to the present time. According to Von Bibra, 30,000,000 pounds are at present annually produced. (*Pharm. Journ. and Trans.*, July, 1870, p. 43; also *Med. Times and Gaz.*, vol. ii. 1871, p. 407.)

The leaves resemble in size and shape those of tea, being oval-oblong, pointed, two inches or more in length by somewhat over an inch in their greatest breadth, and furnished with short delicate footstalks; but they are not, like the tea-leaves, dentate, and are distinguished from most other leaves by a slightly curved line on each side of the midrib, running from the base to the apex. When well dried, they have an agreeable odour resembling that of tea, and a peculiar taste, which, in decoction, becomes bitter and astringent. Some attempts were made to analyze coca before the publication of the eleventh edition of this Dispensatory, of which the main result was, that the leaves contained a peculiar very bitter principle on which their virtues probably depended. M. Stanislas Martin afterwards made a hasty examination, from which it appeared that they contain a peculiar bitter principle, resin, tannin, an aromatic principle, extractive, chlorophyll, a substance analogous to thein, and salts of lime. (*Journ. de Pharm.*, Avril, 1859, p. 283.) Dr. Albert Niemann, of Goslar, has made a more thorough investigation of the leaves, and succeeded in isolating a peculiar alkaloid, to which he gives the name of *cocaina.* The following was his process. The leaves were exhausted with 85 per cent. alcohol acidulated with 2 per cent. of sulphuric acid; the tincture was treated with milk of lime and filtered; the filtrate was neutralized with sulphuric acid, and the alcohol distilled off. The syrupy residue was treated with water to separate resin, and then precipitated by carbonate of sodium. The deposited matter was exhausted by ether, and the ethereal solution, after most of the ether had been distilled, was allowed to evaporate spontaneously. The cocaina was thus obtained in colourless crystals, mixed with a yellowish-brown matter of a disagreeable odour, which was separated by washing with cold alcohol. Pure cocaina is in colourless transparent prisms, inodorous, of a bitterish taste, soluble in 704 parts of cold water, more soluble in alcohol, and freely so in ether. The solution has an alkaline reaction, and a bitterish taste, leaving a peculiar numbness on the tongue, followed by a sensation of cold. The alkaloid melts at 208° F., and on cooling congeals into a transparent mass, which gradually becomes crystalline. Heated above this point it changes colour, and is decomposed. It is inflammable, burning with a bright flame, and leaving charcoal. With the acids it forms soluble and crystallizable salts, which are more bitter than the alkaloid itself. It was found to consist of carbon, hydrogen, nitrogen, and oxygen; and the formula as given by Dr. Niemann is $C_{32}H_{20}NO_3$. He also obtained wax, a variety of tannic acid (*cocatannic acid*), and a concrete volatile odorous substance. (See *Am. Journ. of Pharm.*, March, 1861, p. 122.) Prof. Maisch, of Philadelphia, succeeded in obtaining from the leaves an uncrystallizable alkaloid, having so nearly the properties of cocaina that he considered it merely as the result of the action of heat on the crystallizable principle. (*Ibid.*, Nov. 1861, p. 500.) Still more recently M. Lossen has examined cocaina, and ascertained that, when heated with muriatic acid, it splits into benzoic acid and a new base which he calls *ecgonin.* The mutability of cocaina with acids, explains why the attempts to extract the alkaloid with acid liquids have failed. M. Lossen therefore recommends the omission of acid in operating on the leaves, and proposes the following modification of Niemann's plan. An infusion is first made; this is precipitated with acetate of lead; the lead is removed by sulphate of sodium; the liquid is concentrated, carbonate of sodium added, and the whole shaken with ether. The ether extracts the alkaloid, and yields it in a crude state by evaporation. It is then purified as in the process of Dr. Niemann. (*Journ. de Pharm.*, Juin, 1862, p. 522.)

According to Dr. Weddell, coca produces a gently excitant effect, with an indisposition to sleep; in these respects resembling tea and coffee. It is asserted to support the strength for a considerable time in the absence of food; but it does not supply the place of nutriment, and probably, in this respect also, acts like the two substances referred to. The Indians, while chewing it, pass whole days in travelling or working without food; but they nevertheless eat freely in the evenings. Weddell states that persons, unused to it, are liable to unpleasant effects from its abuse; and he has known instances of hallucinations apparently resulting from this cause. The natives chew with it some alkaline substance, as the ashes of certain plants, or lime. (Weddell, *Voyage dans le Nord de la Bolivia.*) In large quantities, it is said to produce a general excitation of the circulatory and nervous systems, imparting increased vigour to the muscles as well as to the intellect, with an indescribable feeling of satisfaction, amounting altogether sometimes to a species of delirium; and, what is most singular, if true, this state of exaltation is asserted not to be followed by any feelings of languor or depression. (Mantegazza, *N. Am. Med.-chir. Rev.*, March, 1860, p. 340.) A medium dose is from three to four drachms, taken in infusion. For the result of experiments on the physiological action of coca by M. Reis, see *Ann. de Thérap.* (1864, p. 118). From experiments by MM. Gorse and Mantegazza, it is inferred that it increases the frequency of the heart's contractions considerably more than tea or coffee; and, in doses of about an ounce, it causes intense fever, attended with hallucinations and delirium. (Dr. Reis, *Pharm. Journ.*, 2d ser., viii. 299; from *Bullet. Gén. de Thérap.*, Fev. 28, 1866.) M. Moreno, in experiments on animals with coca, found that, so far from supplying the place of food, it causes a more speedy death and a greater loss of weight than starvation alone. (*Ann. de Thérap.*, 1869, p. 64.) Coca has been employed, with supposed advantage, in connection with ergot, in obstinate cases of paraplegia, by Dr. Verardini, of Bologna. (*N. Y. Med. Journ.*, Nov. 1867, p. 160.) A European apothecary, at La Paz, Bolivia, uses the sulphate of cocaina as a substitute for sulphate of quinia in intermittents. (Fuentès, *Journ. de Pharm.*, 4e sér., iv. 268.) W.

ESENBECKIA FEBRIFUGA. The bark of this tree is stated to have been used to a considerable extent to adulterate Angustura bark. (See *Journ. de Pharm.*, Août, 1874, p. 105.) H. C. W.

ESSENCE OF BEEF. *Essence of Mutton.* Under the names of *essence of beef*, *essence of mutton*, &c., a preparation has been long in use, consisting of a saturated solution, at a boiling temperature, of the soluble principles of the meat employed in its own juice. Beef being the kind of meat generally preferred, the *essence of beef* is the preparation which has been most used, though the *essence of mutton* might be substituted in cases in which its flavour would be more acceptable. These preparations are made in the following manner. The flesh, having been deprived as far as possible of fatty matter, and cut into very small pieces, is introduced without water into a convenient long-necked bottle (a common quart porter bottle will answer the purpose very well) until this is filled; the bottle is then placed upright in a pot of boiling water, so that the top of the bottle shall be above the surface of the liquid, and is exposed to a boiling heat for an hour or more; the mouth of the bottle being closed with a cork so tightly as to prevent the escape of vapour, but not so as to endanger the breaking of the vessel. At the end of the process, the liquid is to be poured out of the bottle, and when sufficiently cool, is ready for use. It is somewhat nutritive, and at the same time stimulant, and may often be used with great advantage in the prostrate conditions of low fevers, when the stomach is quite free from inflammation. We have known serious mischief to arise from a neglect of this precaution. The dose is from a teaspoonful to a tablespoonful, which may be repeated every hour or two, in alternation with stimulant medicines. W.

EUCALYPTUS GLOBULUS. The genus Eucalyptus, belonging to the family of Myrtaceæ, affords one of the most characteristic features of the Australian and Tasmanian landscapes. There are about one hundred and thirty-five described species, all evergreens, popularly known as *Gum trees*, *Woolly butts*, *Iron barks*, &c. The most important of them is the E. globulus. This is one of the largest known trees, attaining sometimes a height of 300 or even 350 feet, with a smooth ash-coloured bark, leaves a foot in length, and varying, according to age, from a glaucous-white to a bluish-green colour, and large pinkish-white axillary flowers, sometimes single, sometimes in clusters. Although its wood is very resinous, hard, and durable, the tree is remarkable for the rapidity of its growth, reaching, under favorable circumstances, fifty feet of height in five or six years. It flourishes best in valleys having a rich moist soil, and has very largely been naturalized in semi-tropical countries, partly on account of its economic value, but chiefly because of the reputation it enjoys as a means of overcoming malaria. Large forests of it have been planted in Algeria and Southern Europe, and its culture is spreading to California, Florida, and other of our Southern States. Its sanitary powers appear to be established, numerous famous miasmatic stations and districts having been rendered healthful by its growth. It is not probable that the destruction of the miasma is due so much to emanations from the tree as to the fact that it evaporates water so rapidly from its innumerable large leaves as to drain the swamps and marshes in which it is planted. It is possible, how-

ever, that the large amount of volatile oil which must escape from it has some effect, and it is even affirmed (*Am. Journ. of Pharm.*, 1875, p. 423) that the parasitic phylloxera will not attack the grape-vines growing near it.

In March, 1870, M. Cloez (*Journ. de Pharm.*, 4e sér., xii. 201) reported an elaborate chemical study of the Eucalyptus leaves, and his results have been substantially confirmed by Debray (De l'Eucalyptus Globulus, Paris, 1872), M. Rabuteau (Mém. de l'Académie, Nov. 1872), and by Mr. Broughton (*Pharm. Journ.*, 3d ser., iii. 463). M. Cloez found besides chlorophyll, resin, tannin, and inert substances, an essential oil, upon which the virtues of the drug appear to depend. Of this oil, the fresh leaves afforded 2·75 parts per hundred, the recently dried leaves 6 parts; leaves which had been kept some time yielded a much smaller percentage. In the distillation, the oil for a time comes over freely at from 170° to 178° C.; subsequently another portion of oil distils at 188° to 190° C., and finally a very minute portion does not volatilize until the temperature reaches 200° C. M. Cloez believes the oil to be composed of two camphors, differing in their volatility. The bulk of the oil yielded is the portion first distilled; to this Cloez has given the name of *Eucalyptol*. To obtain it pure a redistillation from caustic potash or chloride of calcium is necessary. It is very liquid, nearly colourless, with a strong, aromatic camphoraceous odour, polarizes to the right, is slightly soluble in water, but very soluble in alcohol, and has the formula $C_{24}H_{20}O_2$. Nitric acid produces with it a crystallizable acid; by the action of phosphoric acid (*Journ. de Pharm.*, 4e sér., xii. 204) it is converted into *eucalyptene*, a substance allied to cymene.

According to M. Duquesnel, the oil is adulterated with alcohol, to be detected by means of fuchsin, which is insoluble in the pure oil but soluble in that containing even a very small percentage of alcohol; with fixed oil, to be detected by boiling with water, when the fixed oil remains on the surface; with essential oil of copaiba or turpentine, to be detected by means of the boiling point, that of eucalyptol being 170° C., that of oil of turpentine 155° C., that of oil of copaiba 260° C. (*Journ. de Pharm.*, 4e sér., xvi. 45.)

Eucalyptus was originally recommended as a remedy in intermittent fever, but experience has failed to establish its value as an antiperiodic. Whatever medical virtues it possesses beyond astringency reside in the volatile oil. This when applied locally acts as a powerful irritant. When taken internally in small doses (10 to 20 drops), according to M. Gimbert (*Arch. Gén.*, 4e sér., xxi. 140), it causes increased rapidity of pulse and general excitation, with restlessness and increased venereal appetite, usually followed by a feeling of calmness and repose, ending in sleep. In some cases fever, constitutional disturbance, and even symptoms of cerebral congestion are produced. In animals small doses produce the same effect as in man, and after large doses symptoms of general depression are manifested by falling of the arterial pressure, progressive diminution of temperature, muscular weakness deepening into paralysis, loss of sensibility, irregular respiration, and finally death from failure of respiration. Upon man, when taken in sufficient quantity, the oil exerts a similar influence. In a case noted by M. Gimbert, 80 drops of the oil produced in an old man a feeling of great internal heat, followed by almost complete loss of power and of feeling in the limbs. Prof. Binz has found (*Boston Med. and Surg. Journ.*, xc. 284) that the oil diminishes the irritability of the spinal cord, but is wanting in any action upon the white blood corpuscles. Oil of eucalyptus possesses some power of checking both putrefaction and fermentation, but the assertion of M. Gimbert that it ranks with carbolic acid is probably founded on an over-estimation of its capabilities. Taken internally it is eliminated by the breath, to which it imparts its odour, and also in a condition of oxidation by the kidneys, to the secretion of which it gives a strong smell of violets. M. Gimbert found that in rabbits it augmented to a marvellous extent the excretion of urea. As a stimulating narcotic the oil of eucalyptus has been used with asserted success in migraine and other forms of neuralgia. As an antispasmodic it has been highly lauded in asthma. In this affection it is best given by inhalation. Cigarettes may be made by rolling up the dried leaves, or the vapour from boiling water containing the oil may be inhaled. In chronic or subacute bronchitis it may often be employed with advantage, especially where there is a tendency to spasm. In subacute or chronic inflammation of the genito-urinary organs it is said to exert a very happy influence. Externally it may be used in chronic skin affections and ulcerations when a stimulant application is indicated. Various formulas have been published for tinctures, fluid extracts, &c., of the leaves, but the oil is much the best form for internal administration. It should be given in doses of 10 to 15 drops on sugar or in a sweetened emulsion. H. C. W.

EUCALYPTUS MANNA. This substance exudes during the summer months from punctures made in the bark and leaves of the Australian trees *Eucalyptus mannifera* and *E. viminalis*. It occurs in small rounded opaque masses, and is said to resemble ordinary manna in its medical properties. H. C. W.

EUPHORBIUM. This was contained in the Materia Medica Catalogue of the late Edinburgh Pharmacopœia; but, having been omitted in the British, is no longer officinal. It is the concrete resinous juice of one or more species of Euphorbia; but its precise source is uncertain. It has been ascribed to *E. officinarum*, growing in the

North of Africa and at the Cape of Good Hope, *E. Canariensis*, a native of the Canary Islands and Western Africa, and *E. antiquorum*, inhabiting Egypt, Arabia, and the East Indies, and supposed to be the plant from which the ancients derived this resinous product. These species of Euphorbia bear some resemblance in form to the *Cactus*, having leafless, jointed, angular stems, divided into branches of a similar structure, and furnished with double prickles at the angles. When wounded they yield an acrid milky juice, which concretes on the surface, and, being removed, constitutes the euphorbium of commerce.

This occurs in the shape of tears, or in oblong or roundish masses, about the size of a pea or larger, often forked, and perforated with one or two small conical holes, produced by the prickles of the plant, around which the juice has concreted, and which sometimes remain in the holes. The masses are occasionally large and mixed with impurities. The surface is dull and smooth, bearing some resemblance to that of tragacanth; the consistence somewhat friable; the colour light yellowish or reddish; the odour scarcely perceptible; the taste at first slight, but afterwards excessively acrid and burning. The colour of the powder is yellowish. The sp. gr. of euphorbium is 1·124. Triturated with water, it renders the liquid milky, and is partially dissolved. Alcohol dissolves a larger portion, forming a yellowish tincture, which becomes milky on the addition of water. Its constituents, according to Pelletier, are resin, wax, malate of calcium, malate of potassium, lignin, bassorin, volatile oil, and water. Brandes found caoutchouc. It contains no soluble gum. The proportions of the ingredients are variously stated by different chemists, and probably vary in different specimens. The most abundant is resin, and the remainder consists chiefly of wax and malate of calcium. The resin is excessively acrid, is soluble in alcohol, and when exposed to heat, melts, takes fire, and burns with a brilliant flame, diffusing an agreeable odour. Dr. Flückiger has found a substance analogous to lactucon which he names *euphorbon*. It is neuter, fusible above 223 F., readily dissolved by boiling alcohol, and soluble in ether, benzine, amylic alcohol, chloroform, acetone, and glacial acetic acid. From its solution in ether and benzine, it separates, on spontaneous evaporation, in feathery needles. Its solution in sulphuric acid, spread on a plate, is coloured violet by nitric acid. Its composition is $C_{26}H_{22}O_2$. While the acrid resin constitutes 38 per cent. of euphorbium, euphorbon constitutes 22 per cent. (*Am. Journ. of Pharm.*, Sept. 1868, p. 393; from *Schweizerische Wochenschrift.*)

Medical Properties and Uses. Euphorbium taken internally is emetic and cathartic, often acting with great violence, and in large doses producing severe gastric pain, excessive heat in the throat, and symptoms of great prostration. In consequence of the severity of its action, its internal use has been entirely abandoned. Applied to the mucous membrane of the nostrils, it excites violent irritation, attended with incessant sneezing and sometimes bloody discharges. They who powder it are under the necessity of guarding their eyes, nostrils, and mouth against the fine dust which rises. Largely diluted with wheat flour or starch, it may be used as an errhine in amaurosis, deafness, and other obstinate affections of the head. Externally applied it inflames the skin, often producing vesication; and on the continent of Europe is sometimes used as an ingredient of epispastic preparations. It is employed in veterinary practice, with a view to its vesicating power. W.

EUPHRASIA OFFICINALIS. *Eyebright.* A small annual plant, common to Europe and the United States, without odour, and of a bitterish, astringent taste. It was formerly used in various complaints, and among the rest in disorders of the eyes, in which it was thought to be very efficacious, and in the treatment of which it is still popular in some countries. The probability is that it is nearly inert. W.

EXTRACTUM CARNIS. Liebig. *Extract of Flesh. Extract of Meat.* The nature of this preparation is truly expressed by its name. Its object is to obtain the nutritive matters of the flesh of animals in a concentrated state, in which they may be long kept without change. Two great advantages are thus gained, cheapness of carriage, and the facility of transfer from places, however remote, where meat is plentiful, to others where it is most needed. Thus, the cattle so abundant on the plains of South America, Australia, and Russia, may be made to contribute to the support of the people of Europe and North America; and this object has already been in some degree accomplished; as factories are in operation in these regions by which, in the condition of *extract of flesh*, beef is largely prepared for distribution over the world; and South American extract of beef is well known in the markets of London, and other European capitals. Though to Liebig belongs the credit of setting this movement on foot, and his process is probably most extensively used, others have employed processes of their own, and some are perhaps equal if not superior to his. To a paper by M. Poggiale, in the *Journal de Pharmacie* (Mars, 1868, p. 172), we must express our indebtedness for many of the facts contained in the present article.

Liebig's extract of beef, besides what is made by various independent operators, who, employing his process, take advantage of the popularity of his name in spreading their products abroad, is now largely prepared by a company which, under his supervision, has established itself in South America. According to M. Poggiale, the process there in use consists in preparing a broth with equal parts of the meat cut fine and of cold water, straining this through a linen cloth, evaporating it in a boiler over a naked fire till reduced to one-sixth of its volume, and then at a lower temperature, by means of a vacuum

apparatus, bringing it to the consistence of an extract. The extract thus made is introduced into varnished stoneware jars, which are carefully closed to exclude the air. It is said that 100 parts of meat yield 2·5 of extract. The preparation keeps well, contains neither fat nor gelatin, and is rich in the nitrogenous principles. It is of a reddish-brown colour, a slightly acrid taste, and an odour that is not agreeable; so that when dissolved in hot water to make soup, it is necessary, in order to make a savory dish, to add leguminous fruits to the extract. To avoid this flavour it would be necessary to effect the evaporation out of contact with the air, and if possible altogether in a vacuum.

The following more particular account of the S. American establishment is given by Mr Hutchinson, in his "*Parana and South American Recollections*," recently published. The works are situated at Fray Bentos, and would appear, from a statement in the *Buenos Ayres Standard* (Sept. 3, 1868), to be of very great extent, covering 20,000 square feet, and "working off" 400 oxen daily. There are four processes in the manufacture; 1. chopping the flesh into mincemeat; 2. the digestive process, in which the chopped meat is exposed to steam in vast iron digesters, each holding 12,000 lbs.; 3. the separation, by straining through wire gauze and clarification, of the fat, albumen, and fibrin; and 4. evaporation, which is wonderfully accelerated by the rotatory motion of thin, circular, steel plates, by means of which more than two millions of square feet of a thin layer of the liquid are exposed to the air in one minute. Liebig directs that, in the preparation of beef-tea, 1 part of the extract should be employed to 100 of water; but the nutritive matter in the extract is said to vary greatly; and Dr. Letheby, in specimens examined by him, found 45 per cent. of water; so that the proportion fixed by Liebig must be greatly increased in reference to inferior specimens. The varying quality of the extract is ascribed, in part at least, to the character of the meat; that from grown animals differing from that of young, and of the male from the female; while, altogether, the mode of living of the roving cattle of the plains, would be likely to lead to inferior results. (*Med. Times and Gaz.*, Jan. 1869, p. 92.) In a letter from Baron Liebig to the *Pharm. Journ.* for Nov. 1866, it is stated that the meat of oxen always yields an extract darker and more strongly flavored, resembling somewhat the flavour of fresh venison, pleasant when diluted; that of cow's meat lighter-coloured, and of a mild flavour; while that of young animals, under four years, is unfit for the preparation of extract, which from such a source is pappy, of a feeble taste like veal, and without flavour. (*Am. Journ. of Pharm.*, March, 1867, p. 145.)

In preparing his extract, M. Bellat exhausts the meat, deprived of fatty matter and tendinous and membranous tissues, and very finely divided, with cold water by the process of percolation, and setting aside the infusion thus obtained, puts the residuary matter into vats heated by vapour and hermetically closed by strong covers; adds an equal weight of water, and a small quantity of bones; digests for six hours at about 200° F., agitating occasionally; then submits the material to the action of an hydraulic press, adds a suitable proportion of water and legumes, and boils the whole. The liquids prepared with heat and without it are now mixed, heated in boilers so as to coagulate any blood present, and, having been rapidly filtered, are evaporated in a vacuum apparatus to the consistence of very thick honey. Thus made, the extract is finally introduced into tin cans, and closed after the manner of Appert. This extract is of a yellowish-brown colour, rather soft, very soluble in water, and possessed of the smell and taste of fresh soup. By adding 25 *grammes* of it to a *litre* of boiling water, with sufficient salt, M. Poggiale obtained a soup having all the characters of that recently made from fresh meat. (*Journ. de Pharm.*, Mars, 1868, p. 172.)

M. Martin de Lignac prepares the extract by boiling 100 kilogrammes of beef (flesh and bones), 20 of fresh pulse, 5 of knuckles of veal, and 100 grammes of common salt, all well divided, in one and a half times their weight of water, and, when the soup is prepared, allowing it to rest, decanting, filtering, and lastly evaporating, by means of a water-bath, at about 160° F., down to 10° of Baumé. The extract is then put into metallic boxes, and preserved by the method of Appert. It is in the form of a translucent jelly, of sufficient firmness, which it owes to the gelatin of the bones. It has a very agreeable smell and taste, and, dissolved in boiling water, yields an excellent soup. This is said to be much used in Paris. (*Journ. de Pharm.*, Mars, 1868, p. 173.)

M. F. J. Tourtelot gives the following formula of an extract prepared by him, which has been for seven years employed in the U. S. Army, and in private practice in this country. His process is based on the propriety of preserving the albumen in the extract, which is undoubtedly beneficial so far as its nutrient qualities are concerned. The fresh beef, deprived of bone, fat, and sinew, and finely chopped, is macerated with cold water for about two hours; steam is then introduced into the vats until the temperature rises to 120° F., care being taken to stir the meat frequently; and the resulting liquid, which contains the albumen, is drawn off, strained, and set aside. The residue is boiled with water for some hours, the liquor separated by gentle pressure, and immediately transferred to the vacuum pan, where it is reduced to one-fourth, when the liquid first obtained is added; after which the evaporation is continued until one pound of the extract represents 20 lbs. of meat. It is then poured into china jars, and covered with waxed paper, coated with tincture of Tolu. (See *Am. J. of Pharm.*, March, 1869, p. 158.) This preparation appears to be based on correct principles.

The extract of meat is much used as an article of diet in making soups. It by no means represents the nutritive qualities of the meat itself; as the two most nutritious ingredients of flesh, albumen and fibrin, are almost wholly wanting; and efforts are made as far as possible to get rid of fat, and in most instances of gelatin also, though, in relation to the latter principle, with, in our opinion, questionable propriety. In low fevers, it is recommended by some as possessing, in addition to its slightly nutritious qualities, the somewhat stimulant properties characteristic of the meat essences. For an account of the chemical constitution of extract of flesh, by Messrs. H. Deane and H. B. Brady, for which we have no space here, the reader is referred to the *Pharmaceutical Journal* (Oct. 1866, p. 199). W.

FERRIDCYANIDE OF POTASSIUM. *Red Prussiate of Potassium.* This is formed by passing a current of chlorine through a solution of ferrocyanide of potassium, until the liquid ceases to form a precipitate with a solution of sesquichloride of iron, a proof that the whole of the ferrocyanide has been converted into the ferridcyanide. The solution, by due evaporation, yields the compound in question. It may also be prepared, in the dry way, by agitating chlorine with the finely powdered ferrocyanide, as long as it is absorbed. The theory of the formation of this compound is that one eq. of chlorine withdraws from two eqs. of the ferrocyanide, one eq. of potassium, forming chloride of potassium which remains in the mother-water. The reaction is explained by the following equation: $2(K_2Cfy)$ and $Cl = K_3Cfy_2$ and KCl. The radical ferridcyanogen is supposed to be formed by the coalescence of two eqs. of ferrocyanogen, and is represented by the symbol Cfdy. Accordingly, the formula of ferridcyanide of potassium is K_3Cfdy. This salt, discovered by Gmelin, is in beautiful deep hyacinth-red anhydrous crystals, which are soluble in four parts of water. Its solution forms a delicate test of the salts of protoxide of iron, with which it produces a blue precipitate; but with the salts of the sesquixoxide, it only strikes a green or brown colour. Ferridcyanide of potassium is directed by the U. S. Pharmacopœia, in conjunction with sulphate of protoxide of iron, as a test of the chlorine strength of chlorinated lime. It is used in dyeing and calico-printing. B.

FERROCYANIDE OF ZINC. *Zinci Ferrocyanidum. Ferrocyanuret of Zinc.* Formed by double decomposition between hot solutions of ferrocyanide of potassium (ferroprussiate of potassa) and sulphate of zinc. It is thrown down as a white powder. It has similar medical properties to those of the cyanide, and is used in the same diseases. The dose is from one to four grains, given in pill. (See *Cyanide of Zinc.*) B.

FLAVOURING EXTRACTS. Under this name, preparations from various aromatics are considerably used for culinary purposes. They are in the liquid form, and are generally alcoholic solutions of the sapid and odorous principles of substances having an agreeable flavour, such as lemon and orange peel, bitter almonds, roses, cinnamon, mace, ginger, and celery. Formulas for their preparation, given by Prof. Procter, may be found in the *Am. Journ. of Pharm.* for May, 1856, p. 215. Others have been added to the list, in a recent communication by Prof. Procter to the same journal (July, 1866, p. 294). The new formulas are for extracts of nutmeg, of soup herbs (thyme, sweet marjoram, sweet basil, summer savory, and celery seed), coriander, and vanilla. W.

FLUORESCENCE. It has been proposed to use this property of various drugs as a means of detecting adulterations. For want of space, the reader is referred to articles in the *Pharm. Journ. and Trans.*, June, 1875, p. 966 (reprinted, *Am. Journ. of Pharm.*, 1875, p. 305), and the *Philad. Med. Times*, Jan. 1875, p. 258. H. C. W.

FORMIATE OF AMMONIUM. From the fact that formiate of ammonium is a chemical homologue of acetate of ammonium, the acid of the former being a derivative of methyl, as acetic acid is of ethyl, it has been suggested that they might resemble each other in their medicinal relations; but, though formic acid is irritant to the skin like the acetic, it has not proved, upon trial, that the two salts have any strong resemblance. The formiate of ammonium has been employed by Dr. Ramskill, at the Hospital for the Epileptic and Paralytic, in London, who considers it useful in chronic paralytic disease with general torpor; especially in cases of reflex paralysis, and, in a less degree, in the paralytic condition arising from long disuse of the muscles. It is said to be equally applicable to palsy of sensation and motion. It is contraindicated by any remaining active irritation or inflammation of the nervous centres or about them, which may have been the original seat of the lesion. The inference is that formiate of ammonium is a stimulant with a special tendency to the nervous centres, and probably analogous to the carbonate. The dose is five grains; and a larger quantity than this is apt to vomit. Patients experience a glow in the region of the stomach when they swallow it. *Formic acid*, diluted with an equal measure of water, is said to be an excellent application to paralyzed limbs, exciting the circulation, and producing erythematous redness, with a prickling sensation as if stung with nettles. (*N. Y. Med. Journ.*, April, 1865, p. 80; from *Med. Times and Gaz.*) For methods of preparing the acid, see *Journ. de Pharm.*, Fev. 1875, p. 85; also Sept. 1875, pp. 196, 1221. W.

FORMIC ETHER. A paper on the physiological action of this substance may be found in the *Journ. de Pharm.*, Juin, 1872, p. 453. H. C. W.

FRAXINUS EXCELSIOR. *Common European Ash.* It has been stated, in the first part of this work, that, in the South of Europe, this tree yields manna by incisions in its trunk. In this place, however, it is noticed only in reference to its bark and leaves. The bark is bitter and astringent, and, before the introduction of cinchona into use, was employed in the treatment of intermittent fever; but has since fallen into neglect. Keller believed that he had found in the bark a peculiar crystallizable organic alkali, which Buchner denominated *fraxinin;* but Rochleder and Schwartz have since shown that the crystals, formed along with the bitter substance obtained by the process of Keller, were nothing but mannite. (*Pharm. Cent. Blatt*, May, 1853, p. 312.) Since that period, however, a crystallizable bitter principle has been discovered by Prince Salm-Horstman, which has been named *fraxinin.* It is obtained by precipitating the decoction with acetate of lead, washing the precipitate, decomposing it by sulphuretted hydrogen, and concentrating the solution, which deposits the fraxinin in needle-shaped crystals. These are four-sided prisms, shining, white with a tinge of yellow, feebly bitter and astringent, inodorous, soluble with difficulty in cold but readily in hot water. The concentrated warm solution has an acid reaction. When much diluted, it exhibits a clear blue fluorescence by daylight, especially if a trace of ammonia be present. Alkalies, alkaline earths, and the carbonates colour it yellow; and chloride of iron first colours it green, and then throws down a yellow precipitate. (*Chem. Cent. Blatt*, July 8, 1857, p. 452.) The *leaves* have been at different times recommended as an antidote to the poison of serpents, and as a remedy in scrofula. Within a few years they have been introduced into use in Germany in the treatment of gout and rheumatism, in which they have acquired considerable reputation. Drs. Pouget and Peyraud, of France, have spoken in the highest terms of their efficacy in these diseases; and, upon the authority of the former, it is stated that they have been used for forty years by the peasants of Auvergne as a specific in gout. M. Garot has shown that they contain 16 per cent. of *malate of calcium*, to which it is thought their anti-arthritic virtues may be ascribed. (*Journ. de Pharm.*, 3e sér., xxiv. 311.) Prof. Gintl (*Ibid.*, 4e sér., xii. 60) has also found the malate of calcium. The leaves have been said to be purgative; but this is contradicted by Drs. Pouget and Peyraud. An ounce may be infused in half a pint of boiling water, and taken three times a day. (See *Am. Journ. of Med. Sci.*, N. S., xxv. 492.) W.

FRENCH CHALK. A variety of indurated talc. It is compact, unctuous to the touch, of a greenish colour, glossy, somewhat translucent, soft and easily scratched, and leaves a silvery line when drawn over paper. It is used chiefly for marking cloth, &c., and for extracting grease spots. W.

FRUIT ESSENCES, ARTIFICIAL. Several of the compound ethers have been found to possess the odour and flavour of certain fruits, a property which has led to their employment as flavouring materials for confectionery and desserts, under the name of fruit essences. The simple ethers, present in these compounds, so far as they have become of commercial importance, are common ether or oxide of ethyl, which should be called ethylic ether, and oxide of amyl or amylic ether. Each of these ethers possesses basic properties, and has its alcohol; common or ethylic ether corresponding to common or ethylic alcohol, and amylic ether to amylic alcohol or fusel oil. These alcohols are hydrated oxides of ethyl and amyl respectively. (See *Alcohol Amylicum*, and *Alcohol*, Part I.) Coloured artificial essences are to be distinguished from the real by the following tests, founded upon the presence of anilin. Fuchsin dyes a woollen or silken thread permanently rose colour, the tint imparted by natural fruit juice washes out (C. Puscher, *Journ. de Pharm.*, 4e sér., xlv. 395); dilute mineral acids redden natural fruit essences, turn yellow those containing an anilin dye; half a volume of nitric acid *instantly* turns an artificial syrup yellow; carbonate of potassium reddens artificial syrups, has no effect on natural syrups; subacetate of lead precipitates red with fuchsin, green with natural fruit. (M. Vandeyvere, *Journ. de Pharm.*, 4e sér., x. 457; Dr. Hager, *Am. Journ. of Pharm.*, xlv. 395.)

Butyrate of Ethylic Ether. Butyric Ether. ($C_4H_5O,C_8H_7O_3$.) This ether is readily prepared by mixing 100 parts of butyric acid with 100 of alcohol, and 50 of concentrated sulphuric acid, and agitating the mixture for a short time. The ether forms a layer on the surface, and may be purified by washing it with water, and subjecting it to the action of chloride of calcium. Butyric ether is sparingly soluble in water, but very soluble in alcohol, and boils at 230°. It is said to be much used to communicate a pine-apple flavour to rum. Dissolved in 8 or 10 parts of alcohol it forms the *pine-apple essence.* From 20 to 25 drops of this essence, added to a pound of sugar containing a little citric acid, imparts to the mixture a strong taste of pine-apple. *Butyric acid* is formed during what is called the butyric fermentation, which usually consumes two or three months before it is completed, and which is preceded by the lactic fermentation. To prepare it a solution of grape sugar is mixed with half its weight of chalk, and with about one-tenth of its weight of cheese to act as a ferment, and the whole is kept at the temperature of 90°. The sugar is first transformed into a viscous substance, and afterwards into lactic acid, which is gradually converted into butyric acid, with the disen-

gagement of hydrogen and carbonic acid. At the end of the fermentation, the liquid contains principally a mixture of butyrate and lactate of calcium, from which the butyric acid may be obtained by precipitating the lime as a carbonate by carbonate of sodium, and decomposing the resulting butyrate of sodium with sulphuric acid. Butyric acid is a colourless liquid, having a very disagreeable odour and a rancid taste. It dissolves in all proportions in water and alcohol, boils at 327°, and has the density 0·963. It is a hydrated acid, having the formula $C_8H_7O_3,HO$.

Pelargonate of Ethylic Ether. Pelargonic Ether. Œnanthic Ether. ($C_4H_5O,C_{18}H_{17}O_3$.) A preliminary step in forming this ether is to prepare the *pelargonic acid*. This is most conveniently obtained, according to Dr. R. Wagner, by the action of nitric acid on oil of rue. Treat the oil with double its weight of very dilute nitric acid, and heat the mixture until it begins to boil. Two layers are formed in the liquid; the upper one being brownish, and the lower consisting of the products of the oxidation of the oil, with the excess of nitric acid. The lower layer, having been separated, is freed from the greater part of the nitric acid by evaporation in a chloride of zinc bath, and then filtered. The filtrate is a solution of pelargonic acid, and may be converted into pelargonic ether by a prolonged digestion, at a gentle heat, with alcohol. The ether as thus prepared has the agreeable odour of quince, and, when dissolved in alcohol in due proportion, forms the *quince essence*. (See *Am. Journ. of Pharm.*, July, 1853, p. 320.) *Pure* pelargonic ether (œnanthic ether) is a colourless liquid, having a peculiar, vinous, stupefying odour, and a taste at first slight but afterwards acrid. Its sp. gr. is 0·872, and boiling point, when constant, 433°. (*Delffs.*) It is insoluble in water, but dissolves readily in alcohol and ether. Pelargonic acid, first obtained from *Pelargonium roseum*, or rose geranium, is a hydrated acid, and has the formula $C_{18}H_{17}O_3,HO$. Delffs's analysis of œnanthic acid gives it the same composition; and, accordingly, he considers the two acids as undoubtedly identical. (*Chem. Gaz.*, April 15, 1852, p. 144.) Gregory adheres to the old formula for œnanthic acid, $C_{14}H_{13}O_3,HO$.

Acetate of Amylic Ether. ($C_{10}H_{11}O,C_4H_3O_3$.) This is prepared by distilling a mixture of one part of amylic alcohol (fusel oil), two of acetate of potassium, and one of concentrated sulphuric acid. The distilled liquid is purified from free acid by washing with a weak alkaline solution, and from water by distillation from chloride of calcium. It is a colourless, limpid liquid, lighter than water, boiling at 272°, insoluble in water, but soluble in alcohol. It possesses the odour, in a remarkable degree, of the Jargonelle pear, and is manufactured on a large scale for flavouring syrups and confectionery. An alcoholic solution of this ether forms the *Jargonelle pear essence*. Fifteen parts of acetate of amylic ether, with half a part of acetic ether, dissolved in 100 parts of alcohol, form what may be called the *bergamot pear essence*, which, when employed to flavour sugar acidulated with a little citric acid, imparts the odour of the bergamot pear, and a fruity, refreshing taste. Acetate of amylic ether, mixed with butyric ether, forms another fruity compound, which recalls the odour of the banana, and forms, in alcoholic solution, the *banana essence*.

Valerianate of Amylic Ether. ($C_{10}H_{11}O,C_{10}H_9O_3$.) This is made by carefully mixing four parts of pure amylic alcohol (fusel oil) with four of sulphuric acid, and adding the mixture, when cold, to five parts of valerianic acid. The whole is warmed for a few minutes in a water-bath, and then mixed with a little water, which causes the ether to separate. Lastly, it is purified by washing it with water and a weak solution of carbonate of sodium. An alcoholic solution of this ether, in the proportion of one part to six or eight of alcohol, forms a flavouring liquid under the name of *apple essence*. For the mode of obtaining valerianic acid, see *Acidum Valerianicum*, Part I., page 75.

It is thus perceived that the bases of the fruit essences are certain ethereal compounds of organic acids with the oxides of ethyl and amyl. Besides the essences here described, there are found in commerce the strawberry, raspberry, apricot, greengage, mulberry, and black currant essences, all of which may be viewed as various mixtures of the ethers of the ethyl and amyl series, modified by the addition of pure nitrous ether, tincture of orris, vanilla, volatile oils, &c., to bring about a resemblance to the fruit, the odour and taste of which it is the object to imitate. In making these essences it is important that the materials should be pure, especially the fusel oil and alcohol. The alcohol, used as a solvent, should be rectified and deodorized.

The fruit essences are extensively employed for flavouring ices, jellies, lozenges, and drops, and for making fruit syrups and effervescent beverages. They are manufactured on a large scale by Messrs. Mander, Weaver & Co., of Wolverhampton, England; and the more useful ones are prepared by Messrs. Powers & Weightman, of Philadelphia. B.

M. Kletzinski has prepared a table giving the ingredients, and their proportions, of a large number of fruit essences, which we append. He states that they are alcoholic solutions of different ethers, to which are sometimes added certain acid and natural essences. Glycerin is present in nearly all, being useful in blending and harmonizing the different odours. The alcohol and other ingredients must be chemically pure. Each column represents the number of measures to be added to 100 measures of alcohol.

Names of the Essences.	Chloroform.	Nitric Ether.	Aldehyde.	Acetate of Ethyl.	Formiate of Ethyl.	Butyrate of Ethyl.	Valerianate of Ethyl.	Benzoate of Ethyl.	Œnanthylate of Ethyl.	Essence of Persicot.	Sebacic Ether.	Salicylate of Methyl.	Amylic Alcohol.	Acetate of Amyl.	Butyrate of Amyl.	Valerianate of Amyl.	Essence of Lemon.	Essence of Orange.	Alcoholic Solutions saturated in the cold of: Tartaric Acid.	Oxalic Acid.	Succinic Acid.	Benzoic Acid.	Glycerin.
Pine-apple	1	...	1	...	...	5	...	...	...	...	...	...	...	...	10	...	...	...	...	...	...	...	3
Melon	...	...	2	...	1	4	5	...	...	...	10	...	...	...	...	...	...	...	...	...	...	...	3
Strawberry	...	1	...	5	1	5	...	...	...	...	...	1	...	3	2	...	...	...	...	...	...	...	2
Raspberry	...	1	1	5	1	1	...	1	1	...	1	1	...	1	1	...	...	...	5	...	1	...	4
Gooseberry	...	...	1	5	...	...	...	1	1	...	...	...	...	...	...	...	...	...	5	...	1	1	...
Grape	2	...	2	...	2	...	...	...	10	...	...	1	...	...	...	...	...	...	5	...	3	...	10
Apple	1	1	2	1	...	...	...	...	...	...	...	...	...	...	...	10	...	...	...	1	...	...	4
Orange	2	...	2	5	1	1	...	1	...	...	...	1	...	10	...	...	...	10	1	...	...	...	10
Pear	...	...	...	5	...	...	...	...	...	...	...	...	...	10	...	...	...	...	...	...	...	...	10
Lemon	1	1	2	10	...	...	...	...	...	...	...	...	...	...	...	10	...	...	10	...	1	...	5
Black Cherry	...	...	...	10	...	...	...	5	2	...	...	...	...	...	...	...	...	...	...	1	...	2	...
Cherry	...	...	...	5	...	...	...	5	1	...	...	...	...	...	...	...	...	...	...	...	...	1	3
Plum	...	...	5	5	1	2	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	8
Apricot	1	...	...	...	...	10	5	...	1	...	...	2	...	...	1	...	...	...	...	1	...	...	4
Peach	...	...	2	5	5	5	5	...	5	...	1	2	...	...	...	...	...	...	...	...	...	...	5

W.

FUCUS VESICULOSUS. *Sea-wrack. Bladder-wrack.* This was omitted as an officinal in the Dublin Pharmacopœia of 1850. It belongs to *Cryptogamia Algæ* in the sexual system, and to the natural order Algaceæ. The following is the generic character. "MALE. *Vesicles* smooth, hollow, with villose hairs within, interwoven. FEMALE. *Vesicles* smooth, filled with jelly, sprinkled with immersed grains, prominent at tip. Seeds solitary." This sea-weed is perennial, with the frond or leaf flat, smooth and glossy, from one to four feet long, from half an inch to an inch and a half broad, furnished with a midrib throughout its length, dichotomous, entire upon the margin, and of a dark olive-green colour. Small spherical vesicles, filled with air, are immersed in the frond near the midrib. The air in these vesicles has not the exact composition of atmospheric; consisting, according to the analysis of M. Ernest Baudrimont, in one instance of 28·4 per cent. of oxygen and 71·6 of nitrogen, in another 26·5 of the former and 73·5 of the latter. (*Journ. de Pharm.*, 4e sér., ii. 446.) The fruit consists of roundish, compressed receptacles, at the ends of the branches, filled with a clear tasteless mucus. The plant grows upon the shores of Europe and of this continent, attaching itself to the rocks by its expanded woody root. On the coasts of Scotland and France, it is much used in the preparation of kelp. It is also employed as a manure, and is mixed with the fodder of cattle. It has a peculiar odour, and a nauseous saline taste. Several chemists have undertaken its analysis, but the results are not satisfactory. It contains much soda in saline combination, and iodine, according to Gaultier de Claubry, in the state of iodide of potassium. These ingredients remain in its ashes, and in the charcoal resulting from its exposure to heat in close vessels. M. Eugene Marchand has ascertained that, though the ashes of the Fucus vesiculosus contain iodine, yet this species is one of those poorest in this constituent; and those of *Fucus digitatus* contain seven or eight times more. Consequently, if it be for the iodine that these plants are chiefly valuable, the latter is greatly preferable to the former. (*Journ. de Pharm.*, 4e sér., ii. 276.)

The charcoal, which is sometimes called *Æthiops vegetabilis* or *vegetable ethiops*, has long had the reputation of a deobstruent, and been given in goitre and scrofulous swellings. Its virtues were formerly ascribed chiefly to carbonate of sodium, in which it abounds; but, since the discovery of the medical properties of iodine, this has been considered as its most active ingredient. The mucus contained in the vesicles was applied externally, with advantage, by Dr. Russell, as a resolvent in scrofulous tumours. M. Duchesne Duparc, having given a trial to this fucus in inveterate psoriasis, in which it had considerable reputation as a remedy, found it of little value; but he observed an unexpected effect, that of diminishing fat, without in other respects injuring the health; and was thus induced to try it as a remedy for morbid obesity. His anticipations of its efficacy in this affection were not disappointed. He employs the whole plant, either in substance in the form of pill, in decoction, or in extract. It is not till two or three weeks after beginning with the remedy that its effects in diminishing the obesity begin to be perceived, and one of the first signs of its favourable action in this respect is the increase of the urine, and the appearance of a black pellicle on its surface. Dr. Godsfrey tried

the experiment on himself with satisfactory results, confirming the statements of M. Duchesne. (*Journ. de Pharm.*, Juillet, 1862, p. 65.) M. Dannecy prepares the extract from the plant, collected at the period of fructification about the end of June, in the neighbourhood of Bordeaux, and rapidly dried in the sun. This mode of desiccation is important, as, when dried by artificial heat, the plant never becomes friable, and always retains its hygroscopic qualities. When sufficiently dry to be friable, he treats it, in the state of coarse powder, for three days, with four times its weight of alcohol of 86°, expresses at the end of this time, and subjects the residue twice successively to a similar treatment with alcohol of 54°. The tinctures are then mixed, the alcohol distilled off, and the remainder evaporated to the consistence of an extract. Of this extract, which is one-fifteenth of the plant, three pills, each containing 25 centigrammes (3·75 grains), may be taken daily in the beginning, and increased gradually to twenty-four pills, a quantity which has often been attained without the slightest derangement of the stomach. The commencing dose would be about equivalent to twenty grains of the powder three times a day. (*Journ. de Pharm.*, Nov. 1862, p. 434.) A syrup may be readily prepared by dissolving the extract in a little diluted alcohol, and mixing this with syrup, in such proportion that a teaspoonful of the syrup shall contain a dose of the extract.

Other species of Fucus are in all probability possessed of similar properties. Many of them contain a gelatinous matter, and a sweet principle analogous to mannite; and some are used as food in times of scarcity. Large quantities of a sea-weed, named in the East *agar-agar*, are gathered on the rocky coasts of the East India Islands, and sent to China, where it is valued for making jellies, and as a size for stiffening silks. The *Ceylon moss* is a delicate fucus (*Gigartina lichenoides*), growing on the coast of Ceylon, where it is gathered by the natives. It abounds in starch and vegetable jelly, which render it applicable to the same purposes as the carrageen or Irish moss. (*Pharm. Journ.*, xiii. 355.) *F. Helminthocorton* (*Gigartina Helminthocorton* of Greville) has some reputation in Europe as an anthelmintic, and is said also to be febrifuge. It is an ingredient in the mixture of marine plants sold in Europe under the name of *Corsican moss* or *helminthocorton*. This is used in decoction, from four to six drachms being boiled in a pint of water, and a wineglassful given three times a day.

Attention has been called by Dr. Sloan, of Ayr, in Scotland, to the *Laminaria digitata*, commonly called *sea-girdles* or *tangles*, which grows about the shores of Scotland, as supplying an admirable material for bougies. The stem is from two to twelve feet long, and an inch or more in breadth, is of great strength and tenacity, with the property of drying readily, and, in doing so, of shrinking much, and acquiring an elastic firmness, with a consistence, if the desiccation be arrested at the proper point, somewhat softer than horn. In this state the plant may be kept for years; and, if at any time exposed to moisture, will absorb it readily, and swell up to the original size. This last property renders it especially applicable for the formation of bougies to be used in the dilatation of strictures and sinuses, for which purpose it was recommended by Dr. Sloan, and has been found useful by others. Mr. M. H. Collis, of the Meath Hospital, Dublin, commends it highly, in a paper on the subject communicated to the *Dublin Quarterly Journ. of Med. Sci.* (May, 1864, p. 373), to which the reader is referred for further information on the subject. W.

FULIGOKALI. This preparation, proposed by M. Deschamps, is formed by boiling for an hour, 20 parts of caustic potassa, and 100 of shining soot, in powder, in a sufficient quantity of water. The solution, when cold, is diluted, filtered, and evaporated to dryness. Fuligokali is in the form of a black powder, or of scales, very soluble in water, and having an empyreumatic odour and mild alkaline taste. It is used in the same affections as *anthrakokali*. The dose is two or three grains, repeated several times a day. An ointment, containing from 16 to 32 grains to the ounce of lard, was found by Dr. Gibert, of Paris, to be detersive, resolvent, and gently stimulant. (See a paper by A. Duhamel, in the *Am. Journ. of Pharm.*, xiv. 284.) B.

FUMARIA OFFICINALIS. *Fumitory.* A small annual European plant, naturalized in this country, growing in cultivated grounds, and flowering from May to August. It was formerly considerably employed as a medicine, and is still used in Europe. The leaves are the officinal part. They are inodorous, have a bitter, saline taste, and are very succulent, yielding by expression a juice which has the sensible and medicinal properties of the plant. An extract, prepared by evaporating the expressed juice or a decoction of the leaves, throws out upon its surface a copious saline efflorescence. The plant, indeed, abounds in saline substances, and to these, in connection with its bitter extractive, its medical virtues have been ascribed. Recently, however, M. Hannon, of Belgium, has ascertained the presence in fumitory of an alkaloid, called *fumarin* (*fumarina*), to which he ascribes the effects of the plant. He obtained it by treating the pulp of the leaves with concentrated acetic acid, with the aid of heat, filtering, evaporating the liquid, treating the extract with boiling alcohol, filtering the alcoholic solution, and, finally, decolorizing, and evaporating so that crystals might form. The acetate thus procured was decomposed by the alkalies, and yielded the fumarina. Fumitory has been considered gently tonic, alterative, and, in large doses, laxative and diuretic. But M. Hannon con-

siders it mainly sedative, and states that its prolonged use diminishes plethora, and may even produce anæmia. He has found fumarina, in the dose of about one-third or one-fourth of a grain, to be moderately excitant; in that of three grains, to be at first irritant and afterwards sedative. (*Ann. de Thérap.*, 1854, p. 78.) Both in ancient and modern times fumitory has been esteemed a valuable remedy in visceral obstructions, particularly those of the liver, in scorbutic affections, and in various troublesome eruptive diseases. Cullen speaks favourably of it in these last complaints. He gave two ounces of the expressed juice twice a day. Others have prescribed it in much larger quantities. The leaves, either fresh or dried, may be used in decoction, without precise limitation as regards the dose. The inspissated juice and an extract of the dried leaves have also been employed. W.

FUSTIC. A yellow dye-wood, obtained from *Morus tinctoria* (*Broussonetia tinctoria*, Kunth), a tree growing in the West Indies and South America. It is not used in medicine or pharmacy. According to Bancroft, two different woods bear in England the name of fustic, one the product of the tree just mentioned, distinguished as *old fustic*, probably from the greater magnitude of the billets in which it is imported; the other derived from the *Rhus Cotinus* or *Venice sumach*, and called *young fustic*, or sometimes *Hungarian fustic*. The wood of M. tinctoria owes its colouring properties to two principles, which have been isolated by R. Wagner; one denominated *morin*, and the other *moritannic acid*, from its resemblance to tannin. (See *Chem. Gaz.*, ix. 1, 21, and 241.) From the fustic of Rhus Cotinus or Hungarian fustic, M. Chevreul extracted a yellow colouring matter, in small crystalline needles when pure, which he called *fissetine* or *fisetic* acid, and a red substance, of which he was unable to say whether it pre-existed in the fustic, or was formed from the fissetine. (*Chem. News*, March 17, 1865, p. 126.) W.

GALANGAL. *Galanga. China Root. India Root.* Two varieties are described by authors, the *galanga major* and *galanga minor*, or *large* and *small galangal*. They are probably the roots of different plants. The large galangal is derived from *Maranta Galanga* of Linn. (*Alpinia Galanga* of Willd.) According to Dr. H. F. Hance, of Canton, the smaller galangal is the product of a distinct but closely allied plant, *Alpinia Officinarum*, Hance. (*Am. Journ. of Pharm.*, xliii. 408.) Both forms are brought from the East Indies. The *larger variety* is cylindrical, three or four inches long, as thick as the thumb or thicker, often forked, reddish-brown externally, slightly striated longitudinally, marked with whitish circular rings, orange-brown internally, rather hard and fibrous, difficultly pulverizable, of an agreeable aromatic odour, and a pungent, hot, spicy, permanent taste. The *small galangal* resembles the preceding in shape, but is smaller, not exceeding the little finger in thickness, of a darker colour, and of a stronger taste and smell. According to Morin, galangal contains a volatile oil, an acrid resin, extractive, gum, bassorin, and lignin. A. Vogel, jun., found also starch and fixed oil. (*Pharm. Cent. Blatt*, 1844, p. 158.) R. Brandes discovered a peculiar crystallizable substance called *kempferid*. (*Annal. der Pharm.*, xxxii. 311.) The active principles are the volatile oil and acrid resin. The medical effects of galangal are those of a stimulant aromatic. It was known to the ancient Greeks and Arabians, and formerly entered into numerous compound preparations. (*Am. Journ. of Pharm.*, xliii. 454.) At present it is seldom employed. Its dose is from fifteen to thirty grains in substance, and twice as much in infusion. W.

GALEGA OFFICINALIS. *Goat's Rue.* A perennial herb, growing in the South of Europe, and sometimes cultivated in gardens. It is without smell unless bruised, when it emits a disagreeable odour. Its taste is unpleasantly bitter and somewhat rough, and when chewed it stains the saliva yellowish-brown. In former times it was much employed as a remedy in malignant fevers, the plague, the bites of serpents, worms, &c.; but it has fallen into merited neglect. It is affirmed to improve both the quality and quantity of the milk in nursing women. (*Am. Journ. of Pharm.*, xliv. 106.) The roots of *Galega Virginiana*, a native of the United States, are said to be diaphoretic and powerfully anthelmintic. They are given in decoction. W.

GALIUM APARINE. *Cleavers. Goose-grass.* This is an annual, succulent plant, common to Europe and the United States, growing in cultivated grounds, and along fences and hedges. It is inodorous, and has a bitterish, herbaceous, somewhat acrid taste. Analyzed by Schwartz, it was found, besides chlorophyll, starch, and other principles common to all plants, to contain three distinct acids, viz., a variety of tannic acid, which he names *galitannic acid*, citric acid, and a peculiar acid, previously discovered by Schwartz and Rochleder, and named *rubichloric acid*. (*Pharm. Journ.*, xii. 190.) The expressed juice is said to be aperient, diuretic, and antiscorbutic, and has been used in dropsy, congestion of the spleen, scrofula, and scorbutic eruptions. In the last complaint it has been thought peculiarly useful. Three ounces of the juice may be taken twice a day. Dr. Winn, of Truro, Cornwall, has called the attention of the profession to this medicine. Several persons in his neighbourhood had been cured of lepra by a decoction of the plant; and he had himself employed it with great advantage not only in this but other cutaneous diseases. At first he gave it in the form of decoction made by boiling a handful of the recent herb in a quart of water for twenty minutes, of which a tumblerful was given three times a

day; but he afterwards preferred the inspissated juice, in the form of a fluid extract, of which a fluidrachm should represent half a pint of the decoction. (*Med. Times and Gaz.*, Feb. 1854, p. 144.) The fresh herb, in the form of ointment or decoction, has been applied externally to scrofulous swellings with supposed advantage. W.

GALIUM VERUM. *Yellow Ladies' Bedstraw. Cheese Rennet.* This species of Galium is perennial, and a native of Europe. The flowers, which are yellow, have a peculiar, agreeable odour, and have been given in nervous affections, with a view to their supposed antispasmodic powers. The herb is inodorous, but has an astringent, acidulous, bitterish taste. The property of coagulating milk was formerly ascribed to it, but is certainly not constant, as the experiment has been frequently tried without success. The bruised plant is sometimes used to colour cheese yellow, being introduced into the milk before coagulation. It is also used for dyeing yellow. The roots of this and of most other species dye red; and the plant, eaten by animals, colours the bones like madder. This plant was analyzed by Schwartz, and found to contain the same principles as *G. Aparine*, mentioned above. It was formerly highly esteemed as a remedy in epilepsy and hysteria, and was applied externally in cutaneous eruptions. It may be employed in the form either of the recently expressed juice, or of a decoction prepared from the fresh plant. Its medical properties, however, are feeble. Testimony has been given in France to the special efficacy of *Galium palustre* in epilepsy. (*Ann. de Thérap.*, 1863, p. 77.)

Of the American species, *G. tinctorium* is closely allied in properties to G. verum. It is said to be useful in cutaneous diseases; and the root is employed by the Indians for staining their feathers and other ornaments red. W.

GARDENIA GRANDIFLORA. A Chinese tree, the fruit of which is employed in dyeing the yellow robes of the mandarins. Lorenz Mayer discovered in the fruit a colouring substance, which proved to be identical with that of saffron, and to which, therefore, the name of *crocin* was given. In powder, it is of a bright-red colour, and is soluble in water and alcohol. By treatment with muriatic acid, it yields another colouring substance called *crocetin*, which is a true dye-stuff. (*Chem. Gaz.*, Sept. 1, 1858, p. 331.) The fruit of another species, *G. campanulata*, growing in the forests of Chittagong, in India, is said to be used by the natives as a cathartic and anthelmintic. (Lindley, *Flor. Med.*, p. 434.) W.

GENISTA TINCTORIA. *Dyers' Broom. Dyers' Weed. Green Weed.* A low shrub, growing wild in Europe, and sometimes cultivated in this country in gardens. The flowering tops of the plant are employed to dye yellow, whence its name was derived. Both these and the seeds have been used in medicine. They are said to be purgative and even emetic, especially the seeds, which were formerly given as a cathartic in the dose of a drachm and a half. By some authors they are said to be diuretic, and to be useful in dropsy. The plant has been long used as a preventive of hydrophobia by the peasants of Podolia, the Ukraine, and other provinces of Russia. They employ it in the form of strong decoction, both internally and locally, in connection with *Rhus coriaria*, and persevere with it for six weeks. The trials made with it in other parts of Europe have failed. W.

GERANIUM ROBERTIANUM. *Herb Robert.* This species of Geranium grows wild both in Europe and the United States, but is rare in this country; and Pursh states that the American plant is destitute of the heavy smell by which the European is so well known, though the two agree in all other respects. The herb has a disagreeable, bitterish, astringent taste, and imparts its virtues to boiling water. It has been used internally in intermittent fever, consumption, hemorrhages, nephritic complaints, jaundice, &c., has been employed as a gargle in affections of the throat, and has been applied externally as a resolvent to swollen breasts and other tumours. W.

GLASS OF ANTIMONY. *Vitrum Antimonii.* This is prepared from the tersulphuret of antimony by a partial roasting and subsequent fusion. The tersulphuret, reduced to coarse powder, is strewed upon a shallow, unglazed earthen vessel, and heated gently and slowly, being continually stirred to prevent it from running into lumps. White vapours of sulphurous acid arise; and, when these cease, the heat is increased a little to reproduce them. The roasting is continued in this manner until, at a red heat, no more vapours are given off. The matter is then melted in a crucible with an intense heat, and kept in a state of fusion until it assumes the appearance of melted glass, when it is poured out on a heated brass plate. In this process, part of the sulphur of the tersulphuret is driven off by the roasting; while the portion of antimony which loses its sulphur becomes teroxidized. The roasted matter, therefore, consists of teroxide of antimony and undecomposed tersulphuret; and these, by uniting during the fusion, form the glass. Glass of antimony is in thin irregular pieces, with a vitreous fracture, and a metallic steel-gray lustre. When well prepared it is transparent, and, upon being held between the eye and the light, appears of a rich orange-red or garnet colour; but if of inferior quality it is black and opaque. It is hard and brittle, and rings when struck with a hard substance. It is insoluble in water, but soluble in acids and cream of tartar, with the exception of a few red flocculi. Its essential constituents are the teroxide and tersulphuret, united in variable proportions. When of good quality it consists of about eight parts of teroxide to one of tersulphuret. It usually contains about 5 per cent. of

silica, and three of sesquioxide of iron, which are derived from the crucible, and to the former of which the vitrification of the product is owing. When good it is dissolved, with the exception of a few red flocculi, in strong muriatic acid. An excess of the silica is shown by the acid leaving a gelatinous residue, and the iron may be detected by ferrocyanide of potassium, and its amount judged of by the bulk of the precipitate and the depth of its blue colour. Sometimes *glass of lead* is sold for glass of antimony, a fraud readily detected by the difference between the two substances in specific gravity; glass of lead having a density of nearly seven, while that of glass of antimony is not quite five.

Medical Properties, &c. Glass of antimony is an active antimonial; but, owing to its variable composition and unequal operation, it is at present very seldom used. When the levigated powder is mixed with one-eighth of its weight of melted yellow wax, and the mixture roasted over a slow fire, with constant stirring, until it ceases to exhale vapours, a coal-like pulverizable mass is formed, which is the *cerated glass of antimony*, a preparation formerly included in the Edinburgh Pharmacopœia. B.

GLECHOMA HEDERACEA. *Nepeta Glechoma. Ground-ivy.* A small perennial herb, indigenous in Europe and the United States, and growing in shady, grassy places, as in orchards and along fences and hedges. It belongs to the family of labiate plants, and shares their general properties. The herb was formerly officinal, and still enjoys some credit as a domestic remedy. It has a peculiar disagreeable odour, and a bitterish, somewhat aromatic taste, and imparts its properties to boiling water. It is very prone to have galls developed on it, and to be infested with micromycetes. (*Journ. de Pharm.*, Fev. 1875, p. 127.) It is said to be gently stimulant and tonic, with, perhaps, a peculiar direction to the lungs and kidneys. It has also been considered aperient. It has been most used in chronic affections of the pulmonary and urinary organs, and at one time had considerable reputation as a remedy in consumption. It has also been employed as a vulnerary and errhine. The usual form for exhibition was that of infusion, of which a dose was given containing the virtues of half a drachm or a drachm of the herb. W.

GLOBULARIA ALYPUM. *Wild Senna of Europe.* This is a small shrub, growing on the European shores of the Mediterranean, the leaves of which have been occasionally used as a cathartic since the middle ages. Dr. Gustave Planchon, of Montpellier, France, in an essay on the plants of this genus, published in 1859, states that the leaves of this species are a mild and efficient cathartic, without the griping properties of senna, and without leaving behind a tendency to constipate like rhubarb, which, however, it resembles in tonic power. One ounce is given for a dose in decoction. It is unknown in this country. (See *Pharm. Journ.*, xvi. 426.) W.

GLUE. An impure form of gelatin, obtained from various animal substances by boiling them in water, straining the solution, and evaporating it till upon cooling it assumes the consistence of jelly. The soft mass which results is then divided into thin slices, which are dried in the open air. Glue, when of good quality, is hard and brittle, of a colour varying from light yellow to brown, and equally transparent throughout. It softens and swells very much in cold water, without dissolving; but is readily dissolved by hot water. It is soluble in a large proportion of glycerin, and with heat forms with it in smaller proportion a jelly. (Maisch, *Am. Journ. of Pharm.*, xlii. 518.) It is employed chiefly for cementing pieces of wood, being generally too impure for the purpose of a test, or as an article of food. An *elastic and imputrescible preparation of glue*, useful for various purposes in the arts and in medicine, may be made by dissolving glue in water by means of a water-bath, concentrating the solution, then adding a weight of glycerin nearly equal to that of the glue employed, thoroughly mixing, evaporating the residue of the water, and finally pouring into moulds, or on a marble slab. It is especially applicable to the preparation of artificial anatomical specimens. (*Journ. de Pharm.*, Jan. 1857, p. 23.) A good *liquid glue* may be made by rubbing up in two pints of rain-water, with the heat of a water-bath, 16 ounces of the best white glue and 4 ounces of dry white lead, until thoroughly mixed, then adding four fluidounces of alcohol, and continuing the heat and the agitation for a few minutes. The mixture is to be poured into bottles while still hot. (*Drug. Circular*, Oct. 1866.) A *liquid glue* may also be readily prepared by mixing in a stoppered bottle 38 parts of glue, properly divided, and 100 parts of acetic acid of commerce, the latter of which dissolves the glue as water dissolves gum. On exposure the acid evaporates, leaving the glue unchanged. (*Journ. de Pharm.*, 3e sér., xlvi. 35.) It is stated that an excellent *liquid glue* may be made by dissolving glue in sweet spirits of nitre. A mode of preparing *strong liquid glue*, recommended by M. Knaff, is to take three parts of good glue in small pieces, cover it with 8 parts of water, and, after having allowed it to stand for some hours, add half a part of muriatic acid and three-fourths of a part of sulphate of zinc, and expose the whole for 10 or 12 hours to a heat from 178° to 189° F. This does not gelatinize and keeps well. (*Am. Journ. of Pharm.*, July, 1868, p. 330; from *Journ. de Pharm.*) It is stated that a *waterproof* glue may be made by adding bichromate of potassium to the solution of glue just before using, in the proportion of one part to fifty of glue. (*Am. Journ. of Pharm.*, xliii. 420.) *Chromatized gelatin*, obtained by the addition of one part of bichromate of potassium to

five parts of a solution (5 or 10 per cent.) of gelatin, forms an excellent cement for glass. The surfaces to be united, after being smeared with the cement, are placed upon each other and exposed to the sun. After a few hours the adhesion is perfect and almost invisible, and boiling water itself has no action on the cement. (*Lond. Lancet*, Nov. 11, 1876; from *Journ. de Med. de Bruxelles*, Juillet, 1876.) For other formulas for liquid glue, see *Am. Journ. of Pharm.*, xliii. 421.

Capsules of Gelatin. Glue has within a few years been applied to an important practical purpose in pharmacy. Certain medicines are so offensive to the taste, and consequently so apt to sicken the stomach, that it is highly desirable to administer them in such a way as to prevent their contact with the tongue and palate. This object is fully accomplished, so far as regards many disagreeable liquid medicines, by the use of the *capsules of gelatin*, invented by M. Dublanc, of Paris. These are prepared from the purest glue in the following manner. Small pouches made of fine skin, of an oval form, are attached by a waxed thread to the smaller extremity of a hollow elongated metallic cone, which is bent towards its point, and has its base closed by a cover, which is screwed so as to make the instrument air-tight. Into this conical tube sufficient mercury is poured to fill the pouch, which, thus distended, is dipped into a concentrated solution, made by heating six parts of pure glue with one of sweetened water, and is afterwards exposed to heat in a vertical position, so as to dry the layer of gelatin which it has received. In the same manner a second coating may be given, and the process again repeated till a sufficient thickness has been obtained. The cone being then reversed, the mercury flows out of the pouch, which collapses, and allows the capsule of gelatin to be removed. Into this the medicine may now be introduced, care being taken to avoid any contact with the outer surface of the capsule. The opening is next to be closed by means of a thin lamina of gelatin previously softened by steam; and a solution of the same substance should be applied to the edges by means of a camel's-hair pencil. Another mode of preparing the capsules is as follows. Take a cylinder of iron or hard wood, four lines in diameter and a few inches long, and smoothly rounded at one end. Dip half an inch of this end first into a saturated warm alcoholic solution of soap, and afterwards, when the soap has concreted upon the surface, into a concentrated hot solution of gelatin, and repeat the latter immersion once or oftener, if it be desired to have a firm capsule. When the glue has concreted, remove the capsule. A top for it may be made in the same way, and, after the body has been filled with the liquid to be given, is to be applied, and secured by rubbing a camel's-hair pencil moistened with hot water over the line of junction. (*Med. Exam.*, N. S., i. 441.) M. Mothès considers the following plan of preparing the capsules the most convenient. He has a number of assorted "copper olives" prepared, covers their surface with a layer of something to prevent oxidation, immerses them in a sweetened and aromatized concentrated solution of gelatin, then places them vertically on boards to cool, and before complete desiccation removes the capsules, places them on sieves, and dries them by a stove-heat. (*Journ. de Pharm.*, xvii. 204.) Mr. Redwood gives the following process, which is a modification of the second method above described. A polished bulb of iron, ivory, or bone, of the size and shape of the capsules required, and connected by a slender rod with a handle, is first greased by rubbing with an oiled cloth, and then dipped into a solution of gelatin made as above directed. Upon being withdrawn, it is held for a short time so as to allow the excess of the solution to run off, and then fixed with the handle in a board, the coated bulb being upward, until the coating becomes cold and firm. The capsule is now removed by the fingers, and further dried by exposure on a tray. A number of capsules having been prepared, they are placed each in a small cell upon a board, with their mouths upward; and the liquid they are to contain is introduced by means of a syringe with a fine point. Their mouths are then closed with a drop of the solution of gelatin applied by means of a camel's-hair pencil, which is afterwards strengthened by an additional coating, given by dipping the mouth of the capsule into the solution diluted with a little water. (*Redwood's Supplement*, p. 664.) The capsules may be made of such a capacity as to contain from ten to fifteen grains of copaiba.

A new application of gelatin has been proposed by Mr. A. F. Haselden; for the formation, namely, of capsules to the tops of bottles, as a substitute for sealing wax or resin. For this purpose, to a pound of gelatin, after it has been melted with as little water as necessary, an ounce and a half of glycerin are to be added to give it pliability and toughness, and a little liquid cochineal to colour it; the cork and neck of the bottle are then dipped into the liquid, which gives them a coating, which may be rendered as thick as required by repeating the immersion if necessary. These are the essentials of the operation, but various manipulations are necessary to meet all the demands of the case, for which we refer to Mr. Haselden's article in the *Pharm. Journ.* (March, 1866, p. 450.) W.

GNAPHALIUM MARGARITACEUM. *Cudweed. Life-everlasting.* An indigenous herbaceous perennial, growing in fields and woods, and flowering in August. The herb of this species and of *G. polycephalum*, or *sweet-scented life-everlasting*, is sometimes used, in the form of tea, by the country people, in diseases of the chest and of the bowels, and in hemorrhagic affections, and externally, in the way of fomentation, in bruises,

languid tumours, and other local complaints; but it probably possesses little medical virtue. Shoepf says that it is anodyne. In Europe different species of Gnaphalium are also occasionally employed for similar purposes. W.

GOA POWDER. *Araroba Powder. Chrsyarobine.* Under these different names are used in Brazil and the East Indies certain powders in diseases of the skin. For the proofs of their identity, see *Pharm. Journ. and Trans.*, April, 1875, pp. 724, 801, 816. Its source is unknown. The varieties of the powder differ in colour from a dark-chocolate or maroon to a light-yellow, and in character from coarse granules or even small pieces to a fine powder. It has been thought to be obtained from a lichen, but, according to J. F. Da Silva Lima, it is the product of a leguminous tree allied to Brazil wood. (*Ibid.*, p. 724.) It is stated to be exceedingly irritating, and to be useful in herpes circinatus, chloasma, intertrigo, &c. Dr. Fayre in a case of mentagra successfully applied with a camel's-hair brush to the roots of the affected hair a pomade consisting of 20 grains of araroba powder, ten drops of acetic acid, and an ounce of ointment of benzoin. For further information, besides the references already given, see *Journ. de Pharm.*, Août, 1875; *Med. Times and Gaz.*, Nov. 1874, p. 547; *Edinb. Med. Journ.*, Feb. 1875, p. 764. H. C. W.

GOLD. *Aurum.* The preparations of this metal were introduced to the notice of physicians by Dr. Chrestien, of Montpellier, in 1810. They are employed both internally and by friction on the tongue and gums. The principal affections in which they have been recommended are secondary syphilis, syphilitic ulcerations, scrofula, and inveterate eruptions, particularly those of a leprous character. The chief preparations which have been employed, up to the present time, are metallic gold in a finely divided state, the oxide (teroxide or auric acid), the chloride (terchloride), the iodide, the double chloride of gold and sodium, the chloroaurate of ammonium (a compound of terchloride of gold and chloride of ammonium), and the cyanide (tercyanide) of gold. *Gold in powder* may be obtained by rubbing up gold-leaf with 10 or 12 times its weight of sulphate of potassium until brilliant particles are no longer visible, and then washing away the sulphate with boiling water. The *oxide* may be procured by treating the nitromuriatic solution of gold with an excess of magnesia, and washing the precipitate, first with water, and afterwards with dilute nitric acid. This process being tedious, M. L. Figuier prefers to obtain the oxide by precipitating the cold solution of chloride of gold, rendered strongly alkaline by caustic potassa, with a solution of chloride of barium. The precipitate, consisting of aurate of barium, is then treated with dilute nitric acid, which dissolves the barium and leaves the oxide of gold pure. Ten parts of gold, thus treated, produced 11·75 parts of oxide; while the same quantity of gold by the magnesia process only yielded 9 parts. (*Journ. de Pharm.*, Dec. 1847.) The *chloride* is obtained by dissolving pure gold in three times its weight of nitromuriatic acid, with the aid of a moderate heat. The solution is evaporated by a gentle heat nearly to dryness, being at the same time stirred with a glass rod. It is in the form of a crystalline mass of a deep-red colour. Its solution has a fine yellow tint. Being deliquescent, it requires to be kept in ground-stoppered bottles. The *iodide* may be made by precipitating a solution of terchloride of gold by one of iodide of potassium, and washing the precipitate with alcohol to remove the excess of iodine. It is of a greenish-yellow colour, and, when heated in a porcelain crucible, is resolved into iodine vapours and a residue of pure gold. *Chloride of gold and sodium* is prepared by dissolving four parts of gold in nitromuriatic acid, evaporating the solution to dryness, and dissolving the dry mass in eight times its weight of distilled water. To this solution one part of pure decrepitated common salt is added, previously dissolved in four parts of water. The mixed solution is then evaporated to dryness, being in the mean time constantly stirred with a glass rod. The salt is of a golden-yellow colour, and, when crystallized, is in the form of long prismatic crystals, unalterable in the air. The *chloroaurate of ammonium* is formed by dissolving one part of the terchloride of gold and two parts of chloride of ammonium in distilled water, assisted by a few drops of nitromuriatic acid, and evaporating the solution to dryness by a gentle heat. The *cyanide* is best obtained, according to M. Oscar Figuier, as follows. Prepare the chloride of gold as neutral as possible by repeated solutions and crystallizations; and to the solution of this salt add, very cautiously, avoiding any excess, a solution of *pure* cyanide of potassium, so long as any precipitate falls. (See *Potassii Cyanidum.*) The precipitate, consisting of cyanide of gold, is to be washed with pure water, and dried in the dark. Gold in powder, and the oxide, chloride, iodide, sodio-chloride, and cyanide are officinal in the French Codex.

The preparations of gold are decidedly poisonous, though in different degrees. The chloride is most virulent, and, according to Dr. Chrestien, is even more active than corrosive sublimate. In an overdose, it produces pain, inflammation, and even ulceration of the stomach and bowels, and otherwise acts as a corrosive poison. The general effect of these preparations, in moderate doses, is to produce increased fulness and frequency of the pulse, and to augment the urine and insensible perspiration, without interfering with the appetite or the regular action of the bowels; but, if the dose be pushed too far, general irritation is apt to be produced, inflammation seizes upon some organ, according to the predisposition of the individual, and fever is developed.

Gold in powder, the oxide, chloride, and *iodide* are not as much used as the double chloride of gold and sodium. The oxide may be given in the form of pill, containing the tenth of a grain, in scrofula and lymphatic swellings, beginning with one pill daily, and afterwards gradually increasing to seven or eight in 24 hours. The chloride has been used with advantage as a caustic in lupus, and in syphilitic tubercles and ulcers by M. Chavannes. The iodide may be given in the same cases with the other preparations. The dose is from the fifteenth to the tenth of a grain.

Chloride of gold and sodium is the preparation of gold most commonly employed. It may be given in lozenges, each containing the twelfth of a grain, by mixing immediately five grains of the salt with an ounce of powdered sugar, and making the whole with mucilage of tragacanth into a proper mass, to be divided into sixty lozenges. Pills, containing the same dose, may be formed by dissolving ten grains of the dried salt in a drachm of distilled water, and forming the solution into a pilular mass with a mixture of four drachms of potato starch and one drachm of gum arabic, to be divided into one hundred and twenty pills. (*Journ. de Pharm.*, xx. 648.) Dr. L. Martini (*B. and F. Medico-chir. Rev.*, Oct. 1870, p. 519) recommends it very highly in pills of one-tenth of a grain five times a day in hysteria. For frictions on the gums and tongue, Chrestien recommends the following formula: Crystallized chloride of gold and sodium one grain; powdered orris root, deprived of its soluble parts by alcohol and water, and dried, two grains. Mix. At first the fifteenth part of this powder is used daily by frictions; afterwards the fourteenth, the thirteenth, &c., until, increasing gradually, the tenth or eighth part is employed. The use of four grains of the salt in this way is said commonly to cure bad cases of recent syphilis; such, for example, as are characterized by the coexistence of chancres, warts, and buboes. In preparing this powder, lycopodium may be substituted for the orris. MM. Rouault and Debreque have used this preparation of gold with success, in daily frictions for some minutes to the tongue, gums, and inside of the cheeks, for the resolution of chronic glandular tumours, especially those which occur in the neck in the form of a chain. The patient should swallow his saliva, while the frictions are practised. (*B. and F. Medico-chir. Rev.*, Am. ed., July, 1857, p. 172.)

Chloroaurate of ammonium has been recommended by Bouchardat in amenorrhœa, and dysmenorrhœa in debilitated subjects, in the dose of about the tenth of a grain. A grain may be dissolved in five teaspoonfuls of alcohol and five of water, and a teaspoonful given morning and evening, mixed with sweetened water.

Cyanide of gold is employed, like the chloride of gold and sodium, mixed with inert powders by friction, and in the form of pill. The fifteenth of a grain may be rubbed into the gums daily for fifteen days, next the fourteenth of a grain for fourteen days, and so on, increasing until the dose amounts to the ninth or eighth of a grain. The dose for internal exhibition is the eighteenth of a grain, gradually increased to the eighth. Cyanide of gold has been found useful in the treatment of syphilis and scrofula by M. Pourché, and is said to be less exciting than the double chloride, when used in those diseases.

The different medicinal compounds of gold should not be prepared in pill, powder, or otherwise, until they are wanted for use; as they are liable to undergo decomposition when kept. They should be carefully secluded from the light. B.

GRASS-TREE GUM. An Australian product, said to be obtained by exudation from different species of Xanthorrhœa, especially *X. hastilis*. As described by Mr. P. L. Simmonds, it is of a resinous character, usually as found in the markets in the state of small fragments or coarse powder, resulting from the breaking up of the larger brittle masses in which it first occurs. It is of a deep reddish-yellow colour in mass, but greenish-yellow in powder. It does not dissolve in the mouth when chewed, nor adhere to the teeth, but has a slightly astringent and aromatic flavour. It melts with heat, and at a higher temperature takes fire in the air, burning with a smoky flame, and emitting a fragrant odour not unlike that of balsam of tolu. It yields carbazotic acid largely under the action of nitric acid. It is recommended as a source of gas for illumination. The natives and early settlers are said to have used it as a medicine in diarrhœa. It is obtainable in inexhaustible quantities; as the plants producing it are abundant throughout almost the whole of Australia. (*Am. Journ. of Pharm.*, Sept. 1866, p. 465; from *Med. Press and Circular.*) W.

GRATIOLA OFFICINALIS. *Hedge-hyssop.* This is a perennial herb, indigenous in the South of Europe, where it flourishes in meadows and other moist grounds. The whole herb is used. It is nearly inodorous, but has a bitter nauseous taste. Both water and alcohol extract its active properties. Its chemical constitution has been investigated by Dr. F. G. Walz, who found the following constituents: 1. *gratiolin*, 2. *gratiosolin*, 3. *gratiolacrin*, 4. fixed oil, 5. a brown resin, 6. tannic acid, and 7. a volatile acid, the *antirrhinic* acid, which exists in many of the *Scrophularineæ*. Each of the peculiar substances mentioned consists of carbon, hydrogen, and oxygen; the formula of gratiolin being $C_{40}H_{34}O_{14}$, that of gratiosolin $C_{46}H_{42}O_{25}$, and that of gratiolacrin $C_{31}H_{29}O_4$. For the mode of preparing them the reader is referred to the *Am. Journ. of Pharm.* (July, 1859, p. 340) and, for a fuller account of them, to the *Chemisches Central Blatt* (Oct. 6, 1858, p. 689). Hedge-hyssop is a drastic cathartic and emetic, possessing also

diuretic properties, and is employed on the continent of Europe in dropsy, jaundice, worms, chronic hepatic affections, scrofula, and various other complaints. With us it is almost unknown as a remedy. The dose of the powdered herb is from fifteen to thirty grains; of the infusion, made in the proportion of half an ounce to the pint of boiling water, half a fluidounce. W.

GRINDELIA ROBUSTA. (*Torrey & Gray, Flora of N. America*, ii. 247.) Under the name of Grindelia robusta, Dr. H. Gibbons, in the *Pacific Med. and Surg. Journal*, notices an herbaceous plant, abundant in California, especially in hilly situations, which is said to have extraordinary efficacy in asthma. It is described as having an erect stem, a foot or two high, without branches, and terminating in a spherical head of compound flowers, the rays of which are white, and about half an inch in length. Upon the calyx is usually to be seen a drop or two of a milky resinous juice, which is characteristic of the plant. The herb has a balsamic odour and taste; and a syrup made from the decoction is not unpalatable, and taken internally acts as an expectorant. But the chief value of the plant is as a remedy in asthma. A clergyman who had suffered extremely from that disease, and in whose case all the remedies usually given had been tried in vain, took, on going to bed, a wineglassful of syrup made from the herb, slept soundly through the night, and, under its continued use, had not been compelled for seven months to pass one night out of bed. (*Med. and Surg. Reporter*, Jan. 22, 1867, p. 520.) It has also been very highly commended in iritis, used internally and externally, and as a local application in burns, vaginitis, and genito-urinary catarrh. It may be used as a poultice or an injection (f℥ss—Oj). (*Am. Journ. of Pharm.*, 1875, p. 423.) W.

GROUND NUTS. *Pea Nuts.* The fruit of *Arachis hypogæa*, a leguminous, annual plant, indigenous probably in Africa and South America, and abundantly cultivated in our Southern States, and elsewhere. A remarkable property of the plant is that its fruit ripens under the surface of the ground, into which the pods penetrate in the progress of their growth. The seeds constitute the well-known ground nuts of our markets, which consist of a dry, brittle envelope, and a yellowish-white kernel. It is said that the crop in the United States in 1873 was valued at $2,250,000. When roasted, ground nuts constitute for many a very agreeable article of food, and in the South are said to be much used as a substitute for coffee. They are, however, chiefly valuable on account of their richness in a fixed oil, which amounts to more than twenty per cent., and which is largely prepared in this country as an article of commerce. It is obtained by expression; the nuts being ground into a paste, and moderately heated before being submitted to pressure. As described by Mr. Jonas Winter, the oil has a bright-yellow colour, the characteristic odour of the fruit, and a mild not unpleasant taste. It is soluble in all proportions in ether, chloroform, and benzine, but insoluble in alcohol. Its sp. gr. is 0·918 at 60° F. At 38° it thickens, at 32° congeals imperfectly, and at 620° is decomposed, giving out spontaneously inflammable vapours. Mr. Winter made experiments to ascertain how far it might be employed with advantage in pharmacy, and found that it answered well in the preparation of cerates and ointments; but would not serve as a substitute for olive oil in the preparation of the lead-plaster. It is a non-drying oil, and will not therefore answer for painting; but it is used for various purposes in the arts, as for lubricating machinery, and in the manufacture of woollen cloths; in lamps it gives even a better light than sperm oil. (*Am. Journ. of Pharm.*, July, 1860, p. 292.) W.

GUACO. This name is given in Central and South America, and the West Indies, to various plants having supposed alexipharmic properties, and belonging to the genera *Mikania* and *Aristolochia;* but it is to the different species of the former genus that the appellative properly belongs, especially to *Mikania Guaco*, described by Humboldt and Bonpland. (*Pl. Æq.* ii. 84.) The genus Mikania belongs to the Linnæan class and order *Syngenesia Æqualis*, and to the natural order *Asteraceæ*. The plants are closely allied to the Eupatoria. For their generic character, see *Lindley's Flora Medica*, and *Griffith's Medical Botany*. Mikania Guaco is described as having twining stems, with round, sulcate, and hairy branches; ovate, subacuminate, remotely dentate leaves, somewhat narrowed at the base, rough above, and hairy beneath; and flowers in opposite axillary corymbs. The plant is a native of intertropical America, and has been introduced into the W. India Islands from the continent. The leaves are the part used. In the recent state they have a bitter taste, and a strong disagreeable odour; but their sensible properties and medical virtues are impaired by drying.

This and other plants have long been employed by the natives as a preventive and cure of the bites of poisonous serpents. This application of them was first made known by Mutis; and his account was confirmed by Humboldt and Bonpland. Very naturally the guaco came afterwards to be considered as antisyphilitic. The medicine has also been employed as a febrifuge and anthelmintic, and a few years since attracted considerable attention for its supposed prophylactic and remedial powers in epidemic cholera and chronic diarrhœa. According to Guibourt, however, the medicine used in France, under the name of guaco, was composed almost entirely of three or four species of Aristolochia, which, as before stated, are used in some parts of Mexico, as antidotes for snake poison, under the name of guaco. The medicine has, moreover, been recommended in

chronic rheumatism, both internally and locally, and as an application to bites of insects, bruises and sprains, and atonic deafness. The probability is that, like eupatorium, it has simply the virtues of a mild tonic, and gentle stimulant to the secretions. It is best employed in the recent state. The natives, when employing it as a counterpoison, apply the bruised leaves and expressed juice to the bite, and at the same time drink of the infusion. It is highly recommended by Dr. E. W. Pritchard in the gouty paroxysm, in which he has seldom known it to fail giving more or less relief. He gives from half a drachm to a drachm of the tincture every four hours, and applies it locally at the same time. (*Pharm. Journ.*, Nov. 1861, p. 288.) The preparations recommended for internal use are chiefly an infusion and tincture, the former made in the proportion of an ounce of the leaves to a pint of boiling water, the latter of about a pound to the gallon of proof spirit. The dose may be about the same as that of analogous preparations of eupatorium. (See *Lond. Med. Times and Gaz.*, Dec. 1852, p. 651; and *Journ. de Pharm.*, 3e sér., xx. 357.) The result of a long and close investigation into the natural history of guaco by the distinguished Guibourt is, that the *Mikania Guaco*, instead of possessing, as has been asserted, a strong, penetrating, and nauseous odour, is in fact inodorous, and destitute of all active properties; and that the strongly aromatic plants which have been employed under the name of guaco all belong to the genus Aristolochia, especially *A. cymbifera* of Martius, growing in Brazil, after this *A. maxima* (De Cand.), and in less degree *A. geminiflora* of Kunth. (*Journ. de Pharm.*, Août, 1867, p. 99.) W.

GUANO. *Bird-manure.* This is a valuable manure, consisting of the decomposed excrement of countless aquatic birds, which has accumulated for ages on certain barren and uninhabited islets of the western coast of South America, and in other localities throughout the world. The best comes from Peru, and will be here described. It is a coarse dry powder of a brown colour. Exposed to the air it absorbs moisture, and becomes somewhat sticky. Its smell is offensive, and slightly ammoniacal. With the powder are intermingled friable lumps, which exhibit in their inside whitish specks, and which, when exposed to the air, fall to powder, exhaling an ammoniacal smell. It is soluble in great part in water, and the solution formed contains chiefly oxalate of ammonium. When exposed to heat it blackens, burns with a slight flame, exhales the smell of ammonia, and leaves a whitish ash, varying in amount from 27 to 35 per cent. The guanos of commerce vary very much in composition, from the best Peruvian to the inferior sorts, which have scarcely any value as fertilizers. A good specimen of guano, analyzed by Fownes, consisted of about two-thirds oxalate of ammonium, and one-third earthy and alkaline phosphates, &c. The source of oxalate of ammonium is undoubtedly the uric acid, originally in the excrement, and which is often found undecomposed in the guano. The value of guano as a fertilizer depends chiefly upon the proportion of the organic ingredients; the phosphates being of secondary importance. M. E. Baudrimont infers, from the analysis of seventeen samples of Peruvian guano, that the proportion of nitrogen may be obtained approximately by dividing the amount of the organic matters by five. The samples varied greatly in value. (*Journ. de Pharm.*, Oct. 1857.) Crystals of carbonate of ammonium have been observed in guano. Columbian guano was found by Dr. C. Morfit, of Baltimore, to be rich in phosphoric acid and lime. (*Chem. Gaz.*, Dec. 1, 1855.) Unger obtained from Peruvian guano, in 1845, a peculiar substance, analogous to uric (zanthic) oxide, called *guanin*. It forms crystallizable salts with acids, and has the formula $C_{10}H_5N_5O_2$. The accuracy of this formula has been confirmed by MM. Neubauer and Kerner. For further information, see *Journ. de Pharm.*, 4e sér., xvii. 328.

In South America, guano has been used with benefit, internally and externally, as a remedy in the different forms of lepra. The late Prof. Horner, of Philadelphia, employed it as a cataplasm, mixed with an equal quantity of potters' clay, in a case of chronic inflammation of the knee-joint. In this proportion it blistered the surface; and cataplasms were afterwards adopted, containing one-third and one-fourth of guano. (*Med. Exam.*, Feb. 1852, p. 69.) Prof. Horner attributed the revulsive effect of guano to urate of ammonium; but the best authorities state that oxalate of ammonium is the characteristic salt of this substance. Since 1852, guano has been a good deal used in cutaneous diseases, especially in ecthyma, eczema, and tinea capitis. It is employed in the form of bath, lotion, and ointment. Récamier prescribed baths in these diseases, each bath containing sixteen ounces of guano; and the practice has been imitated with success by M. Desmartis, and by M. Van der Abeele, of Belgium. The lotion may be made by exhausting an ounce of guano with a pint of boiling water, and filtering the solution. The ointment is formed of various strengths, from one to five parts of guano to fifteen of lard. M. C. Girardin prepares an extract of guano by exhausting it with alcohol, diluted with twice its bulk of water, and evaporating the solution to dryness. Of this extract he makes an ointment, useful in eruptions, by mixing it with three parts of lard, and also a syrup, flavoured with vanilla, of which the dose is a fluidrachm, containing a grain of the extract, to be given in scrofula. The variable composition of guano must always form a serious objection to its therapeutic use. B.

GYNOCARDIA ODORATA. *Chaulmoogra.* This is an East India plant, the fruit of which has been employed, with asserted benefit, in elephantiasis or the leprosy of the

East. The fruit is a succulent indehiscent pericarp, which yields a fixed oil by expression. The seeds are used internally, and the oil applied to the ulcers. Dr. Mouat has used it advantageously in leprosy, ichthyosis, scrofulous enlargements, and constitutional syphilis. He gave the seeds in the dose of six grains three times a day. (*Am. Journ. of Med. Sci.*, N.S., xxx. 493; from *Association Med. Journ.*, Aug. 17, 1855.) W.

HAMAMELIS VIRGINICA. *Witch-hazel.* An indigenous shrub, from five to fifteen feet high, growing in almost all sections of the United States, usually on hills or in stony places, and often on the banks of streams. It is remarkable for the late appearance of its yellow flowers, which expand in September or October, and continue till the weather becomes very cold in winter. The fruit, which is a nut-like capsule not unlike the hazelnut, ripens in the following autumn, and is often mingled on the same plant with the new blossoms. The bark has a bitter, astringent, somewhat sweetish, and pungent taste. It probably first attracted notice as a remedy of the Indians, who are said to have used it as a sedative and discutient in painful tumours, and other cases of external inflammation. It is used in the shape of poultice, or as a wash in the form of decoction, in hemorrhoidal affections and ophthalmia. The leaves are said to possess similar properties, and, in the state of infusion, to be given internally in bowel complaints and hemorrhages. Dr. James Fountain, of Peekskill, N. Y., speaks in strong terms of the efficacy of the bark in hemorrhage of the lungs and stomach, and also highly recommends, as one of the best applications in external piles, an ointment prepared from lard and a decoction of equal parts of this bark, white-oak bark, and that of the apple-tree. He believes the witch-hazel to possess anodyne properties. (*N. Y. Journ. of Med.*, x. 208.) Dr. N. S. Davis agrees with Dr. Fountain in his estimate of this remedy, which he has employed usefully in incipient phthisis. He gives it in decoction, made with an ounce of the bark to a pint of water, of which the dose is a wineglassful every three, six, or eight hours. (*Transact. of Am. Med. Assoc.*, i. 350.) Still another use of the remedy is for the prevention of abortion, for which purpose it is recommended by Dr. W. W. Durham, who states that he has employed it very successfully in obviating the effects of the cotton root in bringing on miscarriage. (*Med. and Surg. Reporter*, Aug. 3, 1867, p. 101; from *Atlanta Med. and Surg. Journ.*) The seeds are black and shining externally, white, oily, and farinaceous within, and edible like the hazelnut. W.

HARSTHORN. *Cornu.* Lond., Ed. This ancient medicine, having been dismissed in the recent revision of the British Pharmacopœia, and not having had a place in our own, requires to be treated of here. It was the horn of *Cervus Elaphus*, the stag or hart, that was directed by the British Colleges. This species of deer inhabits Europe, Asia, and the North of Africa. The horns of our own common deer—*Cervus Virginianus*—though employed in the arts, were not officinal. Hartshorn has been usually imported into this country from Germany, in the form of shavings. These are without smell and taste, pliable, and of an ivory yellow colour. According to M. Merat-Guillot, they contain in 100 parts, 27 of gelatin, 57·5 of phosphate of calcium, 1 of carbonate of calcium, and 14·5 of water including the loss. Boiling water extracts their gelatin, forming a transparent, colourless jelly, which may be rendered palatable by the addition of sugar, lemon or orange-juice, and a little wine. To prepare it, two pints of water are boiled with four ounces of the shavings to a pint, and the residue strained while hot. The liquid gelatinizes upon cooling. By destructive distillation, the shavings yield an impure solution of carbonate of ammonium, which was formerly called *spirit of hartshorn;* and the same name has been applied to similar ammoniacal solutions from other sources.

Cornu Ustum. (Lond.) *Burnt Hartshorn.* The directions formerly given by the London College for the preparation of this substance were to "burn pieces of Hartshorn in an open vessel until they are thoroughly white; then powder them, and prepare them in the manner directed for Chalk." The horn must not only be heated, but also burnt, in order that the animal matter may be entirely consumed. The operation may be performed in a common furnace or stove, the air being freely admitted. Care should be taken that the heat be not too great; as otherwise the external surface of the horn may become vitrified, and prevent the complete combustion of the interior portion, while it is itself rendered less fit for use. Burnt hartshorn consists of bone-phosphate of calcium, with about 1 per cent. of free lime, derived from the carbonate contained in the horns. Calcined bone is usually sold in the shops for burnt hartshorn. For the chemical characters of bone-phosphate of calcium, see *Calcii Phosphas Præcipitata.*

Medical Properties and Uses. The opinion formerly entertained, that burnt hartshorn was antacid, has been abandoned since the discovery of its chemical nature. Its composition suggested its application to the cure of rachitis and mollities ossium, of which the prominent character is a deficiency of phosphate of calcium in the bones; and it is said to have been employed in some cases, in connection with phosphate of sodium, with apparent success. It is probably, however, inert. The dose is twenty grains or more. The jelly prepared from the shavings of hartshorn has been thought to possess medical virtues; but it is only nutritive and demulcent, and is in no respect superior to calf's-foot jelly. The shavings were formerly used in making Pulvis Antimonialis. W.

HEDERA HELIX. *Ivy.* This well-known evergreen creeper is a native of Europe.

The fresh *leaves* have a balsamic odour, especially when rubbed, and a bitterish, harsh, unpleasant taste. They are used for dressing issues, and, in the form of decoction, have been recommended in sanious ulcers and cutaneous eruptions, particularly tetter and the itch. Dried and powdered, they have been employed in the atrophy of children, and in complaints of the lungs, in the dose of a scruple or more. The *berries*, which have an acidulous, resinous, somewhat pungent taste, are said to be purgative and even emetic. MM. Vandamme and Chevallier discovered in ivy seeds a peculiar alkaline principle, which they called *hederin* (*hederia*). It is very bitter, and appears to be closely allied to quinia in febrifuge properties. It is obtained by treating the seeds with hydrate of lime, dissolving the precipitated alkaloid in boiling alcohol, and evaporating the alcoholic solution. (*Am. Journ. of Pharm.*, xiii. 172.) Prof. Posselt has discovered two acids in the seeds, one of which has their taste in a high degree, and was named by him *hederic acid*, the other he did not obtain quite pure. (See *Chem. Gaz.*, March 1, 1849, p. 93.) Dr. F. A. Hartsen has found in the leaves a crystalline glucoside allied to saponin. (*Am. Journ. of Pharm.*, 1875, xlvii. 268.) From the trunks of old ivy plants, growing in the South of Europe and the North of Africa, a resinous substance exudes through incisions in the bark, which has been employed in medicine under the name of *ivy gum*. It is in pieces of various sizes, of a dark yellowish-brown colour, sometimes inclining to orange, more or less transparent, sometimes of a deep ruby-red colour internally, of a vitreous fracture, pulverizable, yielding a lively orange-yellow powder, of a peculiar not disagreeable odour when heated or inflamed, and of a bitterish resinous taste. Its chief constituent is resin, though some pieces contain a considerable proportion of bassorin, and others large quantities of ligneous matter. It was formerly used as a stimulant and emmenagogue, but is now scarcely employed. Placed in the cavities of carious teeth, it is said to relieve toothache. The *wood* of the ivy, which is light and porous, is sometimes used for making *issue-peas*. W.

HELENIUM AUTUMNALE. *False Sunflower. Sneezewort.* An indigenous perennial herb, from three to seven feet high, with large, golden-yellow compound flowers, which appear in August. It grows in all parts of the United States, flourishing best in meadows, moist fields, and other low grounds. All parts of it are bitter, and somewhat acrid, and, when snuffed up the nostrils in the state of powder, produce violent sneezing. The leaves and flowers have been recommended as an excellent errhine. Clayton says that the plant is thought to be useful in intermittent fever. W.

HELENIUM TENNIFOLIUM. A common roadside weed, in Mississippi and Louisiana, which is stated by Dr. Galloway to be very poisonous, producing in animals muscular twitchings, passing into violent convulsions, terminating in death. In four negroes it produced spasms, with more or less delirium and loss of consciousness. (*Am. Journ. of Pharm.*, 1872, p. 309.) H. C. W.

HELIANTHUS ANNUUS. *Common Sunflower.* This very large composite is cultivated in this country, Europe, and especially in China, chiefly for the sake of the fixed oil yielded by the seed. This, when pure, is nearly free from flavour, and is said to make an excellent salad dressing, and to be one of the best burning oils known. The increase in cultivation is stated to be nearly a thousand-fold, 275 pounds of oil being a fair yield per acre. For particulars as to cultivation, see *Am. Journ. of Pharm.*, 1875, p. 460. The stalk, when treated as is flax, yields a long, fine fibre, which is said to be used in China for the adulteration of silk. The sunflower also enjoys the reputation of protecting against marsh miasmata. It is related that a malarious locality in Belgium on the Scheldt has by its planting been rendered healthy. (*N. Y. Med. Rec.*, Oct. 1868, p. 353.) M. Chardon has obtained a small quantity of a peculiar oleoresin from sunflowers grown in Algeria. (*Pharm. Journ. and Trans.*, Oct. 1873, p. 323.) H. C. W.

HELLEBORUS FŒTIDUS. *Bear's Foot.* This is a perennial European plant, growing in shady places, and flowering in March and April. It derived its specific name from its offensive odour. The leaves, which are the part used, have a bitterish, pungent, and acrid taste, and when chewed excoriate the mouth. The footstalks are still more acrid. Marmé and Husemann have discovered the same active principles in this as in the other species of Helleborus. (See *Part* I., p. 467.) This species of hellebore is said by Allioni to be the most acrid and energetic of the plants belonging to the genus. It is powerfully emetic and cathartic, and in very large doses produces dangerous effects. It has long been used in Great Britain as a domestic remedy for worms, and was brought to the notice of the profession by Dr. Bissett, who found it an efficacious anthelmintic, and prescribed it also in asthma, hysteria, and hypochondriasis. M. Decerfs has known it to cause the expulsion of tænia. It is given in powder or decoction. The dose for a child from two to six years old is from five grains to a scruple of the dried leaves, or a fluidounce of the decoction, made by boiling a drachm of the dried leaves in half a pint of water. This quantity should be repeated, morning and night, for two or three days in succession. A syrup made from the juice of the green leaves is used in England. W.

HELONIAS DIOICA. *False Unicorn Plant. Starwort.* This is a small perennial herbaceous plant, growing in most parts of the United States, in shady and hilly situations. The root, which is the part used, is bulbous. Pursh says that it is used as a

remedy in colic. Dr. Braman has found it peculiarly efficacious in atony of the generative organs, and has obtained great advantages from it in leucorrhœa. He states the dose of the powdered root at a drachm and a half three times a day. It may also be given in the forms of syrup and tincture. (*Bost. Med. and Surg. Journ.*, xl. 416.) W.

HERACLEUM LANATUM. (Michaux, *Flor. Boreal. Am.* i. 166.) *Masterwort.* This is one of our largest indigenous umbelliferous plants. It belongs to Pentandria Digynia in the Linnæan system, with the following generic character. "*Fruit*, elliptical, emarginate, compressed, striated, margined. *Corolla* difform, inflexed, emarginate. *Involucre* caducous." (*Willd.*) The root is perennial, sending up annually a hollow pubescent stem, from three to five feet high, and often more than an inch thick. The leaves are ternate, downy beneath, and supported on downy footstalks; the leaflets petiolate, roundish-cordate, and lobed. The flowers are white, in large umbels, and followed by orbicular seeds. Like the European species this is sometimes called *cow parsnep*. It grows in meadows and along fences and hedges, from Canada to Pennsylvania, and flowers in June. The root, which is the part used, bears some resemblance to that of common parsley. It has a strong disagreeable odour, and a very acrid taste. Both the leaves and root excite redness and inflammation when applied to the skin. Dr. Bigelow considers the plant poisonous, and advises caution in its use, especially when it is gathered from a damp situation. Masterwort appears to be somewhat stimulant and carminative, and was used successfully by Dr. Orne, of Salem, Massachusetts, in cases of epilepsy, attended with flatulence and gastric disorder. He directed two or three drachms of the pulverized root to be taken daily, for a long time, and a strong infusion of the leaves to be drunk at bedtime. W.

HERMODACTYLS. *Hermodactyli.* Under this name are sold in the shops of Europe the roots or bulbs of an uncertain plant, growing in the countries about the eastern extremity of the Mediterranean. By some botanists the plant is thought to be a *Colchicum;* and *C. variegatum*, a native of the South of Europe and the Levant, is particularly indicated by Fée, Geiger, and others; while by authors no less eminent, the roots are confidently referred to *Iris tuberosa*. They certainly bear a considerable resemblance to the bulb of Colchicum autumnale, being heart-shaped, channeled on one side, convex on the other, and from half an inch to an inch in length, by nearly as much in breadth. As found in the shops, they are destitute of the outer coat, of a dirty yellowish or brownish colour externally, white and amylaceous within, inodorous and nearly tasteless, though sometimes slightly acrid. They are often worm-eaten. Their chief constituent is starch, and they contain no veratria or colchicia. From this latter circumstance, and from their insipidity, it has been inferred that they are probably not derived from a species of Colchicum; but Geiger observes that they may have lost their acrimony by age. They are in fact almost without action upon the system, and are now seldom used; never, we believe, in this country. It is doubted whether they are the *hermodactyli* of the ancients, which were certainly a powerful medicine, operating very much in the same manner as our colchicum, and like it proving useful in gout and rheumatism. Pereira describes a bitter variety of hermodactyls, which was brought from India by Dr. Royle. The bulbs are smaller and darker than the others, and have externally a striped or reticulated appearance. From their bitter taste they are probably more active. W.

HERNIARIA GLABRU. M. Goblez has obtained from this plant a crystalline principle, which he calls *Herniarine*. (*Journ. de Pharm.*, 4e sér., xx. 270.) H. C. W.

HIBISCUS ABELMOSCHUS. *Abelmoschus moschatus.* Wight and Arnott. An evergreen shrub, growing in Egypt, and in the East and West Indies, and yielding the seeds known under the names of *semen Abelmoschi*, *alceæ Ægyptiacæ*, and *grana moschata*. These are of about the same size as flaxseed, kidney-shaped, striated, of a grayish-brown colour, of an odour like that of musk, and of a warm somewhat spicy taste. They were formerly considered stimulant and antispasmodic; but are now used only in perfumery. The Arabs flavour their coffee with them. They are said to be employed in the adulteration of musk. Another species, *Hibiscus esculentus*, or *Abelmoschus esculentus*, of Wight and Arnott, is cultivated under the name of *okra*, *bendee*, or *gombo* in various parts of the world, for the sake of its fruit, which abounds in mucilage, to which the name of *gombine* has been given, and is used for thickening soup. The leaves are sometimes employed for preparing emollient poultices. The roots, which are a foot or two long, are said also to abound in mucilage, of which they yield twice as much as the althæa root from the same weight, free from any unpleasant odour. Their powder is perfectly white, and superior also to that of the marshmallow. The plant is largely cultivated near Constantinople, where it is much used as a demulcent. (*Am. Journ. of Pharm.*, May, 1860, p. 224.) The bark is also used in making paper and cordage. W.

HIERACIUM VENOSUM. *Rattlesnake Weed.* (*Gray's Manual*, p. 237.) The plants belonging to the genus *Hieracium* are generally called *hawkweed;* but the H. venosum has been distinguished by a special name, derived from its supposed efficiency as an antidote to the bite of the rattlesnake. They are all perennial herbs belonging to the natural family of the Compositæ. The rattlesnake weed has a smooth slender flower-

stem, one or two feet high, either naked or furnished with but a single leaf, and dividing at top into a loose spreading corymb of yellow flowers. The plant is common, growing in dry places and open woods, in most of the eastern and northern parts of the United States. The leaves and root are thought to possess medical virtues, and, being deemed astringent, have been used in hemorrhagic diseases. The juice is supposed by some to have the power of removing warts. The medicine may be given in infusion, made in the proportion of two ounces to the pint, of which the dose is a wineglassful. W.

HOG-GUM. GUM-HOGG. Under the latter of these names, a product was sent us from the establishment of J. B. Lippincott & Co., with the information that it filled a somewhat important part in one of the processes connected with the preparation of books. It is in lumps in various sizes, from that of a chestnut to that of a walnut or larger, of an extremely irregular shape, often much contorted, appearing frequently as if consisting of several pieces which had become agglutinated in their soft state, translucent and nearly colourless, with a slight reddish-yellow tint in some pieces, of a rather dull though somewhat shining surface, very hard, brittle with a glassy fracture, inodorous, and nearly or quite tasteless. With water it swells up into a soft transparent mass, which retains this condition long without change, and, if now stirred, instead of forming a consistent mucilage, breaks up into minute, irregular, transparent fragments, which retain this form indefinitely. At our request it was examined chemically by Prof. Procter, who found a small portion of it soluble in water, the remainder swelling up as just stated; and the solution was precipitated by subacetate of lead, showing an analogy with gum, but differing from gum arabic in not giving a precipitate with oxalate of ammonium. Boiling water does not dissolve the jelly formed with it by cold water; but it is dissolved and slightly discoloured by sulphuric acid, and, boiled with diluted sulphuric acid, appears to be changed into soluble gum. The decoction of the jelly, cooled, is not affected with solution of iodine. The insoluble jelly-like portion appears to approach more nearly to bassorin than any other known substance; agreeing with that principle in not forming an adhesive mucilage; and the drug might almost be considered as a sample of *Bassora gum*, but that it differs in shape from any specimens of that gum that we have seen.

Both its geographical and botanical sources are uncertain; but we were informed that it was purchased of the East India importing merchants, and was supposed to be derived from that part of the world. From the similarity of name, it would seem probable that it might be the same substance referred to by Guibourt and other writers under the name of *hog-gum*, or *doctor-gum*, and said to be derived from the Rhus Metopium, of Linnæus, a small tree or shrub growing in the Island of Jamaica. The gum flows from incisions in the bark, and is called a gum-resin by Guibourt, who states that it has a bitter taste. (*Drogues Simples*, 4e ed., iii. 451.) Dr. Griffith, in his *Medical Botany*, ascribes to it emetic properties in large doses. Dr. James Macfadyen, however, in his *Flora of Jamaica* (p. 139), denies this origin of the hog-gum, stating that Sloane had erroneously referred it to *Rhus Metopium*, and had been followed by Brown and others. According to Dr. Macfadyen, the gum is obtained from the *Moronobea coccinea* of Aublet (Guiana, ii. 789, t. 313) by wounding the bark. On hardening after exudation, it is yellow, hard, and friable, somewhat resembling Burgundy pitch. It has a slightly aromatic odour, is insipid, softens under the teeth, and melts in the flame of a candle. It derives the name of hog-gum from the fact that hogs, when wounded, rub themselves against the tree so as to cover the wound with the juice. This product is obviously a resinous substance, and has no resemblance whatever to the gum in question except the similarity in name. Hog-gum is employed in Jamaica, in the form of ointment, mixed with lard, wax, and rosin, and used for the same purposes as Burgundy pitch.

To return to *gum-hogg*, its main use, so far as we know, is to form, in its gelatinous state, a smooth, soft, yet sufficiently firm surface, well adapted to receive and impart colour in the process of marbling paper, for which it is better adapted than any other known product.

After the foregoing account was put into type, we received information which induces us to believe that this drug is really a variety of *Bassora gum*, imported originally from the Gulf of Persia, in the expectation that it might be sold as a substitute for tragacanth. But, having proved on trial wholly unfit for the ordinary purposes of that drug, it was submitted to a chemical examination, in the hope that it might be found applicable to some useful purpose; and this examination having resulted in the discovery of its extraordinary adaptability to the marbling of paper, gave it an unexpected value, which led to a considerable commercial demand. How it happened to receive the name of Gum-hogg, by which it is exclusively known in trade, has not been satisfactorily explained. W.

HURA BRASILIENSIS. *Assacou.* Hura Brasiliensis of Martius, is a Brazilian tree belonging to the family of Euphorbiaceæ, and known to the natives of the country it inhabits by the name of *assacou*. Another species of the same genus, *H. crepitans*, growing in the West Indies, and characterized by the tendency of its fruit to break when ripe with violence into several pieces, and thus scatter the seeds, has long been known as an

acrid emeto-cathartic, capable in large doses of acting as a violent poison. The fresh juice, the seeds, and a decoction of the bark, all have these properties, which, in fact, belong in a greater or less degree to most of the Euphorbiaceæ; and, as in other members of the same family, an oil expressed from the seeds is actively purgative. It is highly probable that the Hura Brasiliensis is similar in all these respects to its congener. Martius states that the juice is anthelmintic, and employed to intoxicate fish. But attention has recently been especially attracted to the plant, in consequence of reports favourable to its efficacy in that terrible scourge of Brazil, the elephantiasis or leprosy of the country. These reports were received by the Academy of Medicine, of Paris, from the French Consul in one of the towns of Para, of which province the natives are said to regard the remedy as a specific in the complaint referred to. Experiments have been made by the Brazilian physicians, and it is said with favourable results, though complete cures have not been obtained. The fact is that various acrid emeto-cathartic medicines, capable also of producing diaphoresis, have been more or less useful in elephantiasis, as the Calotropis gigantea, and one or more species of Ionidium; and it is probable that the assaceu acts in a similar manner, and with similar results. The milky juice of the plant, and an infusion or decoction of the bark are used. The juice is extremely acrid, producing on the skin, when applied to it, an erysipelatous redness and a pustular eruption; and the natives are said to employ it in the preparation of a poison. A grain of the juice made into a pill, or a scruple of the bark infused in a pint of water, is given every day, and gradually increased as the stomach and bowels will bear it. Every week an emetic preparation is administered, made by boiling half an ounce of the bark in a pint of water to half a pint, to which twelve drops of the juice are added. Every second or third day the patient takes a bath, consisting of a saturated infusion of the bark. (*Journ. de Pharm.*, xiv. 424.) W.

HYDRANGEA ARBORESCENS. *Common Hydrangea. Seven Barks.* This species of Hydrangea is indigenous, growing in shady places, in the woods and on the banks of streams throughout the Middle and Southern States. It is a shrub from four to eight feet high, with ovate or cordate leaves, from three to six inches long, generally acuminate, serrately toothed, and slightly pubescent, or nearly glabrous. The flowers are in fastigate cymes, and appear in July. For a particular botanical description of the plant, the reader is referred to Torrey and Gray's *Flora of North America* (i. 591). The root, which is the part used, consists of a caudex, from which proceed numerous radicles, from the thickness of a quill to that of a finger or more. For use it should be cut into transverse pieces when fresh, and then dried. The taste is aromatic, pungent, and not unpleasant. The root was analyzed by Mr. Laidley, of Richmond, Va., who found in it gum, albumen, starch, resin, and various salts, among which was a protosalt of iron. (*Am. Journ. of Pharm.*, xxiv. 20.) Attention was first called to it as a remedy in the *New Jersey Medical Reporter* for Oct. 1850 (p. 44), by Dr. S. W. Butler, whose father, Dr. E. Butler, long residing as a missionary among the Cherokee Indians, employed it with great apparent advantage in their calculous complaints. Reports of cases, tending to confirm the opinion of its utility in "sabulous or gravelly deposits" in the urine, have since been published by Drs. W. L. Atlee, D. Horsley, and John C. S. Monkur. (*Ibid.*, Sept. 1854, pp. 393 and 416, Oct. 1854, p. 426, and March, 1855, p. 115.) Dr. Butler used it in the form of decoction, or of a syrup made from the decoction with sugar or honey. A strong syrup may be given in the dose of a teaspoonful three times a day. In overdoses it occasions vertigo, oppression of the chest, &c. W.

HYDRIDES, ORGANIC. In the *Medical Times and Gaz.*, 1871, vol. ii. 403, 490, Dr. B. W. Richardson published an elaborate research upon the physiological action of these bodies. For want of space we can here only refer to his paper. H. C. W.

HYDRIODIC ACID, DILUTE. *Acidum Hydriodicum Dilutum.* This preparation was introduced into the U. S. Pharmacopœia in 1860 and dismissed in 1870. The officinal formula was as follows. "Take of Iodine, in fine powder, *a troyounce;* Distilled Water *a sufficient quantity.* Mix thirty grains of the Iodine with five fluidounces of Distilled Water in a tall glass-stoppered bottle, having the capacity of half a pint, and pass into the mixture hydrosulphuric acid gas until the colour of the Iodine entirely disappears, and a turbid liquid remains. Detach the bottle from the apparatus employed for introducing the gas, and gradually add the remainder of the Iodine, stirring at the same time. Then reattach the bottle, and again pass the gas until the liquid becomes colourless. Decant the liquid into a small matrass which it is nearly sufficient to fill, boil it until it ceases to emit the odour of hydrosulphuric acid, and filter through paper. Then pass sufficient Distilled Water through the filter to bring the filtered liquid to the measure of six fluidounces. Lastly, keep the liquid in a well-stopped bottle. The hydrosulphuric acid gas, required in this process, may be obtained by mixing, in a suitable apparatus, *a troyounce and a half* of sulphuret of iron, *two troyounces* of sulphuric acid, and *six fluidounces* of water." *U. S.*

The process consists essentially in passing hydrosulphuric acid (sulphuretted hydrogen) through water in which iodine is suspended. The rationale is extremely simple. The operation takes place between single equivalents of the several elements concerned. One

eq. of the hydrogen of the hydrosulphuric acid unites with one of iodine to form hydriodic acid (HI), while the eq. of sulphur with which it was combined is isolated, and, being insoluble, renders the liquid turbid. The iodine is known to have been all combined by the disappearance of the colour. An excess of hydrosulphuric acid is of no disservice, as it is driven off by the boiling. By filtration the liberated sulphur is separated, and the clear diluted hydriodic acid remains. By taking fixed proportions of iodine and water, an acid of the desired strength is secured.

In its pure state hydriodic acid is in the form of a gas, which fumes in the air, is colourless, and has an odour not unlike that of hydrochloric acid. It has a strong affinity for water, which, when saturated with it, forms liquid hydriodic acid. This has the sp. gr. 1·7, boils at 260° F., and may be distilled.

The diluted acid, as prepared by the former U. S. process, is colourless when recently prepared, of a sour taste, and of the sp. gr. 1·112. When exposed to the air it gradually darkens, in consequence of the separation of iodine, of which it acquires the characteristic odour. It is more rapidly decomposed, with the same result, by chlorine, by nitric, sulphuric, iodic, and sulphurous acids, and by protosulphate of iron. Mr. John A. Dunn has found that this change is prevented by the addition of one-third of a grain of crystallized hyposulphite of sodium to a fluidounce. (*Am. Journ. of Pharm.*, Jan. 1869, p. 42.)

Diluted hydriodic acid was introduced into use as a medicine by Dr. Andrew Buchanan, of Glasgow, under the impression, that it is by passing into this form that iodine, when taken internally, is absorbed, and enters the circulation. He believed it capable of producing all the effects of that element on the system, while it is less unpleasant to the taste, and less apt to offend the stomach. Dr. Buchanan used an extemporaneous formula, which consisted in dissolving 330 grains of iodide of potassium and 264 of tartaric acid, each in one and a half fluidounces of water, mixing the solutions, filtering to separate the bitartrate of potassium formed, and finally adding sufficient distilled water to make the solution measure fifty fluidrachms. Each fluidrachm of this preparation contained five grains of iodine. Beginning with a few drops, he gradually increased to a fluidrachm, and finally even half a fluidounce or a fluidounce three times a day.* The officinal acid contains ten grains of iodine in each fluidrachm, and is therefore twice as strong as Dr. Buchanan's solution. There can be little doubt that hydriodic acid is capable of producing the alterative effects of iodine; and it may be given in all cases to which that medicine is applicable. The dose may be half a fluidrachm three times a day, diluted with water. When the solution becomes discoloured it may be irritant through the liberated iodine; but this effect may be obviated by exhibiting it in any amylaceous liquid, as barley-water. W.

HYDRIODIC ETHER. *Æther Hydriodicus. Iodide of Ethyl.* This ether may be obtained by gradually and cautiously mixing five parts of alcohol, ten of iodine, and one of phosphorus, and distilling. The residue of the distillation, as ascertained by D. K. Tuttle, is phosphovinic acid. The best mode of proceeding, in order to avoid danger, according to Soubeiran, is to melt the phosphorus with a gentle heat under the alcohol, contained in a wide-mouthed matrass, and to add the iodine gradually through a tube, sealed at the lower end, but perforated at the same end with a number of small holes. The tube is made to pass through a grooved cork, to give exit to the vapours, and is so adjusted as to reach nearly to the surface of the melted phosphorus. The matter in the matrass is distilled to the extent of four-fifths, the distillate is washed with water to separate alcohol, and the decanted ether is dried by the addition of a few pieces of chloride of calcium. Dr. de Vrij recommends the following method for procuring this ether on a large scale. Absolute alcohol is to be saturated with dry muriatic acid gas, the liquid being kept well cooled; and the amount of the acid is to be determined by a sample. The liquid thus saturated is to be put into a retort with as much iodide of potassium as may be necessary to form chloride of potassium; the mixture is to stand for a day; and is then to be submitted to distillation. Finally, the ether which comes over is to be washed and rectified. (See *Am. Journ. of Pharm.*, March, 1859, p. 170.) Hydriodic ether is a colourless non-inflammable liquid, insoluble in water, with a penetrating ethereal odour and pungent taste. Its density is 1·92, and boiling point 158°. Exposed to the air it becomes red from the liberation of iodine, a change which is prevented by adding to the bottle containing it a globule of mercury. Being an iodide of ethyl, its formula is C_4H_5I. M. Huette has proposed this ether as a medicine, to be used by inhalation, placed under a layer of water. Fifteen or twenty inspirations suffice to impregnate the system with iodine. Its physiological effects appear to be those of an antispasmodic and general stimulant. It acts also as a powerful anæsthetic, when sufficiently long inhaled. It increases the appetite, renders the pulse fuller, and gives vivacity to the feelings and activity to the intellect. M. Huette considers it a suitable preparation for bringing the

* Mr. John A. Dunn, of Brooklyn, proposes the following modification of Dr. Buchanan's process, for which he claims the advantage that the preparation is much less disposed to deposit bitartrate of potassium on standing, while it has the officinal strength. Take of Iodide of Potassium 209¾ grains; Tartaric Acid, in crystals, 190¾ grains. Dissolve the Iodide in three fluidrachms of distilled water, and the Acid in the same quantity, and filter if necessary; mix the solutions, set the mixture in ice-cold water, and allow it to stand for one hour; then filter, and make up the measure to two fluidounces. Each fluidrachm represents 10 grains of iodine. (*Am. Journ. of Pharm.*, Jan. 1869, p. 41.)—*Note to the thirteenth edition.*

system rapidly under the influence of iodine, and by any desired dose. (See *Am. Journ. of Pharm.*, xxiii. 156.) Since the therapeutic trials of M. Huette were made, Mr. James Turnbull, of Liverpool, and Dr. Henry Fisher, of New York, have used this ether by inhalation in chronic pulmonary diseases with satisfactory results. Dr. Fisher specifies chronic bronchitis and phthisis as the diseases in which he has found it useful. The dose is 15 drops, three or four times a day, inhaled from a handkerchief. Hydriodic ether often has an unpleasant smell from the presence of foreign substances, which render it offensive to patients. Phosphorus is a common and injurious impurity. B.

HYDROCOTYLE ASIATICA. *Thick-leaved Pennywort. Bevilacqua.* Boileau. This is a small umbelliferous plant, with a trailing stem, and, from the shape of its leaves, bearing some resemblance to the violet. It grows in moist grounds in India, Southern Africa, and the islands of the Indian Ocean. It has long been ranked among the medicinal plants of India, where it has been used as an alterative to purify the blood. An elaborate analysis has been made of it by M. Jules Lépine, who discovered in it a peculiar oleaginous substance which he calls *vellarine*, and in which he supposes the active properties to reside. It has a strong odour recalling that of the plant, and a bitter, pungent, and persistent taste. (*Journ. de Pharm.*, Juillet, 1855, p. 49.)

The plant has been supposed to possess diuretic properties; and, according to Ainslie, is employed in infusion with fenugreek in fever and bowel complaints. But it has recently attracted attention, from the claims strongly urged in its favour as a remedy in that most obstinate affection often called leprosy, but more correctly elephantiasis of the Greeks. It was first employed in this complaint by Dr. Boileau, of the Island of Mauritius, who was himself a victim of the disease, and had resorted to this remedy under the false impression that it might be identical or analogous with the *cuichunchulli*. He was so much pleased with its effects that he was induced to try it upon others; and a great many lepers were put under its influence. All the cases were arrested, many were benefited, and in some the disease almost disappeared. The statements of Dr. Boileau have been supported by those of M. Lépine, of Pondicherry, and the medicine would certainly seem to merit a thorough investigation. Dr. Boileau, probably at first in ignorance of its botanical title, gave it the name of *bevilacqua*. He used it in powder, infusion, and syrup. An ounce of the dried plant may be given daily, in the form of infusion made with a pint of water. This should be continued for several weeks, combined with baths, and attention to the state of the bowels. After this preparation, the syrup is to be given in spoonful doses three times a day, to be gradually increased after three weeks, if no improvement has taken place, to eight spoonfuls daily. The powder may be added to the syrup, if deemed necessary, in the dose at first of fifteen grains, to be increased cautiously to a drachm. (*Journ. de Pharm.*, 3e sér., xxiv. 424, and xxv. 153.) This account of the remedy has been in some measure confirmed by the testimony of Mr. E. J. Waring, *of the Madras Medical Service*, and Dr. Hunter, who have found it especially useful in secondary syphilis and scrofulous ulcers. (*Pharm. Journ.*, Aug. 1860, p. 143.) M. Lecocq, however, has been led by his experience and observation to the conclusion, that no sufficient evidence exists of any case of leprosy cured by it, and that it is equally inefficient in other skin diseases. (*Ann. de Thérap.*, 1859, p. 79.) W.

HYDROCYANIC ETHER. *Æther Hydrocyanicus. Hydrocyanate of Ethylen. Cyanide of Ethyl. Cyanuret of Ethyl.* This ether was discovered by Pelouze. It is formed by distilling a mixture of sulphovinate of barium and cyanide of potassium. It is a colourless liquid, of a penetrating garlicky odour, soluble in alcohol and ether, sparingly soluble in water, boiling at 180°, and weighing specifically 0·78. It is very poisonous, but less so than hydrocyanic acid, with which it agrees in therapeutic action and dose. B.

HYDROSULPHATE OF AMMONIUM, SOLUTION OF. AMMONIÆ HYDROSULPHURETUM. *Dub. Solution of Sulphide of Ammonium.* Br. Appendix. This former officinal of the Dublin Pharmacopœia was prepared in the following manner. "Take of Solution of Ammonia *four fluidounces* [Imperial measure]; Sulphuret of Iron *one ounce and a half* [avoirdupois]; Oil of Vitriol of Commerce *one fluidounce and a half* [Imp. meas.]; Water *fifteen ounces* [avoird.]; Distilled Water *two ounces* [avoird.]. Place the Sulphuret of Iron and Water in a two-necked bottle, and, adding the Oil of Vitriol by degrees through a safety funnel, conduct by suitable tubes the sulphuretted hydrogen which is disengaged, first through the Distilled Water placed in a small intermediate vial, and then to the bottom of a bottle containing the Ammonia, the neck of the latter, through which the glass tube conveying the gas passes, being loosely plugged with tow. If, when the development of gas has ceased, a drop of the ammoniacal liquid, added to a saturated solution of sulphate of magnesium, gives no precipitate, the preparation is completed; but, should a precipitate occur, the hydrosulphuret still contains free ammonia, and must, therefore, be again subjected to the action of a stream of sulphuretted hydrogen. The Hydrosulphuret of Ammonium must be kept in a green glass bottle, furnished with an accurately ground stopper. The specific gravity of this solution is 0·999" (*Dub.*). This preparation is a solution of bihydrosulphate of ammonium in water, and is formed by passing a stream of hydrosulphuric acid gas (sulphuretted hydrogen) through water of ammonia, contained in a Woulfe's bottle. Considered as a byhydro-

sulphate, its formula is $NH_3,2HS$; but it is probably a sulphosalt, with the formula NH_4S,HS, and was so considered in the original British Pharmacopœia, where it held a place among the test solutions in the Appendix. In the present Pharmacopœia it is called sulphide of ammonium, without a formula. The hydrosulphuric acid is obtained by acting with dilute sulphuric acid on sulphuret of iron. The water yields its oxygen to the iron forming protoxide of iron, with which the sulphuric acid combines; while the hydrogen of the water, uniting with the sulphur, generates hydrosulphuric acid.

Mr. Spence proposes a cheap method of preparing hydrosulphate of ammonium, should this ever come largely into demand. It consists simply in passing vapour through a mixture of sulphate or chloride of ammonium with twice its weight of oxysulphate of calcium, or the refuse lime of the process for purifying gas, and to receive the volatile product in an apparatus for condensation. The result is hydrosulphate of ammonium, or sulphuret of ammonium. The author of this plan has had the opportunity of learning that the vapours of this salt are highly noxious; a workman having become asphyxiated by them, and been recalled to life with great difficulty. (*Journ. de Pharm.*, Juillet, 1867, p. 73; from *Polytec. Journ.*, clxxiii. 308.)

Hydrosulphuret of ammonium is a liquid of a greenish-yellow colour, very fetid smell, and acrid, disagreeable taste. It is characterized by giving coloured precipitates with neutral metallic solutions, for which it is much used as a test. It is decomposed by acids, which cause the escape of hydrosulphuric acid with effervescence, and the deposition of sulphur. This preparation is sedative, lessening the action of the heart in a remarkable degree, and producing, when given in large doses, nausea, vomiting, vertigo, and drowsiness. It was proposed as a remedy in diabetes mellitus, by Dr. Cruickshank, for the purpose of lessening the morbid appetite in that disease, and has been employed by Dr. Rollo and others. The dose is five or six drops in a tumblerful of water three or four times a day, to be gradually increased until giddiness is produced. B.

HYPERICUM PERFORATUM. *St. John's Wort.* A perennia herb, abundant both in Europe and this country, often covering whole fields, and proving extremely troublesome to farmers. It is usually from one to two feet high, with leaves which, from the presence of numerous transparent vesicles, appear as if perforated, and have hence given origin to the botanical designation of the plant. The flowers, which are numerous and of a deep-yellow colour, appear during the summer from June to August. The flowering summits are the parts used, though the unripe capsules are possessed of the virtues of the plant in an equal degree, and the seeds are said to be even stronger. St. John's wort has a peculiar balsamic odour, which is rendered more sensible by rubbing or bruising the plant. Its taste is bitter, resinous, and somewhat astringent. It imparts a yellow colour to cold water, and reddens alcohol and the fixed oils. Its chief constituents are volatile oil, a resinous substance, tannin, and colouring matter. As a medicine it was in high repute among the ancients, and the earlier modern physicians. Among the complaints for which it was used were hysteria, mania, intermittent fever, dysentery, gravel, hemorrhages, pectoral complaints, worms, and jaundice; but it was, perhaps, most highly esteemed as a remedy in wounds and bruises, for which it was employed both internally and externally. It is difficult to ascertain its exact value as a remedy; but, from its sensible properties, and from the character of the complaints in which it has been thought useful, it may be considered, independently of its astringency, as somewhat analogous in medical power to the turpentines. It formerly enjoyed great reputation for the cure of demoniacs; and the superstition still lingers among the vulgar in some countries. At present the plant is scarcely used except as a domestic remedy. The summits were given in the dose of two drachms or more. A preparation was at one time officinal, under the name of *oleum hyperici*, made by treating them with a fixed oil. It has a red colour, and is still used in many families as a sovereign remedy for bruises. It is commonly called *red oil.* W.

HYPOSULPHITE OF CALCIUM. *Calcii Hyposulphis.* Under the head of *Sodii Hyposulphis*, page 859, reference is made to hyposulphite of calcium, as possessing, with other hyposulphites, useful properties in the destruction of the lower forms of animal and vegetable life, by which the human system is often seriously infested; and the hope is even indulged that it may become a most useful agent in the prevention and relief of a class of diseases depending on infection of the blood. The following mode of preparing it is recommended by M. J. Lanceau, of Paris. Take 1000 parts of sulphur, 400 of lime, and 4000 of rain-water; slake the lime with sufficient of the water, add the sulphur and the residue of the water, and boil for an hour and a half, adding water to keep up the measure; when cool filter the liquid through linen covered with filtering paper; and wash the residue with 1000 parts of water. A solution is thus obtained of polysulphuret of calcium of the sp. gr. 1·141. Into this pass a current of washed sulphurous acid gas until the solution becomes colourless; separate the sulphur precipitated (which may be used for the officinal *Precipitated Sulphur*); and evaporate the clear solution at a heat not exceeding 140° F., until it begins to crystallize, when it is to be set aside. The product is 700 parts of hyposulphite of calcium. This is in six-sided crystals, which effloresce in a dry air. M. Lanceau prepares a syrup of the hyposulphite by dissolving 10 parts of the

crystallized salt in 20 parts of distilled water, and mixing with the solution 170 parts of syrup of orange flowers. (See *Am. Journ. of Pharm.*, May, 1863, p. 223.) The dose of the salt is from ten to twenty grains three times a day, of the syrup from two to four fluidrachms.

Of the *hyposulphites*, generally, it may be said that they closely resemble the sulphites in medical properties, and may be employed as substitutes for those salts, over which they have the advantage of greater stability, passing less readily into sulphates on contact with the air. They may be prepared by boiling a sulphite or bisulphite for some time with sulphur. They are very soluble in water, and are recognised by the precipitation of sulphur when decomposed by an acid. W.

HYPOSULPHITE OF SODIUM AND SILVER. *Sodii et Argenti Hyposulphis.* This double salt may be prepared by dissolving freshly precipitated oxide of silver in a solution of hyposulphite of sodium, and evaporating the solution. It is in the form of minute crystals, very soluble in water, but insoluble in alcohol, and possessing a very sweet taste. Its solution, protected from the light, undergoes no change, and, when quite pure, does not discolour the skin or linen. M. Delioux, of Rochefort, has tried this salt externally only, and thinks it acts like nitrate of silver, but more mildly. He used it with advantage, especially in urethral discharges, dissolved in the proportion of one or two parts in two hundred of water. (*B. and F. Medico-chir. Rev.*, Am. ed., April, 1853, p. 447; from the *Bulletin de Thérap.*) B.

HYRACEUM. This is the product of *Hyrax Capensis*, an animal of South Africa, about the size of a large rabbit. It is said to be collected in small pieces on the rugged sides of mountains, and is probably the excrement of the animal. It is rather hard, tenacious, of a blackish-brown colour, and in taste and smell not unlike castor. It is inflammable, and yields portions of its constituents to water and alcohol. Examined with the microscope, it has been found to contain vegetable tissues, animal hair, sand, and globular particles, either resinous or oily. Schrader has found it to contain stearin, a gum-resin soluble in absolute alcohol, an odorous yellow substance soluble in ordinary alcohol and in water, a brown substance soluble in water, and insoluble residue. Dr. Pereira, from whose paper the above account is extracted, considered it worthless as a therapeutical agent, though in physiological effects it is said exactly to resemble American castor. (*Pharm. Journ.*, x. 123.) For an elaborate paper on this substance by M. J. Léon Soubeiran, see *Journ. de Pharm.* (xxix. 378). W.

HYSSOPUS OFFICINALIS. *Hyssop.* This is a labiate plant, perennial, with numerous erect, quadrangular, somewhat branching stems, which are woody in their interior portion, about two feet high, and furnished with opposite, sessile, lanceolate-linear, pointed, punctate leaves. The flowers are violet-coloured or blue, sometimes white, turned chiefly to one side, and arranged in half verticillated, terminal leafy spikes. The upper lip of the corolla is roundish and notched at the apex, the lower is divided into three segments, of which the undermost is obovate.

Common hyssop is a native of Europe, where, as well as in this country, it is cultivated in gardens. The flowering summits and leaves are the parts used. They have an agreeable aromatic odour, and a warm, pungent, bitterish taste. These properties they owe to an essential oil, which may be separated by distillation with water, and rises also with alcohol. Hyssop is a warm, gently stimulant aromatic, applicable to the same cases as the other labiate plants. Its infusion has been much employed in chronic catarrhs, especially in old people, and those of a debilitated habit of body. It acts by facilitating the expectoration of mucus when too abundantly secreted. In this country, however, it is seldom used by regular practitioners. W.

IBERIS AMARA. *Bitter Candytuft.* A small herbaceous plant, indigenous in Europe, where it is cultivated in gardens on account of its bright milk-white flowers. The leaves, stem, and root are said to possess medicinal properties; but the seeds are the most efficacious. The plant appears to have been employed by the ancients in rheumatism, gout, and other diseases. In large doses it is said to produce giddiness, nausea, and diarrhœa; but its virtues do not seem to be associated with any perceptible physiological effect. It is thought to exercise a happy influence over the excited actions of the heart, and is especially useful in hypertrophy. Much advantage is also said to have accrued from it in asthma, bronchitis, and dropsy. The dose of the seeds is from one to three grains. (*Prov. Med. and Surg. Journ.*, July 28, 1847.) W.

ICAYA. *M'Boundou.* This is an ordeal root of Gaboon, whose physiological action has been investigated by MM. Rabuteau and Peyre. They found it to be devoid of influence upon the muscles, but to act upon the spinal cord, producing violent convulsions. Nasal hemorrhages were observed in the dog, and are stated also to have been noticed among the Gaboonese. (*Pharm. Journ.*, Sept. 1870, p. 187.) H. C. W.

ILEX. *Holly.* Several species of Ilex are employed in different parts of the world. The *I. Aquifolium*, or *common European Holly*, has attracted much attention in France. It is usually a shrub, but in some places attains the magnitude of a middling-sized tree. Different parts of it are used. The viscid substance called birdlime is prepared from

the *inner bark*. The *leaves*, which are of a bitter, somewhat austere taste, were formerly much esteemed as a diaphoretic, and in the form of infusion were employed in catarrh, pleurisy, smallpox, gout, &c. A few years since they gained a brief reputation in France as a cure for intermittents. They were used in powder, in the dose of a drachm two hours before the paroxysm; and this dose was sometimes repeated frequently during the apyrexia. Their febrifuge virtues are said to depend on a bitter principle, for which the name of *ilicin* has been proposed. M. Labourdais obtained this principle by boiling a filtered decoction of holly leaves with animal charcoal, allowing the charcoal to subside, washing it, then treating it with alcohol, filtering off the alcoholic solution, and evaporating it to a syrupy consistence. The liquid thus obtained was very bitter, and, on being allowed to evaporate spontaneously, yielded an amorphous substance, having the appearance of gelatin, which was the principle in question. (See *Am. Journ. of Pharm.*, xxi. 89.) A yellow colouring substance called *ilexanthin* and a peculiar acid, called *ilicic acid*, have been obtained by Dr. F. Moldenhauer. Ilexanthin is obtained in the following manner. The leaves are exhausted with alcohol, the alcohol is distilled off, and the residue set aside for several days. A sediment forms, which is separated from the mother-liquor, treated with ether to remove the chlorophyll, and then purified by repeated solution in alcohol and crystallization. The composition of Ilexanthin is $C_{34}H_{22}O_{22}$. It crystallizes in yellow needles, which change colour at 365° F., melt at 388°, and at 417° boil with decomposition, and are not sublimable. It is insoluble in ether, but soluble in alcohol. In cold water it is almost insoluble; but hot water dissolves it freely, and deposits it in crystals on cooling. (*Chem. Cent. Blatt*, Oct. 21, 1857, p. 766.) The *berries* are about the size of a pea, red and bitter, and are said to be purgative, emetic, and diuretic. Ten or twelve of them will usually act on the bowels, and sometimes vomit. Their expressed juice has been used in jaundice.

The *Ilex opaca*, or *American holly*, is a middling-sized evergreen tree, growing throughout the Atlantic section of the United States, and especially abundant in New Jersey. It is so similar to the European plant, that it is, by some writers, considered as the same species. The berries, examined by Mr. D. P. Pancoast, were found to contain tannin, pectin, two crystallizable organic principles, and salts of potassa, lime, and magnesia. One of the crystallizable principles was inodorous and tasteless, the other inodorous but intensely bitter. The latter was obtained by a treatment similar to that of M. Labourdais, above described; but, after the evaporation of the tincture to a syrupy consistence, the process was continued by adding carbonate of potassium and afterwards ether, and agitating briskly. The ethereal solution, rising to the surface on repose, was separated, and allowed to evaporate spontaneously. Crystals of the bitter principle were deposited. This is probably pure *ilicin*. (*Am. Journ. of Pharm.*, xxviii. 314.) This species is said to possess the same medical properties as *I. Aquifolium*.

Ilex Paraguaiensis, the *I. Mate* of St. Hilaire, yields the celebrated *Paraguay tea*, so extensively consumed as a beverage in the interior of South America. It is a small tree or shrub growing wild along the streams in Paraguay, and also cultivated for the sake of its leaves, which are the part used. These are stripped from each plant every two or three years. (Parodi, *Revista Farmaceutica de Buenos Aires*, Jan. 1861.) The period of their collection extends from December to August, sometimes beginning earlier but never continuing later. Companies are formed who penetrate far into the forest at a distance from the settlements, and devote a long time to the collection and preparation of the leaves. These are first dried by exposure to heat, and are then reduced to powder more or less fine, which is kept for several months protected from moisture, and then packed in sacks, and delivered to commerce. (A. Demersay, *Ann. de Thérap.*, 1868, p. 72.) They have a balsamic odour and bitter taste, and are usually at first disagreeable to the palate. They have a pleasant and corroborant effect upon the stomach; but, when very largely taken, are said to purge and vomit. They are used in the form of infusion. According to Stenhouse, these leaves contain a principle identical with the caffein of tea and coffee; and like them contain also tannic acid; so that a close analogy exists in composition as well as effects between these three products, so little allied botanically, and so far separated in place of growth. According to the analysis of D. A. Strauch, they contain 0·450 of thein, 20·880 of caffeotannic acid, 2·830 of gum, 5·902 of resin, chlorophyll, and wax, 1·200 of starch, 9·361 of protein compounds, 22·148 of cellulose, 8·640 of apotheme, 3·896 of salts, 8·100 of water, with a trace of volatile oil, and some sand and extractive. (*Am. Journ. of Pharm.*, July, 1868, p. 314; from *Wittstein's Vierteljahr.*, A. D. 1867, pp. 167–182.) Mr. Pizarro found the percentage of thein to vary from 0·48 to 1·15, and of tannic acid from 4·10 to 5·50. (*Journ. de Pharm.*, 4e sér., xx. 250.) In the year 1870–71 Brazil is stated to have exported 9,507,086 kilogrammes of mate.

The *Ilex vomitoria* of Aiton and Linn., the *I. Cassine* of Michaux, is a handsome evergreen shrub, growing in our Southern States, and especially abundant along the southern coast of Florida. It is the *cassine* of the Indians, who formerly employed a decoction made from the toasted leaves, called *black drink*, both as a medicine, and as a drink of etiquette at their councils. It acts as an emetic. The leaves of the *Ilex Dahoon* of Walter and Michaux have similar properties, and are also said to have entered

into the composition of the black drink. The leaves of the Ilex Cassine, known as *Yaupon* by the Indians, yielded, in an analysis made by Mr. H. M. Smith, 0·011 per cent. of volatile oil, and 0·122 per cent. of caffein. (*Am. Journ. of Pharm.*, xliv. 217.) W.

ILLICIUM FLORIDANUM. *Florida Anise-tree.* This is an evergreen shrub or small tree, growing in Florida, along the coast which bounds the Gulf of Mexico. The bark, leaves, and probably also the seed vessels, are endowed with a spicy odour and taste, analogous to those of anise, and might, perhaps, be used for the same purpose as that aromatic. It is a question worthy of investigation, whether the capsules of this plant might not be substituted for those of the *Illicium anisatum* or *star aniseed*, which yield much of the oil used in this country under the name of *oil of anise.* (See *Anisum.*) Another species, *I. parviflorum*, a shrub found by Michaux in the hilly regions of Georgia and Carolina, has a flavour closely resembling that of sassafras root. W.

IMPATIENS FULVA AND IMPATIENS PALLIDA. *Touch-me-not. Jewel-weed. Balsam-weed.* These two species of Impatiens are indigenous, annual, succulent plants, from two to four feet high, growing in low moist grounds in all parts of the Union, and flowering in July and August. They may be known by their tender, juicy, almost transparent stems; by their yellow flowers, which in one species are pale and sparingly punctate, in the other, are deeper coloured and crowded with dark spots; and by their capsules, which burst elastically, and curl up with the slightest pressure. They probably possess properties similar to those of the *I. Noli-me-tangere* of Europe, which has an acrid burning taste, and, when taken internally, acts as an emetic, cathartic, and diuretic, though considered dangerous, and therefore little used. The late Dr. Ruan, of Philadelphia, informed us that he had employed with great advantage, in piles, an ointment made by boiling the American plants, in their recent state, in lard. The flowers may be used for dyeing yellow. The *I. Balsamina* or *balsam-weed*, *touch-me-not*, *&c.* of the gardens resembles the other species in its effects. W.

IMPERATORIA OSTRUTHIUM. *Masterwort.* An umbelliferous plant, indigenous in the South of Europe. The root has a strong odour, similar to that of angelica, and a pungent, biting, aromatic taste, attended with a flow of saliva, and followed by a glowing warmth which remains long in the mouth. A crystallizable, tasteless principle, called *imperatorin*, was extracted from the root by Wackenroder, by allowing the ethereal tincture to evaporate, and recrystallizing the residue from ether and alcohol. It was purified by combining it with lime, and decomposing the lime compound by acetic acid. R. Wagner has ascertained that this principle is identical with *peucedanin*, obtained from the root of *Peucedanum officinale*, which was formerly employed in medicine, but is now quite out of use. The principle is composed of carbon, hydrogen, and oxygen, and is probably inert. (*Chem. Gaz.*, Nov. 1, 1854.) M. Gorup Besanez has found in the root another principle, to which he has given the name of *ostruthine.* (*Journ. de Pharm.*, Fev. 1875, p. 175.) The root of masterwort was formerly considered alexipharmic, stomachic, corroborant, emmenagogue, diuretic, and diaphoretic: and was used in a wide circle of complaints with so much supposed success as to have gained for it the title of *divinum remedium.* It is, however, merely a stimulant aromatic, analogous but inferior to angelica, which has nearly superseded it in European practice. In this country it is unknown as a remedy, and its vulgar name has been applied to another plant. W.

INDELIBLE INK. This is prepared by dissolving two drachms of nitrate of silver and a drachm of gum arabic in a fluidounce of distilled water, coloured with a little Indian ink. It is used for writing with a pen on linen and muslin. The place to be marked is prepared by being moistened with a solution of two ounces of crystallized carbonate of sodium and two drachms of gum arabic in four fluidounces of water, and then dried. The alkaline solution decomposes the nitrate, and protects the cloth from the action of the free nitric acid. At the end of 24 hours the spot is to be washed.

Mr. Redwood, of London, proposes the following indelible ink, not requiring the use of a mordant. Dissolve an ounce of nitrate of silver, and an ounce and a half of crystallized carbonate of sodium, separately, in distilled water, and mix the solutions. Wash the precipitated carbonate of silver, and, having introduced it, still moist, into a Wedgwood mortar, rub it with eight scruples of tartaric acid, until effervescence ceases. Then add strong solution of ammonia, just sufficient to dissolve the tartrate of silver formed (about two fluidounces). Lastly, having mixed in half a fluidounce of archil, half an ounce of white sugar, and an ounce and a half of powdered gum arabic, add sufficient distilled water to make the whole measure six fluidounces. M. Soubeiran has given the following formula for indelible ink, which he considers simpler than Mr. Redwood's. Dissolve 8 parts of crystallized nitrate of silver, 3 of nitrate of copper, and 4 of carbonate of sodium, in 100 of water of ammonia, and add to the solution a little gum. The marks, produced by nitrate of silver on linen or muslin, may be completely removed by moistening them with a solution of corrosive sublimate in 30 parts of distilled water, and afterwards washing them with ordinary water.

M. Jules Guiller has devised the three following formulas for marking-inks for linen. 1. Nitrate of silver 11 parts; distilled water 85; powdered gum arabic 20; carbonate of sodium 22; solution of ammonia 20. Dissolve the carbonate of sodium in the water,

rubbing the solution with the gum, and the nitrate of silver in the ammonia. Mix the solutions, and gradually heat the mixture in a flask until it boils. This ink flows readily from a pen. 2. Nitrate of silver 5 parts; distilled water 12; powdered gum arabic 5; carbonate of sodium 7; solution of ammonia 10. The ingredients are treated as in the preceding formula, with the exception that the mixed solution is heated until it becomes of a very dark colour, and is reduced about one-twentieth in volume by evaporation. This ink is suitable for marking on linen with stamps. 3. Nitrate of silver 17 parts; distilled water 85; powdered gum arabic 20; carbonate of sodium 22; solution of ammonia 42; sulphate of copper 33. Dissolve the nitrate of silver in the ammonia, the carbonate of sodium in 25 parts of the water, and the gum in the remaining 60. Then mix with the soda solution, first the gum solution, and afterwards the silver solution. Lastly, add the sulphate of copper. This ink has a blue, instead of the dark-brown colour of the others. (See *Am. Journ. of Pharm.*, Jan. 1853, p. 33.)

Dr. Boettiger gives the following formula. 3·65 grms. of anilin black are rubbed down in a porcelain mortar with 60 drops of concentrated hydrochloric acid, and 22 grms. of alcohol. This solution is mixed with a hot solution of 1·82 grms. of gum arabic in 85 grms. of hot water. This ink does not attack steel pens, and is not acted upon either by strong mineral acid or by alkalies. If the anilin black solution is diluted with shellac solution (21 grms. in 85 of alcohol) an anilin-black lake is obtained, which is suited for colouring wood and leather.

Herberger recommends the following indelible ink for other purposes than marking linen. Dissolve wheat gluten, carefully freed from starch, in a little weak acetic acid, and dilute the solution with rain-water, so as to have about the strength of wine vinegar. For every four ounces of the solution, add ten grains of the best lampblack, two grains of indigo, and a little oil of cloves. This ink has a beautiful black colour, and cannot be removed by chlorine or dilute acids. (*Chem. Gaz.*, No. 70, p. 394.) B.

Dr. Elsner states that an *indelible red ink* can be prepared as follows: Equal parts by weight of copperas and cinnabar, both in fine powder and sifted, are rubbed up with linseed oil with a muller, and finally squeezed through a cloth. The thick paste can be employed for writing or stamping woollen or cotton goods. W.

INDIAN RED. A purplish-red pigment, brought from the island of Ormus in the Persian Gulf. It is a *red ochre*, and owes its colour to the red oxide of iron. W.

INDIAN YELLOW. This is a pigment manufactured from a yellow substance from India, called *purree*. Purree occurs in commerce in balls, of from three to four ounces in weight, which are dark-brown externally, and deep-orange within. It has a peculiar smell, closely resembling that of castor. This circumstance gave rise to the belief that it was of animal origin; but Dr. Stenhouse, who examined it chemically, finds that it contains no nitrogen, and from this and other facts is led to the opinion that it is a vegetable substance. Upon analysis he found it to consist of magnesia, united with a peculiar acid, which he names purreic (*euxanthic acid* of Erdmann), and which forms nearly one-half of the crude substance. *Purreic acid* is in small crystals of a light yellow colour dissolving sparingly in cold water, pretty readily in boiling water, and abundantly in hot alcohol. It has at first a sweetish and then a slightly bitter taste, and possesses, in appearance, considerable resemblance to berberina. When acted upon by boiling nitric acid, it is finally converted into a new acid, crystallizing in yellow needles, called by Erdmann, *oxypicric acid*. Purreic acid has the formula $C_{40}H_{16}O_{21}$. Dr. Stenhouse concludes that purree is probably the juice of some plant, saturated with magnesia, and boiled down to a solid consistence. (*Philos. Mag.*, xxv. 321.) Other authorities conjecture that it is obtained from the deposit of camels' urine, after the animals have eaten the fruit of *Mangostana mangifer*. (*Chem. Gaz.*, April, 1855, p. 134.) B.

INDIGO. This well-known and highly important dye-stuff is obtained from various species of *Indigofera*, especially *I. tinctoria*, *I. Anil*, and *I. Argentea;* and is said to be afforded also by other plants, such as *Wrightia tinctoria*, *Polygonum tinctorium*, *Galega tinctoria*, &c. It does not exist ready formed, but is generated, during fermentation, from another principle existing in the plant. This principle appears to have been isolated from Isatis tinctoria by Ed. Schunck, who has named it *indican*. Through the agency of the mineral acids, it is resolved into indigo and sugar; and perhaps the same result may take place in fermentation. Indican is yellow, amorphous, of a nauseous bitter taste, with an acid reaction, and readily soluble in water, alcohol, and ether. It contains nitrogen. (*Pharm. Journ.*, xv. 166.) In the process of preparing indigo, the plant is macerated in water; fermentation takes place; the liquor becomes of a greenish colour, and in due time is decanted; the colouring principle dissolved by the water absorbs oxygen from the air, and assumes a blue colour, becoming at the same time insoluble; a gradual precipitation takes place, favoured by the addition of lime-water or an alkaline solution; and finally the precipitated matter, having been washed upon linen filters, is dried, shaped usually into cubical masses, and sent into market. Most of the indigo consumed in dyeing is brought from the East Indies, though considerable quantities are imported also from Guatemala, and the northern coast of South America. It was formerly produced in our Southern States, especially Florida, where the plant grows

luxuriantly; and it still appears to be prepared there for local use. (See *Am. Journ. of Pharm.*, xxvii. 473.) It is of an intensely blue colour, but assumes a coppery or bronze hue when rubbed by a smooth hard body, as the nail. Heated to 550°, it emits a reddish-violet vapour, which condenses in minute crystals. It is insoluble in water or alcohol, but is readily dissolved by sulphuric acid, which, without destroying its blue colour, so far alters its nature as to render it freely soluble in water, and thus affords a convenient method of applying it to the purposes of dyeing. It is also soluble in nitro-benzole. (For other solvents, see *American Chemist*, i. 472, and *Am. Journ. of Pharm.*, xliii. 562.) The solution in sulphuric acid is kept in the shops under the name of *sulphate of indigo*. According to Berzelius, indigo contains, among other ingredients, four distinct principles:—1. a substance resembling gluten; 2. a brown colouring substance; 3. a red colouring substance; and 4. a blue colouring substance, which is the principle upon which its value as a material for dyeing depends, and which seldom constitutes so much as one-half of the indigo of commerce. This blue colouring matter is called *indigotin*. According to C. Mehu, if dissolved in a boiling mixture of carbolic acid and a little alcohol or camphor (15 per cent.), on cooling it is deposited in crystals. (*Am. Journ. of Pharm.*, xliv. 71.) By deoxidizing agents it is deprived of its blue colour, which it recovers by exposure to the air, in consequence of the absorption of oxygen. Such is the case with the acid sulphites, and in a less degree with sulphurous acid. Certain volatile oils are said to have the same effect when boiled with tincture of indigo, as the oil of turpentine, peppermint, lavender, juniper, savine, or sage. (*Journ. de Pharm.*, Nov. 1859, p. 399.) Chlorine also destroys the blue colour. M. Preisser has concluded, from an elaborate examination of the *colouring principles* of plants, 1. that these principles are colourless in the young plants; 2. that they acquire colour by combination with oxygen; 3. that all the colouring matters extracted from any one plant, are produced by the oxidation in different degrees of a single principle; 4. that they are deprived of colour by substances having a strong affinity for oxygen, and reacquire it by contact with oxidizing bodies; and 5. that these colouring principles are acids, and the lakes which they form genuine salts. (*Journ. de Pharm.*, 3e sér., v. 263.) For modes of testing the value of any specimen of indigo, see the *Chemical Gazette* (vii. 463, viii. 443, and x. 159); the *Chem. News* (Dec. 12, 1862, p. 284); and the *Am. Journ. of Pharm.* (xxv. 223). Those methods, which are based on the effect of oxidizing agents, by which the colouring matter is destroyed, as chlorate or bichromate of potassium, are asserted by Erdmann to be defective, as it is not only the proper indigo blue that is destroyed, but other principles which are always present in the best indigo of commerce, especially the indigo brown, and a substance like gelatin usually found in the drug. (*Journ. de Pharm.*, 4e sér., ii. 261.) For the value of these tests and the use of indigo in the estimation of nitric acid, see *Journ. de Pharm.*, 4e sér., xx. 415. M. Lowenthal proposes the amount of ash yielded as a test of the purity of indigo; a pure article should give about 4·5 per cent. (*Am. Journ. of Pharm.*, xliv. 354.) This test will detect the not rare adulteration of indigo with lime and other inorganic salts.

Indigo has been proposed by E. Mulder as a test for glucose and fruit sugar, which have the property of changing the blue colour of indigo to white in the presence of the alkalies. To the solution to be examined he adds sulphate of indigo, previously treated with an excess of carbonate of potassium or sodium. The addition of the carbonated alkali to the sulphate of indigo scarcely affects the blue colour even at a boiling heat; but if the solution contain glucose or fruit sugar, the blue colour disappears even in the cold, but more rapidly with heat. Common sugar has no such effect. (*Journ. de Pharm.*, Sept. 1860, p. 179; from *Archiv. der Pharm.*, clv. 268.)

Indigo has been introduced to the notice of the profession as a remedial agent. It was at first employed chiefly by the German physicians, from whose statements our knowledge of its physiological action and therapeutical application was derived. Though without odour and taste, it is said, in most individuals, to produce nausea and vomiting, frequently to operate upon the bowels, giving a bluish-black colour to the stools, to render the urine of a dark-violet or dark-green colour, without increasing its quantity, and sometimes to stimulate the secretory function of the uterus. From these statements it would appear to act as an irritant to the alimentary mucous membrane. The character of its general influence upon the system has not been well ascertained. In some instances, it is asserted to have been given in very large doses without any obvious effect. In connection with its influence, the curious fact may be stated, that a colouring matter has been occasionally found in the urine, either spontaneously deposited or separated by the addition of strong muriatic acid, which in colour and other properties, especially that of being sublimable, bears a close resemblance to indigo, if it be not identical with it. (*Chem. Gaz.*, July 15, 1854, p. 267.) The complaints in which indigo has been employed, with supposed advantage, are epilepsy, infantile convulsions, chorea, hysteria, and amenorrhœa. It is given, usually in connection with some aromatic powder, in the dose of a scruple three times a day, which may be increased to a drachm or more; and from half an ounce to an ounce has been employed daily for months together without disadvantage. (See *Am. Journ. of Med. Sci.*, xx. 487.) The general failure of indigo to produce the desired effects in epilepsy, in which it had at one time considerable credit

as a remedy, has been ascribed to the use of too small doses. M. Ideler, of Berlin, began with about two drachms daily, and increased gradually to two ounces; but there was great difficulty in reconciling the patient to such doses, on account of the intense nausea produced. (*B. and F. Medico-chirurg. Rev.*, Am. ed., Jan. 1856, p. 198.) W.

INÉE. *Onaye. Poison of Pahouius.* This exceedingly violent poison is obtained from the seeds of the *Strophantus hispidus*, an apocynaceous plant of Gaboon. According to Polaillon and Clairville, it kills by arresting the cardiac movements, and acts especially upon the muscles, destroying their contractility. (*Ann. de Thérap.*, 1874, p. 19.) H. C. W.

INKS, COLORED. The following recipes are stated by the *Boston Journal of Chemistry* to be preferable to the solutions of anilin dyes, which are now so extensively used as colored inks.

Green. Two parts of acetate of copper, one part carbonate of potassium, and eight parts water. Boil till half is evaporated, and filter.

Blue. Three parts Prussian blue, one part oxalic acid, and thirty parts of water. When dissolved, add one part of gum arabic.

Yellow. One part fine orpiment, well rubbed up with four parts thick gum-water.

Red. With the aid of a gentle heat dissolve four grains of carmine in one ounce of aqua ammonia, and add six grains of gum arabic.

Gold. Rub gold leaf, such as used by book-binders, with honey till it forms a uniform mixture. When the honey has been washed out with water, the gold powder will settle at the bottom, and must be mixed with gum-water in sufficient quantity.

Silver. Silver leaf treated in precisely the same manner gives a silver ink. Both these inks may, when dry, be polished with ivory.

Black. Three ounces crushed gallnut, two ounces crystallized sulphate of iron, two ounces gum arabic, and twenty-four ounces water.

White. Fine French zinc white or white lead, rubbed up with gum-water to a proper consistency. H. C. W.

INSECT POWDER. Under the name of *Persian* or *Caucasian Insect Powder*, a substance has recently attracted attention in Western Europe, which has long been in extensive use among the people of Western Asia and Eastern Europe, for the destruction of vermin. Among the people south of the Caucasus, it is called *guirila*. It consists of the flowers of the *Pyrethrum carneum*, and *P. roseum*, growing upon the Caucasian mountains, at an elevation of about a mile. It is a coarse powder, of a greenish colour, and pungent odour. It does not appear to be poisonous to man, though it is said to cause some confusion of head in those who sleep in close apartments where much of it is used. Upon the insects, however, which are apt to infest the person of man and animals, as well as bedding and sleeping apartments, it acts very destructively, first stupefying and then killing them. It is scattered over the person, upon the beds, about apartments, &c., and is even employed as a dressing for ulcers and wounds to prevent the formation of maggots. It also answers to preserve dried insects and plants in cabinet collections. The demand for the powder having much increased of late, it is said to be adulterated with the leaves and stems of the plant. (Noodt, *Buchner's Neues Repert.*, vii. 562.) A tincture prepared by macerating one part of the powder in four of alcohol is recommended by F. Jager, a German traveller in the East, as a perfect protection against all kinds of vermin, if applied to any part of the body, diluted with ten times its bulk of water. (*Pharm. Journ.*, July, 1868.) Prof. Maisch has informed the editor of the *Am. Journ. of Pharm.* (March, 1869, p. 128), that in two instances in which he had known it to be tried, it produced a vesicular eruption like that caused by Rhus Toxicodendron. We are not, however, told whether the tincture was diluted with water as recommended by Mr. Jager. W.

IODAL. This substance is prepared with great difficulty by the action of iodine upon a mixture of alcohol and nitric acid. In the presence of an alkali it is decomposed into iodoform and formic acid. M. Rabuteau found it to resemble chloral in its action on animals. (*Ann. de Thérap.*, 1870, p. 98.) H. C. W.

IODATE OF CALCIUM. This salt has been brought forward by E. Sonstadt as a valuable antiseptic, to be used in the preservation of food. (*Chem. News*, xxviii. 297.) Mr. S. W. Moore has employed it in doses of two to four grains three times a day internally in febrile cases, and found it to lower the temperature and improve the appetite. (*Am. Journ. Med. Sci.*, lxx. 190.) It exists in sea-water, but may be prepared by acting upon iodine with chlorinated lime. (*Am. Journ. of Pharm.*, 1874, p. 558.) H. C. W.

IODATE OF POTASSIUM. This salt has been proposed as a substitute for the chlorate of potassium. MM. Demarquay and Custin propose the following mode of preparation, which is followed by the British Pharmacopœia in making its test solution. Take of iodine and chlorate of potassium, each, one part, and mix them with five or six parts of water, previously acidulated with a few drops of nitric acid, and heated to ebullition. As soon as chlorine ceases to escape, treat the liquid with a concentrated solution of chloride of barium. Wash with distilled water, and decompose with dilute sulphuric acid the iodate of barium precipitated; filter to separate the sul-

phate of barium; and slowly evaporate the solution. Wash with distilled water the crystals of iodic acid that are formed, dissolve them in boiling distilled water, and saturate with bicarbonate of potassium. On cooling, the iodate is deposited in small crystals. M. Stas prepares it by heating moderately equal equivalents of iodide and chlorate of potassium, dissolving out the chloride formed with cold water, and repeatedly crystallizing the iodate from hot water. (*Am. Journ. of Pharm.*, 1870, p. 217.) M. Egidio Pollacci has found that phosphorus affords a very delicate test for the iodate, as does also the iodate for phosphorus, free iodine being liberated. (*Journ. de Pharm.*, 4e sér., xx. 104.) The authors first mentioned have employed the iodate of potassium in all those cases of ulcerated and otherwise diseased mucous membrane of the mouth and fauces, in which the chlorate is usually prescribed, and have found it to produce the same curative effects more quickly, more energetically, and in smaller dose. In the healthy state, it acts remarkably on the pharyngeal and buccal mucous membrane, producing, in the quantity of 20 or 30 grains, a peculiar sense of constriction, and appearing considerably to diminish the mucous secretion. The diseases in which they have found it specially beneficial are diphtheria, mercurial affection of the mouth, and gangrenous stomatitis. The dose used by them was from four to eight grains. (*Dorvault's Rev. Pharm.*, 1858, p. 25.) W.

IODATE OF SESQUIOXIDE OF IRON. This has been proposed as a substitute for the iodide by Prof. Cameron. (*Dublin Quarterly*, May, 1869, p. 354.) It is prepared by precipitating five fluidrachms of the liquor ferri perchloridi fortior in four fluidounces of water with a solution of one ounce of the iodate of potassium in ten ounces of water. It has the advantage of being nearly tasteless, and not injuring the teeth. The dose is two to five grains. H. C. W.

IODIC ACID. This is obtained by decomposing the iodate of calcium with sulphuric acid. (*Am. Journ. of Pharm.*, xlvi. 558.) It has been proposed by M. Lutton as a remedy in chronic glandular enlargements and goitre, half a drachm of a two per cent. solution being injected into the affected part. (*Ann. de Thérap.*, 1874, p. 192.) H. C. W.

IODIDE OF ANTIMONY. *Antimonii Iodidum. Teriodide of Antimony.* According to Mr. W. Copney, of London, this iodide may be conveniently prepared by gently heating, in a Florence flask, metallic antimony and iodine, in the proportion of one eq. to three. The elements combine with sudden heat and liquefaction, and, upon the withdrawal of the heat, the iodide formed solidifies, and is removed from the flask by breaking it. Iodide of antimony, as thus prepared, forms a somewhat crystalline, foliated mass, which, when pulverized, yields a deep orange-red powder. By the action of water it is decomposed. It has been tried as an alterative in a dose varying from a quarter of a grain to a grain, given in the form of pill. B.

IODIDE OF BARIUM. *Barii Iodidum.* This compound may be formed by double decomposition, by adding native carbonate of baryta in powder to a boiling solution of iodide of iron. M. Henry, jun., obtained it by decomposing a solution of sulphuret of barium (see *page* 1102) by a concentrated alcoholic solution of iodine. Sulphur is precipitated, which is separated by filtration, and iodide of barium formed in solution, from which it is obtained in the solid state by rapid evaporation to dryness. Iodide of barium crystallizes in small, colourless needles, which deliquesce slightly, and are very soluble in water. The solution promptly undergoes decomposition by exposure to the air, carbonate of baryta being precipitated, and iodine set free, which colours the solution. It has been used with advantage by Jahn, as an alterative, in scrofulous affections and morbid growths. Lugol employed it in scrofulous enlargements. The dose is the eighth of a grain three times a day, gradually increased to three grains. Biett applied it to scrofulous swellings in the form of ointment, made with four grains of the iodide to an ounce of lard. B.

IODIDE OF BISMUTH AND POTASSIUM. This salt has been proposed as a test for the alkaloids, but as it seems to offer no advantages, the reader is referred to the *Am. Journ. of Pharm.*, xlvii. 374, for the method of its preparation and use. H. C. W.

IODIDE OF CALCIUM. This has been brought into notice by M. Malem, in a memoir published in the *Bulletin Thérapeutique* (Avril 30, 1868), as preferable to any other iodic compound in phthisis. He prepares it in the following manner. Treat a solution of iodide of iron with milk of lime. The liquor thus obtained, being filtered, and evaporated, yields crystals of iodide of calcium. Pure iodide of calcium is white, and crystallizes in large plates of a pearly lustre. Procured as recommended, it is yellowish, probably in consequence of the presence of iodine in excess. It is deliquescent, and very soluble in water, and its solution is capable of dissolving iodine added to it. Iodide of calcium is much more unstable than iodide of potassium. When taken, it is rapidly decomposed into hydriodic acid and salts of lime, which are almost immediately absorbed. Most patients bear it very well; and M. Malem had administered it without inconvenience for a year or more. It is especially in scrofulo-tuberculous phthisis that he uses it. After the first doses the appetite is often improved, digestion becomes regular, the respiration deeper and more easy, the cough diminishes, and the expectoration is favourably modified. The muscular system is invigorated, the night-sweats diminish, and the

patient increases in weight. Its long-continued use has in general only induced a little constipation, which often disappears upon a diminution of the dose, or suspension of the medicine. From excessive doses M. Malem has seen symptoms of active irritation induced, as increase of the cough, a deep colour of the urine, uneasiness in its discharge, and pain with a sense of fulness in the region of the kidneys. But these symptoms are fugitive, and easily guarded against by a proper regulation of the dose. From one to three or four grains may be given after each meal. (*Ann. de Thérap.*, A. D. 1869, p. 194.) To make the syrup of iodide of calcium the following formula has been proposed by Mr. O. Eberbach (*Pharm. Journ. and Trans.*, 3d ser., i. 364). Take of iodine 4 oz.; iron (in form of wire) 7½ dr.; distilled water q.s.; milk of lime (fresh) q.s.; sugar 28 oz.; simple syrup q.s.; mix 3 oz. of the iodine with the iron and 4 oz. of water, in a thin flask with long neck; shake occasionally until the reaction has ceased and the solution assumes a pale-green color; filter the solution and add the remainder of iodine; heat to the boiling point, and add milk of lime until all of the iron is precipitated. Filter, and wash the precipitate with hot water until all the iodide is washed out, and then bring the whole to the measure of 20 oz.; add the sugar, and dissolve by a gentle heat; to the solution add enough simple syrup to make it measure 40 oz.; mix thoroughly, and fill into 2 oz. bottles well corked. W.

IODIDE OF SILVER. *Argenti Iodidum.* This compound is formed by double decomposition, by adding a solution of iodide of potassium to one of nitrate of silver. It is a greenish-yellow powder, nearly insoluble in ammonia. According to the experiments of M. Fizeau, it has the remarkable property of contracting with heat and expanding with cold, differing in this respect from the chlorides and bromides of the same metal, and the iodides of other metals. (*Journ. de Pharm.*, Dec. 1867, p. 435.) This appears, however, to be only a partial truth, the iodide having three allotropic forms and a point of maximum density at about 116° C. For particulars, see paper by G. F. Rodwell (*Chem. News*, xx. 288, xxi. 14.) It possesses the general medical properties of nitrate of silver, and, according to Dr. Charles Patterson, of Dublin, may be used without any danger of producing the discoloration of skin which sometimes follows the use of that salt. Dr. Patterson found it generally successful in curing the stomach affections of the Irish peasantry, in the treatment of which nitrate of silver had previously proved useful. He succeeded with it in curing several cases of hooping cough in a short time, and in greatly relieving a case of dysmenorrhœa of three years' standing. Its effects in epilepsy were least satisfactory. The dose is one or two grains, three times a day, given in the form of pill; for children, from the eighth to the fourth of a grain, according to the age. B.

IODIDE OF SODIUM. *Sodii Iodidum.* This iodide may be prepared either by saturating a solution of caustic soda with iodine, or by double decomposition between iodide of iron and carbonate of sodium, precisely as iodide of potassium is obtained by the corresponding processes for that salt. As only small quantities are likely to be wanted as a medicine, the latter process is preferable; being more easily conducted on a small scale. It is a very soluble white salt, crystallizing in anhydrous cubes from a hot solution, and in oblique rhombic prisms, with four eqs. of water, by spontaneous evaporation. Iodide of sodium has the same therapeutic effects, and is used in the same diseases as iodide of potassium. It is said to be better borne than the latter iodide. In Italy it has been used with remarkable success in constitutional syphilis. The dose is twenty grains, gradually increased to forty, three times a day, dissolved in three fluid-ounces of water. (See Prof. Procter's paper on the preparation of this iodide, in the *Am. Journ. of Pharm.*, July, 1854, p. 305.) At the suggestion of Prof. Gross, it has been very frequently employed by Dr. John J. Black, at the Philadelphia Hospital, as a substitute for iodide of potassium in the treatment of syphilitic affections; and seems to be not less efficacious than that medicine, while producing none of its unpleasant effects. (*Am. Journ. of Med. Sci.*, July, 1865, p. 87.) B.

IODIDE OF STARCH. Dr. Andrew Buchanan, of Glasgow, proposed this compound as a means of administering iodine in large doses without causing irritation of the stomach. He prepares it by triturating twenty-four grains of iodine with a little water, adding gradually an ounce of very finely powdered starch, and continuing the trituration until the compound assumes a uniform blue colour. The iodide is then dried by a gentle heat, and kept in a well-stopped bottle. The dose is a heaped teaspoonful, given in water gruel, three times a day, and afterwards increased to a tablespoonful. No nicety is necessary in apportioning the dose. In some cases Dr. Buchanan has given half-ounce doses of the iodide three times a day, immediately increased to an ounce. Thus administered iodine produces, according to this writer, little or no irritation of the alimentary canal, but is freely absorbed, as is proved by its detection in large quantities in the secretions. Dr. Buchanan thinks that, by means of the starch, the iodine is converted into hydriodic acid, and in this state enters the circulation. Prof. John C. Dalton, of New York, found that nearly all the animal fluids decompose iodide of starch, and destroy its blue colour. (*Am. Journ. of Med. Sci.*, April, 1856, p. 327.) This result is owing, no doubt, to the alkaline nature of most of the animal fluids, especially those

of the duodenum. The iodine, being saturated with the alkali of the fluids, is no longer in the free state, the condition necessary to enable the starch to form the blue compound with it. In other words, the starch compound is decomposed, and the starch set free. He prefers the iodide of starch to any other preparation of iodine for obtaining the alterative apart from the irritant effects of this substance. (*Ibid.*, xx. 213 and 217.) See *Diluted Hydriodic Acid*, Part III.

It is a point of importance, to have the iodide of starch soluble in water. M. Magnes-Lahens, of Toulouse, gained this advantage by his original process of roasting the starch moderately, whereby it is converted into dextrin, before it is mixed with the iodine. Subsequently he abandoned the use of torrefied starch, and now contents himself with making an intimate mixture of iodine and starch, slightly moistened, which he subjects to the heat of a water-bath, until it is converted into the iodide of starch, forming a solution with water of a magnificent blue colour. The heat, thus regulated, disaggregates the starch, without completely transforming it into dextrin, and gives a preparation, in the form of a black powder, resembling the soluble iodide of starch, prepared by M. Quesneville by a secret process. M. Seput, of Constantinople, has also given a formula for this soluble iodide, and for a *syrup* to be made from it. (See *Journ. de Pharm.*, Mars, 1852, p. 202.) M. Soubeiran reported upon these preparations to the Paris Society of Pharmacy, and deemed them ineligible on account of their variable strength in iodine, arising from the greater or less loss of this element during the necessary exposure to heat. Nevertheless, as the syrup is called for, he recommended the following process for making it, availing himself of the observations of his predecessors, which he had occasion to cite in his report. The quantities of the ingredients are here stated in French grammes, each of which weighs about fifteen grains. Triturate thoroughly, in a porcelain mortar, 36 grammes of nitric starch with 4½ grammes of iodine, dissolved in three times its weight of ether, and added in successive portions, until, after the evaporation of the greater part of the ether, a blue powder remains. Introduce this into a weighed, stoppered flask, and, having added 520 grammes of water, expose the whole to the heat of a water-bath, with the stopper at first removed, in order to complete the dissipation of the ether. Afterwards the stopper is replaced, being loosely tied with a packthread, so as to permit of its being raised without being driven out; and the heat is continued for about an hour and a half, when the iodide of starch will be completely formed. The flask is then weighed, and a quantity of water added to it, equal to that lost by evaporation. Lastly, 1040 grammes of sugar are added to the liquid, and dissolved by a gentle heat. By this formula a syrup is prepared, containing a quarter of one per cent. of iodine, a small part of which is in the state of hydriodic acid. The *nitric starch* is used by M. Soubeiran, because it unites with the iodine in much less time than the ordinary starch. It is made by mixing ordinary starch, in the cold, with 150 parts of water, to which 1 part of nitric acid has been added, and allowing the whole to dry in the open air. Three grains of this syrup, diluted with a pint of water, communicate to the liquid a sensible blue tint. This test may serve to determine whether the preparation is of full strength. (*Journ. de Pharm.*, Mai, 1852, p. 329.) The dose of the syrup is from one to four tablespoonfuls a day. B.

M. Quesneville, for whom it is claimed that he first introduced iodide of starch into therapeutics, recommends the following method of preparing it. Take of the finest starch, unmixed with that from the potato, 1050 grammes; iodine, in very fine powder passed twice through a sieve of silk, 100 grammes. Carefully mix the powders, and, when the mixture is complete, sprinkle into it gradually, agitating constantly, a mixture of 400 grammes of water and 100 of alcohol. The powder becomes gradually more and more deeply coloured, and soon of a beautiful black. It is to be allowed to stand 15 or 20 days, and is then dried, first by a current of air and then in a stove. When well dried, the powder has no smell of iodine, of which it contains exactly one-tenth of its weight. It is quite insoluble in cold water; but to render it soluble, it is sufficient to heat it in an enameled pan over a very gentle fire with constant agitation; the heat must be removed when a pungent odour is emitted. The powder thus procured is sufficient for pharmaceutical use. If it be desired to obtain it purer and extremely soluble in cold water, and always of a fine violet-blue, it will be necessary to make with heat a concentrated solution, so as to mark 7 or 8 degrees on the areometer for saline solutions, allow it to stand and settle for several days, then decant the liquor, add a quantity of alcohol just sufficient to precipitate the iodide of starch, put the magma which forms upon a linen cloth, press it as strongly as possible, and dry it by a stove-heat upon shallow dishes. (*Journ. de Pharm.*, Juillet, 1868, p. 30.) W.

IODIDE OF ZINC. *Zinci Iodidum.* This iodide may be formed by digesting an excess of zinc, in small pieces, with iodine diffused in water. Combination takes place, and, by evaporation, a deliquescent, very soluble saline mass is obtained, having a metallic styptic taste, resembling that of sulphate of zinc. It may also be obtained by heating in a matrass a mixture of 20 parts of zinc and 170 of iodine, and subliming into a vial. Thus prepared, it is in the form of white needles. This salt is very liable to spontaneous decomposition.

Iodide of zinc is tonic, astringent, and antispasmodic. In 1853, Dr. Barlow tried it in

Guy's Hospital, in cases of chorea, scrofula, cachexia, and some forms of hysteria, with favourable results. (*Med. Times and Gaz.*, Nov. 1853, p. 501.) Since then a further experience has confirmed him in his first estimate of its value. He considers it particularly applicable to the treatment of chorea, when complicated with scrofula. (*Ibid.*, August, 1857, p. 195.) The best form of administration is *syrup*, to protect it from change, originally proposed by the late Dr. A. T. Thomson, and made on the same plan as the syrup of iodide of iron. Mr. A. B. Taylor, of Philadelphia, proposes to form it by gently heating, in an evaporating dish, *twelve drachms and two scruples* of iodine, and *an ounce* of finely granulated zinc, with *nine fluidounces* of water, until they unite, filtering the solution, while hot, on *a pound* (avoird.) of sugar, contained in a wide-mouthed bottle holding a little more than a pint, and adding, through the filter, sufficient water to make the whole measure a pint. This syrup is perfectly clear and colourless, is styptic to the taste, and contains a drachm of iodide of zinc in each fluidounce. (*Am. Journ. of Pharm.*, Jan. 1852, p. 33.) The dose of this syrup is from 20 to 50 drops, sufficiently diluted with water, three times a day.

Iodide of zinc has been used for many years as an external application. Dr. J. J. Ross, of Scotland, employed a solution, containing from 10 to 30 grains to the fluidounce of water, with great advantage in enlarged tonsils, applied by means of a piece of sponge tied to a quill. After the use of the solution for some time, he applied the iodide, rendered liquid by deliquescence, by means of a camel's-hair brush. A solution containing one or two grains to the fluidounce of water has been used as an astringent injection in gonorrhœa. An ointment, made with a drachm of the iodide to an ounce of lard, has been substituted by Dr. Ure for the ointment of iodide of potassium in the treatment of tumours, applied in the quantity of a drachm twice a day. B.

IODO-CHLORIDES OF MERCURY. *Iodides of Calomel. Sel de Boutigny.* These compounds, called subiodide and protiodide of calomel, were brought forward as remedies by M. Boutigny in 1847. To prepare the former, one eq. of iodine and two eqs. of calomel are taken; the calomel is introduced into a matrass, and gradually heated, with agitation, till it begins to sublime; then the iodine is added in small quantities at a time. The combination takes place with some sound, but without sensible loss of iodine. The second compound is prepared in the same mode precisely, one eq. of calomel only being used. (*Arch. Gén.*, Janv. 1857, p. 91.) M. J. Perrens proposes to make them, without the assistance of heat, by rubbing up, in a mortar, the constituents, taken in the proper equivalent quantities. Though called iodides of calomel, the protiodide is a mixture or combination of biniodide and bichloride of mercury, and the subiodide the same, with an excess of calomel. Both these substances are active preparations, and have been employed with success in syphilitic, scrofulous, and cancerous affections. The *subiodide* may be given in pill, in the dose of the twenty-fifth of a grain. The ointment is formed of one part of the subiodide to eighty of lard. It has been used by M. Rochard with advantage in acne rosacea, applied by daily frictions, and as a local application in engorgements of the neck of the uterus. The *protiodide* is used externally only, and should be applied with caution. It acts as a caustic, and may be cast into sticks, like nitrate of silver. An ointment may be made of it, by rubbing one part with twenty of fresh lard. A portion of the ointment, the size of a large *pea*, may be rubbed daily on a scrofulous tumour, in the armpits, or on the inner part of the thigh. Glycerin has been found to be a good excipient. M. Devergie recommends in acne rosacea (couperose) a mixture of 7·5 parts of the salt with 4 of iodide of potassium, 4 of distilled water, and 4 of glycerin, prepared by first triturating the two iodides together, adding the water drop by drop, then filtering, and adding the glycerin. It is applied by means of a hair-pencil. (*Journ. de Pharm.*, 4e sér., v. 199.) B.

IODOFORM. For a new and asserted cheap method of producing this drug, which has appeared since the revision of the earlier portions of this work, see *Pharmacist*, vol. vi., 357; copied in *Pharm. Journ. and Trans.*, Jan. 1874, p. 593. H. C. W.

IODOHYDRARGYRATE OF POTASSIUM. It has been found by chemists that different iodides will unite together in different proportions, forming compounds which are called by Berzelius double iodides. Bonsdorff, of Finland, and Dr. Hare, of this city, with greater reason, have viewed these combinations as a peculiar kind of salts, in which one of the iodides performs the part of an acid, the other of a base. The substance, the name of which is placed at the head of this article, is one of these compounds, and was presented to the notice of the profession, as a new remedy of remarkable powers, in February, 1834, by Dr. William Channing, of New York. (*Am. Journ. of Med. Sci.*, xiii. 388.) It consists of biniodide of mercury acting as an acid, and iodide of potassium as a base. But as these iodides combine in at least two proportions, it is necessary to indicate the particular combination employed by Dr. Channing.

In a difficult case of pectoral disease, in which the ordinary remedies had failed, Dr. Channing determined to make trial of one of the iodides of mercury. He selected the biniodide; and, in order to have it in the liquid form, as it is insoluble in water, he dissolved it in a solution of the iodide of potassium. He was struck with the chemical changes which the compound solution underwent; and, on pursuing his observations

found that the two iodides really united by the intervention of the water; for, with the aid of an operative chemist, he was enabled by evaporation to obtain then in union, in the form of straw-coloured, needleform, deliquescent crystals. He next found, upon consulting the European authorities, that Bonsdorff, who had taken the lead in investigating similar compounds, had discovered the salt in 1826.

Dr. Channing analyzed the salt with which he experimented, and found that it consisted of one eq. of biniodide of mercury, and two of iodide of potassium. This he determined by ascertaining that an aqueous solution of a little more than eight grains of iodide of potassium would dissolve, and combine with, eleven grains of biniodide of mercury, without being liable to decomposition when largely diluted with water. The combination here indicated corresponds with one of the double iodides of mercury and potassium, described by Thenard. (*Traité de Chimie*, 6ème ed., iii. 493.) The other is represented by this author as consisting of a single eq. of each iodide. When copiously diluted with water, every two eqs. of this iodide let fall one eq. of the mercurial iodide; thus converting the salt into the medicinal double iodide. The same decomposition by means of water is noticed by Dr. Channing. For remarks on these double iodides, see a paper by Mr. Ambrose Smith in the *Am. Journ. of Pharm.* (xii. 265).

Dr. Channing attributes to this preparation the effects of diffusing excitement, and equalizing the circulation. In the different cases in which he tried it, he thought he saw evidence of its favourable influence on the lungs, in allaying cough and improving expectoration; on the alimentary canal, in restoring the healthy secretions; on the kidneys, in reviving their activity; on the skin and cellular tissue, in cicatrizing superficial ulcerations; and on the absorbent and exhalant systems, in causing the disappearance of effused fluid. The principal diseases in which he found it useful were chronic bronchitis, hooping-cough, tonsillitis, chronic gastro-enteritis, dyspepsia, ascites, anasarca, amenorrhœa, leucorrhœa, eruptions, and scrofula. In some cases of phthisis, it mitigated the symptoms, and appeared to prolong life. Dr. Hildreth, of Ohio, has tried the preparation, and reports favourably of its effects in functional dyspepsia, enlargement of the spleen, amenorrhœa, dysmenorrhœa, leucorrhœa, scrofulous affections, ascites, and general dropsy. (*Am. Journ. of Med. Sci.*, xxvi. 312.)

The average dose of the remedy may be stated at the twelfth of a grain three times a day; but in peculiar constitutions, not more than the forty-eighth, the ninety-sixth, or the two-hundredth of a grain daily can be borne. For the convenience of physicians who may wish to make trial of the remedy, we give the following formula, deduced from the statements in Dr. Channing's paper. Take of iodide of potassium three and a half grains; biniodide of mercury (red iodide) four and a half grains; distilled water a fluidounce. Dissolve first the iodide of potassium and then the biniodide of mercury in the water. The compound salt in this solution may be assumed to amount to eight grains, though there is a small excess of the iodide of potassium. Of this solution from two to five drops, containing from the thirtieth to the twelfth of a grain, may be given three times a day. It may be administered in the compound syrup of sarsaparilla, which does not decompose it. B.

The iodohydrargyrate of potassium was suggested by F. L. Winckler as a qualitative test of the organic alkaloids, with which it produces insoluble precipitates; and subsequently it has been used by Prof. F. F. Mayer, of New York, for determining the quantity of these alkaloids in any mixture containing them. Prof. Mayer employs, for volumetric analysis, a solution made with 13·546 grammes of corrosive sublimate, 49·8 grammes of iodide of potassium, and a litre of distilled water. For the value, in our own weights and measures, of the gramme and litre, the reader is referred to tables in the Appendix of this work. Of the solution thus made one cubic centimetre precipitates, of

Aconitia...	0·0267 grammes.	Brucia	0·0233 grammes.	Nicotia	0·00405 grammes.
Atropia....	0·0145 "	Veratria...	0·0269 "	Quinia.....	0·0108 "
Narcotina	0·0213 "	Morphia ..	0·0200 "	Cinchonia	0·0102 "
Strychnia	0·0167 "	Conia.....	0·00416 "	Quinidia..	0·0120 "

The resulting precipitates are hydriodates of the alkaloids, respectively, with iodide of mercury. They form in acid, neutral, and feebly alkaline liquids, except with the presence of alcohol and acetic acid, by which they are dissolved. For those who may not possess the requisite instruments, Prof. Mayer gives the following table, having reference to ordinary officinal weights. The solution is now made with 16·25 grains of corrosive sublimate, 100 grains of iodide potassium, and enough distilled water to make altogether 12·5 troyounces, or 6000 grains. Of this solution 10 grains will precipitate, of

Aconitia.....	0·0534 grains.	Sulphate of morphia .	0·0500 grains.	Cinchonia	0·0204 grains.
Atropia.....	0·0289 "	Conia	0.0083 "	Sulphate of cinchonia	0·0250 "
Sulphate of atropia...	0·0389 "	Nicotia.....	0.0081 "	Quinidia	0·0240 "
Strychnia.....	0·0334 "	Quinia.....	0·0216 "	Sulphate of quinidia..	0·0284 "
Brucia.....	0·0466 "	Sulphate of quinia....	0·0296 "	Veratria.....	0·0538 "
Morphia	0·0400 "				

For further observations upon Prof. Mayer's method of effecting the assay of the

alkaloids, the reader is referred to the *American Journal of Pharmacy* (Jan. 1863, p. 20.) W.

IODO-TANNIN. The solution of iodine in water, made with the assistance of tannic acid, called *iodo-tannin*, has been noticed elsewhere in this work. (See *pages* 500 and 1018.) M. Guillermond, of Lyons, makes a *syrup* of this solution, containing about a grain of iodine to the fluidounce, of which the dose is a tablespoonful, gradually increased. B.

IONIDIUM MARCUCCI. This name has been conferred by Dr. Bancroft upon a South American plant, supposed to be the source of a medicine used with great asserted advantage in Maracaibo and elsewhere, in some of the horrible cutaneous affections, especially elephantiasis, to which the inhabitants of the tropical regions of this continent are subject. A specimen, however, received from Dr. Bancroft, was found by Sir W. Hooker to be identical with the *Ionidium parviflorum* of Ventinat. The medicine is called by the Indians *cuichunchulli*, and grows in the neighbourhood of Riobamba, a small town at the foot of the great mountain of Chimborazo. It is said to be diaphoretic, diuretic, occasionally sialagogue, and in large doses emetic and cathartic. The root is the part used. It is highly probable that other vegetable emeto-cathartics, having the same property of stimulating the secretions, would be found equally effectual. For an account of what is known in relation to this medicine, the reader is referred to a paper by Dr. Bancroft, republished in the *Am. Journ. of Pharm.* (iii. 125). W.

ISATIS TINCTORIA. *Woad. Pastel.* A biennial plant, indigenous in Europe, where it is also cultivated. The leaves have a fugitive pungent odour, and an acrid very durable taste, and have been used in scorbutic affections, jaundice, and other complaints; but the plant is valuable only as the source of a blue dye-stuff, called *woad*, which has been long employed in Europe, though at present nearly superseded by indigo. The leaves are prepared by grinding them to a paste, which is made into balls, placed in heaps, and allowed to ferment. When the fermentation is at an end, the mass falls into a coarse powder, which is the dye-stuff in question. W.

ISOPYRUM THALICTROIDES. F. A. Harsten believes that he has found two alkaloids, *isopyrina* and *pseudoisopyrina*, in the root of this plant. (*Am. Journ. of Pharm.*, xliv. 453.) H. C. W.

JABORANDI. The words *jaborandi*, *iaborandi*, and *jamborandi* are used in Brazil to designate various pungent, sudorific plants. Among the chief of these are *Piper nodosum*, *P. citrifolium*, and *P. reticulatum*. Under the same title Dr. Continho (*Journ. de Pharm.*, 4e sér., xx. 51) has introduced into Europe a drug, which is the leaves of one or more species of rue. The leaves obtained by Dr. Continho have usually been referred to *Pilocarpus pinnatus*. Most of them were glabrous beneath, but some were pubescent, so that it is probable that two species were represented, and, according to E. M. Holmes, the smooth leaves correspond most closely to the *P. Selloanus* of the Flora Brasiliensis, and the hairy to the *P. pinnatifolius*. For further botanical details the following references should be consulted: *Journ. de Pharm.* (Janv. 1875, p. 20), *Pharm. Journ. and Trans.* (April, 1874, p. 851; Feb. 1875, p. 640; copied, *Am. Journ. of Pharm.*, 1875, p. 173), *Philad. Med. Times* (vol. vi.). The following description of the drug is adapted from that of Dr. F. V. Greene, U. S. N., who obtained specimens directly from the family of Dr. Continho. The package contained several stems branched at an angle of about 20°; these branches being furnished with alternate leaves, which are impari-pinnate, with from two to five opposite leaflets (Planchon has met with leaves having as many as seven, nine, and more rarely eleven leaflets), articulated to the rachis by short petiolules, thickened at the base. The leaflets, which are coriaceous in texture, vary considerably in size and outline. As a rule they may be considered as oblong-lanceolate, and are entire, emarginate, with an unequal base. The midrib rises very little above the upper surface of the leaflet, but is very prominent and sharp on the lower. The veins, which are rather more prominent on the lower surface, leave the midrib at an angle of about 60°, pursue a parallel course across the leaflet, and finally turn up and anastomose within about a quarter of an inch of the margin. The leaflets are pellucidly punctate; the dots are the receptacles of secretion, are numerously and irregularly distributed over the whole surface, and are plainly visible when the leaflet is held up to the light. The fruit consists of five carpels, of which not more than two or three are usually developed to maturity; when ripe the carpels dehisce into two valves, and then remind one strongly of miniature cockle-shells with the valves open exposing the animals. The black, shining, reniform seed (one for each carpel) had a lancet-shaped hilum, a sharp ridge on the back near the apex, and a smooth, pale-yellow endocarp surrounding it. The jaborandi of Continho was examined chemically by Mr. Byasson, who found in it an alkaloid. (*Repertoire de Pharm.*, 1875; abstracted, *Pharm. Journ.*, April, 1875, p. 826.) Besides the alkaloid, A. W. Gerrard found (*Pharm. Journ.*, May, 1875, p. 865) an acrid resin, volatile oil, and tannic acid. To the alkaloid Byasson gave the name of *Jaborandine*, but *Pilocarpia* is preferable, jaborandine being the previous title of another principle. An infusion of from sixty to ninety grains of the jaborandi will produce in the adult very profuse perspiration and salivation; in some the salivation being in excess, in others perspiration. From nine to fifteen ounces

of sweat are said frequently to be excreted, and it is said to contain a notable amount of urea. The lachrymal glands in some cases show the excitement. The urine appears not to be increased. Sufficient therapeutic experiments have not yet been made to enable us to exactly estimate the value of jaborandi. But it would seem to be indicated whenever profuse diaphoresis is desired, and has been used with asserted success in rheumatism, syphilis, and acute bronchitis. Want of space necessitates our referring the reader desirous of following up this subject more in detail to H. C. Wood's treatise on Therapeutics, and to an article in the 6th volume of the *Philad. Med. Times*, by Dr. Greene.

The *Paraguay Jaborandi*, or *Yarguarundi*, is said to be the product of a species of Piper, and to resemble in its properties the true jaborandi. (See *Pharm. Journ. and Trans.*, April, 1875, p. 781; also *Am. Journ. of Pharm.*, 1875, p. 214.) M. Parodi found a crystalline body, *Jaborandine*, allied to piperine, in it. H. C. W.

JEFFERSONIA DIPHYLLA. *Twin-leaf.* This is a small, indigenous, herbaceous, perennial plant, belonging to the class and order Octandria Monogynia, and natural order Berberidaceæ. From a knotty rhizome, furnished with long radicles, arise a naked one-flowered scape about a foot in height, and leaves which stand in pairs on long footstalks. The flower is white, with a four-leaved coloured calyx, and eight petals; and the fruit is a one-celled, obovate, substipitate capsule, dehiscent near the top, with many oblong seeds, united at the base. The plant grows in the Middle and Western States. The rhizome, which, with the rootlets attached, is the part used, has a brownish-yellow colour, and a bitter, acrid taste, which resides in its cortical part, the inner portion being nearly tasteless. It has been analyzed by Mr. E. S. Wayne, of Cincinnati, and found to contain albumen, gum, tannic acid, starch, pectin, a fatty resin, hard resin, sugar, lignin, and a peculiar acrid principle, having acid properties and resembling polygalic acid, in which it is supposed that the virtues of the root reside. The root is said to be emetic in large doses, tonic and expectorant in smaller doses, and not unlike seneka, as a substitute for which it is sometimes used. (*Am. Journ. of Pharm.*, xxvii. 1.) According to Prof. Mayer, of New York, the rhizome of this plant contains a small quantity of berberina, and another alkaloid which is white and in large proportion, as may be inferred from the reactions noticed by Mr. Bentley, of London. The pectin of Mr. Wayne he considers to be saponin. (*Ibid.*, March, 1863, p. 99.) W.

JELLIES. The form of Jelly is sometimes a convenient method of administering medicines, especially the fixed oils, as cod-liver oil and castor oil, which are thus rendered less adhesive to the mouth and fauces, and less liable to leave that disagreeable impression on the palate behind them, which renders such medicines often so offensive that it becomes difficult to administer them. While preparing the jelly, opportunity is also offered for incorporating sugar and aromatics so as very much to cover the offensive taste and odour of the oil. The same remarks are applicable to the resinous juices, as copaiba and some varieties of turpentine, liquid balsam of Tolu, &c. The following is a formula recommended by Messrs. Ed. Parrish and Wm. C. Bakes. "Take of the fixed oil or liquid resin *a troyounce;* honey, syrup, each, *half a troyounce;* gum arabic, in powder, *two drachms;* Russian isinglass, *forty grains;* orange-flower water, *six fluid-drachms.* Dissolve the isinglass, with the aid of heat, in half a fluidounce of the orange-flower water, replacing the water as it evaporates. Triturate the other ingredients, with the remainder of the orange-flower water, into a homogeneous mass in a warmed mortar, then add the hot solution of isinglass, stir the mixture as it cools, and set it aside to gelatinize." (*Am. Journ. of Pharm.*, Jan. 1861, p. 4.) Any other aromatic water may be substituted for that of the orange-flower, and cinnamon water diluted with an equal measure of pure water would probably better cover the offensive taste. In reference to cod-liver oil, the bitter-almond or cherry-laurel water would be still more effectual; care, however, being taken in this case, that the water is duly diluted, lest too large a dose of it might be administered. W.

KALMIA LATIFOLIA. *Laurel. Mountain Laurel. Broad-leafed Laurel. Calico-bush.* This well-known evergreen inhabits all sections of the United States, being especially abundant on the sides of hills and mountains, which it adorns in summer with its elegant flowers. It is from three to ten feet in height. The leaves are possessed of poisonous, narcotic properties, and have been used in medicine. They have been analyzed by Mr. Charles Bullock, of Philadelphia, and found to contain gum, tannic acid, resin, chlorophyll, fatty matter, a substance resembling mannite, an acrid principle, wax, extractive, albumen, yellow colouring matter, lignin, and salts of potassium, calcium, and iron. (*Am. Journ. of Pharm.*, xx. 264.) Mr. Geo. W. Kennedy has found the alkaloid arbutin in them. (*Ibid.*, xlvii. 5.) They are said to prove fatal to sheep and some other animals, but are eaten with impunity by deer, goats, and partridges. Dr. Barton states, in his "Collections," that the Indians sometimes use a decoction of the leaves to destroy themselves. It is said that death has been occasioned by eating the flesh of partridges and pheasants which have fed upon them during winter. Dr. N. Shoemaker published, in the *North American Medical and Surgical Journal*, two cases of poisoning which resulted from eating a pheasant, in the craw of which laurel leaves

were found. The symptoms were nausea, temporary blindness, pain in the head, dyspnœa, pallid countenance, cold extremities, and a very feeble pulse, which in one case was for some time absent at the wrist, in the other beat only forty strokes in the minute. In both cases relief was afforded by vomiting, produced by a tablespoonful of flour of mustard mixed with warm water. A case of similar poisoning is related in the *Edinburgh Medical Journal* (May, 1856, p. 1014), in which epigastric tension and uneasiness, glowing heat of the head, loss of sight, coldness of the extremities, general prostration, and twitchings of the muscles were the prominent symptoms, followed by nausea and full vomiting, which afforded some relief. But feelings of formication and weakness of the limbs, with great prostration of the circulation, remained for several hours, requiring the use of stimulants.

Dr. Barton was informed that the powdered leaves were employed by an empiric with success in certain stages of fever; and Dr. Thomas, in an inaugural dissertation, published at Philadelphia, A. D. 1802, states that an obstinate case of diarrhœa was cured by a decoction, made by boiling an ounce of the leaves in eight ounces of water down to four ounces. Thirty drops were given six times a day; but this quantity produced vertigo, and the dose was afterwards repeated only four times daily. The leaves are said to have been used advantageously in syphilis. Externally applied, in the shape of ointment or decoction, they have been found useful in tinea capitis, psora, and other cutaneous affections; but caution is necessary in their application, as, according to Dr. Barton, nervous symptoms have resulted from the external use of the decoction. Dr. Bigelow has seen the recently powdered leaves given in doses of from ten to twenty grains, without perceptible effect.

It is probable that other species of Kalmia, as *K. angustifolia* or *sheep-laurel*, and *K. glauca* or *swamp-laurel*, have properties identical with those of *K. latifolia*. A decoction of the leaves of K. angustifolia is used by the negroes of North Carolina as a wash for an ulcerative affection between the toes. W.

KAURI GUM. This is an amber-like substance, varying from a soft cream-white to an amber colour, dug in large quantities from the soil in New Zealand. (See *Journ. Chem. Soc.*, Aug. 1874, and *Pharm. Journ. and Trans.*, Sept. 1874, p. 259.) H. C. W.

KOMBÉ POISON. This is an African poison, prepared from the seeds of an apocynaceous plant, *Stropanthus Kombé*, Oliver. Dr. T. R. Fraser has found it to act primarily on the heart, producing paralysis with permanent contraction. It exaggerates the susceptibility of the voluntary muscles, and finally causes rigidity with acid reaction. The reflex function, but not the motor conductivity, of the cord is suspended soon after the cardiac paralysis. For further details, see Dr. Fraser's paper in the *Proceedings Roy. Soc. Edinb.* 1869–70; abstracted, *Journal of Anatomy*, vol. vii. H. C. W.

KOOSIN. For an elaborate article upon the active principle of Kooso, published since the revision of the earlier portions of the Dispensatory, see *Pharm. Journ.*, Jan. 1875, p. 562. H. C. W.

KOUMYS. *Kumys.* This is a liquor originally prepared by the Tartars from the milk of mares, but recently imitated with cow's milk to a great extent in Europe. It is said to be prepared in Tartary by putting the mare's milk in tall vessels whilst warm, adding koumys, one part for every ten of milk, stirring thoroughly every few minutes, and in three or four hours taking out and bottling in champagne bottles. (*Journ. de Pharm.*, Janv. 1875, p. 59.) For an account of the method employed in Russia, see *Am. Journ. of Pharm.*, 1875, p. 261. The milk of the mares of the Steppes is stated to resemble that of women, being much richer than cow's milk in sugar and poorer in casein. (For analysis, see *Journ. de Pharm.*, Janv. 1875, p. 62.) Accordingly, in preparing the substitute for true kumys, H. and N. Schulze, of Berlin, add sugar of milk to cow's milk and ferment with brewer's yeast in open tanks, stirring frequently, skimming off the casein and butter which rise to the surface, and bottling whilst fermentation is very active. (*Philad. Med. Times*, Jan. 1874.) (For a method of making a very fictitious koumys out of condensed milk see *Ibid.*) Mr. Wilckens adds to every litre of cow's milk 30 grains of milk sugar and twice that weight of beer yeast, and then fills champagne bottles to within about a half inch of the top, corking securely. This koumys is said to be good from the fifth to the twentieth day. (*Journ. de Pharm.*, Févr. 1875.) The true koumys does not keep long, and therefore must be drunk at the place of production. For particulars as to the varieties of it, &c., see *Ibid.*, Janv. 1875.

According to M. Stalberg, the composition of true koumys is as given below; other analyses may be found in the *Journ. de Pharm.*, Janv. 1875, p. 62. *Kumys of June.* In 100 parts, alcohol 1·65, fat 2·05, sugar of milk 2·20, lactic acid 1·15, casein 1·12, salts 0·28, carbonic acid 0·75. *Kumys of September.* Carbonic acid 1·86, alcohol 3·23, fat 1·05, lactic acid 2·92, casein and salts 1·21. M. Stalberg gives the following as the result of an analysis of Swiss kumys, made from skimmed cow's milk to which sugar had been added. Alcohol 3·622, lactic acid 0·256, sugar 2·376, albumen 2·099, butter 2·008, mineral salts 0·574, carbonic acid 1·997.

The taste of koumys is sweet but acidulous and peculiar. In small quantities it is said to increase the appetite, in large quantities to take the place of solid food, each quart of

it containing, according to Dr. Victor Jagielsky, four ounces of solid food. (*New Remedies*, i. 1.) In warm weather it is said to act as a diaphoretic, in cold weather as a diuretic. It is used especially in chronic constitutional diseases attended with emaciation, such as pulmonary phthisis, in chronic abdominal catarrhs, and in albuminuria. In wasting diseases it is affirmed (*New Remedies*, i. 4) that if no improvement in weight occur in ten days, the treatment should be discontinued. Usually the patient should at first take but a small quantity per day, but the ration should be rapidly increased until it constitutes almost all the food taken. Mr. Hourowiz states that in Russia "the cure" requires from twelve to fifteen pounds of milk daily (two mares), and that the koumys is taken in doses of a teacupful to a tumblerful every half-hour or hour early in the morning. H. C. W.

LABDANUM. *Ladanum.* A resinous substance, obtained from various species of Cistus, especially *C. Creticus*, *C. ladaniferus*, and *C. laurifolius*, small evergreen shrubs, inhabiting the islands of the Grecian Archipelago, and the different countries bordering on the Mediterranean. Upon the leaves and branches of these shrubs a juice exudes, which is collected by means of an instrument resembling a rake, with leather thongs instead of teeth, which is drawn over the plant. The juice adheres to the pieces of leather, and is afterwards separated. It is said that labdanum was formerly collected by combing the beards of goats which had been browsing upon the leaves of the cistus; and Landerer states that it is at the present time gathered in the same way in Cyprus from sheep, whose fleeces become loaded with it while they are pasturing. (See *Pharm. Journ.*, xi. 6.) It comes chiefly from the Grecian Islands. Two varieties exist in commerce. The *purest labdanum* is in masses of various sizes, sometimes weighing several pounds, enclosed in bladders, dark-red almost black externally, grayish internally when first broken, of the consistence of a plaster, softening in the hand and becoming adhesive, of an agreeable balsamic odour like that of amber, and of a bitter, balsamic, somewhat acrid taste. It is very inflammable, burning with a clear flame. On exposure it becomes dry, porous, and brittle. Little of this variety is found in the markets. *Common labdanum* is in contorted or spiral pieces, light, porous, blackish-gray, hard and brittle, not softening between the fingers, similar in odour and taste to the preceding variety, but less inflammable, and mixed with sand and other earthy matters, which are obvious to the sight. A specimen exhibited at the International Exhibition of 1862, at London, was in flattish pieces, an inch or more thick, with remains of leaves on one side, of a very dark greenish-brown colour, and a granular somewhat shining fracture. Guibourt found in 100 parts of the labdanum in masses, 86 parts of resin with a little volatile oil, 7 of wax, 1 of watery extract, and 6 of earthy substances and hair. In the contorted variety, Pelletier found 20 per cent. of resin, 3·6 of gum with malate of calcium, 0·6 of malic acid, 1·9 of wax, 1·9 of volatile oil including loss, and 72 of ferruginous sand.

Labdanum is a stimulant expectorant, and was formerly given in catarrhal and dysenteric affections. At present it is employed in plasters, but seldom even for that purpose in the United States. It is sometimes used in fumigation. W.

LAC. A resinous substance obtained from several trees growing in the East Indies, particularly from *Croton lacciferum*, and two species of Ficus, *F. religiosa*, and *F. Indica*. It is found in the form of a crust, surrounding the twigs or extreme branches, and is generally supposed to be an exudation from the bark, owing to the puncture of an insect, belonging to the genus *Coccus*, and denominated *C. Lacca*. By some it is thought to be an exudation from the bodies of the insects themselves, which collect in great numbers upon the twigs, and are embedded in the concreted juice, through which the young insects eat a passage and escape. Several varieties are known in commerce. The most common are *stick-lac*, *seed-lac*, and *shell-lac*.

Stick-lac is the resin as taken from the tree, still encrusting the small twigs around which it originally concreted. It is of a deep reddish-brown colour, of a shining fracture, translucent at the edges, inodorous, and of an astringent, slightly bitterish taste. Its external surface is perforated with numerous minute pores, as if made by a needle; and when broken it exhibits many oblong cells, often containing the dead insect. When chewed it colours the saliva beautifully red, and, when burnt, diffuses a strong, agreeable odour. It is in great measure soluble in alcohol.

Seed-lac consists of minute irregular fragments, broken from the twigs, and partially exhausted by water. It is of a light or dark-brown colour, inclining to red or yellow, feebly shining, almost tasteless, and capable of imparting to water less colour than the stick-lac, sometimes scarcely colouring it at all. It is occasionally mixed with small fragments of the twigs.

Shell-lac is prepared by melting the *stick-lac* or *seed-lac*, previously deprived of its soluble colouring matter, straining it, and pouring it upon a flat smooth surface to harden. It is in thin fragments of various sizes, from half a line to a line thick, often somewhat curved, of a lighter or darker brown colour inclining more or less to red or yellow, shining, more or less transparent, hard and brittle, inodorous and insipid, insoluble in water, but easily and almost entirely soluble in alcohol, especially with the aid of heat. According to Oberdörffer, cold ether takes from shell-lac only about 5 per cent., consist-

ing of wax; and adulteration with resins soluble in ether is thus readily detected. (See *Am. Journ. of Pharm.*, July, 1861, p. 313.)

A variety of lac is mentioned by writers in the form of cakes, called *cake-lac* or *lump-lac* (*lacca in placentis*); but this is at present rare in commerce.

According to John, lac consists of resin, colouring matter, a peculiar principle insoluble in alcohol, ether, or water, called *laccin*, a little wax, and various saline matters in small proportion. The resin, according to Unverdorben, consists of several distinct resinous principles differing in their solubility in alcohol and ether. The laccin is nearly or quite wanting in *shell-lac*, which also contains scarcely any of the colouring principle. Mr. Hatchett found in *stick-lac* 68 per cent. of resin, and 10 of colouring matter; in *seed-lac* 88·5 per cent. of resin, and 2·5 of colouring matter; in *shell-lac* 90·9 per cent. of resin, and 0·5 of colouring matter. The other constituents, according to this chemist, are wax and gluten, besides foreign matters. M. Schapringer gives a method of detecting lac in any mixture, through the property of its colouring matter, which he calls *coccine*, of being deep-red in acid solutions, and becoming violent upon the neutralization of the acid by an alkali. To the suspected substance an excess of acetic or muriatic acid is added; the turbid liquid is heated till it becomes limpid, and the resin has agglomerated; after which the liquid is decanted, and ammonia is added in excess. The red colour, more or less violet, will soon become manifest if lac is present. A quarter of a grain of the lightest-coloured lac found in commerce may be thus revealed. (*Journ. de Pharm.*, 4e sér., v. 239.)

Lac in its crude state is slightly astringent, and was formerly used in medicine; but at present it is not employed. Shell-lac is wholly inert. Stick-lac and seed-lac are used on account of the colouring principle which they contain. Shell-lac, as well as the other varieties deprived of their colouring matter, is applied to numerous purposes in the arts. It is the chief constituent of *sealing wax*. The best *red sealing wax* is made by melting together, with a very gentle heat, 48 parts of shell-lac, 19 of Venice turpentine, and 1 of balsam of Peru, and mixing with the melted mass 32 parts of finely powdered cinnabar. But common resin is often substituted in part for the lac, and a mixture of red lead and chalk for the cinnabar. The best *black sealing wax* consists of 60 parts of lac, 10 of turpentine, and 30 of levigated bone-black; the best *yellow sealing wax*, of 60 parts of lac, 12 of turpentine, and 24 of chromate of lead. (*Berzelius.*) Lac is also used as a varnish, and forms an excellent cement for broken porcelain and earthenware. It may be dissolved in alcohol, oil of turpentine, benzine, or naphtha. For a method of preparing a colourless varnish from lac the reader is referred to the *Pharmaceutical Journal* (Dec. 1864, p. 338). Lac has been highly recommended as an adhesive material for the dressing of wounds, ulcers, &c. It is prepared for use by dissolving, with the aid of a gentle heat, in alcohol contained in a glass bottle, sufficient lac to give it a gelatinous consistence, and then closing the bottle. It is used by simply spreading it on the bandages. W.

LACTATE OF ZINC. *Zinci Lactas.* This salt may be prepared by first obtaining lactate of potassium by double decomposition between lactate of calcium and carbonate of potassium, and then adding the solution of the alkaline lactate, filtered from the carbonate of calcium, to one of acetate of zinc. By a new double decomposition, lactate of zinc, on account of its sparing solubility in cold water, is deposited in crystals, and acetate of potassium remains in solution. The crystals may be purified by dissolving them in boiling water, and recrystallizing. This salt is in the form of white plates, soluble in sixty parts of cold water, and six at the boiling temperature. It is insoluble in alcohol. Its taste is highly saccharine, with a styptic after-taste. Exposed to heat it bears a temperature of 392° without decomposition.

Lactate of zinc was brought forward by M. Herpin as a remedy in epilepsy; and, after a trial of it for nearly two years, he concluded that it is at least as efficacious as the oxide, with the advantages of being better borne, and more easily taken. The dose is two grains three times a day, given in pill, and gradually increased until it amounts to ten grains. The best time for taking it is about an hour after meals. In M. Herpin's cases it was continued for from five to twelve months. Dr. Hart has also found it useful in epilepsy; he combined it with belladonna. (*New York Med. Journ.*, 1869, p. 77.) B.

LAKES. These are compounds of vegetable or animal colouring principles with alumina or other metallic oxide, and are usually obtained by adding alum or bichloride of tin to the solution of the colouring matter in water, and precipitating by means of an alkali. The alumina or oxide of tin unites with the colouring matter at the moment of separation, and forms an insoluble compound. Lakes are obtained in this way from cochineal, madder, Brazil wood, seed-lac, French berries, &c. They are used in painting. W.

LAURUS NOBILUS. *The Bay Tree.* The fruit of this tree, commonly called *bay-berries*, was one of the officinals of the late London Pharmacopœia, but has been omitted in the British. The tree belongs to Enneandria Monogynia in the Linnæan system, and to the natural order of Lauraceæ. The following is the generic character of Laurus

as given by Lindley in his Flora Medica. "*Flowers* diœcious or hermaphrodite, involucrated. *Calyx* four-parted; segments equal, deciduous. *Fertile stamens* twelve in three rows; the outer alternate with the segments of the calyx; all with two glands in the middle or above it. *Anthers* oblong, two-celled, all looking inwards. *Fertile flowers* with two to four castrated males surrounding the ovary. *Stigma* capitate. *Fruit* succulent, seated in the irregular base of the calyx. *Umbels* axillary, stalked." Laurus nobilis is an evergreen tree, attaining in its native climate the height of twenty or thirty feet. Its leaves are alternate, on short petioles, oval-lanceolate, entire, sometimes wavy, veined, of a firm texture, smooth, shining, deep-green upon their upper surface, paler beneath. The flowers are diœcious, of a yellowish-white colour, and placed in small clusters of three or four together, upon a common peduncle in the axils of the leaves. The corolla is divided into four oval segments. The fruit is an oval berry, of the size of a small cherry, and when ripe of a dark-purple, nearly black colour. The bay tree, so famous among the ancients, is a native of the countries bordering on the Mediterranean. Its leaves and fruit, and an oil expressed from the latter, are the parts used.

The *leaves* have a fragrant odour, especially when bruised, and a bitter, aromatic, somewhat astringent taste. They yield by distillation a greenish-yellow volatile oil, upon which their properties chiefly depend. Water distilled from them has their peculiar odour. The *berries* when dried are black and wrinkled, and contain two oval fatty seeds within a thin, friable envelope; or they may be considered as drupes, with a kernel divisible into two lobes. They have the same aromatic odour and taste as the leaves, but are more pungent. Besides an essential oil, they contain also a fixed oil, which may be separated by expression or decoction. The *expressed oil*, which is obtained from the fresh fruit, is concrete, of a greenish colour, and retains a portion of the volatile oil, which renders it agreeably aromatic. Lard, impregnated with the odorous principle of the berries, and coloured green, is said to be often substituted for the genuine expressed oil. The sophistication may be detected by means of boiling alcohol, which dissolves the laurel oil. The leaves, berries, and oil of the bay tree are excitant and narcotic; but at present are never used internally as medicines, and in this country are scarcely employed in any manner. Their chief use is to communicate a pleasant odour to external remedies. Dr. A. T. Thomson says that he has found an infusion of the berries useful in impetigo. W.

LAWSONIA INERMIS. *Henna Plant.* This belongs to Octandria Monogynia in the Linnæan system, and to the natural family of Salicariæ. It is a shrub growing in the Levant, Egypt, Persia, and India, and well known as the source of a dye-stuff denominated *henna*, much used throughout the Mahomedan countries of the East. It is largely cultivated in Egypt. The flowers have a strong pungent odour; and a distilled water is prepared from them, used by the women as a cosmetic. The fruit is thought to have emmenagogue properties. But the leaves are the part which constitute the henna of commerce. They are used by the females to give an orange colour to their feet and hands, and a golden hue to their hair. They are also employed to stain common wood in imitation of mahogany. Henna is in the form of powder, which is strongly astringent. It has been chemically examined by Abd-el-Aziz, of Cairo, Egypt, a former pupil in the laboratory for dyeing, connected with the famous manufacture of the Gobelins at Paris. He found in it a brown substance, of a resinoid fracture, having the chemical properties which characterize the tannins, and therefore named by him *henotannic acid.* (*Journ. de Pharm.*, Janv. 1863, p. 35.) Henna is used in medicine, both internally and locally, as a remedy in leprosy and other affections of the skin. The fresh juice of the plant is said by Ainslie to be applied to the same purpose. (*Mérat et De Lens.*) W.

LEDUM PALUSTRE. *Marsh Tea. Rosmarinus Sylvestris.* A small evergreen shrub, growing in swamps and other wet places in the northern parts of Europe, Asia, and America, and in the mountainous regions of more southern latitudes. The leaves have a balsamic odour, and an aromatic, camphorous, bitter taste; and contain, among other ingredients, volatile oil and tannin. For the properties of the volatile oil, see *Journ. de Pharm.*, 4e sér., xx. 244. They are thought to possess narcotic properties, and have been employed in exanthematous diseases to allay irritation, in hooping-cough, in dysentery, and in various cutaneous affections, particularly leprosy and scabies. In complaints of the skin, they are used both internally and externally in the form of decoction. When placed among clothes they are said to prevent the attacks of moths. In Germany they are sometimes substituted for hops in the preparation of beer. *Ledum latifolium*, or *Labrador tea*, which is a larger plant than the preceding, is a native of North America, growing in damp places in Canada and the northern parts of the United States. The leaves have an agreeable odour and taste, and are esteemed pectoral and tonic. They are said to have been used as a substitute for tea during the war of independence. W.

LEEK. *Porrum. The Bulb of Allium Porrum.* The leek is a biennial bulbous plant, growing wild in Switzerland, and cultivated in the gardens of Europe and this country for culinary purposes. All parts of it have an offensive pungent odour, and an acrid taste, dependent on an essential oil, which is in a great measure dissipated by decoction, and may be obtained separate by distillation. The bulb, which is the medicinal portion

consists of concentric layers, like the onion, which it resembles in medical properties, though somewhat milder. It is generally stimulant, with a peculiar direction to the kidneys. The expressed juice may be given in the dose of a fluidrachm, mixed with syrup. This species of Allium is not used medicinally in the United States. W.

LEONURUS CARDIACA. *Common Motherwort.* (*Gray's Manual*, p. 317.) A perennial labiate herb, thought to be of foreign origin, but growing wild in this country in waste places, around dwellings, &c. The whole plant is used. It has a peculiar aromatic odour and a bitterish somewhat pungent taste, which it no doubt owes to a volatile oil. Its vernacular name implies its possession, in common estimation, of some influence over the uterine functions; and, in the form of infusion or decoction, it is sometimes used in amenorrhœa, suppression of the lochia, and in hysterical affections. W.

LIATRIS SPICATA. *Gay-feather. Button Snakeroot.* An indigenous perennial plant, growing in natural meadows and moist grounds throughout the Middle and Southern States. It has a tuberous root, and an erect annual stem, which terminates in a spike of beautiful, purple, compound flowers, appearing in August. The root is said by Schoepf to have a terebinthinate odour; and a warm, bitterish, terebinthinate taste; to be possessed of diuretic properties; and to be useful in gonorrhœa and sorethroat; being employed internally in the shape of decoction in the former complaint, and as a gargle in the latter. The leaves of the *Liatris odoratissima* are said to be very largely employed in the Southern United States to flavour tobacco, and to preserve clothing, &c., from moths. (*Am. Journ. of Pharm.*, xlvii. 116.) Pursh informs us that *L. scariosa* and *L. squarrosa* are known in Virgina, Kentucky, and the Carolinas, by the name of *rattlesnake's master*; and that their roots are employed to cure the bite of the rattlesnake, being bruised and applied directly to the wound, while their decoction in milk is taken internally. According to Dr. William P. C. Barton, all the tuberous rooted species of Liatris are active plants, and appear to be diuretic. Dr. Goss attributes (*Med. Record*, Jan. 1870, p. 492) great value to *L. squarrosa* as a remedy in chronic bronchitis, and in inflammations of the urino-genital mucous membrane. W.

LIGUSTICUM LEVISTICUM. *Lovage.* An umbelliferous plant, growing wild in the South of Europe, and cultivated in gardens. The whole plant has a strong, sweetish, aromatic odour, and a warm, pungent taste. When wounded it emits a yellow, opaque juice, which concretes into a brownish resinous substance, not unlike opopanax. The roots, stems, leaves, and seeds have all been employed; but the last have the aromatic properties of the plant in the highest degree. They are small, ovate-oblong, somewhat flattened, curved, strongly ribbed, and of a yellowish-brown colour. The medical properties of lovage are closely analogous to those of angelica. It is a stimulant aromatic, and has been employed as a carminative, diaphoretic, and emmenagogue. The best form for administration is that of infusion. The colouring principle has been isolated by M. J. Nicklès, who gives it the name of *ligulin*, and suggests an important application of it that may be made in testing drinking-water. If a drop of its alcoholic or aqueous solution is made to fall into distilled water, it imparts to the liquid its own fine crimson red colour, which undergoes no change; but if limestone water be substituted, the red colour disappears in a few seconds, and is followed by a beautiful blue. (*Journ. de Pharm.*, Mai, 1859, p. 329.) W.

LIGUSTRUM VULGARE. *Privet.* A shrub from four to ten feet in height, growing wild both in Europe and the United States, usually in hedges and by the roadside. The *leaves*, which have an astringent, bitter taste, and the *flowers*, which are small, snow-white, and of an agreeable odour, have been used in the form of decoction, in sorethroat, and aphthous and scorbutic ulceration of the mouth. The *berries* are black, have a sweetish bitter taste, and are said to possess purgative properties, and to colour the urine brown. They are sometimes used for dyeing. The case of a child, between two and three years old, is recorded by Mr. James Cheese in the *Lond. Pharm. Journ.* (2d ser., viii. 607), in which the eating of privet berries appeared to be the remote cause of death, having induced active purgation, and probably set on foot an inflammation of the bowels, which ultimately proved fatal. The bark was analyzed by M. G. Potex, who found a peculiar substance, which he denominated *ligustrin*, besides mannite, sugar, muco-saccharine matter, starch, chlorophyll, bitter extractive, bitter resin, tannin, albumen, and salts. (*Am. Journ. of Pharm.*, xii. 347.) W.

LILIUM CANDIDUM. *Common White Lily.* This well-known plant is a native of Syria and Asia Minor, but has been long cultivated in gardens. The bulb, which consists of imbricated fleshy scales, is without odour, but has a peculiar, disagreeable, somewhat bitter, and mucilaginous taste. It contains much mucilage, and a small proportion of an acrid principle, which is dissipated or destroyed by roasting or boiling. In the recent state, it is said to have been employed with advantage in dropsy. Boiled with water or milk, it forms a good emollient cataplasm, more used in popular than in regular practice. The flowers have an agreeable odour, which they impart to oil or lard; and an ointment or liniment is sometimes prepared from them, and used as a soothing application in external inflammations. A case is recorded by Dr. Jeffries Wyman, of Boston, in which a little girl appeared to have been poisoned by the pollen of the tiger

lily (*Lilium bulbiferum?*), which the child had introduced into her nostrils and probably swallowed. She was affected with vomiting, purging, drowsiness, &c., from which, however, she recovered. (*Am. Journ. of Med. Sci.*, Jan. 1863, p. 271.) W.

LINDEN. M. Boussingault calls attention (*Journ. de Pharm.*, 4e sér., xv.) to a saccharine exudation which occurs upon the leaves of the European linden, which he has found to have the same composition as manna of Mount Sinai. H. C. W.

LINT. As an object of great importance to the surgeon, and a necessary article of sale to the apothecary, this seems not only to admit, but to require a brief notice in the present place. The term lint strictly speaking is applicable, as its name implies, to a substance prepared from linen. It is in fact linen made soft and somewhat fleecy by various mechanical processes, so as to render it suitable for the dressing of wounds. The qualities required in good lint are 1. perfect softness to prevent mechanical irritation to the wound, 2. looseness of texture to render it capable of absorbing the secretions from the surfaces to which it is applied, 3. a certain tenacity so that it may receive unctuous dressings, yet with a facility of being torn in one direction, and 4. sufficient firmness of fibre to prevent small portions from being easily separated, and remaining as foreign bodies in the wound. As formerly and still frequently made for domestic purposes, it consists of old linen scraped by means of a knife with the hand, and thus brought into a soft flocculent state, almost destitute of visible fibres. It is obvious that, though this answers some of the above requisitions, it entirely fails to answer others, and is unfit for general surgical use. It will not readily admit of the application of cerates, and must very often leave portions of its substance in the wound, to serve as future sources of irritation. Much better is the old-fashioned lint, made by machines worked by the hand. This was formerly, and may still be made, in large quantities. Old linen was used for the purpose, such as shirts, sheets, tablecloths, &c., and generally in irregular pieces. This was first cleansed thoroughly by washing with soap and water, or by boiling with a weak ley of soda or pearlash. Sometimes, when coloured, it was bleached before being washed. Thus prepared, it was operated on by a simple machine, in which the rag, wrapped round a cylinder, was submitted to the interrupted action of a knife, made to descend upon it at intervals of one-eighth of an inch, so as to cut the thread in one direction. On being removed from the machine, the cut ends of the thread became untwisted and loose, so as to give a flossy character to the fabric. To render it smooth, it was passed through rollers, and its ragged edges were trimmed. Of course it had different degrees of fineness according to the character of the rags used; and this diversity rendered it fit for different purposes; the finer pieces being used merely as a dressing with unctuous matter to exclude the air, while the thicker were better adapted to the absorption of the liquid secretions.

In the progress of improvement, machines were invented and patented for manufacturing lint on the large scale. Thus made, it is distinguished in the shops as *patent lint*. This is generally prepared out of cloth manufactured for the purpose, and therefore has whatever advantage may be derived from uniformity of shape and consistence. In other respects, it is doubtful whether it has any superiority over the old-fashioned article; especially, as, in consequence of competition, cotton, being the cheaper article, has frequently been in part or altogether substituted for linen. It is said that lint may be rapidly prepared, by attaching a piece of linen to the toothed cylinder of the common carding machine. (*Med. and Surg. Reporter*, Oct. 4, 1862.)

Cotton is in several respects inferior to linen for the preparation of lint; and, unless its presence in any manufactured article sold by this name be made known, it should be looked on as a fraudulent substitution. Its fibre is less soft and therefore more likely to irritate; it has much less absorbing power; and it conveys heat less rapidly. The following are methods by which it may be distinguished. (*Dr. Elsner.*) 1. A linen thread when held erect, and set on fire, appears, after the flame is extinguished, in a smooth continuous form, while cotton thread similarly treated has a tufted aspect. 2. Under a microscope which magnifies 300 diameters, the linen fibre appears to be a straight nearly solid cylinder, with a slender central canal; the cotton, flattened as a piece of tape, with a wide canal, and often twisted like a corkscrew. 3. The potassa test, proposed by Böttger, consists in exposing the doubtful substance to the action of a boiling concentrated solution of potassa. If made of linen, it will in two minutes assume a deep-yellow colour; if of cotton, it will either remain colourless, or will become very faintly yellow; and if the texture be composed of both, it will exhibit a streaked or mottled aspect. The examination must be quickly made, as the yellow colour of the potassa becomes faint with time. 4. Sulphuric acid dissolves the linen fibre, while it leaves that of cotton little changed. 5. Linen thoroughly oiled has the transparent appearance of oiled paper; cotton remains white and opaque. 6. Tinctures of all organic red dye-stuffs, as cochineal, madder, &c., give a much deeper colour to linen than to cotton, and cause a mottled appearance when the two are mixed.

Tow, and hemp in the state of *oakum*, have been employed for dressing wounds; but they are only applicable as exterior dressings to absorb the pus, when the discharge of this is very copious. Dr. L. A. Sayre, Surgeon of Bellevue Hospital, N. Y., has found

picked oakum preferable to lint as an immediate dressing to suppurating wounds, and ascribes its superiority to certain mechanical advantages as regards absorption. (*Bost. Med. and Surg. Journ.*, lxvii. 84.) Without adopting the theory, we may well admit the fact in certain cases; as few local applications are more efficient than tar properly used in promoting granulation in indolent suppurating surfaces; and oakum consists of hemp saturated with tar. *Charpie*, so much used by French surgeons in dressing wounds from the bottom, generally consists of bundles of straight threads, each four or five inches long, made by unravelling old rather coarse linen. It is much inferior as a dressing for wounds to our best forms of lint. On the subject of lint, we would refer the reader to an article in the *Pharmaceutical Journal* (x. 241); and to another in the *American Journal of Pharmacy* (July, 1861, p. 359). W.

LINUM CATHARTICUM. *Purging Flax.* This has been brought hither from the first part of the work, because, though formerly one of the Edinburgh officinals, it was discarded in the preparation of the British standard. The character of the genus to which this plant belongs will be found under *Linum*, in *Part* I. Purging flax is an annual plant, six or eight inches high, having erect, slender stems, dichotomous near the summit, furnished with opposite, obovate-lanceolate, entire leaves, and bearing minute white flowers, the petals of which are obovate and acute. It is a native of Europe, and not found in the United States, where it is never employed as a medicine. The whole plant is very bitter, and somewhat acrid, and imparts its virtues to water, which acquires a yellow colour. It appears to owe its activity to a peculiar drastic principle, which has received the name of *linin*, and which is afforded most largely by the plant after the flower has fallen. (*Pharm. Central Blatt*, 1844, p. 110.) Purging flax formerly enjoyed some reputation in Europe as a gentle cathartic, but fell into disuse. Attention has been again called to it as an excellent remedy in muscular rheumatism, catarrhal affections, and dropsy with disease of the liver. From four to eight grains of the extract, given twice or thrice daily, are said to operate as a purgative and diuretic, without inconvenience to the patient. (*Medical Times*, July, 1850.) A drachm of the powder, or an infusion containing the virtues of two or three drachms of the herb, may be taken for a dose. W.

LIQUIDAMBAR STYRACIFLUA. *Sweet Gum.* An indigenous tree, growing in different parts of the U. States from New England to Louisiana, and flourishing also in Mexico, where, as well as in our Southern States, it sometimes attains a great magnitude. In warm latitudes a balsamic juice flows from its trunk when wounded. This has attracted some attention in Europe, where it is known by the name of *liquidamber*, or *copalm balsam*, and is sometimes, though erroneously, called *liquid storax*. It is not afforded by the trees which grow in the Middle Atlantic States, but is obtained in the Western States bordering on the Ohio, and in those further south, as far as Mexico. It is a liquid of the consistence of thin honey, more or less transparent, of a yellowish colour, of a peculiar, agreeable, balsamic odour, and a bitter, warm, and acrid taste. By cold it becomes thicker and less transparent. It concretes also by time, assuming a darker colour. It is sometimes collected in the form of tears, produced by the spontaneous concretion of the exuded juice. According to M. Bonastre, it contains a colourless volatile oil, a semi-concrete substance which rises in distillation and is separated from the water by ether, a minute proportion of benzoic acid, a yellow colouring substance, an oleo-resin, and a peculiar principle, insoluble in water and cold alcohol, for which M. Bonastre proposes the name of *styracin*. The proportion of benzoic acid is greatly increased by time. Mr. Hodgson obtained from a specimen which he examined 4·2 per cent. (*Journ. of the Phil. Col. of Pharm.*, vi. 190.) According to Mr. Daniel Hanbury, the acid contained in it is the cinnamic, as is the case in all the products of the liquidambar trees. (*Am. Journ. of Pharm.*, xxix. 478.) Examined by Mr. W. P. Creecy, of Mississippi, it was found, besides a volatile odorous principle, and 30 per cent. of a hard resin, to contain cinnamic acid as the prominent acid ingredient, yet associated with a small proportion of benzoic acid. (*Ibid.*, May, 1860, p. 199.) Prof. Procter, on a subsequent examination of the product, could not detect benzoic acid, and states that little, if any of that acid exists in it, and that what had been taken for benzoic acid by the earlier examiners was really the cinnamic. (*Am. Journ. of Pharm.*, Jan. 1866, p. 38.) A very careful examination of the liquidamber gum has been made by Mr. W. L. Harrison. His results have been confirmed by Prof. Maisch (*Am. Journ. of Pharm.*, xlvi. 160, 165), and seem to prove that the American drug is identical with styrax, except in containing no water mechanically mixed with it.

Another product is said to be obtained from the same tree by boiling the young branches in water, and skimming off the fluid which rises to the surface. It is of a thicker consistence and darker colour than the preceding, is nearly opaque, and abounds in impurities. This also has been confounded with liquid storax, which it resembles in properties, though derived from a different source. It is said to be used in Texas in coughs. (Gammage, *N. O. Med. and Surg. Journ.*, xii. 636.)

Liquidamber may be employed for the same purpose as storax, and is said to be used to a considerable extent in the Southern United States, but it is almost unknown in the

shops of the Northern United States. The concrete juice is said to be chewed in the Western States in order to sweeten the breath. Dr. Gammage states that the juice is employed popularly in Texas as an addition to excitant ointments. According to C. W. Wright, of Louisville, Ky., the bark of the tree is used with great advantage in the Western States in the diarrhœa and dysentery of summer, especially in children. It is taken in the form of syrup, which may be prepared from the bark in the same manner as the syrup of wild-cherry bark, according to the U. S. Pharmacopœia. The dose is a fluidounce for an adult, repeated after each stool. (*Am. Journ. of Med. Sci.*, N. S., xxxii. 126.) The editor of the *Va. Medical Journal* (Aug. 1856, p. 143) states that the use of a decoction of the bark in milk is common in many parts of Virginia, as a remedy in the diarrhœa of children. Prof. Procter states that the leaves and capsules of the tree have a somewhat aromatic odour when bruised, and are decidedly acid to the taste and to litmus, and thinks it probable that they contain gallic acid in considerable quantities; the tincture of the fresh leaves being decidedly acid and astringent, and giving a deep bluish-black colour with a persalt of iron, which is in great measure discharged by a heat of 212° F. (*Am. Journ. of Pharm.*, Jan. 1866, p. 38.)

Liquidambar Altingia is said to exude a balsam in the Tennasserim Provinces of India, somewhat resembling liquid storax. (See *Pharm. Journ.*, viii. 243.) W.

LIQUOR MAGNESII BISULPHITIS. Mr. George Archibold having found that the bisulphite of magnesium is capable of arresting the butyric acid fermentation, proposes a solution of it as a remedy in heartburn. He prepares it by treating the carbonate of magnesium with sulphurous acid, adding to an ounce of water 16 grains of the sulphite thus formed, and passing sulphurous acid gas through the mixture till a clear solution is obtained. (*Pharm. Journ. and Trans.*, 3d series, ii. 502.) H. C. W.

LITHOSPERMUM OFFICINALE. *Gromwell. Milium Solis.* A European perennial, the seeds of which are ovate, of a grayish-white or pearl colour, shining, rather larger than millet seeds, and of a stony hardness, from which the generic name of the plant originated. From an opinion formerly prevalent, that nature indicates remedies adapted to certain diseases by some resemblance between the remedy and the character of the complaint or of the part affected, the seeds of this plant were applied to the treatment of calculous disorders; and they retained their ground in the estimation of physicians as a diuretic, useful in complaints of the urinary passages, long after the fanciful notion in which their use originated had been abandoned. But they are at present considered nearly inert, and are not employed. W.

LITMUS. Lacmus. Ed. *Turnsole. Tournesol, Orseille*, Fr. This is a peculiar colouring matter derived from Roccella tinctoria and other lichens. Three purple or blue colouring substances are known in commerce, obtained from lichenous plants. They are called severally *litmus*, *orchil*, and *cudbear*. The lichens employed are different species of *Roccella*, *Lecanora*, *Variolaria*, and others. They grow on alpine or maritime rocks, in various parts of the world, and for commercial purposes are collected chiefly upon the European and African coasts, and the neighbouring islands, as the Azores, Madeira, Canaries, and Cape de Verdes. The particular species most employed are probably *Lecanora tartarea* or *Tartarean moss*, growing in the North of Europe, and *Roccella tinctoria* or *orchilla weed*, which abounds upon the African and insular coasts, and is called commercially, in common with other species of the same genus, *Angola weed*, *Canary weed*, &c., according to the place from which it may be brought.

The principles in these plants upon which their valuable properties depend, are themselves colourless, and yield colouring substances by the reaction of water, air, and ammonia. They are generally acids, and are named *lecanoric*, *orsellic*, *erythric*, &c., according to their use or origin. What is the exact chemical change by which the colouring matters are developed is not determined; but the original body, in some instances at least, undergoes a series of changes, before the ultimate result is obtained. Dr. Stenhouse proposes that the principles should be extracted from the plants at their place of collection, so as to diminish the cost of carriage. For this purpose the lichens, having been finely divided, are to be macerated with milk of lime, the infusion thus obtained to be precipitated with muriatic or acetic acid, and the precipitate to be dried with a gentle heat. Almost the whole of the colouring principles are thus extracted, and obtained in a small bulk. To test the value of the plants as dye-stuffs, they may be macerated in a weak solution of ammonia, or a solution of hypochlorite of calcium may be added to their alcoholic tincture. In the former case, a rich violet-red colour is produced; in the latter, a deep blood-red colour instantly appears, but soon fades. All the three colouring substances above referred to may be obtained from the same plant.

Lacmus or *litmus* is prepared chiefly if not exclusively in Holland. The process consists in macerating the coarsely powdered lichens, in wooden vessels under shelter, for several weeks, with occasional agitation, in a mixture of urine, lime, and potash or soda. A fermentation ensues, and the mass, becoming first red and ultimately blue, is after the last change removed, mixed with calcareous or siliceous matter to give it consistence, and with indigo to deepen the colour, and then introduced into small moulds, where it hardens. It comes to us in rectangular cakes, from a quarter of an inch to an inch in

length, light, friable, finely granular, of an indigo blue or deep-violet colour, and scattered over with white saline points. It has the combined odour of indigo and violets, tinges the saliva of a deep-blue, and is somewhat pungent and saline to the taste. From most vegetable blues it differs in not being rendered green by alkalies. It is *reddened by acids*, and restored to its original blue colour by *alkalies*.

Its chief use in medicine is as a test of acids and alkalies. For this purpose it is employed either in infusion, or in the form of litmus-paper. The infusion, usually called *tincture of litmus*, may be made in the proportion of one part of litmus to twenty of distilled water, and two parts of alcohol may be added to preserve it. *Litmus-paper* is prepared by first forming a strong clear infusion with one part of litmus to four of water, and dipping slips of white unsized paper into it, or applying it by a brush to one surface only of the paper. The paper should then be carefully dried, and kept in well-stopped vessels, from which the light is excluded. It should have a uniform blue or slightly purple colour, neither very light nor very dark. As a test for alkalies the paper may be stained with an infusion of litmus previously reddened by an acid. The following method of preparing litmus-paper is given in *Les Mondes*. Digest for some time 20 grammes of litmus in 100 cubic centimetres of water, shake sometimes, and filter. To the filtered liquid add a slight excess of nitric acid, and boil; and then exactly neutralize with potassa. Now make a weak solution of gelatin by boiling one part of ichthyocolla in 6 parts of water; immerse in this solution some white unsized paper, and afterwards hang it up to dry; then colour one side of it with the solution of litmus. (*Journ. de Pharm.*, Sept. 1868, p. 224.) By gas-light it is said that the change of colour cannot be determined by the eye exactly, as the blue of litmus becomes mauve; but this may be obviated by watching the process through a green glass, by which the faintest trace of blue becomes discernible. (*Pharm. Journ.*, 2d ser., vi. 479.)

M. de Luynes has succeeded in procuring a colouring matter from *orcine*, a peculiar saccharine principle extracted by Robiquet from the *Variolaria dealbata*, a lichenous plant inhabiting the Pyrenees. (Guibourt, *Hist. Nat. des Drogues Simp.*, 4e ed., ii. 80.) For a synthesis of orcine, see *Journ. de Pharm.*, 4e sér., xvi. 108. A fine violet colouring matter had been previously prepared from orcine, by the action of ammonia and oxygen, denominated *orceine* (*Ibid.*); but M. de Luynes was the first to prepare litmus from it. The process consists in mixing, in an imperfectly stopped matrass, orcine with 25 times its weight of crystallized carbonate of sodium, and 5 times its weight of water, to which a little water of ammonia has been added, at most equal in quantity to the orcine. The whole is heated to between 140° and 170° F., for five or six days, care being taken to agitate the mixture from time to time. The resulting liquid, of a deep-violet blue, is diluted with water, and saturated by a slight excess of muriatic acid, which precipitates the colouring matter. Thus prepared, litmus is in little irregular lumps, possessing the iris-like and metallic reflections of most colouring matter; very slightly soluble in cold water, to which it imparts a vinous tint, becoming of an onion-skin colour with acids, and a violet-blue with alkalies; very slightly soluble also in alcohol, which it renders yellow. Its alcoholic solution, diluted with water, is an extremely sensitive agent for the detection of the least traces of alkaline substances. By adding to it a very minute quantity of potassa, a blue liquid is obtained, which is affected by acids in the same manner as ordinary tincture of litmus. (*Journ. de Pharm.*, 4e sér., i. 141.)

Orchil or *archil*, as prepared in England, is in the form of a thickish liquid, of a deep reddish-purple colour, but varying in the tint, being in one variety redder than in another. The odour is ammoniacal. It is made by macerating lichens in a covered wooden vessel, with an ammoniacal liquor, either consisting of stale urine and lime, or prepared by distilling an impure salt of ammonia with lime and water. (*Pereira.*) For details as to the method of preparation, see *Chemical News*, Sept. 1874, p. 143. It is occasionally adulterated with the extracts of coloured woods, as logwood, sappan-wood, &c. A mode of detecting these adulterations is given by Mr. F. Leeshing in the *Chemical Gazette*, of June 1, 1855 (p. 219).

Cudbear is in the form of a purplish red powder. It is procured in the same manner as orchil; but the mixture, after the development of the colour, is dried and pulverized.

The point in which the preparation of these colouring substances differs from that of litmus appears to be, that potash or soda is added, in the latter, to the ammoniacal liquid used. Orchil and cudbear are employed as dye-stuffs, and sometimes, in like manner, with litmus, as a test of acids and alkalies. W.

LOLIUM TEMULENTUM. *Darnel. Ivraie*, Fr. One of the Graminaceæ or grasses, belonging to the Linnæan class and order Triandria Digynia, indigenous in the old world, but introduced into the U. States, and owing its chief importance to the circumstance that it is apt to grow among wheat and other grains, and thus sophisticate the product with its seeds. From ancient times, these have been supposed to be deleterious to the human system, producing symptoms analogous to intoxication from alcoholic drinks, whence the plant derived its specific name of *Temulentum*, and the French name of *ivraie*. The seeds have a sweetish taste, and are said to contain gluten, starch, and sugar; and

there is nothing in their sensible properties which would suggest the idea that they might be poisonous. Indeed, De Candolle states that they are often eaten in bread without inconvenience; and that a beer into which they enter as an ingredient is drank with impunity. (*Mérat et De Lens*, iv. 141.) The testimony, however, to the fact, that they have a narcotic effect on the system, evincing itself by vertigo, dizziness, headache, sleepiness, and a species of drunkenness, is too strong to be resisted; though very few instances, so far as we know, have been recorded of positive fatal effects from their use. MM. Rivière and Maizière have each recorded a fatal case, which occurred in peasants who had for several days lived upon bread, consisting to the extent of two-thirds or five-sixths of darnel. (*Journ. de Pharm.*, Oct. 1863, p. 280.) Though thus acting on man, dogs, sheep, and horses, the seeds are said to be wholly innoxious to hogs, cows, and ducks; and poultry have even been fattened by them. The remedy, in case of poisoning, would be as soon as possible to evacuate the stomach. Lindley states that this is the only one of the grasses which has been satisfactorily proved to have deleterious properties. (*Med. and Economic Bot.*, p. 27.) Two analyses have recently been made of the seeds. One, by MM. Filhol and Baillett, gives as their constituents, about 50 per cent. of starch; a thick, almost solid green oil, consisting of a portion saponifiable and another not so, the latter soft, orange coloured, insoluble in water, very soluble in alcohol, ether, and sulphuret of carbon, producing tremulousness when swallowed, but without any symptoms of narcotism, and capable of causing death in animals; sugar; dextrin; albumen; and a substance hitherto observable only in the form of extractive, soluble in water and alcohol, and acting on animals as a narcotic. The second examination was made by Ludwig and Stahl, who, besides cellulose, gluten, and starch, found 1. a neutral fatty matter burning with smoke; 2. an oily acid, burning without smoke, and precipitated from its alcoholic solution by acetate of lead; 3. an acrid oil, burning with smoke and an odour of incense; 4. a fixed oil, acrid and bitter, saponifiable, and after being saponified, yielding, by precipitation with muriatic acid, a white, rancid matter, volatilizable with watery vapour; and a portion of this substance contained in the seeds as a soap soluble in water. All the above principles, in the free state, are soluble only in alcohol and ether. In addition, there were, 5. a substance soluble in water, producing a viscid mass, of an acrid and bitter taste, and transformable into sugar and volatile acids by boiling in contact with dilute sulphuric acid; 6. uncrystallizable sugar; 7. tannic acid, producing a green colour with the salts of iron, and yielding sugar with dilute sulphuric acid; 8. an acid resembling the metapectic; 9. sulphate of potassium; 10. resinous substances. The authors consider the activity of the seeds to reside in the acrid oils, and the bitter principle mentioned in No. 5. (*Ann. de Thérap.*, 1866, p. 64.) W.

LONICERA CAPRIFOLIUM. *Honeysuckle.* This ornament of our gardens is a native of the South of Europe. Its sweet-scented flowers are sometimes used in perfumery; and a syrup prepared from them has been given in asthma and other pectoral affections. The expressed juice of the plant has been recommended for the stings of bees, being rubbed directly on the injured spot. The fruit of all the species of Lonicera is said to be emetic and cathartic (*Mérat et De Lens*), and that of L. xylosteum to have caused serious poisoning. (*Journ. de Pharm.*, 4é ser., xviii. 65.) W.

LYCIUM BARBARUM. *Matrimony Vine.* The genus Lycium belongs to the Linnæan class and order Pentandria Monogynia, and to the natural order Solanaceæ. Different species have been used in various parts of the world in reference to supposed medical virtues. Lycium barbarum, which is indigenous in the South of Europe and in Asia, is a thorny shrub, with long flexible branches, and is cultivated for hedges and arbours. The leaves and stems were examined chemically by Drs. Husemann and Marme, who succeeded in extracting from them an alkaloid by means of phosphomolybdate of sodium. For the mode of proceeding, as well as for the method of preparing the phosphomolybdate used by them, the reader is referred to the *American Journal of Pharmacy* (May, 1864, p. 226). The alkaloid, which they name *lycin* (*lycina*, or more properly, *lycia*), is characterized by its strong affinity for water, which causes it to deliquesce in a few minutes after exposure, and renders it very soluble in that liquid. It is also readily soluble in alcohol, but nearly insoluble in ether. It is crystallizable, of a sharp but not bitter taste, and forms crystallizable salts with the acids. Prof. Aug. Husemann believes that *lycin* does not exist in the plant, but is formed during the process of extraction, and also that it is identical with betaina. (*Am. Journ. of Pharm.*, xlvii. 209.) The young shoots of one of the species of Lycium are eaten in Spain as asparagus, and its leaves as salad; and the aborigines of New Granada use another species against erysipelas. The leaves of L. barbarum, as well as the fruit, are said to be used by the physicians of Japan. (*Mérat et De Lens.*) W.

LYCOCTONA. For a paper on the physiological action of this alkaloid, see *Philad. Med. Times*, Oct. 16, 1875. H. C. W.

LYTHRUM SALICARIA. *Loosestrife. Purple Willow-herb.* This is an elegant perennial plant, two or three feet high, with an erect, quadrangular, hexagonal, downy, herbaceous stem, bearing opposite, ternate, sessile, lanceolate leaves, cordate at the base, and downy on the under surface and at the margin. The flowers are axillary, forming a

leafy verticillate spike. The calyx is red, with unequal segments, the petals purple and undulate, the fruit a small, elliptical capsule. The plant grows wild in all parts of Europe, and is found in New England and Canada. It prefers meadows, swamps, and the banks of streams, which it adorns in July and August with its showy purple flowers. The whole herbaceous part is medicinal, and is dried for use. In this state it is inodorous, and has an herbaceous, somewhat astringent taste. It renders boiling water very mucilaginous, and its decoction is blackened by the sulphate of iron. Loosestrife is demulcent and astringent, and may be advantageously given in diarrhœa and chronic dysentery, after due preparation by evacuating treatment. It has long been used in Ireland in these complaints, and is said to be a popular remedy in Sweden. The dose of the powdered herb is about a drachm two or three times a day. A decoction of the root, prepared by boiling an ounce in a pint of water, may be given in the dose of two fluidounces. W.

MACLURA AURANTIACA. The bark of the root of this tree, which is indigenous in our Southern States, is said to be considerably used in making a yellow dye. Mr. Alex. King has found in it *moric* and *morintannic acids.* (*Am. Journ. of Pharm.*, xlvi. 257.) H. C. W.

MALAMBO OR MATIAS BARK. A bark received from South America by Dr. Alex. Ure, under the name of *matias bark*, was found to have the characters of the *malambo bark*, which is held in high esteem in New Granada where it is produced, and has been long known to the French pharmacologists. Though conjecturally ascribed by some to a Drimys, and by others to a Croton, its botanical source was unknown till within a few years. It has been ascertained by H. Karston, of Berlin, to be derived from a hitherto undescribed species of Croton, which he names *Croton Malambo*, and which is described in his work entitled "*Floræ Columbiæ Terrarumque adjacentium Specimina Selecta.*" This is a small tree or shrub, growing on the coast of Venezuela and New Granada. (*Pharm. Journ.*, Dec. 1859, p. 321.) The bark is described by Dr. Ure as being three or four lines thick, brittle though somewhat fibrous, of a brown colour, and covered with an ash-coloured tuberculous epidermis. It has an aromatic odour, and a bitter pungent taste, and yields these properties to water and alcohol. Its active ingredients appear to be a volatile oil, and a bitter extractive matter. According to Dr. Mackay, it has been used successfully in intermittents, convalescence from continued fever, hemicrania, dyspepsia, and other cases in which tonic remedies are useful, and also as an adjuvant to diuretics. It is probably nothing more than an aromatic tonic. Dr. Ure has administered it with good effect as a substitute for Peruvian bark. (*Pharm. Journ.*, iii. 169.)

Under the name of *Winter's bark*, a considerable quantity of bark was some time since imported into the United States from South America, which Mr. E. S. Wayne, of Cincinnati, has identified with the malambo bark above described, having found it to correspond with that product both in sensible characters and composition. (*Am. Journ. of Pharm.*, xxix. 1.) We can confirm this decision of Mr. Wayne; as a specimen in our possession answers precisely to the description given by Dr. Ure. The malambo bark, analyzed by Cadet de Gassicourt, yielded volatile oil, bitter resin, and extractive; but no tannic nor gallic acid, and no alkaloid; and the same was the case with the so-called Winter's bark examined by Mr. Wayne. (*Ibid.*) The same bark has been analyzed by Mr. F. B. Dancy, who found in it volatile oil, gum, starch, albumen, resin, extractive, fixed oil, wax, and several inorganic substances. (*Ibid.*, p. 219.) W.

MALT EXTRACTS. Under this name two distinct preparations have been put upon the market; the one being a very strong beer, the other a sort of extract prepared from malt, and chiefly composed of dextrin and glucose, with some albumen and phosphates. True malt extract may be prepared by powdering the drug, mixing it with cold water, raising to a temperature of from 150° to 158° F., maintaining this for several hours, until the tincture of iodine shows that all the starch has been converted into dextrin and glucose, expressing and straining, and finally evaporating the clear fluid to the consistency of a thick syrup. Owing to the proneness to clog the strainer, Prof. Ebert mixes the solution with paper pulp before straining. (*Am. Journ. of Pharm.*, xliii. 33.) M. L. W. Jassoy (*Journ. de Pharm.*, 4e sér., xvi. 440) recommends the following method. Macerate malt for three hours in its weight of cold water, then add four times its weight of water, and carefully raise the temperature to 65° F. during one hour. Filter, boil the residue with three parts of water for a quarter of an hour, remove from the fire, and allow to cool to 75° C., filter, and express the residue. Mix the liquids, maintain for some time at a temperature of 50° C., until the starch is converted into sugar. Reduce to one-third the volume by gentle boiling, allow to stand overnight, filter through a woollen strainer, and evaporate upon a water-bath to the consistence of an extract. Malt extract has been largely used as a dietetic tonic, but is probably one of the preparations destined to a short-lived popularity. H. C. W.

MALVA SYLVESTRIS. *Common Mallow.* This herb was recognised by the Edinburgh College, but has been discarded by the British Council, and is no longer officinal. It belongs to the Linnæan class and order Monadelphia Polyandria, and the natural family Malvaceæ. The following is its essential generic character. "*Calyx* double, the

exterior three-leaved. *Capsules* very many, one-seeded." (*Willd.*) It is a perennial, herbaceous plant, with a round, hairy, branching, usually erect stem, from one to three feet high, bearing alternate, petiolate, cordate, roughish leaves, which are divided into five or seven crenate lobes, and on the upper part of the stem are almost palmate. The flowers are large, purplish, and placed, from three to five together, at the axils of the leaves, upon long slender peduncles, which, as well as the petioles, are pubescent. The petals are five, inversely cordate, and three times as long as the calyx. The capsules are disposed compactly in a circular form. This species of mallow is a native of Europe, growing abundantly on waste grounds and by the way-sides, and flowering from May to August. It is sometimes cultivated in our gardens. Other species, indigenous or naturalized in this country, are possessed of the same properties, which are in fact common to the genus. *Malva rotundifolia* is one of the most common, and may be substituted for *M. sylvestris*. The herb and flowers have a weak, herbaceous, slimy taste, without odour. They abound in mucilage, which they readily impart to water; and the solution is precipitated by acetate of lead. The infusion and tincture of the flowers are blue, and serve as a test of acids and alkalies, being reddened by the former, and rendered green by the latter. The roots and seeds also are mucilaginous. Common mallow is emollient and demulcent. The infusion and decoction are sometimes employed in catarrhal, dysenteric, and nephritic complaints; and are applicable to all other cases which call for the use of mucilaginous liquids. They are also used as an emollient injection; and the fresh plant forms a good suppurative or relaxing cataplasm in external inflammation. It was formerly among the culinary herbs. W.

MANDRAGORA OFFICINALIS. *Atropa Mandragora.* Linn. *Mandrake. Mandragora.* A perennial European plant, with spindle-shaped root, which is often forked beneath, and is therefore compared, in shape, to the human figure. In former times this root was supposed to possess magical virtues, and was used as an amulet to promote fecundity, &c.; and the superstition is still cherished by the vulgar in some parts of Europe. The plant is a poisonous narcotic, somewhat similar in its properties to belladonna, to which it is botanically allied. It was much used by the ancients with a view to its narcotic effects; and the root has been recommended by some eminent modern physicians, as an external application to scrofulous, scirrhous, and syphilitic tumours. It is said to have been used by the ancients as an anæsthetic agent before surgical operations. (*Journ. de Pharm.*, xv. 290.) Its physiological action has been partially investigated by Dr. B. W. Richardson. (*B. & F. Med.-chir. Rev.*, Jan. 1874, p. 242.) It is unknown as a remedy in the United States. W.

MANGANESE. *Manganesium.* This metal and its compounds with oxygen (three regular oxides and two acids) have been already described. (See *Manganesii Oxidum Nigrum.*) Several of its combinations have been proposed as medicines, and the therapeutic trials thus far made with them, place them alongside of those of iron as tonic and anti-anemic remedies. It will be recollected that manganese as well as iron is always present, in minute proportion, in healthy blood, and has been detected in various solids and fluids of the body. (See *page* 569.) According to an analysis by M. Burin-Dubuisson, the amount of manganese in the blood corpuscles is about one-twentieth that of the iron. It is stated, as an advantage of the preparations of manganese, that they may be prescribed in conjunction with tannic acid and the various astringent medicines, which are all incompatible with the preparations of iron. Of the oxides of manganese, the *protoxide* only is strongly salifiable; and this is the oxide present in the ordinary salts of the metal. It may be obtained by precipitation, as a white hydrate, from any of the soluble salts of manganese by the addition of a caustic alkali. This, according to M. Hannon, is a good medical preparation; but a strong objection to it is that it rapidly absorbs oxygen, and passes to the state of the brown hydrated sesquioxide. The officinal deutoxide (native black oxide) is described at *page* 568, where its medical properties are also noticed. The *sulphate of manganese* and the *permanganate of potassium*, having been adopted as officinal, are described in the first part of this work.

Iodide of Manganese. This iodide may be administered in syrup or pill. Professor Procter has proposed the following formula for the *syrup*. Dissolve *sixteen drachms* of sulphate of manganese, and *nineteen drachms* of iodide of potassium, separately, in *three fluidounces* of water, each portion of water being previously sweetened with *two drachms* of syrup. Mix the solutions in a glass-stoppered bottle, and when the crystals of sulphate of potassium have ceased to precipitate, throw the liquor on a strainer of fine muslin, and allow it to filter into a pint bottle, containing *twelve ounces* of powdered sugar. When the solution has ceased to pass, wash the filter with a little sweetened water, and add sufficient of that liquid to make the whole measure *a pint*. Lastly, agitate the liquid until the sugar is dissolved. Prof. Procter states that this syrup contains about a drachm of iodide of manganese in each fluidounce, and corresponds in strength to the officinal solution of iodide of iron. The small proportion of sulphate of potassium which remains dissolved in the syrup, does not interfere with its medicinal efficacy. The dose is from ten to thirty drops, repeated several times a day. (*Am. Journ. of Pharm.*, Oct. 1850.) M. Hannon makes a *pill of iodide of manganese* by double decomposition between equa

weights of iodide of potassium and crystallized sulphate of manganese. The salts are perfectly dried, accurately mixed in powder, and then rubbed up with honey, so as to reduce the whole to a pilular mass, which may be divided into four-grain pills. Assuming that the honey added compensates for the loss of water in drying, each pill will consist of about two grains of iodide of manganese, one of sulphate of potassium, and one of honey, and sulphate of manganese in excess. The dose is one pill daily, gradually increased to six. According to M. Hannon, iodide of manganese is particularly useful in the anæmia attendant on scrofula, phthisis, and cancer, and in syphilitic cachexy. Given in conjunction with cinchona, it rapidly removes the enlargement of the spleen often following protracted fevers.

Carbonate of Manganese. This salt may be obtained by the following formula, which is that of M. Hannon, accommodated to the weights and measures of the U. S. Pharmacopœia. Dissolve *seventeen ounces* of crystallized sulphate of manganese, and *nineteen ounces* of carbonate of sodium, separately, in two pints of water, *a fluidounce* of syrup having been previously added to each pint; and, having mixed the solutions in a well-stopped bottle, allow the precipitate to subside. Decant the supernatant liquid, wash the precipitate with sweetened water, allow it to drain from a cloth saturated with syrup, express, mix with *ten ounces* of honey, and evaporate rapidly to form a pilular mass, which is to be divided into four-grain pills. By a double decomposition between the sulphate of manganese and carbonate of sodium, carbonate of manganese is precipitated, and sulphate of sodium remains in solution. The sulphate is washed away, and the carbonate is brought to a pilular consistence with honey, which, together with the syrup, prevents the protoxide of manganese in the pill from rising to a higher stage of oxidation. The dose is from two to ten pills daily. Carbonate of manganese was tried by M. Hannon as a medicine on himself. After its use for fifteen days he found his appetite improved, and his pulse increased in force; and he experienced a feeling of sanguineous plethora. He afterwards exhibited the remedy in several anemic cases, with the effect of exciting the functions to a more healthy action, increasing the strength and improving the blood.

Phosphate, *tartrate*, and *malate of manganese* have also been proposed by M. Hannon as useful remedies. The phosphate is prepared by double decomposition between sulphate of manganese and phosphate of sodium. A *syrup of phosphate of manganese* has been made by Mr. T. S. Wiegand, of this city. (See his formula in the *Am. Journ. of Pharm.* for July, 1854.) Dr. Simpson, of Edinburgh, informed one of the authors that a syrup made with two grains of phosphate of iron and one grain of the phosphate of manganese in a fluidrachm of syrup, was much and advantageously used by himself and others in Edinburgh. This may be easily prepared by adding to the two ingredients mentioned five grains of glacial phosphoric acid for each grain of the phosphate of iron. (*Pharm. Journ.*, Nov. 1859, p. 288.) *Lactate of manganese* has been given, associated with lactate of iron, in chlorosis, in the dose of a grain, increased to five grains.

Ferro-manganic Preparations. M. Hannon conceives that manganese is peculiarly suited to the treatment of anemic cases in which iron has failed, or acts very slowly; but, instead of passing at once from the use of iron to that of manganese, he prefers to give intermediately a mixture of the two metals. For this purpose he recommends the following formula. Take of crystallized sulphate of iron *six drachms and a half;* crystallized sulphate of manganese *two drachms;* carbonate of sodium *nine drachms;* honey *five drachms.* Rub together, and with syrup make a mass, to be divided into four-grain pills. In this pill both the metals are present as carbonates; and, as the sulphate of sodium is not washed away, it contains that salt also. The dose is from two to ten pills daily. (See the paper of M. Hannon, *Journ. de Pharm.*, 3e sér., xvi. 41 and 189; also a note of the favourable results obtained by M. Pétrequin, of Lyons, *Ibid.*, xvi. 381.) Further experience has confirmed the favourable opinion of M. Pétrequin in relation to the therapeutic value of the ferro-manganic preparations. A number of formulas have been devised by M. Burin-Dubuisson, of Lyons, for making them, containing the metals variously combined; but the most important of them is the *syrup of iodide of iron and manganese*, for the preparation of which we prefer the following formula by Prof. Procter. Take of iodide of potassium 1000 grains; sulphate of protoxide of iron 630; sulphate of protoxide of manganese 210; iron filings 100; sugar, in coarse powder, 4800. Powder the iodide and sulphates separately, and, having mixed them with the filings, add half a fluidounce of distilled water, and triturate to a uniform paste. Then add another half fluidounce of distilled water to the paste, and triturate again; and, after an interval of fifteen minutes, add a third half fluidounce, and mix. Next transfer the magma of salts to a moistened filter, supported on a funnel, and allow them to drain into a bottle, holding a little more than twelve fluidounces, and containing the sugar. After they have drained, add cold boiled water by small portions at a time, until the solution of the iodides has been displaced and washed from the crystalline magma of sulphate of potassium. Finally, add sufficient cold boiled water to make the whole measure *twelve fluidounces.* The object of the iron is to prevent the liberation of iodine. This syrup has a very pale straw colour. It contains a little sulphate of potassium, which does not injure it as a therapeutic agent. If the salts have not been all decomposed during their

reaction, it will be greenish. Each fluidounce contains 50 grains of the mixed iodides, in the proportion of 3 parts of iodide of iron to 1 of iodide of manganese. The dose is from ten drops to half a fluidrachm. (*Am. Journ. of Pharm.*, May, 1853, p. 198.) Syrup of iodide of iron and manganese is considered by M. Pétrequin to be particularly suited to the treatment of anæmia, resulting from obstinate intermittent fevers, prolonged suppuration, and scrofulous, syphilitic, and cancerous affections.

Dr. T. S Speer, of Cheltenham, in imitation of the practice of M. Hannon and M. Pétrequin, has employed the combined carbonates of iron and manganese with excellent effects; but, instead of using the carbonate in pill, protected by honey and syrup, as M. Hannon has done, he prefers a saccharine carbonate of the two metals, in imitation of the London saccharine carbonate of iron, made by the following formula. Dissolve *three ounces and one drachm* of sulphate of iron, *one ounce and one scruple* of sulphate of manganese, and *five ounces* of carbonate of sodium, each, in *thirty Imperial fluidounces* of water, and thoroughly mix the solutions. Collect the precipitated carbonates on a cloth filter, and wash them immediately with cold water, to separate the sulphate of sodium. Then press out as much water as possible, and, without delay, triturate the pulp with *two and a half ounces* of finely powdered sugar. Lastly, dry the mixture at a temperature not exceeding 120°. The *saccharine carbonate of iron and manganese*, as thus prepared, is a reddish-brown powder, devoid of all taste, except that imparted by the sugar. The dose is five grains, gradually increased to a scruple, three times a day, given with the meals, or immediately after them. (See *Am. Journ. of Pharm.*, March, 1854, p. 127; from *Med. Times and Gaz.*) B.

MATA. This name is given, in New Mexico, to an herb much used in that region as an addition to tobacco in smoking. Attention has been called to it by Prof. E. S. Wayne, in a brief communication to the *American Pharmaceutical Association*, published in their *Proceedings* for 1867. It is said, when burning, to have an odour like that of the Tonka-bean, and, when smoked with tobacco, to correct the extremely disagreeable smell imparted by this to the clothing and apartments. From imperfect specimens of the plant raised by Prof. Wayne from seeds which had come into his possession, and sent to Prof. Maisch, it is supposed to be a Eupatorium, probably the *E. incarnatum* of Walter, which is indigenous in Texas, and with the description of which the specimens closely corresponded. (*Am. Journ. of Pharm.*, March, 1868, p. 122.) The name Mata must not be confounded with mate, the name given by the people of the La Plata to the famous Paraguay tea, the product of *Ilex Paraguaiensis*. W.

MAUCONA BARK. According to MM. Gallois and Hardy this is the bark of a leguminous tree, *Erythrophlæum Guineense*, and is used as an ordeal poison in Africa. The observers just mentioned found it to kill the frog by cardiac paralysis, and to exert no influence upon the voluntary muscles. (*Journ. de Pharm.*, Sept. 1875, p. 218.) It is probably the same as Sassy Bark. H. C. W.

MEAT BISCUIT. This alimentary substance, containing much nutriment in a small bulk, is the invention of Mr. Gail Borden, jun., of Texas. It is made by mixing a concentrated fluid extract of flesh, strained through wire-cloth, and freed from fat, with good wheat flour, or other meal, and baking the dough into a biscuit, which must be preserved, in mass or coarse powder, free from moisture, in gutta-percha bags, or air-tight casks or cases. To make the dough, about two parts of the extract are mixed with three of the flour; and about 20 per cent. is lost in baking. The extract contains the soluble ingredients of the flesh, not coagulable by heat; namely, gelatin, kreatin, kreatinin, the phosphoric, lactic, and inosinic acids, and certain salts. Of course, it contains no albumen nor fibrin, unless in some altered state in which they are rendered soluble at a boiling temperature. In this nutritious biscuit, the absence of albumen and fibrin is supposed to be supplied by the gluten of the flour. To prepare a pint of palatable soup, an ounce of the powdered biscuit, first made into a thin paste with cold water, is added, with constant stirring, to sufficient boiling water, and the whole boiled for twenty minutes. Salt and pepper are then added to suit the taste. The meat biscuit forms an important resource in all cases in which food must be carried on long journeys for daily consumption. B.

Borden's Extract of Beef. This, which is also a preparation of Mr. Borden's, might perhaps have been more appropriately referred to under *Extractum Carnis;* but convenience has induced us to place it here in connection with the meat biscuit of that manufacturer. It is prepared in Illinois, in consequence of the abundance, in that State, of the beeves best suited to the purpose. It appears to be prepared essentially as the extracts of beef already noticed, only that the evaporation, which is conducted in vacuo, is carried to dryness. It consists exclusively of the soluble ingredients of the flesh, without addition, even of common salt or other condiment; and, as it is in the process of extraction exposed to a sufficient heat to cook it thoroughly, it requires no further application of heat to fit it for use; all that is necessary being hot water to dissolve it. As it is in the dry solid state, it does not require cans for its preservation; and is kept for sale in the form of packages of different sizes. One pound of it represents 20 pounds of beef. Being free from mustiness or other offensive smell or taste, it may

be made immediately into soup of any desired strength, either for the sick or well. From one-half of an ounce to an ounce cut into small pieces, and stirred with a quart of hot water till perfectly dissolved, with salt and black pepper or such other flavouring material as may be required, will form beef soup. If peas, beans, or other leguminous fruit, with fresh vegetables, be required, these should first be made into a soup, and the extract afterwards added in due proportion while the liquid is still hot. A preparation equivalent to essence of beef may be made by dissolving two-thirds of an ounce in a pint of boiling hot water. W.

Preserved Meat-juice is a nutritive liquid, prepared by Mr. Gillon, a manufacturer of preserved meats, at Leith, in Scotland. For the method of its preparation see last edition of the Dispensatory, or *Med. Examiner*, March, 1855.

Flour of Meat. Dr. A. H. Hassal, of London, has given this name to a preparation of meat, which concentrates within a smaller space, and more completely represents the virtues of meat, than any other preparation of which we have seen an account. Of the different forms of extract and essence of meat, almost all have this great deficiency that, while they contain the stimulating and effete constituents of the meat, they are destitute of the fibrin and albumen, which are probably its most nutritious ingredients; and absolutely all are without the fibrin. His method consists in drying the meat, at a temperature generally below that necessary for coagulating albumen, so as to deprive it of all its water, without removing any of its essential constituents, perhaps in vacuo, and then grinding it into a *very fine powder*. When made from beef, the powder is of a light-brown colour and very agreeable taste; and one pound represents four pounds of flesh, or six pounds of the leanest joints not deprived of bone and fat. In a few words, Dr. Hassal speaks of it as 1. useful for the speedy preparation of beef tea; 2. with vegetables and flavouring substances for quickly making soups; 3. in forming, when combined with farinaceous matter, a nutritious food, well adapted for children, dyspeptics, and invalids; 4. for making, by mixture with cocoa, a nutritious breakfast drink; and 5. for forming meat biscuit. Dr. Hassal has here omitted, what appears to us to be its highest recommendation, that it is an excellent article of diet for the old and toothless, who cannot sufficiently comminute meats for the purpose of easy digestion. (*Lancet*, Feb. 17, 1866, p. 184.) In a subsequent communication to the same journal, Dr. Hassal recognises this as among its useful applications. He speaks also of its being retained by the stomach when meat in its ordinary forms is rejected, of its applicability to cases in which it is necessary to inject nutritive food into the stomach or the rectum, and of its special usefulness as an article of food in dyspepsia, in diabetes, in the weakness following parturition, and in low forms of fever. Dr. Hassal says that it is finer even than wheat flour. (*Ibid.*, April 28, 1866, p. 469.)

Raw Meat has been recommended as an article of diet for consumptive patients, and especially for scrofulous children, and in other cachetic cases, and is asserted to have proved highly useful. It may also be employed with great advantage in dyspepsia and chronic diarrhœa, especially in children. It was brought into notice by M. Fuster, of Montpellier, France. The following formula is recommended by M. Reveil. Take of fillet of beef 100 grammes, deprive it carefully of all fatty and membranous matter, cut it up finely, beat it in a mortar, and add of powdered sugar 20 grammes, chloride of sodium 1·5 grammes, chloride of potassium half a gramme, and powdered black pepper one-fifth of a gramme. The mixture is to be taken in teaspoonful doses through the day. (*Ann. de Thérap.*, 1866, p. 145.) An excellent method of exhibiting raw meat is to *scrape* a thin steak and mix the pulp thus obtained with brandy. M. Ivon asserts that a very pleasant emulsion is afforded by the following formula (*Am. Journ. of Pharm.*, 1874, p. 346). Take of raw meat 250 parts, of sweet almonds 75 parts, of bitter almonds 5 parts, of white sugar 80 parts. Blanch the almonds and beat the whole into a paste. In dissolving, milk may be used instead of water. W.

Pemmican is an alimentary substance, containing much nutriment in a small bulk, which is used by fur traders and others, as their exclusive food, on long journeys in the northwest of this continent. It is made, according to Dr. C. C. Keeney, U. S. Army, by mixing equal weights of buffalo meat and buffalo tallow. The meat, thoroughly dried in the sun, is reduced to powder, and the tallow in the melted state is added to it, and the whole well stirred. The melted mixture is then poured into sacks of untanned buffalo hide, capable of containing from twenty to forty pounds. No salt is used, and yet the mixture keeps perfectly well. (*Med. Statistics, U. S. Army*, p. 56.) B.

MEDEOLA VIRGINICA. *Gyromia Virginica.* Nuttall. *Indian Cucumber.* An indigenous perennial herb, growing in all parts of the United States. The root, which in shape and flavour bears a strong resemblance to a small cucumber, is said by Pursh to be eaten by the Indians. According to the late Professor Barton, it has been thought useful in dropsies, and probably possesses diuretic properties. It is figured and described by Dr. William P. C. Barton in his Medical Botany. W.

MELILOTUS OFFICINALIS. *Melilot.* An annual or biennial plant, indigenous in Europe, and growing also in this country. We have two varieties, one with yellow, the other with white flowers, which are considered by some as distinct species. The plant,

when in flower, has a peculiar sweet odour, which, by drying, becomes stronger and more agreeable, somewhat like that of the Tonka-bean. Indeed, according to M. Guillemette, the odorous principle of the two substances is identical. (*Journ. de Pharm.*, xxi. 172.) The taste of melilot is slightly bitterish. It has little medical power, and, though formerly recommended in various diseases, is at present not employed internally. As a local application, it is used, in decoction or cataplasm, in moderate inflammations, though probably with little other advantage than such as results from the combination of warmth and moisture. W.

MENISPERMUM CANADENSE. *Moonseed. Yellow Parilla.* This is a climbing plant, growing in various parts of the United States, from the northern boundary to the Gulf of Mexico. It is described in the Flora of North America by Torrey and Gray (i. 48), and in Gray's *Manual of the Botany of the U. States* (p. 18). The root or rhizome is long, of a yellow colour, and a bitter taste. Considerable quantities of a root were some time since brought to the market of Philadelphia from New Orleans, and offered for sale as *Texas sarsaparilla.* This was satisfactorily shown by Prof. Robert P. Thomas to be the root of *Menispermum Canadense.* (*Am. Journ. of Pharm.*, xxvii. 7.) In an unpublished inaugural dissertation by Dr. George F. Terrell (Feb. 1844), it is stated that the root of this plant is considerably employed in Virginia, both in domestic practice and by physicians, as a substitute for sarsaparilla, in scrofulous affections. It has a bitter taste, and is said to be a gently stimulating tonic. Its natural affinity with the columbo plant, both belonging to the family of Menispermaceæ, and the sensible properties of its root, naturally suggested that this might contain the same or similar active principles with columbo; and Mr. Maisch, in a chemical examination, determined that, among its constituents, are berberina in small proportion, and a white or colourless alkaloid in larger quantity, which has an alkaline reaction on litmus and turmeric paper, is precipitated by tannin, phosphomolybdic acid, and iodohydrargyrate of potassium, and is soluble in ether, alcohol, and a large proportion of water. (*Am. Journ. of Pharm.*, July, 1863, p. 302.) W.

MENYANTHES TRIFOLIATA. *Buckbean. Marsh Trefoil.* The leaves of this plant were recognised in the Edinburgh Pharmacopœia, but, having been omitted in the British, are noticed in this place, in accordance with our plan of introducing into the third part of the work all the medicines which have ceased to be officinal. Menyanthes trifoliata belongs to the Linnæan class and order Pentandria Monogynia, and the natural order Gentianaceæ, with the following generic character. "*Corolla* hirsute. *Stigma* bifid. *Capsule* one-celled." (*Willd.*) The plant has a perennial, long, round, jointed, horizontal, branching, dark-coloured root or rhizome, about as thick as the finger, and sending out numerous fibres from its under surface. The leaves are ternate, and upon long stalks, which proceed from the end of the root, and are furnished at their base with sheathing stipules. The leaflets are obovate, obtuse, entire or bluntly denticulate, very smooth, beautifully green on their upper surface, and paler beneath. The flower-stalk is erect, round, smooth, from six to twelve inches high, longer than the leaves, and terminated by a conical raceme of whitish, somewhat rose-coloured flowers. The calyx is five-parted; the corolla funnel-shaped, with a short tube, and a five-cleft, revolute border, covered on the upper side with numerous long, fleshy fibres. The anthers are red and sagittate; the germ ovate, supporting a slender style longer than the stamens, and terminating in a bifid stigma. The fruit is an ovate, two-valved, one-celled capsule, containing numerous seeds. This beautiful plant is a native both of Europe and North America, growing in boggy and marshy places, always moist, and occasionally overflowed with water. It prevails, in the United States, from the northern boundary to Virginia. In this country the flowers appear in May, in England not till June or July. All parts of it are efficacious, but the leaves only were officinal.

The taste of buckbean is intensely bitter and somewhat nauseous, the odour of the leaves faint and disagreeable. Its virtues depend on a bitter principle denominated *menyanthin*, which may be obtained sufficiently pure for use by treating the spirituous extract of the plant with hydrated oxide of lead, removing the lead by hydrosulphuric acid, filtering and evaporating the liquor, exhausting the residue with alcohol, and again evaporating with a gentle heat. It has a pure bitter taste, is soluble in alcohol and water, but not in pure ether, and is chemically neuter. (*Pharm. Cent. Blatt.*, A. D. 1843, p. 24.)

Medical Properties and Uses. With the ordinary properties of the bitter tonics, menyanthes unites a cathartic power, and in large doses is apt to vomit. It was formerly held in high esteem in Europe as a remedy in numerous complaints, among which were intermittents, rheumatism, scrofula, scurvy, dropsy, jaundice, and various cachectic and cutaneous affections. In most of these it was administered under a vague impression of its alterative powers. It is little employed in this country; but, as it is a native plant, and applicable to cases where a combined tonic and purgative effect is demanded, it is desirable that country practitioners should be aware of its properties. The dose of the powdered leaves or root as a tonic is from twenty to thirty grains; of an infusion, prepared with half an ounce to a pint of boiling water, from one to two fluidounces; and

of the extract ten or fifteen grains, to be repeated three or four times a day. A drachm of the powder, or a gill of the strong decoction, generally purges, and often occasions vomiting. W.

MERCURIALIS ANNUA. An herbaceous European plant, of the family of Euphorbiaceæ, which has been employed, from the most ancient times, as a purgative and emmenagogue. It has also been considered by some as diuretic, and has been used in the treatment of syphilitic affections. When boiled, it loses its acrid properties, and in this condition has been used as an emollient. Another species, *M. perennis*, also a native of Europe, is ranked among poisonous plants. (*Mérat et De Lens.*) M. Reichardt has discovered in *M. annua* a new volatile alkaloid, *mercurialin* (*mercurialia*). This is a liquid, of an oily appearance, narcotic odour, and alkaline reaction; boils at 284° F.; forms salts with the acids; absorbs carbonic acid; has a strong affinity for water; on exposure to the air is changed into a resin of a buttery consistence; and is very poisonous to man. For the mode of procuring it, see *Annuaire de Thérapeutique* (1864, p. 44) and *Neues Repertorium für Pharm.* (xviii. 296). The existence of a volatile alkaloid in the Mercurialis suggests that other Euphorbiaceæ may owe their acrid properties to a similar constituent. W.

MESEMBRYANTHEMUM CRYSTALLINUM. *Ice-plant.* A biennial plant, growing spontaneously in the South of Europe, and cultivated as a curiosity in colder countries, by the aid of artificial warmth. The stem and under surface of the leaves are covered with crystalline drops, which give the plant the appearance of being coated with ice. The herb is without smell, and has a saline somewhat nauseous taste. It is considered demulcent and diuretic, and has been commended as a remedy in various complaints, especially those of the mucous membrane of the lungs and urinary passages. It has also been used in dropsy. The expressed juice is the form in which it has been generally employed. W.

MESENNA. *Musenna. Bisenna.* Under these different names has been brought into notice, as a powerful tæniafuge, the bark of an Abyssinian tree, the botanical character of which has recently been determined by M. Brongniart from dried specimens brought to Paris by M. Courbon. The tree is leguminous, and belongs to the family of the Mimoseæ. M. Brongniart names it *Albizzia anthelmintica.* The bark is in flat pieces from five to ten inches long, smooth, slightly fissured, of a rusty-gray colour exteriorly, and pale-yellow and fibrous within. It consists of four layers, one of which contains very large cells, with thick coats, and is supposed to be the active part. MM. E. Caventou and Legendre have examined the bark, and found in it no alkaloid, but a peculiar, acid, resinous substance, having an acrid taste, analogous to that of the bark, of which it is probably the active principle. The Abyssinians employ the powdered bark, in the dose of about two ounces, which they take in various ways, suspended in water or other liquid, or mixed with flour in the form of bread, or made into a confection with honey, butter, &c. It is taken in the morning, three or four hours before breakfast, and no other precautions are used. It produces no pain nor any disturbance of the functions, not even purging actively. Fragments of the worm are voided the same evening, and the greater portion of it the next day. Successful trials of the remedy have been made elsewhere than in Abyssinia, though M. Rayer has collected cases which tend to discountenance the opinion of its vermifuge powers. But the bark may in these instances have been injured by time. (See *Ann. de Thérap.*, 1862, p. 161.) W.

MESQUITE GUM. *Gum Mesquite. Gum Mezquite.* This is the product of *Algarobia glandulosa* (Torrey and Gray, *Flor. of N. Amer.*, i. 399), a small thorny tree or shrub, belonging to the family of *Mimoseæ*, and growing in New Mexico, Texas, and other neighbouring regions, where it covers vast extents of country. Captain R. B. Marcy, of the U. S. Army, who commanded an expedition sent by our government into that region, gives a particular account of the tree, in a letter to Messrs. Rushton & Co., of New York. He states that it was first described by Dr. Edwin James, who attended Colonel Long's exploring expedition to the Rocky Mountains many years since. The specimens collected by Dr. James were submitted to Dr. Torrey, by whom the botanical character of the plant was determined. According to Captain Marcy, the tree is found between 26° and 36° of N. latitude, and extends from 97° to 103° of longitude, over a region containing more than 500,000 square miles. In its botanical affinities and habits, it is closely analogous to the Acaciæ, which yield gum arabic. The fruit is a long, compressed pod, filled with a sweep pulp, which is said to be used as food. A gum exudes from the stem and branches, especially when wounded, which hardens in the dry season, sometimes in masses as large as a hen's egg. Specimens of this gum were collected, and sent for examination to various persons in the Atlantic cities, by Dr. Geo. G. Shumard, of the U. S. Army, who was attached to Captain Marcy's expedition. A portion received by one of the authors was in irregular, roundish pieces, of various sizes, and of different hues, from colourless transparency to a dark amber-brown. Some of them had the fissured appearance of the best Turkey gum. Examined by Prof. Procter, the gum was found to resemble gum arabic in its solubilities, but to differ from it essentially in some of its chemical reactions. The most striking points of difference are that

solution of gum mesquite is not precipitated by subacetate of lead, and a strong solution is not coagulated by borax. (*Am. Journ. of Pharm.*, xxvii. 224.) Dr. Campbell Morfit, of Baltimore, found it to approximate very closely to gum arabic in ultimate composition, its constituents being carbon, hydrogen, and oxygen, with three per cent. of inorganic matter. He found also a very little bassorin (0·206 per cent.), which did not exist in the specimens examined by Prof. Procter. (*Am. Journ. of Sci. and Arts*, March, 1855, p. 264.)

There can be little doubt that this gum has all the valuable medicinal properties of gum arabic, and might be substituted for it in all cases, with this considerable advantage, that it may be added to diluted solution of subacetate of lead, so as to communicate to that preparation demulcent properties, in addition to those of a sedative and astringent, for which it is so much used as a local application. Its high price has so far prevented its general employment, although as much as 24,000 pounds are said to have been gathered in 1872, and chiefly used by confectioners. W.

METHYLIC ALCOHOL. Spiritus Pyroxilicus Rectificatus (*Br.* 1864). Pyroligneous Spirit. *Pyroxylic Alcohol. Pyroxylic Spirit. Wood Spirit. Wood Alcohol. Wood Naphtha.* Having been discarded from the Br. Pharmacopœia, at the late revision of that work, methylic alcohol has been transferred from the first part of the Dispensatory to the third. It was discovered in 1812 by P. Taylor, and was afterwards examined by Macaire and Marcet, Liebig, Dumas and Peligot, Kane, and others. When wood is subjected to destructive distillation, there is formed, besides acetic acid, tar, and other products (see *page* 18), about 1 per cent. of an inflammable, volatile liquid, which, when separated and purified, constitutes pyroxylic spirit. The crude liquor, derived from the wood, separates on standing into two liquids; the lighter containing the tarry matters, and the heavier consisting of water, acetic acid, pyroxylic spirit, &c. The heavier liquid is saturated with lime, and subjected to distillation, whereby the impure pyroxylic spirit first comes over, mixed, however, with various compounds, among which are aldehyd and pyroacetic spirit (acetone). This, after having been redistilled, and deprived of water by repeated rectifications from lime, forms the *pyroxylic spirit of commerce.* The spirit of commerce is purified by adding to it as much chloride of calcium as it can dissolve, and allowing the mixture to stand for a few days. The pyroxylic spirit unites with the chloride of calcium, and the compound formed is subjected to distillation to separate certain contaminating substances, which distil over. Finally, the pyroxylic spirit is separated from the chloride of calcium by the addition of water and a new distillation, and from water by rectification from dry lime. M. Berthelot has succeeded in producing wood-spirit synthetically by uniting the elements of water with marsh gas (C_2H_4), through the instrumentality of chlorine. (*Chem. Gaz.*, Jan. 15, 1858, p. 33.) MM. Friedel and Silva have obtained it by the distillation of formiate of calcium. (*Journ. de Pharm.*, 4e sér., xviii. 185.)

Properties. Pure anhydrous pyroxylic spirit is a mobile, colourless liquid, possessing a hot, pungent taste, and a peculiar aromatic smell, recalling that of acetic ether. It mixes in all proportions with water, alcohol, and ether, without having its transparency disturbed. It burns like alcohol, but with a less luminous flame. Its sp. gr. as a liquid is 0·798; as a vapour, 1·041. (*Regnault.*) Its vapour is irritating to the eyes. It boils at 140°, and during ebullition its vapour causes concussions, which render its distillation difficult, but may be prevented by placing in the bottom of the vessel a layer of mercury. As a solvent it resembles alcohol, all bodies soluble in that menstruum being likewise soluble in pyroxylic spirit. As it has the same relation to the compound radical, *methyl* (C_2H_3), that common alcohol has to *ethyl* (C_4H_5), it is deemed an alcohol, and called *methylic alcohol.* It consists of two eqs. of carbon 12, four of hydrogen 4, and two of oxygen 16 = 32; and its empirical formula is $C_2H_4O_2$. Considered as a hydrated oxide of methyl, its formula is $C_2H_3O + HO$. Viewed as a bihydrate of methylen, it is represented by $C_2H_2 + 2HO$. According to Mr. Reuben Phillips, pyroxylic spirit usually contains sulphur, not easily separated from it.

The officinal pyroxylic spirit was directed in the Br. Pharmacopœia to have a sp. gr. from 0·841 to 0·846. From the density, thus recognized, it might be implied that not the pure, but the commercial pyroxylic spirit was contemplated, which has a straw-yellow colour, and a powerful odour of wood smoke. But the Pharmacopœia also directed that the spirit should be without action on litmus-paper, free from smoky taste, and not rendered turbid by water. It therefore intended a purified spirit; and the greater density must be ascribed to the presence of the 10 per cent. of water allowed. According to Mr. Morson, of London, the impure commercial spirit, which is unfit for medical use, may be purified "by largely diluting it with water, when an oily substance separates, after the removal of which the spirit may be recovered by distillation." By passing the mixed liquids through animal charcoal, the purification is rendered more complete. Pyroxylic spirit has been confounded with pyroacetic spirit. They may be distinguished, according to Mr. Scanlan, by chloride of calcium, which is without action on the latter, but dissolves in the former. In applying the test, a drop or two of a *saturated* solution of chloride of calcium is added to the doubtful liquid in a test tube. This solution is immiscible with pyroacetic spirit, separating after agitation, but dissolves instantly in pyroxylic

spirit. The liquid examined must be so pure as not to separate into two layers, nor to become milky with water.

It is sometimes desirable to be able to distinguish the presence of methylic alcohol in ordinary alcohol, and in ether or nitrous ether which may have been prepared from the methylated instead of the pure spirit. For this purpose Mr. W. Young proposes a solution of permanganate of potassium as a test. Dissolve a grain of the crystallized permanganate in a fluidounce of distilled water. If ten minims of this solution be added to four fluidrachms of pure alcohol in a test tube, the bright pink colour of the former fluid will be retained at least ten minutes, after which it will gradually fade. If only ten per cent. of methylated alcohol be contained in the alcohol, the solution, instead of retaining its colour for some time, will almost instantly change to a pale-brown tint. With a larger proportion of the methylic alcohol, the change will be even more striking. One part of methylic alcohol can be thus readily detected in 300 of proper alcohol. The same test will detect methylic alcohol in ether and sweet spirit of nitre; but, in the latter case, the spirit should be purified from acid by mixing it with an equal measure of solution of potassa twice as strong as the officinal, and, after the mixture has stood an hour, distilling off the original measure of the nitrous spirit. (See *Am. Journ. of Pharm.*, Jan. 1866, p. 58; from *Pharm. Journ.*, Nov. 1865.) The test of Dumas and Peligot converts the wood spirit into an oxalate of methyl; A. Riche and C. Bardy condemn this process, as not applicable when the proportion of ethylic alcohol is large, and propose a substitute founded upon the different coloured products yielded by the oxidation of ethyl-anilin and methyl-anilin. For details of this process the reader is referred to the *Pharm. Journ. and Trans.*, June, 1875, p. 1007. For a method of detecting methylic alcohol in any mixture, by Mr. John T. Miller, see *Pharm. Journ.* (2d ser., vii. 318).

Medical Properties, &c. Pyroxylic spirit, under the incorrect name of naphtha, was introduced as a therapeutic agent, some years ago, by Dr. John Hastings, of London, who proposed it as a remedy for consumption. It exerts no curative power over this disease, but may be usefully employed to palliate the cough and lessen the febrile excitement which attend it. The therapeutic properties of pyroxylic spirit have not been fully investigated; but, so far as observation has gone, it may be ranked as a narcotic, sedative, and anti-emetic. In chronic vomiting, whether dependent on functional or organic disease, Dr. Christison has found it useful, having frequently seen the vomiting arrested or greatly mitigated by its use. Dr. D. W. Yandell speaks favourably of its efficacy in diarrhœa and dysentery. It is not improbable that the impurities in the commercial spirit may have some remedial efficacy; and the purified spirit directed by the Br. Pharmacopœia may be less efficacious than the impure. The dose is from ten to forty drops, three times a day, sufficiently diluted with water. At one time it was doubtful whether the substance, used by Dr. Hastings under the name of naphtha, was pyroxylic or pyroacetic spirit; but it is now decided to have been the former.

Crude pyroxylic spirit, varying in density from 0·846 to 0·890, is employed by hatters and varnish-makers for dissolving resinous substances, and by chemists for burning in lamps as a substitute for alcohol. For the latter purpose it is more economical than alcohol; giving out more heat for equal weights.

In Great Britain alcohol is subjected to a heavy duty, which, until lately, prevented it from being used in many manufactures; because the products of its use can be more cheaply obtained from abroad. The British parliament, wishing to encourage the use of alcohol in the arts, but not as a beverage, passed an act in 1855, allowing it to be used duty-free, provided it be mixed with at least one-ninth of its bulk of pyroxylic spirit, which renders it unfit for drinking, but does not spoil it for use in the arts. This mixture is called *methylated spirit*, and is now employed extensively in Great Britain, by hatters, brass founders, and cabinet-makers for dissolving shell-lac and other resinous substances, and by manufacturing chemists for making ether, chloroform, and sweet spirit of nitre. From the purification of pyroxylic spirit already referred to, so as to deprive it of offensive taste, it has been supposed that the intended operation of the British revenue laws might be evaded; but, in opposition to this idea, it is asserted that the purifying process is too expensive, on the large scale, to render it available for the purpose. The use of this spirit, however purified, would be unjustifiable in medical preparations, unless officinally recognised. B.

METHYLIC ETHER. This substance was discovered by MM. Dumas and Peligot, but was first employed as an anæsthetic by Dr. B. W. Richardson in 1867. He prepares it by mixing one part of pure methylic alcohol with two of strong sulphuric acid, heating, and collecting and washing repeatedly with strong potassa solutions the methylic ether which passes over. It is a gas even at low temperature. Dr. Richardson saturates absolute ethylic ether, at 32° F., with it, and at once closely bottles the compound under the name of *methyl-ethylic ether*. (For a detailed description of the preparation of methylic ether and of its properties, see *Journ. de Pharm.*, 4e sér., xix. 438.) According to Dr. Richardson, methylic ether is a very rapid and a safe anæsthetic, producing great muscular relaxation with extreme quickness. (*Am. Journ. of Pharm.*, Sept. 1870; *Dublin Quarterly*, Aug. 1870; *Lancet*, March, 1870.) H. C. W.

MITCHELLA REPENS. (*Gray's Manual*, p. 172.) *Partridge-berry. Checker-berry. Winter Clover.* This must not be confounded, in consequence of its common name, with Gaultheria procumbens. It is a small evergreen, trailing, indigenous plant, creeping about the roots of trees, with fragrant flowers, and a berry-like, edible fruit, of a scarlet colour, which lasts through the winter. The whole plant is supposed to possess remedial properties, and is said to be employed, in decoction, by the Indian squaws to facilitate parturition. It appears to be diuretic, tonic, and astringent, resembling in these respects the pipsissewa, and may be used for the same purposes, and in the same manner as that plant. W.

MIMORDICA BALSAMINA. *Balsam Apple. Balsamina.* An annual climbing plant, a native of the East Indies, but cultivated in our gardens for the sake of the fruit. This is ovate, attenuated towards each extremity, angular, warty, not unlike a cucumber in appearance, of a lively red or orange-yellow colour, easily falling when touched, and spontaneously separating into several pieces. It was formerly highly esteemed as a vulnerary, and is still in use among the common people. A liniment formed by infusing the fruit, deprived of its seeds, in olive or almond oil, is applied to chapped hands, burns, old sores, piles, prolapsus ani, &c.; and the fruit itself is sometimes mashed, and used in the form of poultice. According to M. Descourtlitz, it is poisonous when taken internally, having proved fatal to a dog in the quantity of two or three drachms. An extract prepared from it is said to be useful in dropsy, in the dose of from six to fifteen grains. W.

MONESIA. Under this name, a vegetable extract from South America was, a few years since, introduced to the notice of the medical profession in France by M. Bernard Derosne, and for a time attracted much attention. Its origin was for some time uncertain; but at present it is believed to be derived from the bark of *Chrysophyllum glycyphlæum*, a tree of middling size, growing in the forests near Rio Janeiro, and elsewhere in Brazil. (*Journ. de Pharm.*, 3e sér., vi. 63.) Specimens of the bark were obtained along with the extract.

The bark is in pieces, some of which are three or four lines thick, is very compact and heavy, of a deep-brown or chocolate colour, contrasting strongly with the grayish colour of the epidermis when this remains, and of smooth fracture. The extract was received from S. America in cakes weighing rather more than a pound, from three-quarters of an inch to an inch in thickness, of a dark-brown almost black colour, very brittle, of a fracture neither very dull nor very shining, and of a taste at first sweet, then astringent, and ultimately acrid; the acrimony being very persistent, and especially felt in the fauces. It is entirely soluble in water. The bark was analyzed by MM. Derosne, Henry, and Payen, and found to contain, in 100 parts, 1·2 of stearin, chlorophyll, and wax, 1·4 of glycyrrhizin, 4·7 of an acrid principle analogous to saponin, called monesin, 7·5 of tannic acid, 9·2 of a red colouring substance, 1·3 of malic acid and malate of calcium, 3·0 of various salts, including silica and oxides of iron and manganese, and 71·7 of pectic acid or pectin and of lignin, including loss, besides traces of an aromatic principle and of gum. *Monesin* was obtained by treating the bark or extract with alcohol, adding to the tincture an excess of hydrate of lime in fine powder, filtering, evaporating the clear liquor to dryness, treating the residue with water and animal charcoal, filtering, and again evaporating to dryness. Thus procured it was in transparent yellowish scales, which were easily pulverized, forming a white powder. It was uncrystallizable, readily soluble in alcohol and water, to the latter of which it gave the property of frothing, and insoluble in ether. It had no power to saturate acids, was without odour, but had a slightly bitterish taste, followed by a decided and permanent acrimony in the posterior mouth and fauces. (*Journ. de Pharm.*, Janvier, 1841.) Monesia owes its activity probably to this principle and to tannic acid.

The effects of this medicine upon the system appear to be those of a moderate stomachic excitant, a general alterative, and a feeble astringent. In overdoses it is said to produce heat in the epigastrium, with obstinate constipation and tenesmus. It has been used internally with asserted advantage in diarrhœa, hæmoptysis, menorrhagia, scrofula, scurvy, the chronic catarrh of old people, and dyspepsia. As a local remedy it has been found useful in leucorrhœa, ulcerations of the mouth and fauces, spongy and scorbutic gums, carious teeth, and obstinate scrofulous and otherwise unhealthy ulcers upon the surface. The extract may be given in pill or powder, in aqueous solution, in tincture or in syrup. The dose of it is from two to ten grains, repeated every hour, two, or three hours, or less frequently. From ten grains to a drachm may be given daily. In scrofulous affections, it must be used in large quantities, and persevered in for several weeks, in order to obtain its curative effects. Monesia is applied to ulcers either by being sprinkled in powder upon the surface, or in the form of ointment made with one part of the extract and seven parts of simple ointment. Monesin, or the acrid principle, has been given internally in the dose of about half a grain, and has also been applied to ulcers.

Mr. Dupuy, of New York, states that specimens of an extract sold as monesia, which have come under his notice, bear so close a resemblance to extract of logwood as to suggest the inquiry, whether they might not really have been the product of the same plant. (*N. Y. Journ. of Pharm.*, i. 167.) W.

MOXA. The term *moxa* is employed to designate small masses of combustible matter, intended, by being burnt in contact with the skin, to produce an eschar. They are of various forms, and made of different materials. The Chinese moxa is in small cones from eight to twelve lines in height, and is prepared from the leaves of one or more species of Artemisia. *A. Chinensis* and *A. Indica* were indicated by the Dublin College; but Lindley states that it is the *A. Moxa* of De Candolle which is employed. According to some authors, the part used is the down which covers the leaves and stems; but others, with greater probability, assert that it is a fine lanuginous substance, prepared from the leaves by beating them in a mortar. A coarser and a finer product are obtained, the former of which is used for tinder, the latter worked up into moxa. A similar moxa has been made in France, by a similar process, from the leaves of *A. vulgaris.*

Various substitutes have been proposed for the Chinese moxa, all composed of some light, porous, soft, inflammable substance, which burns slowly, and thus allows the heat to be regulated according to the effect desired. Linen rolled into a cylinder, cotton formed into the same shape and enclosed in a piece of linen, cords of cotton in small masses of various shapes, and even common punk made from the agaric of the oak, have been employed by different persons with the desired effect. But all these bodies are subject to the inconvenience of requiring to be constantly blown upon, in order that their combustion may be sustained. To remedy this defect, cotton impregnated with nitre has been recommended; and the moxa usually employed is prepared from that substance. It is important that the impregnation should be uniform; as otherwise different parts of the cylinder, burning with different degrees of rapidity, would produce unequal effects upon the skin. The following process is recommended. One pound of cotton is introduced into a vessel containing two ounces of nitre dissolved in half a gallon of water, and a moderate heat applied till all the liquid is evaporated. The cotton, when perfectly dry, is formed into thin, narrow sheets, which are rolled round a central cord of linen, so as to form a cylinder from half an inch to an inch in diameter, and several inches long. This is enclosed in a covering of silk or linen sewed firmly around it; and, when used, may be cut by a razor into transverse slices a few lines in thickness. By leaving a hole in the centre of the cylinder, the combustion will be rendered more vigorous, and a deeper eschar produced.

The pith of *Helianthus annuus*, or the common *sunflower*, has been proposed by M. Percy for the preparation of moxa, for which it is well adapted by the nitre which it contains, and which enables it to burn without insufflation. The stem, when perfectly mature, is cut into transverse sections about half an inch in thickness, which must be carefully dried, and kept in a perfectly dry place. They have this advantage, that, in consequence of the retention of the cortical portion, they may be held with impunity, while burning, between the fingers of the operator. They are, however, often defective from an insufficiency of nitre in the pith, or the unequal inflammability of different parts.

M. Robinet has perfected the preparation of moxa, by combining the advantages of the two kinds last described. He rolls cotton round a small central cylinder of pith and envelops the whole in a piece of muslin, which is more or less firmly applied, according to the degree of compactness required. The cylinders, thus made, burn without assistance, uniformly, and with a rapidity proportionate to their firmness.

Dr. Jacobson, of Copenhagen, has proposed, as a substitute for the ordinary forms of moxa, small cylinders formed out of strips of paper imbued with a solution of chromate of potassium; and cotton impregnated with the solution of chlorate of potassium instead of nitre, is said to answer an excellent purpose. (*Journ. de Pharm.*, xix. 608.) Small cylinders made out of strips of coarse muslin saturated with the same solution are also employed. M. Guepratt proposes paper or cotton dipped into the solution of subacetate of lead, and afterwards dried. (*Med. Exam.*, N.S., iii. 455.)

Lime in the act of slaking has been employed by Dr. Osborne. A portion of powdered quicklime, half an inch in thickness, and of suitable lateral dimensions, is applied to the skin, and confined by some convenient arrangement. A few drops of water are then added, and a degree of heat is soon evolved sufficient for a caustic effect, if the lime is allowed to remain as long as the heat continues. This may be increased or diminished by increasing or diminishing the quantity of lime employed. The eschar formed is somewhat more than double the extent of the base of the moxa. (*Dublin Journ.*, Jan. 1842.)

Medical Uses. Cauterization by fire, in the treatment of disease, has been commonly practised among savage and half civilized nations from the earliest periods of history, and has not been unknown as a remedy in the most polished communities. The ancient Egyptians and Greeks were acquainted with the use of moxa; and in China, Japan, and other countries of Asia, it appears to have been employed from time immemorial. From these countries the early Portuguese navigators introduced it into Europe; and the term *moxa* is said to have been derived from their language, though supposed by some to be of Chinese origin. The true Chinese name is said to be *kiew.* (*Percy and Laurent.*) Some years since, the remedy became very popular in France, and attracted

some attention in this country. It acts on the principle of revulsion; relieving deep-seated inflammation, and local irritation whether vascular or nervous, by inviting the current of excitement to the skin. In some cases it may also operate advantageously by the propagation of a stimulant impression to neighbouring parts.

The celebrated Larrey was among those who contributed most to bring this remedy into repute. The diseases in which it was recommended by that author were amaurosis, loss of taste, deafness, paralytic affections of the muscular system, asthma, chronic catarrh and pleurisy, phthisis, chronic engorgement of the liver and spleen, rachitis, diseased spine, coxalgia, and other forms of scrofulous and rheumatic inflammation of the joints. It has also been used advantageously in neuralgia, and is applicable to chronic complaints generally in which powerful external revulsion is indicated.

The parts of the body upon which, according to Larrey, it should not be applied, are the cranium where protected only by the skin and pericranium; the eyelids, nose, and ears; the skin over the larynx, trachea, and mammary glands; over superficial tendons, projecting points of bones, and articular prominences in which the capsular ligament might be involved; the anterior surface of the abdomen; and the genitals.

As a general rule, it should be applied as near as possible to the seat of the disease; and, in neuralgic or paralytic cases, at the origin or over the course of the nerves proceeding to the part affected. Some advise that the cylinder be attached to the skin by some adhesive liquid; but a more general practice is to retain it in the proper position by a pair of forceps or other instrument. Larrey recommends that the skin around it be covered with a piece of moistened lint, having a hole in the centre to admit the base of the cylinder. The moxa should be set on fire at the summit, and the combustion sustained if necessary by the breath, the blow-pipe, or the bellows. The size of the cylinder should vary according to the effect desired, from half an inch to an inch or more in diameter, and from a few lines to an inch in height. Any degree of effect may be obtained, from a slight inflammation to the death of the skin, by regulating the time during which the moxa is allowed to burn. When a slough is required, it should be suffered to burn until consumed. The first sensation experienced is not disagreeable; but the operation becomes gradually more painful, and towards the close is for a short time very severe. W.

MUREXIDE. A fine purple dye-stuff, made by the reaction of nitric acid on uric acid. As resulting from the action of nitric acid on urine, it was supposed by Mr. Prout to consist of purpuric acid and ammonia, and hence was named *purpurate of ammonium;* but chemists are not agreed as to its precise composition. (See *Chem. News*, Dec. 1874, pp. 255, 283.) It is now made from guano. This is first treated with muriatic acid to remove foreign substances, and then with soda to dissolve the uric acid, which is separated by neutralizing the soda with muriatic acid. The uric acid is dissolved in nitric acid, the solution is heated, and after it cools ammonia or its carbonate is added, which develops the purple colour. Murexide is obtained in crystals, which have a square form, and are of a rich-green colour by reflected, but of a purple-red by transmitted light. They are slightly soluble in cold water, more so in boiling water, and insoluble in alcohol and ether. With potassa they form a rich purple solution. (*Brande and Taylor.*) See for an article on the subject of murexide, the *Pharmaceutical Journal* (xviii. 328). W.

MURIATIC ETHER. *Æther Muriaticus. Muriate of Ethylen. Chloride of Ethyl.* This ether was discovered by Rouelle, but first obtained in sufficient quantities to permit the examination of its properties by Basse. It may be procured by several processes, but the following is the best. Distil a mixture of equal measures of concentrated muriatic acid and alcohol, and receive the product, by means of a curved glass tube, in a tubulated bottle, half filled with water at a temperature between 70° and 80°, and connected by means of a second tube with another bottle, loosely corked, and surrounded by a mixture of common salt with snow or pounded ice. The ether, as it enters the first bottle, is mixed with alcohol and acid, which are retained by the water; while the pure ether passes forward, and is condensed in the refrigerated bottle. It must be kept in strong bottles, well secured with ground stoppers covered with leather. Before being opened, the bottle should be cooled to the freezing point.

Muriatic ether is a colourless liquid, having a strong, slightly saccharine, alliaceous taste, and a penetrating, ethereal, alliaceous smell. Its sp. gr. at the temperature of 41° is 0·774. It is extremely volatile, entering into ebullition at 54°; so that in summer it may be collected in the gaseous state, in bell-glasses over water. Its density in the state of vapour is 2·22. When kindled as issuing from a fine orifice, it burns with an emerald-green flame without smoke, diffusing a strong odour of muriatic acid; but, when set on fire in quantities, it burns with a greenish-yellow, smoky flame. Water dissolves one-fiftieth of its weight of this ether, and acquires a sweetish, ethereal taste; and alcohol unites with it in all proportions. These solutions are not precipitated by nitrate of silver, showing that the chlorine present is in a peculiar state of combination. Like hydric and nitric ether, it dissolves sulphur and phosphorus, the fat and volatile oils, and many other substances. It consists of one eq. of muriatic acid 36·5, and one

of ethylen 28 = 64·5; or, in volumes, of two volumes of the acid, and one volume of the vapour of ethylen, condensed into two volumes. Its formula is C_4H_4,HCl. Viewed as the chloride of ethyl, it is represented by C_4H_5,Cl.

Muriatic ether is a diffusible stimulant; but, owing to its extreme volatility, cannot be kept in the shops. It may, however, be preserved in a cool cellar, the temperature of which does not rise above 45° or 50°, being well secured in bottles, which should be placed reversed. When used as a medicine, it is generally mixed with an equal bulk of alcohol, forming what is called *alcoholic muriatic ether*. The dose is from five to thirty drops, given in sweetened water, or other convenient vehicle. W.

MUSCULUS VENOSUS. Dr. F. Crumpe has called attention to a mussel found in a dock near the town of Tralee, Ireland, which is exceedingly poisonous, producing collapse, with complete paralysis of the voluntary muscles. He treated successfully a woman with traumatic tetanus with three of the raw mussels. In a case of fatal poisoning, the stomach and intestines were excessively distended with gas. (*Dublin Quart. Journ. of Med. Sci.*, Oct. 1872.) H. C. W.

MUSHROOMS. *Fungi.* This extensive family of cryptogamous plants is interesting to the physician, from the consideration, that, while some of them are very largely consumed as food, others are deleterious in their nature, and capable, when eaten, of producing poisonous effects. Their substance is made up of a cellular tissue, which is usually of that soft consistence denominated fungous, but is sometimes corky, ligneous, or even gelatinous. Many of them have an agreeable odour and taste, while others are unpleasant or offensive both to the nostrils and palate. Their juice generally exhibits an acid reaction. According to Braconnot, most of them contain, among other substances, a peculiar principle denominated *fungin*, a peculiar acid called *fungic acid* usually combined with potassium, and a saccharine matter, less sweet than most other varieties of sugar, less soluble in alcohol and water than that of the cane, and distinguished by some writers as the *sugar of mushrooms*. (Consult *Journ. de Pharm.*, 4e sér., xviii. 12, xx. 476; *Chem. News*, Dec. 1874, p. 294.) M. Bolby found *mannite* in two different species, with *oxalic acid* in one, an acid which he supposed to be the *fumaric* in a second, and *lichstearic acid* in a third. (*Journ. de Pharm.*, 3e sér., xxiv. 236.) M. Dessaignes has ascertained the identity of the fumaric and fungic acids. (*Ibid.*, xxvi. 133.) *Fungin* constitutes the basis of these vegetables, and is the principle upon which their nutritive properties chiefly depend. It is the fleshy substance which remains after they have been treated with boiling water holding a little alkali in solution. It is whitish, soft, and insipid; inflammable; insoluble in water, alcohol, ether, weak sulphuric acid, and weak solutions of potassa and soda; soluble in heated muriatic acid; decomposed by nitric acid, and by concentrated alkaline solutions; and converted by destructive distillation into substances resembling those which result from the distillation of animal matters. MM. Payen and Fromberg affirm that the fungin of Braconnot is nothing but cellulose; and this assertion is confirmed by M. Gobley, who attributes the animal properties ascribed to it, to the presence of unseparated albumen. M. Gobley also found the supposed peculiar saccharine matter to be mannite. He gives, as the result of his analysis of the edible mushroom, water, albumen, cellulose, mannite, extractive matters, salts, and fatty matter consisting of olein, margarin, and a peculiar concrete fatty substance analogous to cholesterin, and called by him *agaracin*. (*Ibid.*, xxix. 91.) Mushrooms are very largely cultivated in Europe for the table. They require a rich soil; but the discovery is asserted to have been recently made, that they will flourish better, and attain a much greater size, in artificial beds of sulphate of calcium, in which the spores are buried mixed with powdered nitrate of potassium to the depth of about one-third or one-half of an inch; at least this is said to be true of a variety of the *Agaricus campestris*, called by the French "*l'agaric de couche.*" (*Journ. de Pharm.*, Sept. 1861, p. 196.)

It is highly important for those who employ mushrooms as food, to be able to distinguish those which are wholesome from the poisonous. The following general rules are given by M. Richard in the *Dictionnaire des Drogues*. Those should be rejected which have a narcotic or fetid odour, or an acrid, bitter, or very acid taste; which occasion a sense of constriction in the throat when swallowed; which are very soft, liquefying, changing colour, and assuming a bluish tint upon being bruised; which exude a milky, acrid, and styptic juice; which grow in very moist places, and upon putrefying substances; in fine, all such as have a coriaceous, ligneous, or corky consistence. The last, however, are injurious in consequence rather of their indigestible than of their poisonous nature. Even mushrooms which are usually edible may prove poisonous if collected too late, or in places which are too moist. It is said, moreover, that the poisonous species sometimes become innocent when they grow under favourable circumstances. It is affirmed, for example, that mushrooms which prove poisonous in England are eaten with impunity in Russia, a fact which Mr. W. Hamilton is disposed to ascribe less to difference in the plant, than in the mode of preparation; salt being much more largely used with them by the Russian than by the English cooks. (*Pharm. Journ.*, xiv. 67.) In the autumn of 1859, out of six officers of the French army stationed at Corte, who partook of mushrooms, five died. In consequence of this event, the Army Board of Health drew

up instructions for the use of the army as to the mode of distinguishing the poisonous from edible mushrooms. We have no space for them here, and must content ourselves with referring to the *Journal de Pharmacie* (Nov. 1860, p. 339), and the *Pharmaceutical Journal* (Jan. 1861, p. 387). Dr. Alfred S. Taylor, the distinguished toxicologist, makes the following observations about the poisonous fungi. As a rule, he states, these fungi may be recognised by the pileus or cap having a peculiar conical or flattened shape, and by being coloured yellow, brown, green, red, or orange-red; by the want of a pink or purple colour in the gills, and by a very disagreeable odour when the plant is bruised. They generally grow under trees, in groves or woods, and are often attached to decayed animal matter. (*Guy's Hospital Reports*, A. D. 1865.) According to Mr. W. G. Smith, who is familiar with the mushroom as an article of food, nearly all the fungi with white spores or seeds are edible; and the seeds of the innocent kinds are for the most part roundish or oval, while those of the poisonous are generally angular, and in one instance are covered with spines. (*Pharm. Journ.*, Jan. 1869, p. 433; from *Gardener's Chronicle.*) Immense quantities of mushrooms are eaten in France, Germany, Italy, and other parts of continental Europe; and they are said to constitute the chief food of the people in certain provinces.

Some experiments of M. Gerard would tend to show that poisonous mushrooms may be rendered innocent, by treating them with water slightly acidulated with vinegar, before cooking them. About a pound avoirdupois of poisonous mushrooms, cut into pieces, are to be macerated for two hours in a quart of water, acidulated with two or three spoonfuls of strong vinegar, and afterwards to be washed with a large quantity of water. Next day they are to be put into cold water, boiled for half an hour, then taken out, washed, and dried. They are now fit for food. (See *Am. Journ. of Pharm.*, xxv. 274.) But subsequent experiments by MM. Demartis and Corne, of Bordeaux, have proved that this method is not always to be relied on; as certain mushrooms, after having been treated in the manner suggested, have nevertheless produced fatal effects on animals; and, as the same mushrooms may be poisonous at one season or in one situation, and innocent in another, the inference is that those experimented on by M. Gerard, though ordinarily poisonous, may not have been so in that particular instance. (*Journ. de Pharm.*, 3e sér., xxi. 468.)

In a communication on the poisonous principle of mushrooms, made by M. Letellier, to the Paris *Academy of Medicine*, the author gave the following summary of the conclusions to which his investigations had conducted him. The poisonous mushrooms of the genus Agaric, section Ammonites, owe their fatal effects to the same narcotic principle, which is a fixed alkaloid, uncrystallizable, and capable of being precipitated by nothing but iodine or tannin, to which he thinks the name of *amanitine* (*amanitia*) should be applied. The different species confounded under the name of *bulbous agaric*, possess, besides this, a deleterious acrid principle. The best treatment of poisoning by these species consists in the use of oleaginous emeto-catharties, attended and followed by tannin in very strong aqueous decoction. (*Arch. Gén.*, Avril, 1866, p. 493.) MM. Sicard and Schoras make a similar statement as to the alkalinity of the poisonous principle, as they found it capable of forming salts with the acids. A salt prepared by them was extremely poisonous. A portion almost infinitely small always proved fatal to frogs; and the effects were the same as those produced by curarin. (*Journ. de Pharm.*, 4e sér., i. 442, A. D. 1865.) The physiological action of amanitia or *muscaria* has been elaborately studied, especially by O. Schmiedeberg and R. Koppe (*Das Muscarin, das Giftige Alkaloid des Fliegenpilzes*, Leipzig, 1869). For a brief summary, see *Agaricus Muscarius*, p. 1567.

The symptoms produced by the poisonous mushrooms are anxiety, vertigo, nausea, faintness, vomiting, and, if they are not rejected from the stomach, somnolence, stupor, small and intermittent pulse, tension of the abdomen, cold extremities, livid skin, and death in thirty-six or forty-eight hours. Sometimes violent pains in the stomach and bowels are experienced; and occasionally severe vomiting and purging occur, and save the patient. Blackish or bloody dejections, with tenesmus, sometimes attend the action of the poison. In some instances the symptoms are said to be remarkably like those from alcoholic drinks. The symptoms are not generally experienced until several hours, usually from five to ten, after the mushrooms have been eaten, showing that their deleterious effects depend upon the entrance of the poisonous principle into the circulation. The remedies are emetics, if the physician is called in time, accompanied with the free use of warm drinks, and followed by cathartics. After the evacuation of the alimentary canal, demulcent and nutritive beverages should be given, and the strength of the patient sustained by mild tonics or stimulants. Ether is particularly recommended; and opiates would no doubt prove serviceable in the absence of coma, should any irritability of the stomach and bowels remain.

Some of the poisonous species have been used as medicines; but in this country they are never employed; and too little seems to be precisely known of their modes of action, and their qualities, even in the same species, vary too much, according to the circumstances of their growth and situation, to justify their introduction into the materia medica, without further investigation. A species of *Lycoperdon* or puff-ball, *L. proteus*, was thought to have been proved by Dr. B. W. Richardson, of London, to have remark-

able narcotic and anæsthetic properties. Having noticed that the smoke of this fungus was used in the country for stupefying bees, he experimented with the fumes upon various animals, which, when caused to inhale them, became insensible, and could be operated on without evincing any signs of pain. When carried far, they caused death. He had himself inhaled the fumes clarified by passing them through water, and experienced symptoms of intoxication and drowsiness. They were procured by burning the fungus. (*Lond. Med. Times and Gaz.*, June, 1853, p. 610.) Mr. Thornton Herapath, however, maintains, as the result of his experiments, that these anæsthetic effects are in reality not owing to any narcotic principle present in the fungus, but to the carbonic oxide gas generated during their combustion. (*Philosoph. Magaz.*, July, 1855.) A tincture of *Lycoperdon bovista*, made in the proportion of four troyounces to a pint of alcoholic menstruum, has been used by Dr. Addinell Hewson, of Philadelphia, in nervous diseases, in the dose of a teaspoonful. (*Am. Journ. of Pharm.*, March, 1867, p. 113.) W.

MUSK, ARTIFICIAL. *Moschus Factitius.* This is prepared, according to M. Elsner, by adding, by small portions at a time, one part of rectified oil of amber to three parts of fuming nitric acid. The resulting resin is washed with water, to separate acid, and brought to the consistence of a firm extract in a water-bath. Thus prepared it is a dark brownish-red substance, having a burning, bitter, aromatic taste, and a musky odour. It is very soluble in alcohol, ether, and the volatile oils; and its alcoholic solution reddens litmus. Triturated with caustic potassa, it gives off ammonia. When set on fire, it burns with a very smoky flame, and leaves a shining porous charcoal. Its formula, deduced from its combination with protoxide of lead, is $C_{15}H_8N_2O_7$. Comparing its composition with that of the oil of amber, the action of the nitric acid evidently consists in eliminating a portion of carbon and hydrogen, adding to the oxygen, and furnishing nitrogen. M. Elsner found oil of amber to consist of several oily principles, having different boiling points, one of which, resembling eupion, he calls *amber eupion*. As this substance yields artificial musk by the action of fuming nitric acid, he believes the property possessed by oil of amber yielding the same substance to be due to its presence. (*Journ. de Pharm.*, 3e sér., ii. 144.) During the reaction of nitric acid with oil of amber, Dr. John T. Plummer, of Indiana, has observed that oxalic acid is generated.

Dr. S. W. Williams gives the following formula for the preparation of artificial musk. Add gradually, drop by drop, *three drachms and a half* of concentrated nitric acid to *a drachm* of rectified oil of amber, contained in a glass tumbler or very large wineglass. The mixture grows hot, and emits offensive fumes, which the operator must avoid. When the ordinary nitric acid is employed, which is not of full strength, the reaction must be assisted by heat; in which case Dr. Williams recommends that the vessel containing the mixed ingredients be placed in a plate before the fire, they being, meanwhile, continually stirred with a glass rod. After the mixture has remained at rest for 24 hours, it acquires a resinous appearance, and divides into two portions, an acid liquid below, and a yellow resin above, resembling musk in smell. This being thoroughly washed, first with cold and then with hot water, until all traces of acid are removed, is the artificial musk. (See *Am. Journ. of Pharm.*, viii. 14.)

Artificial musk is an antispasmodic and nervine, and possesses the general therapeutic properties of the natural substance, though in a weaker degree. It is praised by Dr. Williams in the treatment of hooping-cough, typhoid states of fever, and nervous diseases generally. When combined with water of ammonia, compound spirit of lavender, or laudanum, he found no remedy so efficient in the sinking faintness occurring in the last stage of pulmonary consumption. The average dose for an adult is ten grains; for a child two years old, from half a grain to a grain, repeated, in each case, every two or three hours. It may be prepared as the musk mixture, or with almonds in the form of emulsion. According to Berzelius, *tincture of artificial musk* is formed by dissolving *a drachm* of the musk in *an ounce* of alcohol, equivalent to *ten fluidrachms*, of the sp. gr. 0·835. Of this the dose for an adult is a teaspoonful. This tincture has been employed by Prof. Hauner, chief physician of the Children's Hospital at Munich, in uncomplicated spasm of the glottis, with invariable success in more than thirty cases. Though artificial musk is not equal in power to the natural substance, when genuine, yet it is in all probability superior to the adulterated article, so frequently sold under the name of musk. B.

MYRICA CERIFERA. *Wax-myrtle. Bay-berry.* This is an indigenous shrub, growing in great abundance in the sandy soil along the sea-shore, and even on the shores of our northern lakes. It belongs to Diœcia Tetrandria in the Linnæan system, and the natural order Myricaceæ. The genus is characterized by its sterile flowers in cylindrical, and its fertile in ovoidal closely imbricated catkins, without calyx or corolla, solitary under a scale-like bract with a pair of bractlets; the stamens 2 to 8, with filaments somewhat united below; the ovary with 3 scales at its base, and 2 thread-like stigmas; the fruit a small spherical nut. (*Gray's Manual.*) The leaves of the wax-myrtle are oblong-lanceolate, narrower at their base, entire or somewhat toothed near the apex, shining, with resinous dots on both sides, and very fragrant when rubbed. The fruit is covered with a coating of white wax, and sometimes continues on the plant for two years or more. The shrub is from three or four to ten feet high, often thickly

crowded, and, under such circumstances, scenting the air with its spicy odour. The coating of wax upon the surface is collected, and known in commerce as *myrtle wax*. (See *Vegetable Wax*, page 256.) A volatile oil might probably be collected by distillation from the leaves, and used for purposes similar to those to which oil of pimento is applied. The bark of the stem and root is supposed to possess valuable remedial properties, and has been employed to a considerable extent. In the dried state it is in quilled pieces of variable length, covered with a thin epidermis of a grayish colour somewhat mottled, and marked with slight circular fissures. Within the epidermis the colour is reddish-brown. The bark is brittle, and of a peculiar, astringent, bitterish and pungent taste, followed by a slight sense of acrimony. Its powder has a peculiar aromatic odour, and irritates the nostrils and throat when inhaled. It yields its virtues to water and alcohol. Chemically examined by Mr. Geo. M. Hambright, it was found to contain volatile oil, starch, lignin, gum, albumen, extractive, a red colouring substance, tannic and gallic acids, an acrid resin soluble in alcohol and ether, an astringent resin soluble in alcohol and not in ether, and a peculiar acrid principle having acid properties, analogous to saponin, for which the name of *myricinic acid* is proposed. (*Am. Journ. of Pharm.*, May, 1863, p. 193.)

In relation to its effects on the system, the bark appears to be moderately tonic and astringent, with probably expectorant properties connected with its acrid principle, and in large doses emetic. It has been considerably used by the "eclectics," in diarrhœa, jaundice, scrofula, &c. Externally the powdered bark is used as a stimulant to indolent ulcers; and the decoction as a gargle and injection in chronic inflammation of the throat, leucorrhœa, &c. The dose of the powder is twenty or thirty grains, of a decoction made with an ounce to the pint of water, one or two fluidounces. An alcoholic extract, very inappropriately named *myricin*, is given in the medium dose of about five grains. W.

MYROBALANS. *Myrobalani.* These are the fruits of various East India trees, particularly of different species of Terminalia. They are noticed here partly on account of their ancient reputation, partly because they are still occasionally to be found in the shops, though seldom if ever used in medicine. Five varieties are distinguished by authors. 1. *Myrobalani bellericæ.* These are obtained from *Terminalia Bellirica.* They are roundish or ovate, from the size of a hazelnut to that of a walnut, of a grayish-brown colour, smooth, marked with five longitudinal ribs, and sometimes furnished with a short, thick footstalk. They consist of an exterior, firm, resinous, brown, fleshy portion, and an interior kernel, which is light-brown, inodorous, and of a bitterish very astringent taste. 2. *Myrobalani chebulæ.* This variety is produced by *Terminalia Chebula.* The fruit is oblong, pointed at each extremity, from fifteen to eighteen lines in length, of a dark-brown colour, smooth and shining, with five longitudinal wrinkles but without footstalks. In their internal arrangement and their taste, they resemble the preceding. 3. *Myrobalani citrinæ* vel *flavæ.* These are from a variety of the same tree which affords the last-mentioned myrobalans, from which they differ only in being somewhat smaller, of a light-brown or yellowish colour, and of a taste rather more bitter. They were formerly sometimes sold in the shops of Philadelphia, under the name of *white galls*, to which, however, they bear no other resemblance than in taste. 4. *Myrobalani Indicæ* vel *nigræ.* These are thought to be the unripe fruit of *Terminalia Chebula*, or *T. Bellirica.* They are ovate-oblong, from four to eight lines long, and from two to three lines thick, of a blackish colour, wrinkled longitudinally, and presenting, when broken, a thick brown mass, without kernel, but with a small cavity in the centre. They are sourish and very astringent. 5. *Myrobalani emblicæ.* This variety is wholly different from the preceding, and derived from a plant having no affinity to the Terminaliæ, namely, the *Phyllanthus Emblica* of Linnæus. It is often in segments, as kept in the shops. When the fruit is entire, it is blackish, spherical, depressed, of the size of a cherry, presenting six obtuse ribs with as many deep furrows, and separating into six valves, and has a strongly astringent and acidulous taste.

These fruits were in high repute with the Arabians, and were long employed by European practitioners, as primarily laxative and secondarily astringent, in various complaints, particularly diarrhœa and dysentery. Their dose was from two drachms to an ounce. They are not now employed as medicines. We have been told that they have been used as a substitute for galls in the preparation of ink-powder. R. Hennig has found in them 45 per cent. of tannic acid, and recommends them as a good and cheap source of that principle. (*Am. Journ. of Pharm.*, xlii. 318.) W.

NAPHTHALIN. This may be obtained by subjecting coal tar to distillation, when it passes over after the coal naphtha. For a method of preparing it pure, and on a large scale for commercial purposes, see a paper by Vohl, in the *Journ. de Pharm.* (Mai, 1868, p. 399; from *Polyt. Journ.*). It is a white, shining, crystalline substance, fusible at 176° and boiling at 423°. According to Kopp, its sp. gr. in the liquid state is 0·9774, according to Alluard, at 210° F., 0·9628. (*Journ. de Pharm.*, Avril, 1860, p. 318.) It is soluble in alcohol, ether, naphtha, and the oils, but insoluble in water. Notice has already been taken of the artificial preparation of alizarin, a colouring principle of madder, from naphthalin, by M. Roussin. (See *Rubia*, p. 778.) It has been proposed by Dupasquier

as an expectorant, and has been found, on trial, to act decidedly as such. In the impending suffocation, sometimes occurring in the chronic pulmonary catarrh of old persons, and in humoral asthma, it facilitated expectoration in a remarkable degree. Being a stimulating remedy, it is not proper in acute bronchitis, or where pulmonary inflammation exists. The dose is from eight to thirty grains, given in emulsion or syrup, and repeated at intervals of a quarter of an hour, until an abundant expectoration takes place. (*Journ. de Pharm.*, 3e sér., ii. 513.) M. Rossignon considers naphthalin to act like camphor, and to be capable of replacing it on many occasions as a remedy. It produces excellent effects in verminose affections. It has been found useful by M. Emery, in the form of ointment, made by mixing a scruple of naphthalin with five drachms of lard, in dry tetter, psoriasis, and lepra vulgaris. (*Annuaire de Thérap.*, 1843, pp. 64 and 66.) In the Cambridge Museum of Natural History its superiority as a means of preventing the ravages of insects is said to have been completely established. B.

NAPLES YELLOW. A yellow pigment prepared by calcining a mixture of lead, sulphuret of antimony, dried alum, and chloride of ammonium, or a mixture of carbonate of lead, diaphoretic antimony, dried alum, and chloride of ammonium. (*Gray.*) W.

NARCISSUS PSEUDO-NARCISSUS. *Daffodil.* This well-known bulbous plant is a native of Europe, but very common in the gardens of this country, where it attracts attention by the early appearance of its conspicuous yellow flowers. Both the bulb and flowers have been used in medicine. The latter have a feeble peculiar odour, and both have a bitter mucilaginous taste. They are emetic, though uncertain in their operation. It is probable that the flowers of the wild plant are more powerful than those of the cultivated. They may be given dried and powdered, or in the form of extract. The dose of the powder, to produce an emetic effect, varies, according to the statements of different physicians, from a scruple to two drachms; while the extract is said to vomit in the dose of two or three grains. It is conjectured that the emetic property is developed by the agency of water. The bulb is most powerful in the recent state, and, within our own knowledge, is occasionally used as an emetic in domestic practice in the country. When dried and powdered, it has been given in the dose of thirty-six grains without vomiting. The author, when a student of medicine, wishing to ascertain whether this root might not, like ipecacuanha, possess diaphoretic properties, took a dose of it suspended in some warm water at bedtime, and on awaking in the morning found himself bathed in a copious sweat, and freed, at the same time, from the symptoms of a severe attack of catarrh under which he was at the time labouring. The flowers are said also to possess antispasmodic powers, and have been used in France, with supposed advantage, in hooping-cough, epilepsy, and other convulsive affections. It is probable, however, that they operated in these cases by their nauseating or emetic property. They have, moreover, been advantageously employed in diarrhœa, dysentery, and intermittent fever. Other species of Narcissus are said to possess the same properties, though they have not been so much used. W.

NARD. *Spikenard.* Several aromatic roots were known to the ancients under the name of *nardus*, distinguished, according to their origin or place of growth, by the names of *nardus Indica*, *nardus Celtica*, *nardus montana*, &c. They are supposed to have been derived from different species of *Valeriana*. Thus the nardus Indica is referred to *V. Jatamensi* of Bengal, the nardus Celtica to *V. Celtica*, inhabiting the Alps, Apennines, &c., and the nardus montana to *V. tuberosa*, which grows in the mountains of the South of Europe. The Indian nard, or spikenard, sometimes also called Syrian nard, is still occasionally to be found in the shops. It is a small delicate root, from one to three inches long, beset with a tuft of soft, light-brown, slender fibres, of an agreeable odour, and a bitter, aromatic taste. It was formerly very highly esteemed as a medicine, but is now almost out of use. Its properties are analogous to those of the officinal valerian. W.

NASTURTIUM OFFICINALE. R. Brown. *Sisymbrium Nasturtium.* Linn. *Watercress.* A small, perennial, herbaceous, succulent plant, growing in springs, rivulets, and ponds, in North America, Europe, and some parts of Asia. The fresh herb has a quick penetrating odour, especially when rubbed, and a bitterish, pungent taste, but loses both when dried. In sensible and medical properties it bears some resemblance to scurvy grass, though milder, and on this account is preferred for the table. It is thought to be useful in scorbutic affections, and visceral obstructions. The expressed juice is sometimes given in the dose of one or two ounces; but the herb is more frequently used in the form of a salad. It contains a volatile oil, which, according to A. W. Hoffman, is a mixed substance, chiefly composed of the nitrite of phenyl, propionic acid. (*Am. Journ. of Pharm.*, 1874, p. 331.) Other species of Nasturtium, as *N. Palustre* or *marsh water-cress*, and *N. amphibium* or *water-radish*, grow in similar situations with the *N. officinale*, and possess similar virtues. W.

NEAT'S-FOOT OIL. This oil was formerly included in the U. S. P. Materia Medica List with the title of *Oleum Bubulum*, but was dropped in the revision of 1870, having been substituted by lard in its only officinal use, the preparation of citrine ointment. It

is obtained by boiling in water for a long time the feet of the ox, previously deprived of their hoofs. The fat and oil which rise to the surface are removed, and introduced into a fresh portion of water heated nearly to the boiling point. The impurities having subsided, the oil is drawn off, and, if required to be very pure, is again introduced into water, which is kept for twenty-four hours sufficiently warm to enable the fat which is mixed with the oil to separate from it. The liquid being then allowed to cool, the fat concretes, and the oil is removed and strained, or filtered through layers of small fragments of charcoal free from powder. The oil is yellowish, and when properly prepared, inodorous, and of a bland taste. It thickens or congeals with great difficulty, and is, therefore, very useful for greasing machinery in order to prevent friction. It has been used as a substitute for cod-liver oil in scrofulous diseases, and, according to Dr. C. R. Hall, of England, with happy effects, especially in cases in which the latter does not agree with the stomach. It is apt to be laxative, and in certain cases proves useful in this way. It is given in the same dose as cod-liver oil. (See *Am. Journ. of Med. Sci.*, N. S., xxiv. 498.) W.

NERIUM OLEANDER. A notice of the *oleander*, so well known as an ornamental shrub of our conservatories, is introduced here mainly on account of its presumed poisonous properties. The peasantry in the South of France, where the plant grows wild, employ the powdered bark as a poison for rats, and death is said to have occurred from eating food roasted by the oleander wood. (*Mérat et De Lens.*) The leaves, boiled in lard or oil, yield an ointment which is said to be very efficacious, rubbed on the skin, against insects that infest the person. A case has been recorded in which a man in Hindostan swallowed somewhat more than an ounce of the juice of *Nerium odorum*, with the effect of producing the most violent narcotic symptoms, as stupor, stertorous breathing, and convulsions, followed by great prostration, with involuntary evacuations, from which, however, after two days of danger, he recovered under the use of emetics, followed by supporting treatment. (*B. and F. Med.-chir. Rev.*, Am. ed., April, 1860, p. 387.) M. Latour has made a careful chemical examination of oleander, from which he obtained the following results. 1. The poisonous principle exists in the leaves, bark, and flowers, but most largely in the bark. 2. This principle is of a resinous nature, and not volatile, and is found more largely in the wild than the cultivated plant. 3. The solubility of this resin in water is much facilitated by alkaline salts, and hence it exists in the watery extract. 4. The distilled water of the bark and leaves possesses some activity, which it owes to a small portion of the resin carried over with the steam. (See *Am. Journ. of Pharm.*, March, 1858, p. 172.) Prof. E. Pelikan, of St. Petersburg, has made experiments with this plant on frogs, from which he concludes that the poisonous properties reside in the yellow resin of M. Latour; and that the poison acts especially on the heart, the pulsations of which it first accelerates, then retards, and finally causes to cease altogether. He thinks that the alcoholico-aqueous extract closely resembles digitalis, and might be substituted for it in therapeutics. (*Journ. de Pharm.*, 4e sér., iii. 206.) According to Gmelin (xvii. 596), two alkaloids have been discovered in oleander; one by Lucas, named *pseudocurarin;* the other by Leukwasky, named *oleandrin.* Both neutralize acids; the former dissolves in water and alcohol, but not in ether, and is neither volatile nor poisonous; the latter is yellow, amorphous, very bitter, very slightly soluble in water, but more freely in alcohol and ether, and poisonous in its action on the system. W.

NIGELLA SATIVA. *Nutmeg-flower. Small Fennel-flower.* A small annual plant, growing wild in Syria and the South of Europe, and cultivated in various parts of the world. The seeds, which are sometimes kept in the shops under the name of *semen nigellæ*, are ovate, somewhat compressed, about a line long and half as broad, usually three-cornered, with two sides flat and one convex, black or brown externally, white and oleaginous within, of a strong, agreeable, aromatic odour, like that of nutmegs, and a spicy, pungent taste. Their chief constituents are a volatile and fixed oil, and a peculiar bitter principle denominated *nigellin*, which exists in the seeds in very minute proportion. (*Journ. de Pharm.*, 3e sér., ii. 128.) In India they are considered as stimulant, diaphoretic, and emmenagogue, and are believed to increase the secretion of milk. They are also used as a condiment, and as a corrigent or adjuvant of purgative and tonic medicines. W.

NITRATE OF COPPER. *Cupri Nitras.* This well-known salt has been employed with advantage, as a caustic, in a severe case of ulceration of the throat and tongue, and in several similar cases, by Dr. William Moore, of Ballymoney, Ireland. The application is attended with no danger, provided the ulcer or part is dried before applying the caustic, and afterwards smeared with oil. (See *Braithwaite's Retrospect*, xxv. 201.) B.

NITRATE OF SODIUM. *Cubic Nitre.* This salt may be formed by treating carbonate of sodium with nitric acid. It is found naturally in the desert of Atacama and elsewhere in Peru, where it forms beds of vast extent. Attempts were made between 1820 and 1830 to export it to England and the United States; but the cargoes were unsalable. Soon afterwards, however, its value became known; so that at present large quantities are exported from Peru, being consumed in the manufacture of sulphuric and nitric

acids, and as a fertilizer. The salt has also been found largely in Brazil, in the Province of Bahia, near the river San Francisco. (*Am. Journ. of Pharm.*, Nov. 1861, p. 502.) For a particular account of the nitrate of sodium deposits of Peru, in a commercial point of view, see *Ibid.* (March, 1862, p. 263).

The crude salt, as it comes from Peru, is in saline lumps, rather soft and friable, and damp on the surface. It is distinguished into varieties according to its colour and state of aggregation, as *white compact*, *yellow*, *gray compact*, *gray crystalline*, and *white crystalline*, and varies very much in purity, containing from 85 to only 20 per cent. of the pure salt. Some of the varieties contain iodine. The impurities consist of common salt, sulphate and carbonate of sodium, and chloride of calcium. Occasionally borate of calcium, associated with borate of sodium, is found under the beds of the nitrate.

Nitrate of sodium, when pure, is a white salt, crystallizing in rhomboidal prisms, and having a sharp, cooling, and bitter taste. It attracts moisture slightly from the air, and dissolves in about twice its weight of water, at 60°. It has been praised as a remedy in dysentery by two German physicians, Drs. Velsen and Meyer, given in the quantity of from half an ounce to an ounce in the course of the day, dissolved in gum water, or other mucilaginous liquid. It has been used with success in the same disease by Dr. Rademacher, of Vienna, who recommends it in a number of other diseases having nothing in common. (*Ann. de Thérap.*, 1854.) Dr. J. B. Brown also bears very emphatic testimony to the value of nitrate of sodium as a speedy and safe remedy in dysentery and dysenteric diarrhœa. (*Charleston Med. Journ.*, May, 1854, p. 398; from *North-Western Med. and Surg. Journ.*)

As nitrate of sodium has been imposed upon our merchants for nitre, it may be useful to mention that the former salt may be distinguished by its giving rise to an orange-yellow flame when thrown on burning coals, and by the rhomboidal shape of its crystals; those of nitre being long, six-sided prisms. B.

NITRITE OF ETHYL. *Nitrite of Oxide of Ethyl. Nitrous Ether.* This compound is here introduced, in order that the reader may be made acquainted with the results obtained by Dr. B. W. Richardson, in reference to its physiological action when inhaled. The mode of preparing it, its sensible and chemical properties, and its composition, have been already incidentally considered, under Spiritus Ætheris Nitrosi, of which it is the characteristic ingredient. M. Champion converts alcohol into it by introducing a mixture of sulphuric acid and alcohol, 95°, into a mixture of two parts of sulphuric and one of nitric acid, 48°, allowing to stand for a half hour, and decanting the ether which rises to the surface. (*Journ. de Pharm.*, 4e sér., xx. 205.) The liquid in its pure state is so volatile as to require an admixture of a proportion of proper ether (say from 10 to 50 per cent.), in order that it may be duly manipulated. Its action, according to Dr. Richardson, is closely analogous to that of nitrite of amyl. Inhaled in the quantity of a grain, it induces a sense of fulness in the head, rapid action of the heart, and some suffusion of the surface. Animals, made to inhale air containing fifteen minims of the fluid diffused through a cubic foot, die almost instantly from suspended action of the heart; retaining, however, sensibility and consciousness to the last. The nitrite is, therefore, in no degree anæsthetic. After death, the lungs appear bloodless, almost as if washed free from blood with water; an effect ascribed by Dr. Richardson to the rapid contraction of the pulmonary capillaries. The muscles are also blanched. The colour of the blood is changed, the arterial having become very dark, and the venous of a deep chocolate tint; but coagulation takes place as usual. A curious effect on cold-blooded animals is that, after apparent death, the animal will sometimes recover spontaneously, even after an interval of nine days. If a young hot-blooded animal, a kitten, for example, be suddenly subjected to its influence, it will fall senseless, and apparently dead, without respiration, or any discoverable action of the heart; but, after a period of six or eight minutes, respiration and circulation are spontaneously renewed, and this condition may last so long as half an hour, when the animal again relapses into inertia, and positively dies.

In the human subject, after inhalation, there are extreme suffusion of the face, a sense of fulness of the head, a tendency to fall forward, rapid and painful respiration, and excessive rapidity in the action of the heart. The effects soon cease when the agent is withdrawn; but it may be readily conceived that a little excess of this action would prove fatal. (*B. and F. Medico-chir. Rev.*, July, 1867, p. 259.) W.

NITRITE OF SODIUM. This salt at one time attracted attention, from the circumstance that, in the original edition of the British Pharmacopœia, it was employed in the preparation of Sweet Spirit of Nitre. As nitrite of sodium contains the same acid that forms with oxide of ethyl, the nitrous ether, which is the basis of Sweet Spirit of Nitre, it was believed that a simplification of the process might be effected by distilling a mixture of the nitrite, sulphuric acid, and alcohol, and thus, through the liberation of the nitrous acid by the sulphuric, bringing the former directly to bear on oxide of ethyl produced by the action of the sulphuric acid on the alcohol. But the process failed, probably from the difficulty of obtaining the nitrite of sodium pure; the British directions for the preparation of the nitrite yielding but a small proportion of that salt. In the revised Pharmacopœia, the process for Sweet Spirit of Nitre originally adopted was abandoned; and nitrite of sodium has ceased to be an object of special interest. W.

NITROGLYCERIN. *Glonoïn.* When equal parts of strong nitric and sulphuric acids are gradually added, in small portions at a time, and at a temperature kept below freezing, to glycerin, this is converted into a bright-yellow liquid, which has remarkable explosive properties, and has received the name at the head of this article. Nitroglycerin was discovered about 21 years ago, by Dr. Sobrero, now a Professor in Turin. It was afterwards made a subject of study by Dr. de Vrij, of the Netherlands, Dr. Gladstone, and Dr. Kopp; but did not attract general attention until after 1864, when its capacities as an explosive agent became known. It is a yellow liquid (said to be colourless or slightly yellowish when pure); of a sp. gr. from 1·525 to 1·6; inodorous; of a sweet, pungent, aromatic taste; very slightly soluble in water, but readily soluble in ether, alcohol, and methylated spirit; not freezing above 4° F. when quite pure (J. R. Wagner), but, as it occurs in commerce, solidifying by continued exposure to a temperature of 46·4° F., and assuming the form of long needles, which it is dangerous to handle, as they explode violently when gently broken. In the liquid state, it does not inflame or explode by the mere contact of flame; but with concussion, or by touching it with a red-hot iron, it explodes with great vehemence. Detonating mixtures, or exploding gunpowder, in its near vicinity, produce the same effect. By keeping it undergoes partial decomposition; and, in confined vessels, the pressure of the accumulated gases which result is sometimes so great as to cause its explosion upon the slightest concussion. Its explosive force greatly exceeds that of gunpowder. According to Nobel, one measure of the fluid explodes into 10,384 measures of gas, while one measure of gunpowder yields only 800 measures. It has, therefore, been much employed in exploding rocks, in mining, quarrying, road-making, &c.; and its economical advantages have kept it in extensive use, notwithstanding the danger. Important inferences from these facts are, that it should not be kept in large quantities, nor conveyed to any considerable distance; and the most fearful consequences have followed a neglect of these precautions. Practical operators recommend that it should be made extemporaneously where wanted as an explosive agent.

Nitroglycerin is formed by the substitution of three eqs. of hyponitric acid (NO_4) for three of the eqs. of hydrogen of the glycerin. Its formula, therefore, is $C_6H_5O_6,3NO_4$; or, supposing glycerin to be a hydrate of glyceryl ($C_6H_7O_5+HO$), and the substitution to take place in the radical exclusively, $C_6H_4O_5,3NO_4H+O$. Among the products of the explosion of nitroglycerin, are glycerin, oxalic and hydrocyanic acids, ammonia, and others unknown. (A. Adriani, *Chem. News*, Jan. 3, 1868, p. 11.) Hence it may be inferred that the dangers from its explosion, are not only those from mechanical violence, but also from the inhalation of its vapours.

M. E. Kopp gives the following as his method of preparing nitroglycerin on the spot where it is needed. First, fuming nitric acid, of the sp. gr. 1·51 to 1·53, is mixed with twice its weight of the strongest sulphuric acid. At the same time commercial glycerin, free from lead and lime, is evaporated in a pot to 30° or 31° Baumé, so that, on cooling, it shall have a syrupy consistence. Into 3300 grammes of the acid mixture, contained in a glass or porcelain capsule, placed in a trough of cold water, 500 grammes of the prepared glycerin are slowly poured with constant stirring; great care being taken to prevent any sensible heating of the mixture. The whole is then to be left for five or ten minutes, after which the mixture is to be poured into five or six times its volume of cold water, to which a rotatory motion has been given. The nitroglycerin precipitates rapidly in the form of a heavy liquid, which is separated by decantation, then washed with a little water which is decanted, and lastly is put into bottles. In this state it still contains a little acid and water; but these do not interfere with its use as an explosive agent.

Effects on the System. Nitroglycerin appears to act as a powerful but temporary stimulant both to the circulatory and nervous systems, causing increased frequency of pulse and severe headache, followed, if the dose is considerable, by symptoms of prostration, which are alarming from overdoses; but we have met with no account of a fatal termination in any instance. As a local application it is said to have little effect; and, to operate on the system, it must be absorbed. The idea has been suggested that nitrous oxide might be one of the results of its decomposition, and the cause of the symptoms; but these differ materially from the known effects of that agent. The dose required to affect the system is very small. Mr. J. M. Merrick experienced decided effects from one-fortieth of a drop; and, in a case recorded by Mr. Field, a temporary loss of consciousness and other alarming symptoms of narcotic poisoning are said to have been produced by about the forty-fifth of a drop. Yet two drops of the poison have been taken with no other effect than slight confusion of the head; so that the drug would seem to be of extremely uncertain operation. Mr. B. Sepuchardt, of Hanover, made experiments on himself, with the following results. Taking a single drop, he felt, five minutes afterwards, a great deal of giddiness, attended with weakened vision, headache with throbbing in the temples, a sense of weariness, sleepiness, a strong aromatic taste in the mouth, burning in the throat, and severe pain in the cardiac region. An hour afterwards, these symptoms having subsided, he was attempting to take another dose from a bottle of the nitroglycerin by means of a glass tube, when accidentally a large quantity entered the fauces; and, though he discharged most of it from the mouth, he must have swallowed a considerable portion, perhaps as much as ten drops. The previous symptoms returned so severely that he was

compelled to lie down; and a half unconscious condition came on, which lasted several hours, and left behind it a violent throbbing headache, sensitiveness to light, giddiness, and universal trembling. At first there was increased heat and frequency of pulse, afterwards a feeling of coldness, with a burning sensation in the region of the heart, and nausea, but no vomiting. There were no symptoms of a convulsive character. Next day the effects had entirely ceased. (*Am. Journ. of Pharm.*, March, 1867, p. 164; from *Zeitschrift für praktische Heilkund. Medicinal.*, heft 1.) Inhalation of the vapour produces similar effects. Mr. Merrick experienced intense headache from this cause, with intolerance of light, and feelings of general distress, faintness, and exhaustion. (*Ibid.*, Nov. 1863, p. 564.) The same symptoms have been experienced by workmen engaged in its preparation and use. Few trials have as yet been made with it therapeutically; and its precise effects are not sufficiently well understood to justify its use, except experimentally and with great caution. Trials with the drug on animals have shown that relatively very large doses are necessary to cause death. W.

NITROPRUSSIDE OF SODIUM. This is the most interesting of a series of salts, discovered by Dr. Playfair, called *nitroprussides*, which are produced, for the most part, by saturating *nitroprussic acid*, formed by the action of nitric acid on ferrocyanide of potassium, with different bases. The sodium salt is best obtained by the process of A. Overbeck, as follows. Dissolve *four parts* of powdered ferrocyanide of potassium, contained in a flask, in *five and a half parts* of commercial nitric acid, diluted with an equal weight of water. After the action is completed, which generally occupies about ten minutes, and is accompanied by a copious evolution of gases, heat the resulting coffee-brown liquid in a water-bath, until a drop of it gives a dingy green, instead of a blue precipitate, with a solution of sulphate of protoxide of iron. Then allow the liquid to cool; whereupon the larger part of the nitrate of potassium generated will be deposited in crystals. Pour off the green mother-liquor from these, and separate the remaining nitrate of potassium by repeated concentrations. Next neutralize the liquid, while heated in a water-bath, with carbonate of sodium, taking care to add the carbonate so long only as a pure blue precipitate is produced. Lastly, filter the solution, and set it aside for the formation of crystals, which must be washed with water, and dried between blotting-paper. (*Chem. Gaz.*, July 15, 1853, p. 271.) This salt is in the form of large, ruby-coloured, prismatic crystals, very much resembling those of ferridcyanide of potassium (red prussiate of potassa). It is soluble in two and a half parts of cold water, and in a less quantity of hot water. Its solution, exposed to sunshine, is decomposed, with evolution of nitric oxide gas, and deposition of Prussian blue, at the same time acquiring a green colour. Nitroprusside of sodium, as well as the other soluble nitroprussides, is a most delicate test for the alkaline sulphurets, with which it strikes a beautiful violet colour. Its composition is not certainly known; but the following formula, given by Gerhardt, is probably the correct one: $Na_2,Fe_2Cy_5NO_2+4HO$. Nitroprussic acid is the nitroprusside of hydrogen, with the formula $H_2,Fe_2Cy_5NO_2$. B.

NITROSULPHATE OF AMMONIUM. This compound, discovered by Pelouze in 1835, may be formed by passing nitric oxide through a solution of sulphate of ammonium in five or six times its volume of water of ammonia. A large number of crystals are formed, which must be quickly washed with water of ammonia previously refrigerated, and dried without heat. Nitrosulphate of ammonium has been used at the Hôtel-Dieu in Paris, in doses of twelve grains, with apparent advantage, in typhoid fever. Its composition corresponds with one eq. of nitric oxide, one of sulphurous acid, and one of ammonia; but as the salt is not precipitated by barytic water, Pelouze conceives that the nitric oxide and sulphurous acid, together, form a peculiar acid, which he calls *nitrosulphuric acid*, consisting of one eq. of nitrogen, one of sulphur, and four of oxygen (NSO_4). B.

NITROUS OXIDE. *Protoxide of Nitrogen. Laughing Gas.* These names have been given to a gaseous substance, discovered by Priestley in 1776, but first brought into general notice in 1800 by Sir Humphry Davy, who discovered and made known the remarkable exhilarating properties which earned for it the name of laughing gas.

Preparation. In its preparation, nitrate of ammonium, in its purest state, is submitted in a glass retort to a heat sufficient to decompose it, not exceeding 400° F.; and the resulting gas and vapour are collected in a glass receiver over warm water, or a saturated aqueous solution of common salt. Warm water is preferred because cold water absorbs much of the gas, and would consequently occasion loss; and even warm water, though it takes up much less, is not entirely unobjectionable on this score; and the saline solution is therefore probably, on the whole, best adapted to the purpose. When nitrate of ammonium is heated to the point of decomposition, it is wholly resolved into watery vapour and nitrous oxide; the nitric acid giving three of its five eqs. of oxygen to the three eqs. of hydrogen of the ammonia, to form three eqs. of water, and being itself reduced to the state of nitric oxide or deutoxide of nitrogen, which is then converted into the nitrous oxide or protoxide of nitrogen, by combining with the single eq. of nitrogen of the ammonia which had been set free. But it is necessary not to let the heat employed be too high, as otherwise, besides nitrous oxide, there will come over portions

of nitric oxide, uncombined ammonia, and probably even nitric acid, which contaminate the product, and render it unfit for use. This may be avoided by arresting the process as soon as any white fumes appear in the retort. Peculiar care also must be taken that the nitrate of ammonium should be pure, and especially free from chloride of ammonium, which might cause an admixture of chlorine in the product. To insure against impurities of this kind, it is best in any case in the least doubtful, and perhaps it might be best in all cases, to cause the nitrous oxide, before it is used by inhalation, to pass successively through two solutions; one of protosulphate of iron, to remove any nitric oxide that might be present; the second, of caustic potassa or soda, to neutralize acid impurities and chlorine.

Properties. Nitrous oxide gas is colourless, nearly or quite inodorous, slightly sweetish to the taste, and of the sp. gr. 1·527. Cold water will absorb about three-fourths of its bulk of the gas, and, under pressure, much more; and, thus impregnated, has a slight, not unpleasant smell, and sweetish taste. By the joint influence of cold and pressure the gas may be condensed into a liquid, which is colourless, very mobile, and capable, under the ordinary atmospheric pressure, of remaining liquid at 9° F. The liquefaction was effected by M. Bianchi at 32° F., under a pressure of thirty atmospheres. (*Am. Journ. of Pharm.*, July, 1865, p. 275.) Inflammable bodies will generally burn with increased vigour in nitrous oxide, which is capable also of supporting life for a time when respired, by giving oxygen to the blood. It consists of one eq., each, of nitrogen and oxygen, and its formula is NO.

For use it may be kept in two states, according as it is to be used by inhalation or by the stomach; the gaseous, namely, and the liquid. In the former state, it is best kept in gasometers, from which it may be readily transferred to bags when wanted for inhalation; though, even for this purpose, it may not be amiss to follow the plan, suggested by Dr. Ziegler, of compressing it in water, which may be made to absorb five times its bulk, and when the gas is needed, will readily give it up if heated. More will be said in a subsequent page of the liquid form in which it is kept for internal use.

Effects on the System. Nitrous oxide is a general stimulant, with a special direction to the brain and nervous system generally. When inhaled, it very speedily excites the cerebral functions, exhibiting its effects in exhilaration of the spirits, often attended with laughter, the occurrence of various delusions, and a strong tendency to muscular action, not unfrequently leading to assaults on those around. It is said also sometimes to cause aphrodisiac excitement. Carried further it induces a loss of consciousness, with complete insensibility to pain, so that severe surgical operations may be performed unfelt by the patient. These effects quickly subside, leaving behind none of that depression, nausea, and general uneasiness so apt to follow the use of stimulant narcotics. This is one of the most extraordinary properties of nitrous oxide, forming an exception to the almost universal rule of depression following excitement; and explicable only on the supposition that, through its constituents, it immediately yields to the nerve-tissue nutritive material to supply the waste occasioned by its excessive action. The proportion of deaths caused by nitrous oxide is probably less than that by any other known anæsthetic, unless it be ether. Fatal results have, however, been produced by it. (See *New Remedies*, July, 1873; *Dental Cosmos*, June, 1872; *British Med. Journ.*, Feb. 1873.)

Anæsthetic Use and Administration. The anæsthetic property of nitrous oxide, as well as its exhilarating influence, was discovered by Sir Humphry Davy, who even suggested that it might be used to prevent pain in surgical operations; but the first practical application of it to this purpose is due to the late Dr. Horace Wells, of Connecticut. Having occasion for the extraction of a tooth, Dr. Wells successfully tried, in his own person, the efficacy of the nitrous oxide in preventing the pain of the operation; and soon afterwards, as the result of his experiment, two surgical operations were performed under the same influence, and with the same success. The measure, however, so promising at the outset, seems to have been entirely neglected, until after the discovery of the anæsthetic properties of ether, and its introduction into surgery, in Boston. Sixteen or eighteen years after the experiments of Dr. Wells, the use of nitrous oxide as an anæsthetic was revived in New York by Mr. G. L. Colton, in its application to dentistry, and by Dr. J. M. Carnochan, of the same place, to surgery; and so successfully that, at the present time, it is admitted among the regular anæsthetic agents, exhibited by inhalation, and probably the safest of all of them. It is, however, liable to two objections, which, unless obviated, will prevent its universal use; one, the relative inconvenience of its application; the other, the brevity of its action. It cannot well be exhibited without the co-operation of the patient; and this is scarcely possible in those protracted operations in which the anæsthetic influence may require repeated renewal; and, in general, the higher surgical operations demand a longer anæsthesia than can be obtained by one administration of this gas. Nitrous oxide will, therefore, probably be confined to dentistry and to the shorter operations of the higher surgery; especially the former, as arrangements may be made, in the office of the dentist, for the preservation and convenient exhibition of the gas, which cannot always be commanded elsewhere.

But the inhalation of nitrous oxide as an anæsthetic agent is applicable not only in painful operations; but also to relieve violent attacks of pain, whether in the form of

neuralgia or spasm; as in tic douloureux and severe gastrodynia, enteralgia, nephralgia, &c. Its stimulant influence, in the same way, may also often be resorted to, independently of any painful complication, in various low forms of disease in which a sudden and powerful impression is required, as in malignant chill, sudden prostration occurring in the low forms of fever, and in protracted syncope. The difficulty of administration, however, forms an objection, which, in many of these cases, is at present insurmountable.

The common mode of exhibition is by means of an air-tight bladder or bag, with a tube and mouth-piece attached. The patient, with his nostrils closed, inhales the air from the bag, into which the expired air returns; so that, when the administration is somewhat protracted, the air in the bag becomes contaminated, and at length insufficient to support life. In such cases, the bag should be removed; or an instrument may be resorted to, in which, by a proper arrangement of valves, the inspired air may come from the bag, and that expired be allowed to escape by a different outlet. The capacity of the bag is often not more than one or two gallons; but, to obviate, in some measure, the inconvenience alluded to, it may be made to contain several gallons, three or four, for example, or according to Dr. Spear, six or eight gallons. The period at which the anæsthetic effect is produced varies greatly. It may occur at the end of two or three minutes, or may be postponed a good deal longer; much depending, in this respect, on the ability of the patient to take a full breath. The effect is said to have been produced after three deep and prolonged respirations; but sometimes twenty are required where any impediment may exist to a free expansion of the lungs. For the figure of an apparatus, combining the means of preparation, the reception and preservation in a gasometer, and the means of exhibition, suitable for a dentist's office, see the *American Journal of Pharmacy* (Sept. 1868, p. 412). W.

Nitrous Oxide Water. Water, impregnated by pressure with about five times its volume of this gas, forms the *nitrous oxide water*, known in England under the name of *Searle's patent oxygneous aërated water*, which has been used to some extent as an internal remedy. Sir H. Davy tried the aqueous solution, made without pressure, and thought it acted as a diuretic, and promoted digestion; and Sérullas used it in Asiatic cholera with apparent advantage. The patent water is asserted to be suited to the treatment of torpor, debility, depression of spirits, asthma, and dyspepsia; but to be contraindicated in inflammatory and plethoric states of the system. Dr. George J. Ziegler, of Philadelphia, has made a number of therapeutic trials with nitrous oxide water, charged with five times its volume of the gas, and finds it to possess tonic, resolvent, exhilarant, and diuretic properties. He has observed, however, that its free and prolonged use is apt to produce emaciation. Dr. Ziegler has also made some interesting experiments, tending to show the antidotal and revivifying properties of nitrous oxide. In these experiments dogs were asphyxiated or poisoned with carburetted hydrogen, chloroform, carbonic acid, hydrocyanic acid, and other agents, and, when in a state of suspended animation more or less complete, were generally revived by the nitrous oxide water, injected into the bowels in the quantity of from two to three pints. When administered by the stomach, the dose of the water is from half a pint to a pint and a half, taken in the course of the day. Dr. Ziegler concludes from his observations and experiments that nitrous oxide is a powerful arterial, nervous, and cerebral stimulant, possessing, at the same time, valuable antidotal powers. (*Bost. Med. and Surg. Journ.*, xlvi. 453, and xlvii. 383.)* Dr. Chapelle, of Angouleme, in France, has found this remedy especially useful in *lypomania*, or that form of monomania, in which the delusion is attended with melancholy. B.

NOCTILUCINE. For an account of this substance, to which is ascribed the phosphorescence of various animals, see *Journ. de Pharm.*, 4e sér., xvii. 117. H. C. W.

NYMPHÆA ODORATA. *Sweet-scented Water-lily.* An indigenous herbaceous perennial, growing in most parts of the United States, in fresh-water ponds and on the borders of streams, and distinguished by the beauty and delicious odour of its large, white, many-petaled flowers. Its root is large and fleshy in the recent state, but becomes light, spongy, and friable by drying. It is very astringent and bitter, and, according to Dr. Bigelow, contains much tannin and gallic acid. It is sometimes employed, in the form of poultice, as a discutient application. The root of the *Nymphæa alba*, or European *white water-lily*, was esteemed antaphrodisiac by the ancients, but has long lost this reputation. Like that of the American plant, it is bitter and styptic, and may have been useful by its astringency in some cases of leucorrhœa, gonorrhœa, dysentery, &c., in which it was formerly employed for its reputed sedative virtues. W.

OCHRES. These are native mixtures of argillaceous or calcareous earth and oxide of iron, employed in painting. They are prepared for use by agitating them with water, decanting the turbid liquor after the coarser particles have subsided, then allowing it to rest in order that the finer parts may be deposited, and, lastly, drying the sediment which forms. The colour of the ochres varies with the state of oxidation of the iron, and

* In a letter addressed to one of the authors by Mr. R. C. Clark, it is stated that the writer had been effectually cured of severe neuralgia by taking a fluidounce of the nitrous oxide water every six hours.

with the proportion which it bears to the other ingredients, and is sometimes artificially modified by the agency of heat. Several varieties are kept in our shops under different names, according to their colour or place of origin. Such are the *brown ochre*, the *yellow ochre*, the *red ochre*, the *Roman ochre* of a brownish-yellow changing by heat to a purple-red, the *Oxford ochre* of a brownish-yellow colour less deep than the Roman, and the *French ochre* which is yellow. The *Indian red* from the Persian Gulf, and the *Spanish brown* may also be ranked in this class of pigments. Sometimes ochres come in a powdery state, and sometimes in hard masses; in the latter state they are called *stone ochres*. W.

OCYMUM BASILICUM. *Basil.* An annual plant, a native of India and Persia, and cultivated in Europe and in this country in gardens. The whole plant has a strong, peculiar, agreeable, aromatic odour, which is improved by drying. The taste is aromatic, and somewhat cooling and saline. It yields by distillation a yellowish-green volatile oil, lighter than water, which on being kept solidifies into a crystalline camphor, isomeric if not identical with turpentine-camphor. (*Gmelin's Handbook*, xiv. 359.) Basil has the ordinary properties of the aromatic plants, and is in some places considerably used as a condiment. The seeds are said by Ainslie to be used in India, in the form of infusion, as a remedy in gonorrhœa and nephritic affections. W.

ŒNANTHE CROCATA. *Hemlock Water-dropwort.* A perennial, umbelliferous, aquatic European plant, exceedingly poisonous both to man and inferior animals. (*London Lancet*, June, 1873, p. 918.) The root, which has a sweetish not unpleasant taste, is sometimes eaten by mistake for other roots, with the most dangerous effects; and numerous instances of fatal results are on record. The symptoms produced are such as attend irritation or inflammation of the stomach, besides failure of circulation, and great cerebral disturbance, indicated by giddiness, convulsions, and coma. (See *Pharm. Journ. and Trans.*, Sept. 1874, p. 202.) Externally applied, the root produces redness and irritation of the skin, with an eruptive affection. It is said to be sometimes used empirically as a local remedy in piles; and a case is recorded in which an obstinate leprosy was cured by the continued use of the juice of the plant. Other species of *Œnanthe* are poisonous, and the whole genus should be regarded among the suspected plants. We have two or three indigenous species. The proper remedies, in cases of poisoning from these plants, are emetics, followed, after the stomach has been thoroughly evacuated, by demulcent drinks. A peculiar resinoid principle, denominated *œnanthin*, has been found by Mr. Gerding in *Œnanthe fistulosa*, of which half a grain, given to an adult, produced long-continued irritation of the fauces, with hoarseness, and a grain occasional vomiting. (See *Am. Journ. of Pharm.*, xxi. 68.) W.

ŒNANTHE PHELLANDRIUM. (Sprengel.) *Phellandrium aquaticum.* Linn. *Fine-leaved Water-hemlock.* A biennial or perennial, umbelliferous, European water-plant, the fresh leaves of which are said to be injurious to cattle, producing a kind of paralysis when eaten. By drying, they lose their deleterious properties. The *seeds* have been used in Europe to a considerable extent in the treatment of disease. They are from a line to a line and a half in length, ovate-oblong, narrow above, somewhat compressed, marked with ten delicate ribs, and crowned with the remains of the calyx, and with the erect or reverted styles. Their colour is yellowish-brown; their odour peculiar, strong, and disagreeable; their taste acrid and aromatic. Among their constituents is a volatile oil, upon which their aromatic flavour depends. By Mr. C. Fronfield it has been rendered probable that they contain a volatile alkaloid, analogous to conia, if it be not conia itself; for if the powdered seeds are rubbed with solution of potassa, the peculiar mouse-like odour of that alkaloid is exhaled. The powder was submitted to distillation with caustic potassa, the alkaline liquid obtained was neutralized with sulphuric acid and evaporated to a syrupy consistence, alcohol was added to precipitate the sulphate of ammonia, the liquid was then filtered, treated with caustic potassa, and again distilled. On the surface of the distillate a yellow oily fluid floated, which was only slightly soluble in water but readily so in ether and alcohol, evinced an alkaline reaction with turmeric paper, and neutralized the acids. (*Am. Journ. of Pharm.*, May, 1860, p. 211.) By different writers the seeds are described as aperient, diuretic, emmenagogue, expectorant, and sedative. They probably unite mild narcotic properties with the stimulant powers which are common to most of the aromatics, and may be directed, according to circumstances, to different secretory organs. In overdoses they produce vertigo, intoxication, and other narcotic effects. They appear to have been used most successfully in chronic pectoral affections, such as bronchitis, pulmonary consumption, and asthma. They have been given also in dyspepsia, intermittent fever, obstinate ulcers, &c. The dose of the seeds, to commence with, is five or six grains, so repeated as to amount to a drachm in twenty-four hours. They should be given in powder. A tincture and alcoholic extract have been prepared, of which the former, containing the virtues of half a drachm of the seeds in a fluidounce, is given in a dose varying from half a fluidrachm to a fluidrachm, and the latter in that of three to five grains. (*Pharm. Journ.*, xii. 591.) W.

ŒNOTHERA BIENNIS. *Tree Primrose.* A biennial indigenous plant, growing in

fields and along fences from Canada to the Carolinas. It is from two to five feet high, with a rough stem, alternate, ovate-lanceolate leaves, and fine yellow flowers, which make their appearance in July and August. Schoepf states that it is esteemed useful as a vulnerary. The late Dr. R. E. Griffith found a strong decoction of the small branches, with the leaves and cortical part of the stem and larger branches, very beneficial in eruptive complaints, especially tetter. He applied the decoction several times a day to the affected part. He believed the virtues of the plant to reside in the cortical part, which has a mucilaginous taste, and leaves a slight sensation of acrimony in the fauces. W.

ŒTHUSA CYNAPIUM. This British plant is an active poison, producing symptoms similar to those caused by Œnanthe crocata. (*Pharm. Journ. and Trans.*, Sept. 1874, p. 202.) H. C. W.

OIL OF ANDA. A fixed oil procured by expression from the seeds of *Anda Brasiliensis* (Radde), *Anda Gomesei* (Ad. Jussieu), a tree of Brazil, belonging to the family of Euphorbiaceæ. The bark yields on being wounded a milky juice, which is said to be poisonous, and to be used for stupefying fish. The fruit, which is about as large as an apple, ash-coloured, with two larger and two smaller angles, encloses a two-celled nut, containing two seeds, about the size of a chestnut. Like the seeds of other Euphorbiaceous plants, these are actively purgative; one seed, according to Martius, being the dose for a man. By expression these seeds yield a pale-yellow, transparent oil, with little smell or taste, which is said to be used in Brazil for burning and painting. Dr. Norris, who tried the oil at the Pennsylvania Hospital, found it to operate on the bowels moderately in the dose of fifty drops, and copiously, when more largely given. (*Cyclopædia of Prac. Med. and Surg.*, i. 470.) Dr. Alexander Ure, who has experimented with it in several cases, states that, in the average dose of twenty drops, it usually operates mildly, without producing heat or pain in the throat, and seldom causing nausea or vomiting. W.

OIL OF BEN. This is a fixed oil extracted from the seeds of the *Moringa pterygosperma* and *M. aptera* of *Gærtner*, confounded by Linnæus under the name of *Guilandina Moringa*. *Hyperanthera Moringa* (Vahl) is a synonym of the former species. These are trees belonging to the family of *Leguminosæ*, inhabiting different parts of India, Arabia, Syria, &c., and introduced into the W. Indies. Mr. James Macfadyen, in his *Flora of Jamaica* (i. 325), states that it is not the M. pterygosperma which yields the commercial oil of ben, but the M. aptera, which has not been introduced into Jamaica. He says, however, that an excellent and palatable oil may be obtained by expression from the seeds of M. pterygosperma, growing in that island. The leaves and other parts have an acrid property, which has probably given the name of *horse-radish tree* to M. pterygosperma. The oil of the seeds has long been known, though used rather in the arts than in medicine. It is prepared in Europe from the seeds brought from Egypt (*Mérat et De Lens*); and it would appear, from the statements of Mr. Macfadyen, that the idea generally prevailing that it is also extracted in the W. Indies is incorrect. The oil is inodorous, clear, and nearly colourless, and keeps long without becoming rancid. It is employed for similar purposes with olive oil. Mérat and De Lens say that it is purgative; but most of the fixed oils are so in sufficient doses. According to Völcker, the oil contains margarin, olein, and a peculiar fatty matter yielding an acid by saponification, which he names *benic acid*. (*Journ. de Pharm.*, xvi. 77.) W.

OIL OF CADE. *Oleum Cadinum. Huile de Cade.* French. This is a kind of tar, obtained by distillation, *per descensum*, from the interior reddish wood of *Juniperus communis*, or more strictly of *J. Oxycedrus*, which grows in the South of France, where the substance is prepared. It is a thick liquid, black, and of a smell analogous to that of common tar. It has long been employed in the treatment of the cutaneous diseases of horses, sheep, &c.; and is also applied by the peasantry to their own skin affections. More recently, it has acquired much reputation in these complaints, in consequence of its extensive and successful use in the hospitals of Paris. M. Bazin has employed it with success in psora, lichen agrius, the different scaly affections, the advanced stage of eczema, and favus. In most of these complaints we have long been in the habit of employing common tar ointment, and with probably equal success. A kind of soap is prepared from the oil of cade, which affords a convenient method of applying it. In the *Ed. Monthly Journ.* for July, 1852 (*page* 66), it is stated that the soap is made by distilling the tar, incorporating the volatile oil obtained with a fixed oil, and then saponifying this with soda. It is in the form of black balls, readily unites with water, and may be applied to the surface like any other soap. The best plan is probably to apply it at bedtime, and wash it off next morning. A *glycerate of the tar* has been recommended for external use, made by mixing, with the aid of heat, an ounce of glycerin, half a drachm of the purified oil of cade, and half an ounce of powdered starch. (See *Am. Journ. of Med. Sci.*, Jan. 1859, p. 228.) W.

OIL OF EUPHORBIA. A fixed oil, obtained from the seeds of *Euphorbia Lathyris*, a biennial plant growing wild in this country, though believed to have been introduced

from Europe. It is often found near gardens and in cultivated fields, and is generally called *mole plant*, under the impression that moles avoid the grounds where it grows. (*Pursh.*) It is the *caper plant* of England. (*Loudon's Encyc. of Plants.*) Like the other species of Euphorbia, it contains a milky juice, which is extremely acrid; and the whole plant possesses the properties of a drastic purge; but the oil of the seeds is the only part used in regular practice. This may be extracted by expression, or by the agency of alcohol or ether. In the first case, the bruised seeds are pressed in a canvas or linen bag, and the oil which escapes is purified by decanting it from the whitish flocculent matter which it deposits upon standing, and by subsequent filtration. By the latter process, the bruised seeds are digested in alcohol, or macerated in ether, and the oil is obtained by filtering and evaporating the solution. According to Soubeiran, however, the oils obtained by these different processes are not identical. That procured by expression is probably the purest.

Oil of euphorbia is colourless, inodorous, and, when recent, nearly insipid; but it speedily becomes rancid, and acquires a dangerous acrimony. Soubeiran has ascertained that it has a complex composition, containing, beside the pure oil, four distinct proximate principles. (*Journ. de Pharm.*, xxi. 259.) From 40 to 44 parts are obtained by expression from 100 of the seed. It is a powerful purge, operating with much activity in a dose varying from five to ten drops. It was, some years since, much used by certain Italian and French physicians, who did not find it to produce inconvenient irritation of the stomach and bowels. Its want of taste, and the smallness of the dose, recommended it especially in the cases of infants. It was said to be less acrid and irritating than the croton oil, over which it also has the advantage of greater cheapness. Some trials made with it on this side of the Atlantic have not confirmed these favourable reports. It was found uncertain in its cathartic effect, and very liable to vomit. (Scattergood, *Journ. of the Phil. Col. of Pharm.*, iv. 124.) It may be given in pill with the crumb of bread, or in emulsion. W.

OIL OF JASMINE. This oil is obtained from the flowers of *Jasminum officinale* or *common white jasmine*, and from those also of *J. Sambac* and *J. grandiflorum*. Alternate layers of the fresh flowers, and of cotton saturated with the *oil of ben* (see *page* 1716), or perhaps other fixed oil, are exposed in a covered vessel to the warmth of the sun; the flowers being occasionally renewed till the oil becomes impregnated with their odour, when it is separated from the cotton by pressure. This method is necessary, as the flowers do not yield their aroma by distillation. The oil is used only as a perfume.

In the *Medical and Surgical Reporter* (Jan. 5, 1861) the case of a child is recorded, under the care of Dr. W. H. Hall, of Brooklyn, N. Y., who was severely poisoned by eating the fruit of a species of Jasmine, growing in the garden, probably the common white jasmine above referred to. The symptoms were those of an energetic narcotic; as coma, largely dilated pupil, and snoring respiration, with a cold pale surface, and slow and feeble pulse, followed by violent convulsions, with rigidity of the muscles about the head and throat. Under the use of the hot-bath, with active emetics, the spasms relaxed, vomiting took place, and the patient, though feeble for a few days, ultimately recovered his wonted health. (*B. and F. Medico-chirurg. Rev.*, April, 1861, p. 283.) W.

OLEIC ACID. *Oleates. Oleostearates.* In 1872 (*London Lancet*, May, 1872, p. 709), Prof. Jno. Marshall introduced to the profession the oleates as substitutes for some of the older ointments, claiming that they are not only cleaner and more elegant, but are also much more efficacious. In experiments made at his suggestion it was found that although the ordinary sublimed scales of red oxide of mercury are with difficulty dissolved in oleic acid, the recent yellow, impalpable oxide, precipitated by soda or potash from a solution of the metal in nitric acid, is freely soluble at a temperature of about 300° F. The 5 per cent. solution thus made was a perfectly clear yellow liquid, the 10 per cent. entirely fluid but as dark and thick as linseed oil, the 20 per cent. an opaque, yellowish, unctuous substance, melting readily at the temperature of the body. To the *oleates of mercury* thus formed Prof. Marshall afterwards added morphia, one grain to the drachm, distinguishing such preparation as *oleate of mercury and morphia*. There appears to be no difficulty in making these and similar preparations with pure oleic acid, but with the commercial acid the task is sometimes difficult, there being a reduction of a portion of the metal. The druggist may prepare for himself the pure acid, but this renders the preparations rather costly. The suggestion of Mr. Chas. Rice (*Am. Journ. of Pharm.*, xlv. 2) seems, therefore, to have value. It is to expose the commercial acid to a temperature of 40° F., and express the liquid portion, which is oleic acid deprived of most of its contaminating acids. Then to take of this oleic acid 1536 grains; of perfectly dry oxide of mercury 192 grains. Rub the mercury with a portion of the acid into a perfectly smooth paste; add the remainder of the acid; and by means of a water-bath keep the mixture for some time at a temperature of not above 200° F., with constant stirring. When the oxide has disappeared, or is reduced to a pure gray colour, allow to cool; after 24 hours pour off the clear solution, wash the residue with ether, add this to the oleic solution, and evaporate off the ether at a low temperature. The residue is practically metallic mercury, 200 grains of which represent 216 grains of the oxide; calculate the

amount and substract it from 192 grains to get the amount of oxide of mercury taken up, whence the per cent. strength of the solution may be estimated. Usually the solution contains between 9 and 10 per cent. of the oxide of mercury. Morphia may be readily dissolved in it. A writer in the *Amer. Journal of Pharmacy* (xlv. 97) prepares *oleic acid* for making oleates by saponifying, with potassa, almond oil; decomposing by tartaric acid, separating the precipitated bitartrate; heating for several hours on a water-bath with half its weight of finely powdered oxide of lead; after cooling, mixing with three times its volume of ether, settling, decanting, and treating the residue with ether as before; agitating the mixed ethereal solutions with dilute hydrochloric acid; skimming off the ethereal solution of oleic acid, washing it with water, skimming again, and finally recovering the ether by distillation. The impure oleic acid thus obtained is freed from *oxyoleic acid* by saturation with ammonia, precipitation with chloride of barium, drying the precipitate, treating it with boiling alcohol, which deposits on cooling crystals of pure oleate of barium; and finally decomposing these by a solution of tartaric acid in *boiled* water; care must be exercised not to expose the oleic acid to the air. As thus obtained, the acid readily dissolves as much as 20 per cent. of the binoxide of mercury. Various oleates besides those of mercury and morphia may be prepared, probably all of the alkaloids and most, if not all, of the officinal metallic oxides being readily made to combine in the acid. Thus the *oleates of lead* and *of zinc*, containing each 20 per cent. of the oxide, may be prepared by heating one part of the respective oxides with four of the acid. (*Am. Journ. of Pharm.*, Oct. 1872.) In some instances the union is said to be best obtained by an indirect process. A solution of almond soap is added to a solution of a soluble salt of the base. The soap must always be in excess. (See *Philad. Med. Times*, iv. 68.) The resulting *oleostearate* which precipitates is very soluble in olive oil and other ordinary fatty menstrua.

The *oleate of mercury and morphia* was brought forward by Prof. Marshall (*loc. cit.*, 711) as a remedy in chronic superficial or external inflammations, such as subacute or chronic synovitis, threatened abscesses of mammary glands, &c.; in hordeolum a mixture of the 20 per cent. solution with an equal amount of pure lard he has found very useful. He has also obtained good results from these preparations in various skin affections, such as sycosis, chloasma, tinea, pruritus. Usually the strength should not be over 5 per cent. in these cases. In eczema and psoriasis the remedy has not yielded its introducer satisfactory results. It is probable that all the oleates and oleostearates will act very much as corresponding ointments, but more actively, owing to the medicine being in a form to be more readily absorbed. In syphilis, Prof. Marshall commends the mercurial oleate very highly, both for its local action on parts to which it can be directly applied and also as a means of influencing the system. A piece of the 20 per cent. solution, the size of a pea, placed night and morning in the axilla of a child, it is stated, will decidedly influence the system in five or six days. H. C. W.

OLIBANUM. Olibanum, the *frankincense* of the ancients, was erroneously ascribed by Linnæus to *Juniperus Lycia*. There are two varieties, one coming to Europe from the Mediterranean, and the other directly from Calcutta. These varieties were formerly considered distinct, but recent researches indicate their common origin. In 1843, Captain Kempthorne, of the E. India Company's Navy, saw the olibanum tree growing upon the mountains, on the African coast, between Bunder Maryah and Cape Guardafui. According to his statement, it grows on the bare marble rocks composing the hills of that region, without any soil or the slightest fissure to support it, adhering by means of a substance thrown out from the base of the stem. This rises forty feet, and sends forth near the summit short branches, covered with a bright-green, singular foliage. The juice, which exudes through incisions made into the inner bark, has at first the colour and consistence of milk, but hardens on exposure. (*Pharm. Journ.*, iv. 37.) Sir Wm. J. Hooker says that the African olibanum is derived from *Plösslea floribunda* of Endlicher (*Boswellia*, Royle); but thinks it highly probable that it is furnished by more than one species. (*Ibid.*, Oct. 1859, p. 217.) Mr. Bennett, of the British Museum, has also identified Kemper's specimens as P. floribunda. But in 1847 Mr. Carter described very closely the olibanum district, and procured living specimens, the descendants of which appear still to flourish in the "old gardens" of the Bombay Agri-Horticultural Society. Dr. Birdwood, who is in charge of these gardens, has examined the subject with great care, and published a monograph in the Transactions of the Linnæan Society, xxvii. He asserts that no olibanum is obtained in India, all coming from a coast district of Arabia, and being the product of a new species of Boswellia, *B. Carteri*, Birdwood. The newly made out district is precisely that described by Theophrastus as the locality from which olibanum was brought in his day. The various species of Boswellia are described in the monograph of Dr. Birdwood.

The Arabian or African frankincense is in the form of yellowish tears, and irregular reddish lumps or fragments. The tears are generally small, oblong or roundish, not very brittle, with a dull and waxy fracture, softening in the mouth, and bearing much resemblance to mastic, from which, however, they differ in their want of transparency. The reddish masses soften in the hand, have a stronger taste and smell than the tears, and are often mixed with fragments of bark, and small crystals of carbonate of lime.

The Indian frankincense, or olibanum, consists chiefly of yellowish, somewhat translucent, roundish tears, larger than those of the African, and generally covered with a whitish powder produced by friction. It has a balsamic resinous smell, and an acrid, bitterish, somewhat aromatic taste. When chewed it softens in the mouth, adheres to the teeth, and partially dissolves in the saliva, which it renders milky. It burns with a brilliant flame, and a fragrant odour. Triturated with water, it forms a milky imperfect solution. Alcohol dissolves nearly three-fourths of it, and the tincture is transparent. From 100 parts, Braconnot obtained 8 parts of volatile oil, 56 of resin, 30 of gum, and 5·2 of a glutinous matter insoluble in water or alcohol, with 0·8 loss. Various saline substances were found in its ashes. The oil may be separated by distillation, and resembles that of lemons in colour and smell. According to Stenhouse, it is isomeric with oil of peppermint, having the formula $C_{35}H_{28}O$, and consists of an oxygenous and non-oxygenous oil. (*Gmelin's Handbook*, xiv. 390.)

Dr. W. F. Daniell has described an odorous product, used as *frankincense* in Sierra Leone, and obtained from a large tree, growing in the mountainous districts of that region. The tree has been described by Mr. John J. Bennett in the *Pharmaceutical Journal* for December, 1854 (p. 251), under the name of *Daniella thurifera*. According to Dr. Daniell, the juice exudes through openings made by an insect, and, concreting in connection with the woody particles resulting from the boring of the insect, falls at length to the ground, where it is collected by the negroes. (See *Am. Journ. of Pharm.*, xxvii. 338.)

Olibanum is stimulant like the other gum-resins; but is now very seldom used internally. M. Delioux, of Toulon, however, is in the habit of using it for the same purposes as the balsams of Tolu and Peru, having satisfied himself by much experience that it produces similar effects, while it is less costly. He gives it, in the form of pill, in the medium dose of fifteen grains, which may be increased to a drachm or more. It appears to act more favourably when combined with a little soap. He has also obtained advantage from the inhalation of its fumes, when heated, in chronic bronchitis and laryngitis. (*Bullet. Gén. de Thérap.*, Fev. 28, 1861.) It is chiefly employed for fumigation, and enters into the composition of some unofficinal plasters. W.

ONION. *Cepa.* The bulb of *Allium Cepa*. This is a perennial bulbous plant, with a naked scape, swelling towards the base, exceeding the leaves in length, and terminating in a simple umbel of white flowers. The leaves are hollow, cylindrical, and pointed. The original country of the onion is unknown. The plant has been cultivated from time immemorial, and is now diffused over the whole civilized world. All parts of it have a peculiar pungent odour, but the bulb only is used. This is of various size and shape, ovate, spherical, or flattened, composed of concentric fleshy and succulent layers, and covered with dry membranous coats, which are reddish, yellowish, or white, according to the variety. It has, in a high degree, the characteristic odour of the plant, with a sweetish and acrid taste. Fourcroy and Vauquelin obtained from it a white acrid volatile oil containing sulphur, albumen, much uncrystallizable sugar and mucilage, phosphoric acid both free and combined with lime, acetic acid, citrate of lime, and lignin. The expressed juice is susceptible of the vinous fermentation.

The onion is stimulant, diuretic, expectorant, and rubefacient. Taken moderately it increases the appetite and promotes digestion, and is much used as a condiment; but in large quantities it is apt to cause flatulence, gastric uneasiness, and febrile excitement. The juice is occasionally given, made into syrup with sugar, in infantile catarrhs and croup, in the absence of much inflammatory action. It is also recommended in dropsy and calculous disorders. Deprived of its essential oil by boiling, the onion becomes a mild esculent; and it is much more used as food than as medicine. Roasted and split, it is sometimes applied as an emollient cataplasm to suppurating tumours. W.

OPOPANAX. A concrete juice usually ascribed to *Pastinaca Opopanax* (Willd.), *Opopanax Chironium* (De Candolle). This species of parsnep, usually called *rough parsnep*, has a thick, yellow, fleshy, perennial root, which sends up annually a strong branching stem, rough near the base, about as thick as a man's thumb, and from four to eight feet in height. The leaves are variously pinnate, with long sheathing petioles, and large, oblong, serrate leaflets, of which the terminal one is cordate, others are deficient at their base upon the upper side, and the whole are hairy on their under surface. The flowers are small, yellow, and form large flat umbels at the termination of the branches. The plant is a native of the Levant, and grows wild in the South of France, Italy, and Greece. When the base of the stem is wounded, a juice exudes, which, when dried in the sun, constitutes the opopanax of commerce. Some authors state that it is obtained from the root. A warm climate appears necessary for the perfection of the juice; as that which has been collected from the plant in France, though similar to opopanax, is of inferior quality. The drug is brought from Turkey. It is said to come also from the East Indies; but Ainslie states that he never met with it in any Indian medicine bazaar. The method of its production is not known with any certainty.

It is sometimes in tears, but usually in irregular lumps or fragments, of a reddish-yellow colour, speckled with white on the outside, paler within, and, when broken, ex-

hibiting white pieces intermingled with the mass. Its odour is strong, peculiar, and unpleasant, its taste bitter and acrid. Its sp. gr. is 1·622. It is inflammable, burning with a bright flame. In chemical constitution it is a gum-resin, with an admixture of other ingredients in small proportion. The results of its analysis by Pelletier were from 100 parts, 33·4 of gum, 42 of resin, 4 2 of starch, 1·6 of extractive, 0·3 of wax, 2·8 of malic acid, 9·8 of lignin, 5·9 of volatile oil and loss, with traces of caoutchouc. Water by trituration dissolves about one-half of the gum-resin, forming an opaque milky emulsion, which deposits resinous matter on standing, and becomes yellowish. Both alcohol and water distilled from it retain its flavour; but only a very minute proportion of oil can be obtained in a separate state.

Opopanax was formerly employed, as an antispasmodic and deobstruent, in hypochondriasis, hysteria, asthma, and chronic visceral affections, and as an emmenagogue in suppression of the menses; but it is now generally regarded as a medicine of very feeble powers, and in this country is scarcely ever used. The dose is from ten to thirty grains. W.

ORANGE RED. *Orange Mineral. Sandix.* Red oxide of lead, prepared by calcining carbonate of lead. It is of a brighter colour than *minium*, and is used as a pigment. W.

OREODAPHNE CALIFORNICA. The *California Bay Laurel* is an evergreen tree of considerable size, rather abundant throughout the State. Its wood is much prized on account of the beauty of its grain and its immunity from the attacks of insects. The leaves yield about 4 per cent. of a neutral, straw-coloured, limpid volatile oil, which has a warm camphoraceous taste and a pungent aromatic odour, resembling somewhat that of a mixture of oils of nutmeg and cardamom. It is soluble in 1000 parts of water, and with alcohol and ether in all proportions. It is said, when inhaled, to cause dizziness and headache. Its chemical characters have been studied by Mr. Jno. P. Heamy. (*Am. Journ. of Pharm.*, xlvii. 105.) He finds it to consist of a pure hydrocarbon, sp. gr. ·894, boiling at 175° C., and an oxygenated pungent portion, which boils at 210° C. This he calls *oreodaphnol*. *Oreodaphnene* was obtained by distilling oreodaphnol with glacial phosphoric acid. For the reactions of these principles want of space compels us to refer the reader to Mr. Heamy's paper. H. C. W.

ORIGANUM VULGARE. *Common Marjoram. Origanum.* This plant was officinal in the former U. S. and Ed. Pharmacopœias; but as the volatile oil which was ascribed to it, and for which it was chiefly valued, has proved to be really the oil of thyme, it has been omitted both in the present U. S. and the Br. Pharmacopœias, though, in consideration of its aromatic properties, it might well have been introduced into the Secondary Catalogue of the former. The genus *Origanum* belongs to Didynamia Gymnospermia in the Linnæan system, and to the natural family Lamiaceæ or Labiatæ, and is characterized as follows. "*Strobile* four-cornered, spiked, collecting the calyces. *Corolla* with the upper lip erect and flat, the lower three-parted, with the segments equal." (*Willd.*) Two species have been used in medicine, *O. Majorana*, or sweet marjoram, and *O. vulgare*, or common marjoram. The former grows wild in Portugal and Andalusia, and is cultivated as a garden herb in other parts of Europe, and in the United States. Some authors, however, consider *O. Majoranoides*, which is a native of Barbary, and closely allied to *O. Majorana*, as the type of the sweet marjoram of our gardens. *Sweet marjoram* has a pleasant odour, and a warm, aromatic, bitterish taste, which it imparts to water and alcohol. By distillation with water it yields a volatile oil, which was directed by the Edinburgh College among their preparations. It is tonic and gently excitant, but is used more as a condiment in cookery than as a medicine. In domestic practice, its infusion is much employed by the vulgar to hasten the tardy eruption in measles and other exanthematous diseases.

Origanum vulgare or *common marjoram* is a perennial herb, with erect, purplish, downy, four-sided, trichotomous stems, about eighteen inches high, and opposite, ovate, entire, somewhat hairy leaves, of a deep yellowish-green colour. The flowers are of a pinkish-purple or rose colour, disposed in roundish, panicled spikes, and accompanied with ovate reddish bractes, longer than the calyx. This is tubular and five-toothed, with nearly equal segments. The corolla is funnel-shaped, with the upper lip erect, bifid, and obtuse, the lower trifid, blunt, and spreading. The anthers are double, the stigma bifid and reflexed. The plant is a native of Europe and America. In this country it grows along the roadsides, and in dry stony fields and woods, from Pennsylvania to Virginia, and is in flower from June to October; but it is not very abundant, and is seldom collected for use. It has a peculiar, agreeable, aromatic odour, and a warm, pungent taste. These properties it owes to a volatile oil, which was formerly employed, but has been superseded, in great measure, if not altogether, by the oil of thyme. It may be separated by distillation with water. Origanum is gently tonic and excitant, and has been used in the form of infusion as a diaphoretic and emmenagogue, and externally as a fomentation; but it is at present little employed. W.

OROBANCHE VIRGINIANA. *Epifagus Americanus.* Nuttall. *Beech-drops. Cancer-root.* This is a parasitic, fleshy plant, with a tuberous, scaly root, and a smooth

stem, branched from the base, from twelve to eighteen inches high, furnished with small ovate scales, of a yellowish or purplish colour, and wholly destitute of verdure. It is found in all parts of North America, growing upon the roots of the beech tree, from which it obtained its popular name. It is in some places very abundant. The plant has a bitter, nauseous, astringent taste, which is said to be diminished by drying. It has been given internally in bowel affections; but its credit depends mainly upon the idea that it is useful in obstinate ulcers of a cancerous character, to which it is directly applied in the state of powder. The late Professor Barton conjectured that it was an ingredient of a secret remedy, at one time famous as *Martin's cancer powder*, of which, however, the most active constituent was arsenious acid.

Other species of Orobanche, growing in America and Europe, have been employed. They are all parasitic, fleshy plants, without verdure, and of a bitter, nauseous taste. In Europe they are called *broom-rape*. The *O. Americana* and *O. uniflora*, of this country, are said to be used for the same purposes as the species above noticed, and like it are called *cancer-root*. W.

ORPIMENT. *King's Yellow.* A native tersulphuret of arsenic, consisting of one eq of metal 75, and three eqs. of sulphur 48 = 123. It is in masses of a brilliant lemon yellow colour, composed of flexible laminæ, and slightly translucent. It exists in various parts of the world, but is obtained for use from Persia and China. (*Guibourt.*) It is sometimes mixed with realgar, which gives it a reddish or orange hue. A similar sulphuret may be made artificially by passing sulphuretted hydrogen through a solution of arsenious acid in muriatic acid. There is reason to believe that neither the native sulphuret, nor the artificial, when prepared in the manner just mentioned and well washed, is poisonous, at least in a degree at all comparable to other arsenical compounds.

Artificial orpiment is prepared for use by fusing together equal parts of arsenious acid and sulphur. (*Turner.*) In Germany, according to Guibourt, it is prepared by subliming a mixture of these two substances. In this case, however, it retains a large portion of the acid undecomposed, and is therefore highly poisonous. Guibourt found a specimen which he examined to contain 94 per cent. of arsenious acid, and only 6 per cent. of the tersulphuret.

Orpiment is an ingredient of certain depilatories. *Atkinson's depilatory* is said to consist of one part of orpiment and six parts of quicklime, with some flour and a yellow colouring matter. (*Ann. der Pharm.*, xxxiii. 348.) But this arsenical sulphuret is chiefly used in fireworks, and as a pigment. W.

ORYZA SATIVA. *Rice.* This is an annual plant, originally, perhaps, derived from the East Indies, but now cultivated in all parts of the globe where the climate and soil are adapted to its growth. Barth says, in his Travels (Am. ed., 1857, ii. 345), that it grows wild in Central Africa. The rice of commerce consists of the seeds of the plant deprived of their husk. Carolina rice was found by Braconnot to contain 85·07 per cent. of starch, 3·60 of gluten, 0·71 of gum, 0·29 of uncrystallizable sugar, 0·13 of fixed oil, 4·80 of vegetable fibre, 5·00 of water, and 0·40 of saline substances. This grain is highly nutritious, and of easy digestion, and constitutes the almost exclusive diet of whole nations. Being entirely free from laxative properties, it is admirably adapted to cases of weak bowels, in which there is a strong tendency to diarrhœa. Care, however, should be taken that it be boiled till it becomes soft. A decoction of rice, usually called *rice-water*, is a good nutritive drink in fevers, and inflammatory affections of the bowels, lungs, and kidneys. There appears to be no ground for the opinion, entertained by some, that a diet of rice is injurious to the eyes. W.

OSHA ROOT. This is the root of an unknown New Mexican umbellifer. It has been analyzed by Mr. H. Haupt, and found to contain an acid, *oshaic acid*, closely resembling, but he believes distinct from, angelic acid. (See *Am. Journ. of Pharm.*, 1867, p. 202; 1868, p. 106; 1873, p. 347.) H. C. W.

OXALIS ACETOSELLA. *Wood-sorrel. Acetosella.* The wood-sorrel is a small, perennial, herbaceous, stemless plant, with numerous radical leaves, which are all ternate, and supported upon slender hairy petioles. The leaflets are obcordate, entire, hairy, of a yellowish-green colour, but frequently purplish on their under surface. The scape or flower-stalk, which usually exceeds the petioles in length, is furnished with two scaly bractes near the middle, and terminates in a large white, or flesh-coloured flower, marked with red streaks. The styles are of the same length as the inner stamens. This plant is a native both of Europe and North America. In this country it is found chiefly in the mountainous regions of the interior. It selects shady places, such as woods, groves, and hedges, and flowers in May. Other indigenous species of Oxalis, more widely diffused than *O. Acetosella*, might be substituted for it without disadvantage; as they possess similar properties. They all have ternate leaves with obcordate leaflets, and, with the single exception of *O. violacea*, bear yellow flowers. The whole herbaceous portion may be used.

Wood-sorrel is without smell, and has an agreeable sour taste. It owes its acidity to *binoxalate of potassium*, which is sometimes separated for use, and sold under the name of *salt of sorrel*. This is prepared in Switzerland and Germany, from different species of Oxalis and Rumex, by the following process. The plants, previously bruised, are macerated for some days in water, and then submitted to pressure. The liquid thus obtained is mixed with clay, and occasionally agitated for two days. At the end of this time, the clear liquor is decanted, and evaporated so that crystals may form when it cools. These are purified by solution and a new crystallization. Five hundred parts of the plant afford four parts of the acidulous salt. The same salt may be prepared by exactly neutralizing with potassa one part of oxalic acid in solution, then adding one part more of the acid, and evaporating the solution so that it may crystallize upon cooling. Binoxalate of potassium is in rhomboidal crystals, of a sour, pungent, bitterish taste, soluble in forty parts of cold and six parts of boiling water (*Kane*), and unalterable in the air. It contains 72 parts or two equivalents of oxalic acid, 47·2 parts or one eq. of potassa, and 27 parts or three eqs. of water. *Quadroxalate of potassium* is often substituted for the binoxalate. It is prepared in the same manner except that, instead of one part, three parts of the acid are added to the original proportion neutralized by potassa. Both salts are kept in the shops under the names of *salt of sorrel* and *essential salt of lemons*, and are employed for removing iron mould and ink stains from linen, and sometimes as a test for lime. Both are poisonous, though in a less degree than uncombined oxalic acid.

This and other species of sorrel are refrigerant; and their infusion, or a whey made by boiling them in milk, may be used as a pleasant drink in febrile and inflammatory affections. A solution of the binoxalate of potassium is used on the continent of Europe, as a substitute for lemonade. It has recently been recommended by W. H. Taylor as extraordinarily efficacious in scurvy, having effected cures in that complaint after lemon-juice had failed. The salt used contained an excess of oxalic acid. It was probably the quadroxalate. Four grains were given three times a day. (*Lancet*, June 5, 1869, p. 777.) The fresh plant, eaten raw, is said to be useful in scurvy. *Oxalis crassicaulis*, a Peruvian species, yields an edible root, and, by expression from its leaves, a very sour and astringent juice, which is employed in the form of syrup, in hemorrhages, chronic catarrh, bowel affections, and gonorrhœa, with asserted advantage. W.

OX-GALL. *Fel Bovinum.* The bile of the ox is a viscid fluid, of a green or greenish-yellow colour, a peculiar nauseous odor, and a bitter taste. The exact composition of bile is not yet settled. According to Berzelius, it contains, 1. *bilin*, 2. *cholepyrrhin*, to which the bile owes its colour, 3. mucus, 4. extractive matters, 5. a peculiar fatty matter, originally found in biliary calculi, called *cholesterin*, 6. oleate, margarate, and stearate of sodium, with a little fatty matter not saponified, 7. chloride of sodium, sulphate, phosphate, and lactate of sodium, and phosphate of calcium. Of these substances, the most abundant and essential is *bilin*. This, when pure, is uncrystallizable, colourless, translucent, inodorous, of an acrid and bitter taste with an after-taste of sweetness, inflammable, soluble in all proportions in water and anhydrous alcohol, insoluble in ether, neither alkaline nor acid, and composed partly of nitrogen. One of its most striking properties is the great facility with which it undergoes decomposition; and hence the numerous principles which different chemists have found in bile, many of which are nothing more than metamorphoses of bilin. Under the action of acids, it is changed into two resinous acids called respectively *fellinic* and *cholinic acid*, and into *taurin** and ammonia. The colouring principle or *cholepyrrhin* is also readily changed, and gives rise to various new products, among which are *biliverdin*, a green colouring matter resulting from the absorption of oxygen, and *bilifulvin*, a yellow colouring matter, which is a double salt of lime and soda with a peculiar azotized acid. (*Journ. de Pharm.*, 3e sér., iii. 177; from the *Journ. für praktische Chemie.*) E. A. Platner succeeded in separating the chief constituent of bile in a crystalline form, and considered it a compound of soda with a peculiar organic body. Liebig denominated this compound *bilate of sodium*. Among the most recent and authoritative analyses of bile is that of Strecker, whose views differ essentially from those of Berzelius. According to Strecker, the bile of the ox, independently of the colouring, fatty, and saline matters above mentioned, consists essentially of a mixture of nitrogenous acid free from sulphur, which he calls *cholic acid* (*glycocholic acid*), and an uncrystallizable, sulphuretted acid also containing nitrogen, denominated *choleic acid* (*taurocholic acid*), both of which are combined with soda, constituting a mixture of cholate and choleate of that alkali. These two salts may be separated in the following manner. Dry ox-bile is treated with absolute alcohol, and the tincture precipitated by ether in excess. Both salts are deposited, and the cholate crystallizes upon standing, the choleate remaining in an amorphous form, resembling oily or resinous matter. They may be separated more completely by taking advantage of their different relations to the acetate and subacetate of lead. Both the acids are precipitated by the subacetate, the cholic only by the acetate. If the deposit above referred to be dissolved in water, solution of acetate of lead will throw down a cholate of lead, while the addition of the subacetate of lead to the remainder will precipitate the choleate. The acids may be separated from the salts of lead by sulphuric acid, and then recombined with soda. Both

* For an elaborate research on taurin, see *Journ. de Pharm.*, Oct. 1875.

of the acids are decomposed by the alkalies, with the aid of heat, into *cholalic acid*, which contains neither nitrogen nor sulphur, and into another complex body, which, in the case of cholic acid, is a nitrogenous basic substance named *glycocine* (the glycocoll or sugar of gelatin of other chemists), and in that of choleic acid, a neuter substance called *taurine*, which contains both nitrogen and sulphur, the latter in the extraordinary proportion of 24 per cent. Acids with a boiling heat have an analogous effect, though the nature of the acid produced is different, the cholic acid being resolved into *choloidic acid* and glycocine, and the choleic into the same acid and taurine. Hence it has been inferred that the characteristic acids of bile consist of one acid, associated in the cholic with glycocine, and in the choleic with taurine; so that they have now received the more distinctive names of *glycocholic* and *taurocholic acids*, the former nitrogenous, the latter containing nitrogen and additionally two eqs. of sulphur. (See Gregory's *Organic Chemistry*, 4th ed., Lond., p. 513; also a paper by Dr. J. C. Dalton in the *Am. Journ. of Med. Sci.*, N.S., xxxiv. 305.) Since the examination of bile by Strecker, which ended in these results, further researches have led him to the discovery of other new principles in that part of bile which is soluble both in alcohol and ether. Independent of the fatty matters (glycerides) and cholesterin, he has detected 1. *lecithin*, a substance previously noticed by M. Gobley, which is resolved under the influence of baryta water into fatty acids, and *phosphoglyceric* acid, 2. *sarcolactic* acid, and 3. an energetic base which he calls *cholin*. For the methods of isolating these substances, we must content ourselves with referring to the *Journal de Pharmacie* (Nov. 1861, p. 374). Besides soda, it is said that there are small but variable quantities of potassa and ammonia combined with the glycocholic and taurocholic acids. In relation to the fatty matters of bile, M. Gobley has shown that they consist of olein, margarin, cholesterin, and especially *lecithin*, a fatty principle the characters of which were made known by M. Gobley, and that the oleic and margaric acids, generally supposed to exist in bile combined with soda, are the results of the decomposition of the last-mentioned principle, through the influence of putrefaction or chemical reagents. (*Journ. de Pharm.*, xxx. 246.) According to Franz de l'Arbre, the bile acids form with the alkaloids salts, which are soluble in an excess of the bile. (*New Remedies*, ii. 160.)

Bile was formerly highly valued as a remedy in numerous complaints, and was considered peculiarly applicable to cases attended with deficient biliary secretion. It is supposed to be tonic and laxative. It is prepared for use by evaporating it to the consistence of an extract. The dose is from five to ten grains. Dr. Bonorden has found the most extraordinary effects, in the resolution of hypertrophies, from bile applied directly to the parts affected. Hypertrophy of the mamma and that of the tonsils are particularly mentioned as yielding with surprising facility to this application; but good may be expected from it in all cases of the affection, in which the part can be reached. He employs a mixture of 3 parts of inspissated bile, 1 part of extract of conium, 2 of soda soap, and 8 of olive oil, to be rubbed on the part four times a day. He has also found advantage in similar affections of the eye, as opacity of the cornea, pannus, and staphyloma, from bile dropped into the eye, or applied by a hair-pencil, several times a day. (*Med. Times and Gaz.*, Oct. 1858, p. 353.) *Refined ox-gall*, much used by limners and painters, is prepared, according to Gray, in the following manner. Take of "fresh ox-gall one pint; boil, skim, add one ounce of alum, and keep it on the fire for some time; to another pint, add one ounce of common salt in the same manner; keep them bottled up for three months, then decant off the clear; mix them in an equal proportion; a thick yellow coagulum is immediately formed, leaving the refined gall clear and colourless." A formula is given in the British Pharmacopœia for purifying bile. (See *Fel Bovinum Purificatum*, page 1207.) W.

OZOKERIT. This substance, which is brought from Moldavia, Wallachia, and near the Caspian Sea, in its crude state, is a dirty, greenish solid. When purified by distillation, it is a hard, white, spermaceti-like substance. It is stated to be a vegetable wax, but appears to be allied to the petroleum series, resembling in its purified state paraffin. It is said to resemble tar in its therapeutic properties, and, dissolved in glycerin or linseed oil, has been employed in skin diseases by Dr. Purdon as a substitute for that remedy. (*British and For. Med.-chir. Rev.*, April, 1872, p. 535.. See also *Arch. Gén.*, Avril, 1873.) H. C. W.

PÆONIA OFFICINALIS. *Peony.* This well-known plant is a native of Southern Europe, but is everywhere cultivated in gardens for the beauty of its flowers. The root, flowers, and seeds were formerly officinal. The *root* consists of a caudex about as thick as the thumb, which descends several inches into the ground, and sends off in all directions spindle-shaped tubers, which gradually taper into thread-like fibres, by which they hang together. It has a strong, peculiar, disagreeable odour, and a nauseous taste, which is at first sweetish, and afterwards bitter and somewhat acrid. The odour is lost, or much diminished by drying. Peony root was in very great repute among the ancients, who used it both as a charm and as a medicine in numerous complaints, particularly epilepsy. In modern times it has also been given in epilepsy and various nervous affections, but is at present seldom used. Dr. A. Livezey, of Lumberville, Penn., states that it is much used in the convulsions of children in his neighbourhood, and bears testimony

to its possession of decided nervine powers. (*Bost. Med. and Surg. Journ.*, lv. 467.) The dose of the fresh root is from two drachms to an ounce, boiled in a pint of water down to half a pint, which should be taken daily. It is said to be less active when dried. The expressed juice of the recent root is recommended in the dose of an ounce. It is milky, of a strong odour, and very disagreeable taste. The *flowers* are usually deep-red, though in some varieties light-red, and even whitish. They have, when fresh, an odour similar to that of the root, but feebler, and an astringent, sweetish, herbaceous taste. When dry they are inodorous. As a medicine they have little power. The *seeds* are roundish-oval, about as large as a pea, externally smooth, shining, and nearly black, internally whitish, inodorous when dry, and of a mild, oleaginous taste. By some authors they are said to be emetic and purgative, by others antispasmodic. They may be given in the same dose with the root, but are not used in regular practice. W.

PALM OIL. This highly valuable fixed oil is the product of *Elais Guiniensis*, a palm growing on the western coast of Africa, and cultivated in the West Indies and South America. It is among the handsomest trees of its graceful family which flourish in the tropical regions of Africa. The oil is obtained by expression from the fruit. It is brought to this country chiefly from Liberia and other places on the African coast, though prepared also in the West Indies, Cayenne, and Brazil. It is not improbable that various species of palms contribute to the supply of this article of commerce.

Palm oil has the consistence of butter, a rich, orange-yellow colour, a sweetish taste, and an agreeable odour, compared by some to that of violets, by others to that of the Florentine orris. By age and exposure it becomes rancid and of a whitish colour. It melts with the heat of the hand, and when perfectly fluid passes readily through blotting-paper. Highly rectified alcohol dissolves it at common temperatures, and in ether it is soluble in all proportions. According to M. Henry, it consists of 31 parts of stearin and 69 of olein. But, from the experiments of Frémy and Stenhouse, it appears that the stearin has peculiar properties entitling it to be considered as a distinct principle; and it has accordingly received the name of *palmitin*. This is converted into *palmitic acid* by saponification. (*Kane's Chemistry.*) It appears also that a considerable proportion of this acid, together with some glycerin, exists uncombined in the oil, as ascertained by MM. Pelouze and Boudet; so that the changes which are effected in oils, through the agency of alkalies, in the process of saponification, take place, to a certain extent, spontaneously in palm oil. (*Journ. de Pharm.*, xxiv. 389.) Hence it is more easily saponified than any other fixed oil. Preparatory to saponification, it may be bleached rapidly, according to J. J. Pohl, by heating it quickly to 464° F., and keeping it for ten minutes at that temperature. It loses for a time its peculiar odour by the process, acquiring an empyreumatic smell; but this after a while ceases to be perceived, and the characteristic odour returns. (See *Am. Journ. of Pharm.*, xxvii. 346.) Englehart bleaches it in the following manner. One thousand pounds of the oil are heated in a boiler to 144° F., and kept at that temperature until the next day, when it is decanted into a clean vessel, and cooled to a point between 98° and 104° F. In another vessel 15 lbs. of bichromate of potassium are dissolved in 45 lbs. of boiling water; and, when the solution is partially cooled, 60 lbs. of muriatic acid are added. This solution is then mixed with the oil, and briskly agitated. In five minutes the colour changes to green, through the reduction of the chromic acid; and, with a continuation of the agitation, the oxide of chromium separates, and nothing more is necessary than washing with water to get the oil colourless. (*Am. Journ. of Pharm.*, July, 1868, p. 333.) Palm oil is said to be frequently imitated by a mixture of lard and suet, coloured with turmeric, and scented with Florentine orris. It is much employed in the manufacture of a toilet soap, which retains its pleasant odour. Palm oil is emollient, and has sometimes been employed in friction or embrocation, though not superior for this purpose to many other oleaginous substances. W.

PANCREATIC EMULSION. As it is generally admitted that, among the offices of the pancreatic juice, is that of emulsionizing fatty matters that may pass through the stomach undigested, so as to facilitate their absorption, it would appear highly probable that this secretion might prove useful in cases in which fats are digested with difficulty if at all. Dr. Horace Dobell, physician to the "Royal Infirmary for Diseases of the Chest," having noticed that consumptive patients are very apt to have a dislike for fat, and thinking that this dislike might result from an inability to digest this kind of food, reasonably inferred that the pancreatic secretion might prove useful in these cases by supplying the wanted power. He was, therefore, induced to treat a series of consumptive cases of this kind with the pancreatic juice of the pig, which he gave in the form of emulsion with the fat of beef stirred in milk. His expectations were confirmed by the results. The great majority of cases were improved by the remedy, which he now confidently recommends. The preparations which he prefers are pancreatic emulsions of cod-liver and lard oils. In this connection, the pancreatic juice remains sound for a long time; though, unmixed with fat, the juice speedily undergoes decomposition. The emulsion with cod-liver oil, as prepared by Messrs. Savory and Moore, of London, has the appearance of a white paste, and the consistence of thick clotted cream. The dose is from one to three teaspoonfuls, once or twice daily, in a cup of milk, to which a little brandy may be added. (See *Am. Journ. of Pharm.*, March, 1866, p. 143; from *The*

Chemist and Druggist, Jan. 15, 1866.) The name of *pancreatine* has been conferred on the pancreatic juice itself, which was brought to the notice of medical men, by Dr. G. Harley, so early as 1858, "as uniting in itself the properties of all the digestive fluids." But Dr. Dobell appears to have first carried the idea into effect; though it was not till September, 1864, that his communication was published in the *Lancet*. It has been suggested that, if the juice really acts beneficially in aiding the digestion of the fatty ingredients of food, it would be best to administer it, not previously mixed with fat which probably neutralizes it; perhaps in spirit, which dissolves it readily. (*Pharm. Journ.*, Feb. 1, 1866, p. 405.) Mr. R. V. Mattison prepares a "*Saccharated pancreatine*" as follows. Macerate the cut-up pancreas in water acidulated with hydrochloric acid for 48 hours; filter till clear. Add a saturated solution of chloride of sodium, and allow to stand until pancreatine rises to the top; skim this, drain on a muslin filter, wash with a less concentrated solution of salt, and press until nearly dry; then rub up with sugar of milk, dry thoroughly, without heat, and dilute with sugar of milk until 10 grains just emulsify two drachms of cod-liver oil. Saccharated pancreatine is a white powder soluble in between five and six parts of water. Mr. Mattison also proposes an *elixir of pancreatine* prepared directly from the glands, by macerating in acidulated water, straining, adding glycerin, and flavouring with oil of orange. (*Am. Journ. of Pharm.*, iii., iv.) Dr. Dobell very recently has commended pancreatine after meals, to prevent loss of appetite, following the exhibition of opium, but the general professional verdict seems to be settling against the value of the remedy. (See *Reports on Diseases of Chest*, vol. i., 1875, p. 264; *Boston Med. and Surg. Journ.*, June, 1873.) W.

PARAFFIN, COSMOLINE, VASELINE. The petroleum derivative paraffin is now produced in enormous quantities for use in the arts. In its pure state it is usually white, with an apparently crystalline structure. There is said to be one variety with an almost gelatinous consistence, constituting the so-called *gum stock*, used by confectioners for the production of *chewing gum*, but it is doubtful whether this substance is a pure paraffin. Its uses in the arts are exceedingly numerous. To physicians paraffin is especially interesting, from the widespread surgical employment of *cosmoline*, *vaseline*, and other preparations, whose composition is more or less secret, but which appear to be chiefly paraffin mixed with the heavy petroleum oils allied to paraffin, and known to the trade as *paraffin oil*, *neutral oil*, *lubricating oil*, &c. (See *Am. Journ. of Pharm.*, xlv. 534, xlvi. 1.) *Cosmoline* is a yellowish unctuous substance, free, or nearly free, from petroleum odour, usually melting at the temperature of the body, and free from irritant properties. It is not a simple body, and accordingly varies in physical properties, being more free from odour and more firm in consistence the nearer it approaches pure paraffin. It affords a most excellent protective dressing for ulcers, wounds, burns, &c., but, as it is patented, is sold at a price somewhat above a fair value.

A pint of *paraffin oil* taken by a woman, in mistake, produced but very slight symptoms. It was, however, retained but a short time, an emetic being given. (*Edinb. Med. Journ.*, Nov. 1874, p. 435.) The workmen in paraffin factories are said to suffer from a peculiar eruption on the arms and hands, produced by the crude substance. (*Ibid.*, Dec. 1871, p. 544.) H. C. W.

PARIETARIA OFFICINALIS. *Wall Pellitory.* A perennial European herb, growing on old walls and heaps of rubbish. It is inodorous, has an herbaceous, somewhat rough and saline taste, and contains nitre derived from the walls where it flourishes. It is diuretic and refrigerant, and is said also, but without good reason, to be demulcent and emollient. The ancients employed it in various complaints, and it is still considerably used on the continent of Europe, especially in domestic practice. It is given in complaints of the urinary passages, dropsy, and febrile affections, usually in the form of decoction. The expressed juice is also used, and the fresh plant is applied in the shape of a cataplasm to painful tumours. W.

PARTHENIUM INTEGRIFOLIUM. *Prairie Dock.* This is an herbaceous perennial, growing abundantly in the prairies of our South-western States. It is recommended by Dr. Mason Houlton as a powerful antiperiodic. The flowering tops are the part used. They have an intensely bitter taste; and two ounces of them in the dried state, given in the form of infusion, are thought by Dr. Houlton to be equivalent to twenty grains of sulphate of quinia. Thirty successive cases of periodic fever were cured by this remedy, without any unpleasant effect on the nervous system. (*Med. Exam.*, N. S., ix. 719, from *Memphis Med. Recorder;* and *Pharm. Journ.*, xii. 602, from *N. Y. Journ. of Pharm.*) W.

PATENT YELLOW. *Mineral Yellow.* A pigment, consisting of chloride combined with protoxide of lead. It is prepared by mixing common salt and litharge with a sufficient quantity of water, allowing the mixture to stand for some time, then washing out the liberated soda, and exposing the white residue to heat. W.

PAULLINIA. *Guarana.* This is a new medicine introduced into Europe from Brazil, which has attracted some attention from the asserted fact, that it contains a principle identical with caffein. The name of *paullinia* has been bestowed upon it from the generic title of the plant from which it is obtained. That of *guarana*, by which it was previously known, was derived from a tribe of aborigines, called Guaranas, who are said to use it

extensively as a corrigent of their vegetable diet. It is prepared from the seeds of the *Paullinia sorbilis* of Martius, a climbing shrub, belonging to the class and order Octandria Trigynia of the Linnæan system, and the natural family of the Sapindaceæ. Another species, the *P. Cupana*, growing on the banks of the Orinoco River, is said also to yield it. (*Ann. de Thérap.*, 1858, p. 70.) The seeds, which are contained in a three-celled, three-valved, coriaceous capsule, are lenticular and almost thorny, and invested with a flesh-coloured arillus, which is easily separable when dry. They are prepared by powdering them in a mortar, or upon a chocolate stone previously heated, mixing the powder with a little water, exposing it for some time to the dew, then kneading it into a paste, mixing with this some of the seeds either whole or merely bruised, and finally forming the mixture into cylindrical or globular masses, which are dried and hardened in the sun, or by the smoke of a fire. These masses are of a reddish-brown colour, rugose on the surface, very hard, and of a marbled appearance when broken. Paullinia is of a somewhat astringent and bitterish taste, and, in this as well as in its odour, bears some resemblance to chocolate, though not oleaginous. It swells up and softens in water, which partially dissolves it. Martius found in it a crystallizable principle, which he named *guaranin*, but which has been proved by MM. Berthemot and Dechastelus to be identical with *caffein*. Alexander Bennett, in an elaborate series of physiological experiments, has confirmed this identity. The discovery of caffein in plants belonging to distinct natural families, namely, the coffee and tea plants, the Paraguay tea, and the Paullinia, is a highly interesting result of recent chemical investigations. It is said to be more abundant in the Paullinia than in either of the other vegetables; 5·07 per cent. having been found by Dr. Stenhouse in Paullinia, while he got only 2·13 from good black tea, 1·00 per cent. from coffee, and 1·2 from Paraguay tea. (*Pharm. Journ.*, xvi. 213.) According to Berthemot and Dechastelus, it exists in the seeds united with tannic acid, with which it appears to form two compounds, one crystallizable and soluble in water, the other of a resinoid appearance and insoluble. Besides these ingredients, the seeds contain free tannic acid, gum, albumen, starch, and a greenish fixed oil. (*Journ. de Pharm.*, xxvi. 514.) For a method of preparing Guaranine, see *Journ. de Pharm.*, 4e sér., xviii. 224. M. Fournier has found in paullinia, besides tannate of caffein, the following principles; gum, starch, an acrid green fixed oil, a concrete volatile oil, an aromatic liquid volatile oil soluble in water with a little alcohol, another liquid volatile oil scarcely soluble in water, a peculiar principle not precisely determined, and tannic acid. (*Ibid.*, Avril, 1861, p. 291.)

It is said to have been by mistake that *paullinia* and *guarana* have been considered identical; the former term being applicable exclusively to the product of the two species of Paullinia above referred to, while the latter belongs properly to a preparation made by the aborigines, which, though it contains the seeds of the Paullinia, is a mixture of various substances, among them chocolate and farina, but the precise composition of which is most carefully kept secret by the natives. (*Ann. de Thérap.*, 1858, p. 70.)

The effects of paullinia upon the system are said to be those of a tonic; but they do not appear to have been very accurately investigated. It is highly probable, both from its composition and the use made of it by the natives of Brazil, that it has an influence over the nervous system similar to that of tea and coffee. It is habitually employed by the Indians, either mixed with articles of diet, as with cassava or chocolate, or in the form of drink, prepared by scraping it, and suspending the powder in sweetened water. It is considered by them useful in the prevention and cure of bowel complaints. Dr. Gavrelle, who was formerly physician to Dom Pedro, in Brazil, and there became acquainted with the virtues of this medicine, called the attention of the profession to it some years since in France. He had found it advantageous in the diarrhœa of phthisis, sick headache, paralysis, tedious convalescence, and generally as a tonic. By Dr. Ritchie, Surgeon in the British navy, it is highly recommended in irritation of the urinary passages. (*Ed. Month. Journ. of Med. Sci.*, N. S., v. 467.) Dr. Hervé has been in the habit of using it daily for five or six years, and has never failed to derive advantage from it in idiopathic diarrhœa, even in the most obstinate cases. (*B. and F. Med.-chir. Rev.*, Jan. 1858, p. 192.) Dr. E. A. Rawson commends it in lumbago and other forms of chronic rheumatism. (*Irish Hosp. Gaz.*, April 15, 1874.) It may be given in substance, in the quantity of one or two drachms, scraped into powder and mixed with sweetened water; but the most convenient form of administration is that of spirituous extract. According to M. Dechastelus, alcohol is the only agent which completely extracts its virtues; ether and water effecting this object but partially. Of the extract eight or ten grains may be given during the day in the form of pill. Paullinia may also be taken along with chocolate as a drink. A fluid extract may be made in accordance with the usual officinal formula; dilute alcohol being employed as the first menstruum, and then glycerin and water. For formula for *elixir*, see *Am. Journ. of Pharm.*, xlvii. 300. W.

PEACH LEAVES. *Leaves of Amygdalus Persica.* (Willd. *Sp. Plant.* ii. 982.) *Persica vulgaris.* (Miller, Lamarck.) Every one is familiar with the appearance of the common peach-tree. It is characterized specifically by having "all the serratures of the leaves acute, and by its sessile solitary flowers." Though its native country is not certainly known, it is generally supposed to have been brought originally from Persia. In no

country, perhaps, does it attain greater perfection, as regards the character of its fruit, than in the United States. Peaches are among the most grateful and wholesome of our summer fruits. They abound in saccharine matter, which renders their juice susceptible of the vinous fermentation, and a distilled liquor prepared from them has been much used, in some parts of the country, under the name of *peach brandy*. The kernels of the fruit bear a close resemblance in appearance and properties, and probably in chemical nature, to bitter almonds, for which they are frequently, and without inconvenience, substituted in our shops. They are employed by distillers in the preparation of *liqueurs*, and by cake-bakers to give flavour to various productions of their ovens; and are said to yield as much amygdalin as bitter almonds. The flowers, leaves, and bark also have the peculiar odour and taste of bitter almonds, and yield hydrocyanic acid. The leaves afford a volatile oil by distillation. The distilled water prepared from them was found, in one instance, to contain 1·407 parts of hydrocyanic acid in 1000, and in another only 0·437 parts in the same quantity. From some experiments it is inferred that the proportion of acid is greatest where there is least fruit. (*Am. Journ. of Pharm.*, xxiv. 172.)

Medical Properties. Peach leaves are said to be laxative; and they probably exert, to a moderate extent, a sedative influence over the nervous system. They have been used as an anthelmintic with great reported success. More recently their infusion has been recommended in irritability of the bladder, in sick stomach, and hooping-cough. Half an ounce of the dried leaves may be infused in a pint of boiling water, and half a fluid-ounce given for a dose three times a day, or more frequently. Dr. Dougos gives, in hooping-cough, a pint of the strong infusion, in small doses, in the course of the day. (*Journ. de Pharm.*, xxiii. 356.) The flowers are also laxative; and a syrup prepared from them is considerably used, in infantile cases, upon the continent of Europe. Woodville states that a drachm of the dried flowers, or half an ounce in their recent state, given in infusion, is the dose as a vermifuge. Cases of fatal poisoning from their use in children are on record. The kernels have more of the peculiar powers of hydrocyanic acid, and therefore require to be used with some caution. Blanched, and rubbed up with hot water, they form an emulsion well adapted to coughs depending on or associated with nervous irritation. The bruised leaves, flowers, or kernels may be used by the apothecary for cleansing his vessels from disagreeable odours. The dried fruit, stewed with sugar, is an excellent laxative article of diet, suitable to cases of convalescence attended with torpid bowels. W.

PEARL WHITE. *Pearl Powder.* This is identical with the subnitrate of bismuth, described at *page* 1105, and is made by adding a solution of the ternitrate of teroxide of bismuth to distilled water. It is used as a cosmetic. B.

PELARGONIUM ODORATISSIMUM. *Rose Geranium.* This well-known plant, so much a favourite for its odour in our dwellings and conservatories, is a native of the Cape of Good Hope, but is said to be cultivated extensively in the South of France and in Turkey for the sake of its volatile oil, which is much employed for the adulteration of the oil of roses. According to Guibourt, three species of Pelargonium yield a volatile oil by distillation, closely analogous in smell to that of the rose; the species above named, *P. capitatum*, and *P. roseum*. (*Hist. Nat. des Drogues*, 4e ed., iii. 52.) The oil is obtained from the leaves. M. Recluz obtained from 35 ounces of *P. odoratissimum* two drachms of a volatile, crystallizable oil. (Mérat et De Lens, *Dict. de Mat. Méd.*, iii. 368.) According to Septimus Piesse, 1 cwt. yields about two ounces. (See *Am. Journ. of Pharm.*, xxvi. 368.) As we have seen the oil in our shops, purporting to be the oil of P. odoratissimum, it is perfectly fluid at ordinary temperatures, of a pale brownish-yellow colour, and the characteristic smell of the plant, recalling merely that of the rose. Gregory states that pelargonic acid was first obtained from the oil of *P. roseum*, which is probably the same as that under consideration. (*Organic Chem.*, 4th ed., Lond., p. 274.) This oil is now much used in perfumery, and, dissolved in alcohol in the proportion of three ounces to the gallon, forms the preparation called "*extract of rose-leaf geranium.*" Mr. Piesse states that, as this oil is used to adulterate that of roses, so is it in its turn adulterated with the cheaper oil of *Andropagon nardus*, cultivated in the Moluccas. (*Am. Journ. of Pharm.* xxvi., 368.) W.

PERCHLORATE OF POTASSIUM. *Hyperchlorate of Potassium.* This salt has been examined, with a view to its remedial character, by M. Rabuteau, whose memoir on the subject was published in the *Gazette Hebdomadaire* (Nov. 6, 1868). The following are his conclusions. 1. Introduced into the system in the quantity of five grammes (77 grains), it is eliminated in 36 or 48 hours, without having undergone any change of composition. Its effects are wholly different from those of the chlorate of potassium. 2. It appears to be useful in intermittents, and, if it prove in fact to have antiperiodic powers, it will be preferable to quinia in pernicious fever from the rapidity of its action. 3. Arsenic diminishes the urea discharged much more than has been supposed; neither sulphate of quinia nor perchlorate of potassium has this effect unless long administered. 4. From the properties it possesses, M. Rabuteau thinks it applicable to all diseases in which quinia and nitre are used in reference to their sedative or diuretic properties. (*Ann. de Thérap.*, 1869, p. 141.) W.

PEROXIDE OF HYDROGEN. *Oxygenized Water.* This substance, though long known to chemists, has but recently been brought into notice as a remedy. It consists of water in which, by the presenting to it of oxygen in a nascent state, an additional equivalent of this element has combined with the hydrogen, forming the deutoxide (HO_2). It was discovered by Thenard in 1818. To prepare it, peroxide of barium is rubbed with distilled water so as to form a liquid paste, which is added gradually, with constant stirring, to distilled water acidulated with one-third of its weight of muriatic acid, contained in a vessel immersed in a freezing mixture. The peroxide of barium (BaO_2) gives up one of its eqs. of oxygen to one eq. of the water (HO), forming an eq. of deutoxide or peroxide of hydrogen (HO_2); while the protoxide of barium left reacts with an eq. of muriatic acid to form one eq. of chloride of barium and one of water. When the muriatic acid is saturated, a fresh quantity of the acid in a concentrated state is added, and then more of the peroxide of barium; and the operation is repeated till the solution will hold no more chloride of barium. It is then immersed in a mixture of ice and salt, and the greater part of the chloride of barium is deposited. The portion remaining in solution may be got rid of by the cautious addition of sulphate of silver, which precipitates sulphate of barium and chloride of silver. The liquid being now filtered, is concentrated by exposing it in vacuo in a shallow vessel placed over another containing sulphuric acid. The water rises in vapour which is absorbed by the acid, and at last the peroxide of hydrogen is left nearly pure. (*Regnault.*) Thus procured it is a colourless liquid of a fluid consistence, of the sp. gr. 1·452, remaining liquid at zero, beginning to give out oxygen when heated above 60°, and at a higher heat rapidly and sometimes explosively resolved into water and oxygen. But when diluted with water, with which it unites in all proportions, it is not decomposed under 100°. The great facility with which it parts with oxygen renders it a powerful oxidizer; and the simple contact with various substances, as platinum, gold, and silver, causes it to be resolved into oxygen and water. On the contrary, certain other substances, even though ordinarily evincing a strong affinity for oxygen, as phosphorus, for example, are unaffected by it, and there is a large number of bodies, as ammonia, hydrocyanic acid, tobacco, aconite, and most other narcotic substances, which have the property not only of being unaffected by it, but of restraining its oxidizing influence on other bodies. Its relations to ozone are peculiar; and at one time it was conjectured that ozone was nothing else than peroxide of hydrogen. At present the oxygen in it is considered by some as in the positive state and called *antozone*, while *ozone* itself is oxygen in the negative state, and the two mixing produce oxygen in its ordinary state or neutral oxygen. When this neutral condition of oxygen is disturbed, giving rise to the phenomena of ozone, antozone is also liberated. Hence, according to Schönbein, whenever, upon the contact of phosphorus with water, ozone appears, the water is found to contain peroxide of hydrogen. These facts may at some future time prove to have an important bearing on peroxide of oxygen as a physiological or remedial agent; but at present they may be left out of view in treating of it medicinally. It has been detected by M. Struvé, of St. Petersburg, in minute proportion, in the air of the atmosphere in Southern Russia. (*Chem. News*, July 2, 1869, p. 23.) Schönbein has made the same discovery in the vicinity of Basel, in Switzerland. In both instances it was found in the rain-water. (*Neues Repertorium*, 1869, xviii. 364.)

The profession is indebted to Dr. B. W. Richardson, of London, for most of what is known of the physiological operation and therapeutical effects of peroxide of hydrogen. In relation to its influence on organic bodies, Dr. Richardson found that to venous blood, deprived of its fibrin, it imparts oxygen, with an increase of heat, and a change of the colour to red. Fibrin and cellular tissue cause it to evolve oxygen. Sugar and starch are decomposed by it, giving out carbonic acid. Albumen, gelatin, urea, and cutaneous tissue have no effect on it. Injected into the left cavities of the heart of an animal, it restores the irritability of that organ, but has an opposite effect in the right cavities. Thrown into the arteries, immediately after death, it restores for a time the contractile power of the muscles, and suspends cadaveric rigidity, while it counteracts the influence of various medicinal substances that cause muscular spasm. Dr. Richardson inferred from his experiments that the peroxide might be found useful as an antidote to the narcotic poisons, as a local application to gangrenous ulcers, and as an internal remedy in low forms of fever. Subsequently, from numerous therapeutical trials of the remedy, he came to the conclusion, that it is of great value in chronic and subacute rheumatism; acts in the removal of scrofulous tumours like iodine; relieves the paroxysms of hooping-cough, and cuts short the disease more effectually than any other medicine; affords great relief in chronic bronchitis with dyspnœa; and, in phthisis, operates favourably in the early stage by improving digestion and giving increased activity to chalybeate remedies, while, in the advanced stages, it afforded great relief to the dyspnœa and oppression, acting, indeed, in this respect like opium, without its narcotic effects. In general, it seemed to him to improve digestion, and therefore to be useful in cases complicated with dyspepsia. Sometimes, when freely employed, it produced profuse salivation, suggesting the idea that it might in other respects resemble mercury, and possibly be found capable of replacing this remedy to a certain extent in the treatment of disease. Dr. Richardson recommends that a solution of the peroxide should be used charged with

ten volumes of oxygen, the dose of which may be from one to four fluidrachms, freely diluted with water. There are so many substances which decompose the peroxide, that, as a general rule, it is best given without addition; at least nothing should be allowed to remain long in contact with it. There can be no difficulty in obtaining the desired strength of ten volumes of oxygen to one of the solution, by estimating the quantity of oxygen contained in the peroxide of barium employed in the process. (See *Lancet*, Oct. 20, 1860, and April 12, 1862.)

Ozonic ether is a name proposed for a solution of peroxide of hydrogen in ether, which was first noticed by Dr. Richardson. Ether will take a portion of the peroxide from its watery solution, forming a compound of considerable stability, as it has borne a voyage to Australia without change. Dr. Richardson recommends it for diffusion in the state of spray in the sick chamber, as it has great purifying power. Care, however, must be taken to guard against the consequences of its extreme inflammability. (See *Am. Journ. of Pharm.*, March, 1869, p. 156.) But ozonic ether owes the reputation into which it has so suddenly risen to its supposed efficacy in the treatment of diabetes. In a letter by Dr. John Day, dated in Australia, August, 1867, and published in the *Lancet* (Jan. 11, 1868), an account is given of an apparently quite desperate case of that disease, in which he was induced to give the ethereal solution of the peroxide of hydrogen, by the hope of oxidizing the sugar in the circulation, and thus causing its elimination through the lungs instead of the kidneys. He gave half a drachm of the solution, mixed with an ounce of distilled water, three times a day. The effect was most striking. The quantity of urine discharged rapidly decreased to the normal standard, its sp. gr. diminished at the same time, the thirst disappeared, and the patient, who was a woman, appeared to have been snatched from the brink of the grave. In less than a month, she had so far improved that she considered herself quite well, though there was probably still sugar in the urine. The case of a man was afterwards described, in a letter from Mr. S. J. Bayfield, of London, to the *Med. Times and Gaz.* (Oct. 17, 1868, p. 404), in which a cure was effected under the use of the medicine as employed in the case of Dr. Day. Experience thus far would seem to be greatly in favour of the remedy; but, among the first therapeutic experiments of Dr. Richardson with peroxide of hydrogen, had been its use in diabetes; in which, though it appeared to have considerable effect in diminishing the discharge of urine and the secretion of sugar, it had shown no power of arresting the course of the disease, which, so far as traced to its results, had proved uniformly fatal. (*Med. Times and Gaz.*, Dec. 1868, p. 662.) Dr. Pavy, also, who tried it in a few cases, failed to get any advantage from its use. (*On Diabetes*, 2d ed., p. 268.) Dr. John Day believes that the efficacy of iodide of potassium in chronic syphilis is much increased by the exhibition of peroxide shortly after each dose of the iodide. He thinks that the iodide is in this way liberated in the blood. (*Med. Times and Gaz.*, May, 1871, p. 569.)

Locally employed, peroxide of hydrogen sometimes acts very beneficially, especially in feeble, flabby, or ill-conditioned ulcers, in chancre and diphtheric sores, in all of which it operates, not as a corrosive substance, but probably by imparting oxygen to the diseased tissues, and thus destroying them. W.

PESSARIES, MEDICATED. Pessaries, which are bodies of various magnitude, intended for introduction into the vagina, for the support of the uterus, and other purposes, and were long confined, so far as concerns their preparation, to the domain of the surgical instrument maker, have recently been brought, by Sir J. Y. Simpson, of Edinburgh, within that of the pharmaceutist also. Sir James conceived the idea of making remedial impressions upon the vagina and uterus by the introduction of medicated pessaries, in the same way as suppositories are often introduced into the rectum, with the view of favourably influencing the condition of the neighbouring parts and of the system. For this purpose, some soft material, as cacao butter, with or without a little wax, impregnated with the medicine to be exhibited, is formed into a suitable shape, in the same manner as suppositories, for an account of which the reader is referred to the heading of Suppositoria in the second part of this work. These preparations have now come into extensive use. Prof. Simpson prefers those of a conical shape, almost precisely like that of a Minié bullet. Instead of being rubbed up with the material of the pessary, the medicine may sometimes be introduced into a cavity in its centre, as, for example, a few drops of chloroform liniment. The following is a list of medicines, with their doses, which may be administered in the mode above indicated.

Acetate of lead ..... 7½ grs.	Borax ..... 15 grs.	Morphia ..... ½ grs
Acetate of lead.....5 } 7 "	Bromide of potassium 10 "	Opium ..... 2 "
Opium.....2 }	Carbonate of sodium 15 "	Perchloride of iron.... 5 "
Alum .....15 "	Gallic acid ..... 10 "	Persulphate of iron.... 5 "
Alum ..... } each.....15 "	Iodide of lead..... 5 "	Sulphate of iron, dried ..... } ..10 "
Catechu ... }	Iodide of lead.. 5 } ..5 1/20 "	
Alum ..... } each.....10 "	Atropia ..... 1/20 }	Sulphate of zinc, dried, as caustic } ..10 "
Iron ..... }	Iodide of potassium.. 10 "	
Atropia ..... 1/20 "	Matico..... 10 "	Tannin.....10 "
Bismuth, oxide of.....15 "	Mercurial ointment 30 "	Zinc, oxide of .....15 "

(*Ed. Med. Journ.*, May, 1865, p. 1042.) W.

PETROLEUM. *Rock Oil.* This was recognised by the late London and Edinburgh Colleges, but has been omitted in the British Pharmacopœia, and, as it holds no place in that of the United States, takes rank among the extra-officinal medicines. Petroleum belongs to the class of native inflammable substances, called *bitumens*. These are liquids or readily fusible solids, which emit, when heated, a peculiar smell, burn easily, and leave a very small carbonaceous residue. They exist in nature either isolated, or combined with carbon in various proportions, forming the different kinds of bituminous coal. Formerly the lighter coloured, purer, and more liquid forms of petroleum were distinguished by the name of *naphtha*, which was defined to be a transparent, yellowish-white, very light and inflammable limpid liquid, of the bituminous character; but as this name has been conferred of late upon the lighter liquid resulting from the distillation of coal tar or petroleum at a comparatively low temperature, and as there is no sufficient line of distinction between the native naphtha and the impure forms of rock oil, it is, we think, desirable that the name should be confined to the artificial product, while the term petroleum is considered as embracing all the native liquid substances belonging to this class. When the bitumen is in the solid state it is called *asphaltum*. This is black, dry, friable, and soluble in water or alcohol. Not unfrequently asphaltum exists in nature mixed with more or less of the liquid substance; and this semi-solid mixture is distinguished by the name of *maltha* or *mineral tar*. Exposed to the air, petroleum gradually passes into the state of asphaltum.

Petroleum has been known from the earliest historical period. Herodotus refers to wells of it existing in Zante, and from time immemorial it has been known in Persia, where it was probably connected with the origin and ceremonies of fire-worship. Till recently the best-known sources of it were the borders of the Caspian Sea in Persia, at Amiano in Italy, at Gabian in France, the island of Trinidad in the West Indies, and in the Burman Empire near Rangoon, where vast quantities have been annually raised for many centuries, without any apparent exhaustion of the wells from which it is drawn. Within the limits of the United States it has long been known to exist in a few localities. On the borders of Seneca Lake in the State of New York, small quantities of it were collected, and to some extent used in medicine under the name of Seneca oil. In Western Pennsylvania, on Duck Creek in Ohio, near Scottsville in Kentucky, and on the Kenhawa in Virginia, it attracted local attention; and a certain locality in Western Canada had acquired some notoriety by its burning spring. But little attention was paid to it until about twenty years since; when, the preparation of oil for burning, distilled from coal tar, having proved very profitable, and a strong resemblance if not identity having been proved to exist between this and petroleum, enterprise was directed towards some of the known sources of the latter liquid, and, being greatly stimulated by success, soon led to further and astonishing discoveries. Hitherto the most productive locality of rock oil has been in Western Pennsylvania; but it has been found to exist in great quantities elsewhere, and in fact occupies large portions of a region commencing in Western Canada, and extending, through New York and Pennsylvania, westward into Ohio and Kentucky, and far southward into Western Virginia. From later accounts it appears that petroleum exists also abundantly in California, and promises to vie with gold as a source of wealth to that country. Establishments for purifying the petroleum have multiplied with great rapidity, and the quantity of oil collected, and either exported or consumed at home, would be incredible, considering the short time since the trade in it may be said to have begun, were it not attested by positive returns. The quantity of petroleum exported, either crude or refined, independently of that consumed in this country, from the ports of Boston, New York, Philadelphia, and Baltimore, amounted in 1862 to 10,887,701 gallons; in 1863, to 28,250,721; and in 1864, to 31,772,972. (*N. Y. Times*, Feb. 16, 1865.) A copious source of petroleum has been developed in the Caucasus; a single boring, 276 feet deep, near Kuaaco, having yielded 1500 barrels daily for a month. (*Pharm. Journ.*, March, 1868, p. 443.)

Petroleum sometimes exists in overflowing springs, as in Canada, N. W. Virginia, and very largely in California, issuing along with the water, and spreading itself over the surface of streams for a considerable distance. It is, however, much more abundantly obtained by digging or boring wells. In this case, if the point struck be below some underground reservoir of the oil, it may rise, as in artesian wells, to the surface. Sometimes it is driven up with considerable though variable force, probably by the expansive power of compressed gas, which not unfrequently escapes along with the oil, and in some places so copiously and steadily as to be used for lighting purposes in the immediate vicinity; the gas being some form of carburetted hydrogen. But in most instances it is necessary to raise the oil by pumps. The distance at which it is found beneath the surface is very different, the depth of boring in Western Pennsylvania varying from 71 to 600 feet. (D. Murray, *Trans. Albany Instit.*, iv. 149.) It is necessary to bore through an overlying rock before reaching it. The oil is generally collected in the fissures and pores of some spongy rock, as sandstone or shale. Its original source was probably an underground distillation of the remains of sea weed, carried on upon a vast scale by nature, by means of subterranean heat. Its close resemblance to the tar resulting from destructive distillation of organic matter, and its containing certain principles which abound in sea weed and not in land plants, can be explained only upon this supposition

Crude petroleum is variable in character, being sometimes transparent and of an amber colour, but more generally brown or almost black and opaque in mass, or of various shades between the two, in some instances very thin and mobile, in others thicker, and occasionally almost semi-solid, of a peculiar characteristic odour, always lighter than water, and in great measure volatilizable by heat. A specimen of *Pennsylvania petroleum*, fresh from the wells, was found by Mr. E. S. Wayne, of Cincinnati, to have the sp. gr. 0·815, which, however, after the petroleum had been exposed to the air for 24 hours, rose to 0·825. When subjected to fractional distillation, it yielded liquid products varying in sp. gr. from 0·668 to 0·825; the lightest coming over first. The paraffin from this petroleum Mr. Wayne believes to be very different from that obtained from coal tar, having both a lower boiling point and lower sp. gr., and, besides, differing in chemical constitution. (*The Druggist*, Cincinnati, June 15, 1860.) In the purer form of naphtha, petroleum is a carbohydrogen, and, on account of the absence of oxygen, has been used for the preservation of potassium. The crude oil consists of a large number of distinct substances, generally carbohydrogens of various sp. gr. and boiling points, which may be separated by distillation, and by the action of sulphuric acid and soda or potassa. Mr. Schorlemmer states, as the result of his examination of refined American petroleum, the product of the first rectification, that it contains benzol and toluol in small proportion, but consists mainly of hydrides (hydrurets) of the alcohol radicals, of which he isolated four; namely, *hydride of amyl*, $C_{10}H_{12}$, boiling at 92° F.; *hydride of hexyl*, $C_{12}H_{14}$, boiling at 154° F.; *hydride of heptyl*, $C_{14}H_{16}$, boiling at 208° F.; and *hydride of octyl*, $C_{16}H_{18}$, boiling at 236°. (*Chem. News*, April 4, 1863, p. 157.) MM. Pelouze and Cahors have isolated seven distinct carbohydrogens from rectified American petroleum, of a lower boiling point than 392° F.; viz., *butyl hydride* C_8H_{10}, *amyl hydride* $C_{10}H_{12}$, *caproyl hydride* $C_{12}H_{14}$, *œnanthyl hydride* $C_{14}H_{16}$, *capryl hydride* $C_{16}H_{18}$, *pelargonyl hydride* $C_{18}H_{20}$, and *rutyl hydride* $C_{20}H_{22}$. (*Ibid.*, April 25, 1863, p. 197.) W.

Barbadoes petroleum is a black, nearly opaque, inflammable liquid, of the consistence of molasses, unctuous to the touch, and possessing a bituminous taste, and strong and tenacious odour. Its sp. gr. varies from 0·730 to 0·878. When subjected to distillation it yields naphtha, and leaves a solid residue of asphaltum. It is little affected by alcohol, acids, or alkalies, but dissolves in ether and in the fixed and volatile oils. It consists chiefly of carbon and hydrogen, associated with a little nitrogen and oxygen. *Rangoon petroleum*, also called *Rangoon tar* and *Burmese naphtha*, has a greenish-brown colour, a peculiar, rather fragrant odour, and the consistence of goose-fat. It is lighter than water. Heated to 90° it becomes a very mobile liquid. By distilling it in a current of steam, first at 212°, and afterwards super-heated, Drs. W. De la Rue and H. Müller obtained 96 per cent. of volatile products, solid and liquid. The solid product (*paraffin*) amounted to from 10 to 11 per cent., and was found resolvable by these chemists, by fractional crystallization from hot alcohol, into at least two polymeric carbohydrogens, having the probable formula C_nH_n. The liquid product, usually called naphtha, is separable by sulphuric and nitric acids into two sets of carbohydrogens; one set removable by these acids, the other resisting their action. The former set contain fewer eqs. of hydrogen than of carbon, and embrace, among other carbohydrogens, benzol and toluol. The latter, which form by far the larger portion of the liquid product, are perfectly colourless, almost inodorous, very mobile liquids, not congealable by intense cold. Their probable formula, according to Drs. De la Rue and Müller, is C_nH_{n+1}. (See *Chem. Gaz.*, Oct. 1, 1856, p. 375.) B.

The method of purifying petroleum is very nearly the same as that already described for purifying coal tar. The following description is taken chiefly from a communication of Mr. David Murray to the Albany Institute, Dec. 1862, and published in its Transactions (vol. iv. p. 149). Much water is often pumped up with the petroleum, but separates from it on standing, the oil rising to the surface. The crude oil is put into large retorts of cast or wrought iron and exposed to a heat between 600° and 800°, by which all the volatile ingredients are distilled, leaving 10 or 12 per cent. of solid residue, constituting a sort of coke. The liquid thus obtained is comparatively colourless, though still retaining the strong odour of the crude oil. To separate various organic alkaloids and acids with which it is mixed, the distilled petroleum is agitated first with sulphuric acid, and afterwards with a strong solution of soda or potassa; the sulphuric acid with its dissolved impurities being drawn off, and the oil well washed with water, before the addition of the alkali, and afterwards again washed when the alkali has performed its function. The purified petroleum is now submitted to another distillation, but at first at a temperature not exceeding 120° (*Murray*), in order that only the more volatile carbohydrogens may be driven over, which are unsuitable for lamp-oil. These, being condensed, constitute what is now commonly called *naphtha*, which is used as a solvent for varnishes and caoutchouc, and for mixture with paints, a purpose which it answers as well as oil of turpentine, except for its offensive smell. It is unsuitable for lamps from its extreme volatility, its liability to smoke when burned, and the danger of explosion from the admixture of its vapour with atmospheric air. After the *naphtha*, which is equivalent to the benzine of coal tar, has all come over, the heat is increased and the distillation continued until the distilled liquid attains the sp. gr. 0·820. This is the part

sold for lighting, and is by far the most important product of petroleum. The quantity of it obtained varies greatly, sometimes not exceeding 30 per cent., sometimes amounting to 80 or 90. It is clear, and of a fine, deep-amber colour, and answers admirably for lighting, yielding a brighter and purer flame than perhaps any other kind of lamp-oil. If the distillation be now continued, a darker and heavier product comes over, which upon cooling deposits paraffin. The part remaining liquid, which is too impure for burning, is employed for lubricating machinery.

The oil of petroleum is said to be largely adulterated in Europe, so as to increase its density, by the addition of the heavier oils called paraffin oils, which cannot otherwise be used for the purpose of lighting. The mixture differs in its sensible properties from the pure oil only by a much stronger odour; but it is said to be much more inflammable, and, consequently, dangerous. (*Journ. de Pharm.*, Juillet, 1867, p. 50.) W.

Medical Properties and Uses. Petroleum is accounted a stimulating antispasmodic, expectorant, and diaphoretic. In large quantities it may prove poisonous, as shown by a case recorded in the *Journal de Pharmacie* (Mars, 1869, p. 227), in which, after swallowing by mistake a quantity of rectified petroleum, a workman was seized almost immediately with violent inflammation of the throat, with colicky pain, and a desire to vomit, followed in an instant by a fearful tetanic seizure, and a general rigidity, attended with the most frightful cries. After a relaxation of ten minutes the symptoms returned with still greater violence; and life was probably saved only through the prompt action of the powerful emeto-cathartic medicines administered. It is occasionally given in disorders of the chest, when not attended with inflammation. In Germany it has been extolled as a remedy for tape-worm. Schwartz's formula in such cases was a mixture of one part of petroleum with one and a half parts of tincture of assafetida, of which forty drops were given three times a day. Externally, petroleum is employed in chilblains, chronic rheumatism, affections of the joints, paralysis, and diseases of the skin, and is said to be very effectual in psora and prurigo. It also affords a good antiseptic dressing for wounds. (*Med. Times and Gaz.*, Jan. 1870, p. 101.) It is an ingredient in the popular remedy called *British oil.* (See *note*, p. 645.) The dose of Barbadoes petroleum is from thirty drops to a small teaspoonful, given in any convenient vehicle. Rangoon petroleum is probably more active, and should be given in a smaller dose. The *New York petroleum*, called *Seneca oil*, is used to a considerable extent as an external application in domestic practice. It is lighter-coloured, thinner in consistence, and less sapid and odorous than the Barbadoes petroleum, and probably contains more naphtha. The finer kinds of petroleum, called naphtha, have been used with advantage in epidemic cholera by Dr. Andreosky, of the Russian army, by M. Cloquet, physician to the Shah of Persia, and by M. Moretin, of France. They gave from ten to twenty drops in half a glass of white wine or mint-water. It is affirmed that many cases of asthma are much benefited by inhaling petroleum vapours. From observations made in India, there is some reason to hope that the vapour of petroleum may prove a protection against the morbid influence of marsh miasmata; as it is stated that the workmen engaged in the petroleum works, at Dibrooghur, are in an extrordinary degree exempt from the malarious diseases previously existing. (*Med. Times and Gaz.*, Oct. 1868, p. 405.) Nor would this be surprising if true, for the air of large cities is known to exercise a similar influence, probably through the smoke from their numerous fires. In pharmacy the lighter parts of petroleum have been suggested as a substitute for ether in the preparation of oleoresins, and for exhausting such drugs as contain these principles. (*Journ. de Pharm.*, 4e sér., xvi. 363; *New Remedies*, Oct. 1874.) B.

PHLORIDZIN. This is a bitter principle, discovered by Dr. Konink, of Germany, in the bark of the apple, pear, cherry, and plum trees. It is most abundant in the bark of the root, and derived its name from this circumstance (from two Greek words φλοιος bark, and ῥιζα a root). It is light, white, crystallizable in silky needles, of a bitter taste, soluble in about 1000 parts of cold and in all proportions in boiling water, very soluble in alcohol, scarcely soluble in ether cold or hot, dissolved without change by solutions of the alkalies, especially by ammonia, deprived of its water of crystallization at 212°, and fusible at a somewhat higher temperature. It is without acid or alkaline reaction, and consists of carbon, hydrogen, and oxygen; its formula being, according to G. Roser, when dry, $C_{42}H_{25}O_{20}$, with the addition of 4 eqs. of water when crystallized. When heated with dilute muriatic or sulphuric acid, it is converted into sugar and a peculiar substance called *phloretin.* (See *Chem. Gaz.*, viii. 392.) To obtain it, the fresh bark of the root of the apple-tree should be selected, as the dried bark is said to contain it in much smaller proportion. The bark is to be boiled for an hour or two successively in two separate portions of water, each sufficient to cover it, and the decoction set aside. At the end of thirty hours they will have deposited a considerable quantity of coloured phloridzin, which may be purified by boiling for a few minutes with distilled water and animal charcoal, filtering, repeating this process two or three times, and then allowing the solution to cool slowly. The phloridzin is deposited in the crystalline state. An additional quantity may be obtained by evaporating the decoction to one-fifth of its bulk, allowing it to cool, and purifying the substance deposited in the same manner as before. Rochleder states that the leaves contain a principle, *isophloridzin*, isomeric with phlorid

zin, belonging to the benzolic series. Phloridzin belongs to the salicylic series, and the conversion of it into isophloridzin appears to be a step towards the formation of amygdalin. (*Am. Journ. of Pharm.*, xli. 419.)

Phloridzin is said to possess the anti-intermittent property in a high degree, and to have proved successful where quinia had failed. It was employed by Dr. Konink in the dose of 10 or 15 grains, and effected cures in several cases of intermittent fever. Dr. De Ricci recommends it very strongly as a tonic in the dyspepsia of delicate females, in the debility of children requiring a supporting treatment, and in all cases in which quinia is indicated but is not well borne. He has never known it to disagree with patients in the dose of 10 grains three or four times a day. As a tonic, 5 grains of it may be given at a dose. Though nearly insoluble in water alone, it may be readily exhibited in solution by adding to the water a few drops of spirit of ammonia. (*Dub. Quart. Journ.*, Aug. 1862.) W.

PHOSPHATE OF POTASSIUM. *Potassii Phosphas.* The phosphate of potassium, which has of late come into use as a medicine, is the neutral tribasic phosphate, having the formula $2KO,HO,PO_5$, and therefore a composition precisely analogous to that of the medicinal phosphates of sodium and ammonium. It is derived from the variety of phosphoric acid containing three eqs. of water, by the substitution of two eqs. of potassa for two of water, and, notwithstanding its slight alkaline reaction, is called *neutral*, in order to distinguish it from the decidedly *alkaline* tribasic phosphate, $3KO,PO_5$. It may be formed precisely as phosphate of sodium is prepared; or by saturating, by means of carbonate of potassium, glacial phosphoric acid (HO,PO_5), changed by solution in water and ebullition into common phosphoric acid ($3HO,PO_5$). The medicinal phosphate of potassium is a white, amorphous, deliquescent salt, incapable of crystallization. It has been given as an alterative in scrofula and phthisis, and in some other diseases, with supposed advantage. The dose is from ten to thirty grains three times a day, dissolved in a tablespoonful of water. B.

PHOSPHATE OF ZINC. *Zinci Phosphas.* Dr. Barnes, of London, has brought forward this salt of zinc, as having special advantages over other salts of the same metal in the treatment of nervous diseases. The theoretical ground of preference is that, in diseases of the brain there is apt to be a waste of phosphorus in the cerebral substance, and the phosphoric acid offers the means of supplying the deficiency. Phosphate of zinc may be prepared by the mutual reaction of sulphate of zinc and an alkaline phosphate. It is white, insoluble in water, but soluble in an excess of phosphoric acid. Dr. Barnes has found it peculiarly useful in the insanity occurring in the convalescence from fevers, in which he associates it with quinia, and in epilepsy attended with disorder of the uterine functions. He also uses it preferably to the sulphate of zinc in the sweats of phthisis. He finds it less liable to disturb the stomach than the sulphate. It may be given in pill, or dissolved in water acidulated with phosphoric acid, in the dose of from one to three grains. W.

PHYSALIS ALKEKENGI. *Alkekengi. Common Winter Cherry.* A perennial herbaceous plant, growing wild in the South of Europe, and cultivated in our gardens. The fruit is a round red berry, about as large as a cherry, enclosed in the calyx, and containing numerous flat kidney-shaped seeds. All parts of the plant are bitter, especially the leaves and the capsules enveloping the fruit. The berries are very juicy, and have an acidulous, bitterish taste. By drying they shrink, and become of a brownish-red colour. The bitter principle has been isolated by MM. Dessaignes and Chautard, and named by them *physalin*. It is obtained by agitating an infusion of the plant with chloroform, which extracts the bitter principle, and yields it by evaporation. To purify it, dissolve it in hot alcohol, add a little animal charcoal, filter, precipitate by water, and wash the precipitate with the same liquid. It is a light powder, white with a shade of yellow, of a taste slight at first, but in the end permanently bitter, very slightly soluble in cold water, somewhat more soluble in boiling water, and very soluble in alcohol and chloroform, especially with the aid of heat. It consists of carbon, hydrogen, and oxygen. (*Journ. de Pharm.*, 3e sér., xxi. 24.) The berries are said to be aperient and diuretic, and have been recommended in suppression of urine, gravel, and other complaints of the urinary passages. M. Gendron recommends them very highly as a febrifuge. He thinks they are most effective when allowed to ripen and begin to dry on the stem. He usually administers about three drachms daily in two doses. (*Arch. Gén.*, xxiii. 536.) A French physician has lately published a pamphlet on gout, in which he strongly recommends alkekengi as more efficacious even than colchicum. He takes the flowers and unripe fruit, dries and powders them, makes the powder into a paste with water and a little slaked lime, treats the mixture with boiling alcohol, and finally filters and evaporates the alcoholic liquid. The residue is given in the form of pill, made with solution of silicate of sodium and powdered *Teucrium Chamædrys*. Five or six of the pills are taken daily. (*Braithwaite's Retrospect*, Am. ed., No. 46, p. 214.) From six to twelve berries, or an ounce of the expressed juice, may be taken for a dose; and much larger quantities are not injurious. They are consumed to a considerable extent in some parts of Europe as food. The berries of the *Physalis viscosa*, of this country, are said by Clayton to be remarkably diuretic. W.

PICHURIM BEANS. The seeds of an uncertain tree growing in Brazil, Guiana, Venezuela, and other parts of South America. The tree has been supposed to be the *Ocotea Pichurim* of Kunth (*Laurus Pichurim*, Richard, *Aydendron Laurel*, Nees); but its position in either of these genera is denied by F. Nees von Esenbeck; and the plant is now referred to the genus *Nectandra* with the specific name *Puchury*. There appear to be two varieties of *Nectandra Puchury*, one bearing larger and the other smaller fruit, and distinguished as the *major* and *minor*. Professor Carson, of the University of Pennsylvania, has had specimens of the fruit and other parts of the tree sent him, sufficient to verify the ascription of the Pichurim beans to this source. (*Am. Journ. of Pharm.*, xxvii. 385.) The beans are the kernels of the fruit separated into halves. They are ovate-oblong or elliptical, flat on one side, convex on the other, of a grayish-brown colour externally, chocolate-coloured within, of an aromatic odour between that of nutmegs and sassafras, and of a spicy pungent taste. There are two kinds, one about an inch and a half long by half an inch in breadth, the other little more than half as large, rounder, and of a dark-brown colour. The former are said by Dr. Carson to come from Brazil, the latter from Venezuela, and may be severally the product of the varieties of the tree above referred to. (*Ibid.*, p. 387.) Bonastre has found them to contain a concrete volatile oil, a fatty matter of the consistence of butter, stearin, resin, brown colouring matter, fecula, gum, sugar, and lignin. Their virtues depend on the volatile oil. In the *American Journal of Pharmacy* for Jan. 1851 (p. 1), Prof. Procter describes a liquid product brought from South America, known as "*the native oil of laurel* or *sassafras*," or "*aceyte de sassafras*," said to be obtained by making incisions in the trunk of a tree growing on the Orinoco. As described by Prof. Procter, it is an oleoresin, of the sp. gr. 0·898, of a light auburn colour, a peculiar penetrating odour, and an aromatic, bitterish, pungent, and somewhat camphorous taste. On distillation, almost the whole passes over in the shape of a colourless volatile oil; a small proportion only of resinous matter being left behind. This oleoresin is conjectured to be the same as that employed for adulterating the copaiba exported from Maracaibo. It may be distinguished from copaiba by its ready solubility in alcohol of 0·838, and by the fact that its volatile oil is acted on by potassium. It is believed to be the same product as the "native oil of laurel" described by Pereira, which was obtained from Demerara, and by incisions in a large tree. Prof. Carson, on comparing with it a specimen of oil presented to him as obtained from the same tree with the fruit above mentioned, has no hesitation in considering them as identical, and, therefore, in referring the so-called native oil of laurel to Nectandra Puchury. In medical properties the pichurim beans resemble the common aromatics, and may be employed for the same purposes. In South America they are said to be used as a substitute for nutmeg, and have even been called by that name. They are rare in this country. The oil obtained from the tree is said to impart its odour to the perspiration and urine, and to be useful in rheumatism, gout, &c. The bark is sometimes employed as a tonic and febrifuge. W.

PICRORHIZA KUERVA. Under the name of *kali-kutki* a root has long been in use in India, which is stated to be the product of Picrorhiza kuerva. It is said to be a very valuable tonic, but has not yet found its way into European commerce. Want of space compels us to refer the reader to the *Pharm. Journ. and Trans.*, Dec. 1870, p. 502, for an account of its physical characters. H. C. W.

PIMPINELLA SAXIFRAGA. *Small Burnet Saxifrage. Saxifraga.* A perennial umbelliferous European plant, growing on sunny hills, and in dry meadows and pastures. The root is officinal in some parts of Europe. It has a strong, aromatic, yet unpleasant odour, and a sweetish, pungent, biting, aromatic, bitterish taste. Its active constituents are volatile oil and an acrid resin. It is considered diaphoretic, diuretic, and stomachic; and has been used in chronic catarrh, asthma, dropsy, amenorrhœa, &c. The dose in substance is about half a drachm, and in infusion two drachms. The root is used also as a masticatory in toothache, as a gargle in palsy of the tongue and in collections of viscid mucus in the throat, and externally to remove freckles. W.

PINCKNEYA PUBENS. Michaux. A large shrub or small tree, growing in South Carolina, Georgia, and Florida, in low and moist places along the sea-coast. It is closely allied, in botanical characters, to the Cinchonæ, with which it was formerly ranked by some botanists. The bark is bitter, and has been used with advantage in intermittent fever. Dr. Law, of Georgia, cured six out of seven cases in which he administered it. The dose and mode of preparation are the same with those of cinchona. The chemical composition and medical properties of this bark deserve a fuller investigation than they have yet received. W.

PISCIDIA ERYTHRINA. *Jamaica Dogwood.* Dr. William Hamilton, of Plymouth, England, in a communication to the *Pharmaceutical Journal* (iv. 76, August, 1844), speaks of this plant as a powerful narcotic, capable of producing sleep and relieving pain in an extraordinary manner. He had noticed, when resident in the West Indies, the use of the bark of the root in the taking of fish, upon which, even when of a large size, it exercised a very strong narcotic effect. He was induced to try it as an anodyne in toothache, and found a saturated tincture exceedingly efficacious, not only affording

relief when taken internally, but uniformly curing the pain when introduced upon a dossil of cotton into the carious tooth. The bark of the root, to be effectual, should be gathered during the period of inflorescence in April. When chewed it has an unpleasant acrimony like that of mezereon. It yields its virtues to alcohol, but not to water. The formula employed by him in preparing the tincture was to macerate an ounce of the bark, in coarse powder, in four fluidounces of rectified spirit, for twenty-four hours, and then to filter. The dose is a fluidrachm. He first tried it on himself, when labouring under severe toothache, taking the quantity mentioned in cold water on going to bed. He first felt a violent sensation of heat internally, which gradually extended to the surface, and was followed by profuse perspiration, with profound sleep for twelve hours. On awaking, he was quite free from pain, and without the unpleasant sensations which follow a dose of opium. W

PLANTAGO MAJOR. *Plantain.* A well-known perennial herb, growing in fields, by the road-sides, and in grass-plots, and abounding both in Europe and in this country. The leaves are saline, bitterish, and austere to the taste; the root saline and sweetish. The plant has been considered refrigerant, diuretic, deobstruent, and somewhat astringent. The ancients esteemed it highly, and employed it in visceral obstructions, hemorrhages, particularly from the lungs, consumption, dysentery, and other complaints. In modern times it has been applied to similar purposes, and the root is said to have proved useful in intermittents. At present, however, it is generally believed to be very feeble, and is little used internally. As an external application it has been recommended in ulcers of various kinds and in indolent scrofulous tumours. Among the vulgar it is still much used as a vulnerary and as a dressing for blisters and sores. The dose of the expressed juice is from one to four fluidounces. Two ounces of the fresh root or leaves may be boiled in a pint of water, and given during the day. Externally the leaves are applied whole, or in decoction. *Plantago media* and *P. lancifolia* or *rib-grass*, which are also indigenous, possess properties similar to those of P. Major, and may be used for the same purposes.

Under the name of *semen psyllii*, the seeds of several species of Plantago, growing in Europe, are sometimes kept in the shops. The best are those of *Plantago Psyllium* or *fleawort*, which grows in the South of Europe and Barbary. They are small, about a line long by half a line in breadth, convex on one side, concave on the other, flea-coloured, shining, inodorous, and nearly tasteless, but mucilaginous when chewed. They are demulcent and emollient, and may be used internally and externally in the same manner as flaxseed, which they closely resemble in medical properties. W.

PLATINUM. In 1826 Prof. Gmelin, of Tubingen, made experiments to determine the action of this metal on the economy. In 1841 Dr. Ferdinand Hoefer published some observations on the same subject. The latter experimented chiefly with the bichloride, and the double chloride of platinum and sodium. They are both poisonous; the bichloride in the dose of 15 grains, the double chloride in that of 30 grains. When a concentrated solution of the bichloride is applied to the skin, it produces violent itching, followed by an eruption. Administered internally it irritates the mucous membrane of the stomach and occasions headache. The double chloride has no action when externally applied, and, when given internally, operates on the system in a less sensible manner than the bichloride. It possesses the power of augmenting the urine. Dr. Hoefer ranks the preparations of platinum with the alteratives, by the side of those of iodine, arsenic, and gold. He considers them particularly suited to the treatment of syphilitic diseases; the bichloride to cases of long standing and inveterate, the double chloride to those which are recent. The dose of the bichloride is from half a grain to two grains twice a day, given in pill. Eight grains may be made into sixteen pills, with a drachm of the extract of guaiacum wood of the French Codex, and sufficient powdered liquorice root. Of these, one, two, or three may be taken morning and evening. The double chloride may be prepared by dissolving five grains of the bichloride and eight of pure chloride of sodium in seven fluidounces of gum-water; and the whole may be taken by tablespoonfuls in the course of twenty-four hours. For frictions on indolent ulcers, Dr. Hoefer used an ointment composed of sixteen grains of the bichloride, thirty-two grains of extract of belladonna, and an ounce of lard. (*Journ. de Pharm.*, xxvii. 213.) B.

PLUMBAGO EUROPÆA. *Leadwort. Dentellaria.* A perennial, herbaceous plant, growing in the South of Europe. It has an acrid taste, and, when chewed, excites a flow of saliva. This is particularly the case with the root, which has been long used to relieve toothache. Hence the plant derived the name of *dentelaire*, by which it is known in France. A decoction of the root in olive oil has been highly recommended for the cure of the itch. Writers differ much in their statements in relation to the activity of the plant, some speaking of it as a rubefacient, vesicatory, and caustic, and, when swallowed, as violently emetic, and liable to produce dangerous irritation of the alimentary canal; while others consider it nearly inert. Perhaps the difference may be ascribed in part to the use of the plant in the recent state in one case, and dried or long kept in the other. A crystallizable, acrid principle, called *plumbagin*, has been extracted from the root by Dulong. W.

POLYPODIUM VULGARE. *Common Polypody.* A fern belonging both to the old and new continents, and growing in the clefts of old walls, rocks, and decayed trunks of trees. The root, which is the part considered medicinal, is rather long, about as thick as a goose-quill, somewhat contorted, covered with brown, easily separable scales, furnished with slender radicles, and marked by numerous small tubercles. As found in the shops, it is sometimes destitute of the scales and radicles. Its colour is reddish-brown with a tinge of yellow, its odour disagreeably oleaginous, its taste peculiar, sweetish, somewhat bitter, and nauseous. The root of the variety growing upon the oak has been preferred, though without good reason. It was deemed purgative by the ancients, who employed it for the evacuation of bile and pituitous humours in melancholic and maniacal cases. Modern physicians have used it in similar complaints, and as a pectoral in chronic catarrh and asthma. At present, however, it is scarcely ever employed, being considered nearly inert. It was given in doses varying from a drachm to an ounce, usually in connection with cathartics. W.

POLYTRICHUM JUNIPERINUM. *Hair-cap Moss. Robin's Rye.* This moss is a native of the United States, and abounds in New England. For a particular description of it, the reader is referred to a communication in the *Am. Journ. of Med. Sci.*, N.S. (xxvii. 267), by Dr. Wm. Wood, of East Windsor Hill, Connecticut, who speaks in very strong terms of its efficacy as a diuretic, having found it the most successful remedy which he has employed in the treatment of dropsy. He infuses a large handful of the whole plant in water, and allows the patient to drink freely of the tea, "the more so the better." Dr. Ariel Hunter, of Hyde Park, Vermont, has subsequently given additional testimony in its favour as a diuretic, doing good service in dysury. (*N. J. Med. and Surg. Reporter*, ix. 417.) W.

POPULUS. *Poplar.* Several trees belonging to this genus have attracted some attention in a medical point of view. In most of them the leaf-buds are covered with a resinous exudation, which has a peculiar, agreeable, balsamic odour, and a bitterish, balsamic, somewhat pungent taste. This is abundant in the buds of *Populus nigra* or the *black poplar* of Europe, which are officinal in some parts of that continent. They contain resin and a peculiar volatile oil. The buds of *P. balsamifera*, growing in the northern parts of N. America and Siberia, are also highly balsamic; and a resin is said to be furnished by the tree, which is sometimes, though erroneously, called *tacamahac*. The virtues of the poplar buds are probably analogous to those of the turpentines and balsams. They have been used in pectoral, nephritic, and rheumatic complaints, in the form of tincture; and a liniment, made by macerating them in oil, has been applied externally in local rheumatism. The *unguentum populeum* of European pharmacy is made, according to the directions of the French Codex of 1837, by bruising in a marble mortar, and boiling in 2000 parts of lard, with a gentle fire, till the moisture is dissipated, 250 parts, each, of the fresh leaves of the black poppy, deadly nightshade, henbane, and black nightshade; then adding of the dried buds of the black poplar, bruised, 375 parts; digesting for 24 hours; straining with strong expression; and finally allowing the ointment to cool after defecation. This is an anodyne ointment, occasionally employed in Europe in painful local affections. It has been ascertained that poplar buds are capable of imparting a principle to ointments, which in a considerable degree obviates their tendency to rancidity.

The bark of certain species of poplar is possessed of tonic properties, and has been used in intermittent fever with advantage. Such is the case with that of *P. tremuloides* or *American aspen*, and of *P. tremula* or *European aspen*. In the bark of the latter Braconnot found *salicin*, and another crystallizable principle which he named *populin*. It is in these, probably, that the febrifuge properties of the bark reside. They may be obtained by precipitating a saturated decoction of the bark with solution of subacetate of lead, filtering, precipitating the excess of lead by sulphuric acid, again filtering, evaporating, adding animal charcoal towards the end of the evaporation, and filtering the liquor while hot. Salicin gradually separates, upon the cooling of the liquor, in the form of crystals. If, when this principle has ceased to crystallize, the excess of sulphuric acid in the liquid be saturated by a concentrated solution of carbonate of potassium, the populin will be precipitated. If this be pressed between folds of blotting-paper, and redissolved in boiling water, it will be deposited, upon the cooling of the liquid, in the crystalline state. The leaves also of *P. tremula* afford populin, and more largely even than the bark. It is probable that both principles exist in the bark of *P. tremuloides*, and other species. Salicin is described under *Salix*. *Populin* is very light, purely white, and of a bitter, sweetish taste, analogous to that of liquorice. When heated it melts into a colourless and transparent liquid. It is soluble in 2000 parts of cold, and about 70 parts of boiling water; and is more soluble in boiling alcohol. Acetic acid and the diluted mineral acids dissolve it, and, upon the addition of an alkali, let it fall unchanged. Piria regards it as a complex body, consisting of benzoic acid, *saligenin*, and glucose. (See *Am. Journ. of Pharm.*, xxiv. 240.) Of these principles saligenin and glucose have been found in salicin; and it was inferred that, by separating benzoic acid, populin might be converted into salicin. This has been effected by Piria. When pop-

ulin is boiled with baryta water or milk of lime, the benzoic acid precipitated by sesquichloride of iron, the excess of iron removed by lime, and the excess of lime by carbonic acid, the remaining liquid yields salicin on evaporation. The same conversion may be effected by heating populin with an alcoholic solution of ammonia to 212°. Piria obtained from populin 28·9 per cent. of benzoic acid. (*Pharm. Journ.*, xv. 378.) Dr. T. L. Phipson, basing his experiments upon the results of Piria, has succeeded in preparing populin artificially by combining salicin and benzoic acid. Nothing more is necessary than to dissolve the two substances in alcohol, and to concentrate the solution. Crystals are formed having all the characters of populin, and consisting of salicin and benzoic acid combined in the proportion of their equivalents. (*Chem. News*, Dec. 6, 1862, p. 278.) W.

PORTULACA OLERACEA. *Garden Purslane.* An annual succulent plant growing in gardens and cultivated grounds, in the United States, Europe, and most other parts of the globe. It has an herbaceous, slightly saline taste, and is often used as greens, being boiled with meat, or other vegetables. It is considered a cooling diuretic, and is recommended in scurvy, and affections of the urinary passages. The seeds have been thought to be anthelmintic; but they are tasteless and inert. W.

POTENTILLA REPTANS. *Cinquefoil.* A perennial, creeping, European herb with leaves which are usually quinate, and have thus given origin to the ordinary name of the plant. The root has a bitterish, styptic, slightly sweetish taste, and was formerly used in diarrhœa, and other complaints for which astringents are usually prescribed. W.

POWDER OF ALGAROTH. *Pulvis Algarothi. Oxychloride of Antimony. Nitromuriatic Oxide of Antimony.* This powder is formed by dissolving tersulphuret of antimony in muriatic acid, assisting the action, at first, by a gentle heat, which must be gradually increased to ebullition; and then pouring the resulting solution, when cold, into a large quantity of water. By a double decomposition between the tersulphuret and acid, sulphuretted hydrogen is given off copiously with effervescence, and a solution of terchloride of antimony is formed. When this is thrown into water, the greater part of the terchloride is converted, by the elements of that liquid, into muriatic acid, which remains in solution, and teroxide of antimony, which precipitates in union with the remainder of the terchloride as the powder of Algaroth.

Properties, &c. This is a white powder, having a crystalline appearance if left long in contact with the solution from which it is precipitated. When exposed to a red heat it fuses, and forms a yellow liquid, which, on cooling, concretes into a grayish crystalline mass of a pearly aspect. Its usual composition is represented by the formula $2SbO_3,SbCl_3 + HO$. It was formerly used in the preparation of tartar emetic, but has been superseded for this purpose by the pure teroxide. It has also been used in medicine; but, owing to its unequal operation, has been properly laid aside. It is liable to contain tersulphuret of arsenic (orpiment), unless when obtained from the distilled concrete terchloride of antimony. (Larocque, *Journ. de Pharm.*, Mars, 1849.) B.

PRENANTHES SERPENTARIA. *Lion's Foot.* This is a perennial, indigenous herb, growing in the mountainous districts of Virginia and North Carolina. It belongs to *Syngenesia Æqualis* in the sexual system, and to the natural family of *Chicoraceæ*. The genus is characterized by its "four-flowered nodding *heads*, its cylindric *involucre* calyculate at the base, its subterete unbeaked *akenes*, its scabrous *pappus* in several series, and its naked *receptacle*." This particular species has rough dentate leaves, of which the radical are palmate, the cauline with long footstalks, sinuate pinnatifid, disposed to be three-lobed, with the middle lobe three-parted, the upper lanceolate. The racemes are terminal, somewhat panicled, short, and nodding, with an eight-cleft calyx, and twelve florets. (*Pursh.*) Dr. Darlington considers this a variety of *Prenanthes alba*. It is about two feet high, with purple flowers. Pursh speaks of it as in great repute among the inhabitants of the regions it inhabits as a remedy for the bite of poisonous serpents, and relates a case in which he had seen it used effectively. The milky juice of the plant was taken internally, and the leaves steeped in water were applied to the wound and frequently changed. In October, 1849, the author received a specimen of a plant from Dr. Newsom J. Pittman, of N. Carolina, with the information that he had employed it in ten or twelve cases of the bite of the rattlesnake with uniform success. He gave internally a decoction of the root, which is extremely bitter. This plant was the *Prenanthes Serpentaria* of Pursh. W.

PROPYLAMIA. *Propylamin. Trimethylamin. Secalia. Secalin.* Wertheim in 1850 prepared from narcotina a substance having the formula C_6H_9N, and gave it the name *metacetamine*. In the same year Anderson prepared from codeine, and Hoffmann from methyl, substances having the same formula, giving respectively the names of propylamia and trimethylamin. Other chemists have obtained similarly constituted principles from cod-liver oil, ergot, herring-pickle, putrid calf's blood, codeia, &c., and have even found them in saline combination in the flowers of Cratægus oxycantha, Sorbus aucuparia, and of one or more species of Chenopodium. Under the name of propylamia some of these principles were introduced into medicine by Dr. Awenarius, of St. Petersburg, and met

for a time with considerable favour; so that several processes for preparing propylamia were published before the last edition of the U. S. Dispensatory. Prominent among these was that of Prof. Procter (*American Journal of Pharmacy*, March, 1859, p. 127), as follows. Herring-pickle procured from the dealers in salt fish, having been mixed with sufficient potassa to render the liquid strongly alkaline, is introduced into a retort or alembic, and heated. The vapours are condensed in a receiver containing distilled water duly refrigerated, and the heat is continued until the distillate, as it forms, ceases to have the odour of herrings. The condensed liquid, which contains the propylamia separated by the potassa from its saline combination in the pickle, is now neutralized with muriatic acid, and carefully evaporated to dryness. Ammonia, which comes over and is condensed with the propylamia, combines like it with the muriatic acid, and the dry salt obtained is a mixture of the muriates of both of these bases. This is exhausted with absolute alcohol, which dissolves the chloride of propylamia, and leaves the chloride of ammonium. If the alcoholic solution be treated with hydrate of lime, propylamia in vapour is given out abundantly with very little heat, and may be condensed in a receiver, which should be kept well cooled. The process may be simplified, as suggested by Prof. Procter in a subsequent number of the journal (May, 1859, p. 222), by acidulating the liquid in the receiver with muriatic acid, added gradually as the acid becomes neutralized, thus directly forming the muriate, which may be obtained crystallized by subsequent concentration, and, if necessary, freed from the accompanying chloride of ammonium in the manner already mentioned. Since the last edition of the U. S. Dispensatory it has been very clearly shown that these various substances, although containing the same number of atoms, have them differently arranged, and are consequently possessed of diverse properties. The material obtained from herring-pickle and other sources and sold as propylamia is indeed not propylamia at all, but a more or less impure solution of trimethylamin; it is, in truth, doubtful whether propylamia has ever been procured from a natural source, or made in any other way than by treating iodide of propyl with ammonia. Both principles are ammonias, but propylamia is a primary compound ammonia (monamine), and trimethylamin is a tertiary compound ammonia (tri-amine). In the first body the nitrogen is combined with two atoms of hydrogen and one of propyl, C_6N, in the second with three atoms of methyl.

Propyl, C_6H_7, H, H $\Big\}$ $N = C_6H_9N$, Propylamia. Methyl, C_2H_3, C_2H_3, C_2H_3 $\Big\}$ $N = C_6H_9N$, Trimethylamin.

The physical differences are very marked. Thus propylamia boils at 49° C., trimethylamin at 6° C. The commercial propylamia contains other ammonia compounds besides trimethylamin, the latter substance indeed being sometimes present in very small quantity.

M. E. Perret (*Pharm. Journ. and Trans.*, May, 1873, p. 884) states that a very pure preparation may be made by the following process. The digestive apparatus of cows, oxen, or sheep is to be cut up, washed, mixed with four to six times its weight of water and one-fifteenth of carbonate of potassium or dry soda, and allowed to ferment at a temperature of from 59° to 64·5° F. during thirty-two to thirty-six hours. The liquid is then drained through a wire sieve, and to it is added half its weight of caustic soda (soap-maker lees at 40°), and the whole distilled very slowly. Methylic gas very rapidly escapes, and the mass swells; the heat is then moderated. When this reaction is ended propylamia comes over, mixed very slightly with methylic and ammoniacal gases. It is contained in the earlier portions of the distillate. This should now be saturated with hydrochloric acid, filtered, and evaporated to dryness. The dry hydrochlorate is pounded with three times its weight of caustic soda (lees at 40°), then distilled in a retort provided with a tube which reaches to near the bottom of distilled water placed in the recipient. The trimethylamin is absorbed by the water. So soon as this is saturated and the bubbles pass off at the surface the contents of the receiver should be replaced by fresh water. Messrs. Ferris & Co., of Bristol, England, are said to produce the drug upon a large scale, as follows. Herring-brine is distilled with soda-lime, the alkaline distillate saturated with hydrochloric acid and evaporated; the residue treated with alcohol, the alcohol drawn off. What remains is distilled with caustic lime or potash, and the products, condensed in cold water, sold as "propylamin." If a purer article is desired, the distilled products are condensed in hydrochloric acid, this evaporated to dryness, the residue treated with absolute alcohol and again distilled with lime. This last process is repeated until a pure product is obtained.

The best form of trimethylamin for use is probably the chloride, which may be prepared in a state of purity as a very deliquescent salt, crystallizing in long needles. Mr. Frederick Wurtz makes it artificially by converting methylic alcohol into iodide of methyl, heating this under pressure with ammonia, washing the crystals of iodide of tetramethylammonium with distilled water, distilling this with chalk, receiving the gas of trimethylamin in hydrochloric acid, and freeing the chloride of trimethylamin by solution in absolute alcohol from chloride of ammonium, which is insoluble in such menstruum. (*Ann. de Thérap.*, 1874, p. 98.) To form the chloride naturally the distillatory products in M. Perret's process may be received into hydrochloric acid and separated from any

chloride of ammonium by means of absolute alcohol. *Commercial propylamia*, *i.e.* impure solution of trimethylamin, is a colourless transparent liquid, of a characteristic odour, usually attended with some pungency, which may possibly be ascribed to the ammonia frequently mixed with it. It is soluble in water and alcohol, has a strong alkaline reaction, and forms crystallizable salts with the acids. If the end of a glass rod, previously dipped into muriatic acid, be held over the open mouth of a vial containing it, a white cloud of the muriate will be seen, as in the case of ammonia. *Pure propylamia* is said to be a perfectly clear, strongly refractive fluid, with the odour of ammonia; a boiling point of 49° C.; a sp. gr. (at 20° C.) of 0·7186; inflammable; miscible with water. With hydrochloric acid it makes a deliquescent salt, soluble in alcohol, forming with chloride of platinum a double salt, which crystallizes in large, dark, golden-yellow cincho-rhombic plates, somewhat soluble in hot water and alcohol. *Pure trimethylamin* is a gas at ordinary temperatures.

Dr. Awenarius, of St. Petersburg, Russia, first called attention to the use of commercial propylamia in rheumatism, for which he considered it a specific; so much so that a case of doubtful rheumatism might be diagnosticated by the successful use of this remedy in the course of a few days. Between March, 1854, and June, 1856, he treated in the Hospital Kalinkin, in St. Petersburg, 250 cases of rheumatism with success. Some of the cases were acute, some chronic, many metastatic, with pericardial, pleuritic, and meningeal complications; and hemiplegic and paraplegic cases were not wanting; but all recovered. In the acute cases the pain and fever disappeared in a day or two. He mixed 25 drops of propylamia with six fluidounces of distilled water, flavoured if necessary with sugar and oil of peppermint, and gave a tablespoonful every two or three hours, taking care that the alkaloid was pure and freshly prepared. (*Ann. de Thérap.*, 1859, p. 74.) In this city some years since the remedy was extensively employed by various practitioners both in hospital and private practice, and finally abandoned as not yielding as good results as the ordinary alkaline treatment. Whether the disrepute was caused by the impurity of the drug employed, by the insufficiency of the dose, or by the real want of power in the remedy, we do not know. Recently it has come largely into vogue in France and to a less extent in other European countries, and much testimony has been brought forward both as to its value and to its want of value, though on the whole the evidence as to its usefulness is in the ascendant.

Locally applied, trimethylamin acts as a powerful irritant or, if in sufficient concentration, even as a mild caustic. According to M. Laborde, in its physiological action it resembles the chloride or carbonate of ammonium, though differing in not causing convulsions in animals fatally poisoned with it. (*Med. Times and Gazette*, Aug. 1874, p. 241.) The chloride was found to act in the same way as the trimethylamin, but to be scarcely more than half as powerful. The irritant action of the drug is very apparent in man, so that doses of over half a drachm of the commercial propylamia, even if freely diluted, are almost sure to produce decided symptoms of gastro-intestinal irritation. In a case recorded by Dr. B. F. Eaton, after using it for about three days, the patient was seized with vomiting, accompanied with faintness, and excessive thirst; but whether these phenomena were the effects of the propylamia could not be determined. (See *Am. Journ. of Pharm.*, May, 1862, p. 277.) Large doses are said in rheumatism to reduce the pulse very decidedly in force and frequency, and also the temperature and the elimination of urea. (*Ann. de Thérap.*, 1874, p. 104.) Hamdy and Dujardin-Beaumetz (*Ibid.*, pp. 104, 97) state that in animals the circulation is much depressed by it, but M. Laborde affirms (*Med. Times and Gaz.*, Aug. 1874, p. 246) that the drug, unless given in such doses as to endanger serious results from its local action, increases both in man and animals the force of the circulation. There is probably no better plan of administering the remedy than that recommended by Dr. Awenarius; namely, in watery solution. A solution of twenty-four to forty-eight drops of commercial propylamia in six fluidounces of peppermint water, with two drachms of sugar, may be given in the dose of half a fluidounce, equivalent to two to four drops of the commercial solution, every two hours in the more acute cases. Or thirty-six grains of the chloride may be substituted in the mixture for the twenty-four drops, and six fluidrachms of the solution of potassa added. This would give, with each dose of the propylamia, three or four grains of chloride of potassium, which could have no material effect, and certainly none of an injurious character. In France the chloride of trimethylamin is preferred. The following is a favorite formula. Chloride of trimethylamin ten grammes, tincture of orange-peel twenty-eight grammes, syrup nine hundred and seventy grammes. A tablespoonful contains about three and a half grains. The dose of the chloride of trimethylamin is 7 to 15 grains. H. C. W.

PRUNELLA VULGARIS. *Self-heal. Heal-all.* A small perennial labiate plant, common both in Europe and the United States, growing especially by the waysides. It is inodorous, but has an austere bitterish taste. The herb in flower was formerly used, in the state of infusion or decoction, in hemorrhages and diarrhœa, and as a gargle in sorethroat. In this country it is not employed in regular practice. W.

PSORALEA EGLANDULOSA. (*Elliot.*) P. MELILOTOIDES. (*Michaux.*) *Congo Root. Bob's Root. Samson's Snakeroot.* (See Psoralea melilotoides, *Gray's Manual of Botany*,

revised ed., p. 94.) This leguminous plant, a foot or two high, which grows wild in Ohio westward to Illinois, and in Virginia southward, has been brought into notice as a remedy by Dr. John P. Mettauer, of Prince Edward's Court-House, Va. The root, which, according to Dr. Mettauer, is the most active part of the plant, is spindle-shaped, generally smaller than the little finger, and, when dry, of a light-brown colour, and corrugated on the surface. It has a feeble, pleasantly aromatic odour, and a bitterish, pungent, aromatic, and not disagreeable taste. The ligneous fibres of the root are interspersed with starchy matter, which renders it liable to the attack of worms. The leaves, which are trifoliate, with oblong-lanceolate leaflets, have a taste analogous to that of the root, and little inferior in strength. Both root and leaves yield their virtues to water and to alcohol; but the latter is the most efficient menstruum. The season for collecting the plant is when it is in flower, which, in Virginia, is from the first of June to the middle of July. To prevent the action of worms, the roots, after having been dug up, carefully washed, and then dried in the shade, should be exposed for a few days to the sun, or for half an hour to 120° F. in an oven.

Dr. Mettauer states that the psoralea is a gently stimulant tonic, with some influence over the nervous system analogous to that produced by tea. He considers it as peculiarly applicable to subacute irritations of the alimentary mucous membrane, especially when in some degree involving the mesenteric glands, and attended with diarrhœa. It has been much and very advantageously employed by the negroes of the South, in an affection known among them by the name of "poison," characterized by diarrhœa, emaciation, anorexia, exceeding dryness and huskiness of the skin, a heavily furred or unnaturally clean tongue, a hectic-like fever, thirst, sunken eyes with remarkable whiteness of the conjunctiva, a peculiar bleaching of the skin in the advanced stages, frequently cough, a small and generally accelerated pulse, depressed spirits, and great debility; symptoms which strongly indicate tuberculous deposition in the abdomen. In this affection, the psoralea has proved eminently serviceable. The usual mode of exhibition is that of tincture, which may be made by digesting, for fourteen days, four ounces of the bruised or coarsely powdered root with a pint of diluted alcohol. A compound tincture is sometimes used, made by adding to the above ingredients three drachms of the bruised root of Gillenia trifoliata, half an ounce of that of Apocynum androsæmifolium, and two drachms of chamomile flowers. The dose of the tincture is from three to six fluidrachms, which may be given three times a day, in a cupful of infusion of green willow twigs or fresh leaves of the mistletoe; the former being preferred in the state of diarrhœa, the latter in cases attended with nervous disorder and diminished urine. Dr. Mettauer recommends the psoralea also in dyspepsia, especially when attended with nausea and vomiting after meals. For the statements in this article we are indebted almost exclusively to the paper of Dr. Mettauer, contained in the *Boston Med. and Surg. Journ.* (Oct. 3, 1867, p. 185), to which the reader is referred for further information on the subject. W.

PTELEA TRIFOLIATA. *Wafer-ash. Wingseed. Shrubby Trefoil. Hop-tree.* (See *Gray's Manual of Botany*, revised edition, p. 75.) This is a shrub, six or eight feet in height, growing in rocky places from Pennsylvania to Wisconsin, and southward. General attention seems to have been first called to it by Dr. O. F. Potter, in the *St. Louis Medical Reporter* (i. 9); and to this paper, and to another by Justus Steer, Ph.D., in the same journal (May, 1867), we are indebted mainly for the following statements. The flowers have a disagreeable odour; and the fruit, which is bitter, is said to be sometimes used as a substitute for hops. The bark of the root is the part used in medicine. When dried, it comes in cylindrical rolls or quills, one or two lines in diameter, and from one to several inches long, of a light-brownish colour, irregularly wrinkled, and covered with a thin epidermis. Internally it is yellowish-white, but darkens by exposure. It has a peculiar somewhat aromatic smell, and a bitter, persistently pungent, and slightly acrid, yet not disagreeable taste. It yields its virtues to water, but more readily to alcohol. It is said to have been much employed of late, among the physicians of the Western States, in the treatment of dyspepsia, and generally in diseases requiring tonics, to which class the ptelea belongs. Dr. Potter considers it a valuable and reliable remedy. He has long used it in the debility following low fevers, and especially connected with gastro-intestinal irritation, to which it seems to be peculiarly applicable from its mild and unirritating qualities. It exercises a soothing influence on the stomach, which receives it when rejecting other tonics; while it promotes the appetite, invigorates digestion, and helps greatly to re-establish health in convalescence. Dr. Potter uses a tincture, made by macerating six ounces of the bark and half an ounce of ginger in two quarts of whisky, which he gives in the dose of one or two tablespoonfuls three times a day. (*N. Y. Med. Journ.*, ii. 184.) The bark has been examined chemically by Mr. Steer, who found it to contain, besides other ingredients, an oleoresin, of an acrid and bitter taste, and an odour recalling that of the bark, starch, albumen, a yellow colouring substance, and salts of lime, potassa, and iron. He also extracted from it the alkaloid berberin (*berberia*), which is probably the tonic principle, while the oleoresin may impart to the bark somewhat stimulant properties. (*Am. Journ. of Pharm.*, July, 1867, p. 337.) See also a paper by Mr. G. M. Smyser, in the same journal (1862, p. 198). W.

PULMONARIA OFFICINALIS. *Lungwort.* An herbaceous perennial, European

plant, sometimes cultivated in this country in gardens. The leaves are inodorous, and have an herbaceous, somewhat mucilaginous, and feebly astringent taste. They have been considered pectoral and demulcent, and employed in catarrh, hæmoptysis, consumption, and other affections of the chest; but their virtues are doubtful, and they were probably used in pectoral complaints as much on account of the supposed resemblance of their speckled surface to that of the lungs, as from the possession of any positively useful properties. W.

PUMICE STONE. *Pumex.* A very light porous stone, found in the vicinity of active and extinct volcanoes, and believed to have been thrown up during their eruption. The pumice stone of commerce is said to be obtained chiefly from Lipari. It is used whole, in the manner of a file, for removing the outer surfaces of bodies, or for rubbing down inequalities, and, in the state of powder, for polishing glass, metals, stones, &c.; purposes to which it is adapted by the hardness of its particles. W.

PYRETHRUM PARTHENIUM. (Willd.) *Matricaria Parthenium.* (Linn.) *Chrysanthemum Parthenium.* (Persoon.) *Feverfew.* A perennial herbaceous plant, about two feet high, with an erect, branching stem, pinnate leaves, oblong, obtused, gashed, and dentate leaflets, and compound flowers in a corymb upon branching peduncles. It is a native of Europe, but cultivated in our gardens. The whole herbaceous part is used. The plant has an odour and taste analogous to those of chamomile, which it resembles also in the appearance of its flowers, and in its medical virtues. According to Zeller, a pound of it yields 4·8 grains of volatile oil. (*Cent. Blatt*, 1855, p. 205.) Though little employed, it is undoubtedly possessed of useful tonic properties. The flowers of this and of a closely resembling species, *Matricaria parthenoides* (Desf.), are said to be used in France, to a considerable extent, indiscriminately with those of the true chamomile plant, Anthemis nobilis, which they closely resemble, especially when double. They may, however, be distinguished, in this state, by their peculiar odour, their smaller receptacle, which is, moreover, rounded and flattened above, instead of being conical and somewhat pointed as in the Anthemis, and by the tubular five-toothed central florets, which in the chamomile are small, few, and scarcely visible, but, in the two species of Pyrethrum, are large, very numerous, and very long. Two other species of Pyrethrum, *P. roseum* and *P. carneum*, have recently come into notice, as the source of the Persian insect powder. (See *Insect Powder*, p. 1675.) W.

PYROACETIC SPIRIT. *Pyroacetic Ether. Acetone.* This substance may be obtained by carefully distilling acetate of calcium, and rectifying the product by repeated distillations from quicklime in a water-bath, until the boiling point becomes stationary, whereby it is freed from water and empyreumatic oil. It is a colourless, volatile, inflammable liquid, having a peculiar penetrating smell, and a pungent taste like that of peppermint. Its specific gravity is 0·792, and boiling point 132°. As found in the shops, its density is not generally lower than 0·820. It is miscible in all proportions with water, ether, and alcohol, without disturbing its transparency. If it becomes turbid when mixed with water, the fact shows that it contains empyreumatic oil. It has been confounded with pyroxylic spirit, from which it is distinguished by its inability to dissolve a saturated solution of chloride of calcium, which is instantly dissolved in pyroxylic spirit. (*Scanlan.*) Its formula is C_3H_3O; while that of pyroxylic spirit is $C_2H_4O_2$. In constitution it bears considerable resemblance to alcohol. Thus, its formula doubled is $C_6H_6O_2$, and that of alcohol is $C_4H_6O_2$. It was thought at one time that the substance brought to the notice of the profession by Dr. John Hastings, of London, under the name of naphtha, as a remedy for pulmonary consumption, was pyroacetic spirit; but it now appears to be settled that what he intended was pyroxylic spirit. (See *Methylic Alcohol*, page 1699.) There is no doubt that these spirits were used indiscriminately in the therapeutic trials which grew out of the publication of Dr. Hastings' book; but no exact experiments have been made, so far as we know, to determine the precise physiological action of pyroacetic spirit. B.

In the arts, it is proposed to use acetone in the preparation of varnish. Though some substances employed for this purpose, as dammar, yellow amber, and caoutchouc, are almost insoluble in this fluid, it dissolves with great facility mastic and sandarac; and a solution of the former of these resins in pyroacetic spirit constitutes a brilliant and beautiful varnish. Wiederhold thinks that it may be advantageously used in the restoration of oil-paintings which have become deteriorated by age, in consequence of the varnish having become partially opaque. Acetone, carefully applied, immediately dissolves this opaque varnish, which afterwards redisposes itself on the picture, assuming a vitreous state upon the solidification of the solution. (*Chem. News*, March 17, 1865, p. 128.) W.

PYROGALLIC ACID. *Pyrogalline* or *Galline* (Rosing). This substance has recently acquired some importance as an agent in photography. It is one of the results of the igneous decomposition of gallic acid, and may be obtained by submitting extract of galls to the same treatment as that used for preparing benzoic acid from benzoin. The vapours of pyrogallic acid rise, and condense on the upper surface of the paper diaphragm. The chief difficulty in the process is properly to regulate the heat; as at a high

temperature this acid passes rapidly into metagallic acid, and thus the product is diminished. According to Löwig, it is best prepared by heating gallic acid, previously dried at 212° F., in a glass retort, by means of a chloride of zinc bath, to 410° F., when the pure acid sublimes. Liebig recommends another method, calculated especially to obviate the effects of heat, which, with all the details, may be seen in the *Am. Journ. of Pharm.* for July, 1857 (p. 338). In the same journal (July, 1854, p. 362) are the details of a process by H. Gruneberg, of the character of the one first referred to above, by which he obtained from 50 pounds of Chinese galls 2 pounds of the acid. It is stated by MM. de Luynes and Espandieu that, in the ordinary method of obtaining pyrogallic acid, much of the acid is lost. According to Pelouze, gallic acid, when heated to 410° F., is resolved completely into carbonic and pyrogallic acids; and the proportion of the latter acid produced ought to be very nearly 75 per cent. But the processes in use yield only 25 per cent.; the pyrogallic acid itself undergoing rapid decomposition at an elevated temperature. MM de Luynes and Espandieu have succeeded in preventing this loss by decomposing gallic acid in water under pressure, instead of dry sublimation. Gallic acid is introduced into a bronze boiler with twice or three times its weight of water; the temperature is raised to a point from 392° to 410° F., and maintained at that point for half an hour, when the liquid is allowed to cool. The boiler now contains a slightly coloured solution of pyrogallic acid. This is heated with a little pure animal charcoal, filtered, evaporated sufficiently, and set aside to crystallize. The crystalline mass obtained is somewhat coloured. To obtain it entirely white, nothing more is necessary than to distil in a vacuum. The product is quite 75 per cent. The carbonic acid escapes through the joinings of the apparatus, while the watery vapour is retained. (See *Am. Journ. of Pharm.*, Jan. 1865, p. 22.)

Pyrogallic acid is in white, shining scales, inodorous, very bitter, soluble in three and a half parts of water, readily dissolved by alcohol and ether, fusible at 239° F., and sublimable at 410° in irritating vapours. According to Rosing, of Christiania, it is always partially converted, when sublimed, into metagallic acid, to which probably it owes its acid reaction as generally found in commerce; for, when quite pure, it has no influence on litmus-paper. Rosing denied altogether its claims to be considered as an acid, and proposed to call it *pyrogalline* or *galline*. (*Journ. de Pharm.*, Juillet, 1857, p. 53.) In a subsequent memoir, however, he admits its neutralizing power, and gives as its formula $C_{12}H_6O_6$. One of its characteristic properties is its strong affinity for oxygen, in consequence of which it instantly undergoes change by contact with chlorine, iodine, bromine, and the acids which readily yield oxygen. Through the same property it rapidly reduces some of the metallic oxides; and its use in photography is based on this effect exercised on the salts of silver. Though unalterable in the air when quite dry, it is rapidly changed in solution by the absorption of oxygen, so that it may be used for ascertaining the proportion of this gas in a mixture of gases. M. J. Personne, believing that phosphorus acts as a poison on account of its affinity for oxygen, was led to make experiments with pyrogallic acid. (*Comptes Rendus*, Oct. 1869.) He found that in doses of 30 grains it produced in dogs symptoms similar to those caused by phosphorus, and ending in death. The autopsy revealed fatty degeneration of the liver, heart, &c.* W.

QUINOA. The *Chenopodium quinoa* is largely cultivated in Southern Peru and Southern Chili, often above the height at which barley and rye will ripen, for the sake of its seeds. These are about the size of white mustard-seeds, but flatter, and afford a flour resembling somewhat oat-meal. The starch grains are very small and constitute about 40 per cent. of the grain, which also contains 5 per cent. of sugar, 7½ of casein, and 11 of albumen and other protein compounds. One variety, the red quinoa, contains a bitter principle in the seed-husks, and is used to some extent as an emetic and antiperiodic. (*Am. Journ. of Pharm.*, 1872, p. 559.) H. C. W.

REALGAR. This is the bisulphuret of arsenic, consisting of one eq. of arsenic 75, and two of sulphur 32 = 107. It is found native in Saxony, Bohemia, Transylvania, and in various volcanic regions. Realgar is artificially made by melting arsenious acid with about half its weight of sulphur. (*Turner.*) Thus prepared, it is of a crystalline texture, of a beautiful ruby-red colour, of a uniform conchoidal fracture, somewhat transparent in thin layers, and capable of being sublimed without change. Native realgar is said to be innocent when taken internally, while that artificially prepared is poisonous, in consequence, according to Guibourt, of containing a little arsenious acid. Realgar is used only as a pigment. W.

RED CHALK. *Reddle.* A mineral substance of a deep-red colour, of a compact texture, dry to the touch, adhering to the tongue, about as hard as chalk, soiling the fingers when handled, and leaving a lively red trace when drawn over paper. It consists of clay and oxide of iron, and is intermediate between *bole* and *red ochre*, containing more oxide of iron than the former, and less than the latter. It is used for drawing lines upon wood, &c., and is sometimes made into crayons by levigating and elutriating it, then forming it into a paste with mucilage of gum arabic, moulding this into cylin-

* For an elaborate study of its action with the salts of iron, see *Journ. de Pharm.*, 4e sér., xviii. 385, xx. 87; on its use as a reagent, *Pharm. Journ. and Trans.*, 3d series, iv. 772.

ders, and drying it in the shade. It has been used internally as an absorbent and astringent. W.

REGIANINE. This is a principle obtained by Mr. Phipson from the nut of Juglans regia. It occurs in octohedral, prismatic, or feathery crystals, and gives with ammonia and other alkalies a reddish-purple solution, from which hydrochloric acid precipitates an amorphous powder, *regianic acid.* H. C. W.

RENNET. GASTRIC JUICE. PEPSIN. As a remedial agent, the gastric juice of the inferior animals has been used in three forms; 1. that of the fresh liquid taken from the stomach, 2. that of rennet, or an infusion of the dried stomach, in wine or water, and 3. that of a preparation called pepsin.

1. *Gastric juice* is a liquid secretion of the mucous membrane of the stomach, whereby nitrogenous food is rendered soluble and capable of being absorbed, and other changes are effected essential to healthful digestion. Various methods have been employed for extracting it from the stomach for experiment, which it is unnecessary here to describe. For use in medicine, the most convenient method is to collect it from the stomachs of animals killed fasting, as the hog, sheep, and calf, and then deprive it, by filtration, of the mucus and undigested alimentary matters mingled with it. In this state it is a limpid liquid, slightly yellowish or brownish-yellow, heavier than water, of a somewhat saltish taste, and a characteristic odour, which, when the juice is heated, resembles that of soup. It usually has an acid reaction. At the temperature of 100° or lower, it has the property of dissolving nitrogenous articles of food, and, without affecting starch, of changing glucose or the sugar of grapes into lactic acid. When separated from its attendant acid, it loses in a greater or less degree this solvent power, which it recovers upon the addition of lactic or muriatic acid. The idea has been advanced that, in normal digestion, it supplies itself with the requisite lactic acid, by converting into that substance the glucose taken into the stomach, or resulting from the reaction of saliva or the gastric mucus upon starch. But in cases where no starch is taken, there must be other means of supplying the necessary acid. When the juice is heated to the boiling point, it becomes turbid, and loses the solvent property. The same change takes place more slowly at the temperature of 122° F. Strong alcohol causes a deposition of solid matter, and impairs the digestive power. Tannin produces a precipitate which has no influence on food. Some of the metallic salts, as bichloride of mercury and acetate of lead, also produce a precipitate; but this, when deprived of the metallic oxide, regains the characteristic solvent property. Pure gastric juice contains about 97 per cent. of water, 1·75 of salts, a free acid, and 1·25 of a substance, which has been considered by some chemists as a distinct organic principle, and has received the name of *pepsin.* (Boudault, *Journ. de Pharm.*, Sept. 1856, p. 162.) This principle is nitrogenous, and is believed to have the properties of a ferment, whereby the gastric juice is enabled, with the assistance of an acid, to exercise its peculiar power over food. It may be separated from the gastric juice by first precipitating this with a metallic salt, as the acetate of lead, and then decomposing the metallic precipitate by sulphuretted hydrogen, which throws down the metal as a sulphuret, and leaves the pepsin in solution. The liquid is then evaporated at a very gentle heat, and the pepsin is left in the form of a soft, viscous substance, which can with difficulty be brought to a dry state without addition. But it is very doubtful whether the substance thus procured, though it has the digestive power of the gastric juice, is a pure proximate principle; as, in the purest state in which it has been obtained, it does not yield identical results on analysis. When gastric juice is completely protected from the air, it may be kept unchanged for a long time; but, on exposure, it speedily undergoes decomposition, acquires a very offensive odour, and loses its characteristic digestive property. The juice itself is almost never used internally; but, more than forty years ago, it was employed by Dr. P. S. Physick, the celebrated surgeon of Philadelphia, with considerable success, as a local application to cancers and sloughing ulcers, with the view of removing the dead bone and flesh, correcting the offensive odour, and yielding a healthful stimulus to the diseased surface. It has also been used with success, by Dr. Ellsworth, of Hartford, Connecticut, for dissolving a portion of tough animal food, which had become impacted in the œsophagus of a lad affected with stricture of that passage. The gastric juice of a pig was used. (*Bost. Med. and Surg. Journ.*, April 17, 1856.) The inner coat of the gizzard of the South American ostrich is said, in the state of powder, to be used in Buenos Ayres, as a remedy in dyspepsia. (E. S. Wayne, *Am. Journ. of Pharm.*, March, 1868, p. 123.)

2. *Rennet.* This is an aqueous or vinous infusion of the dried stomach of the calf, though that of the sheep or other animal would probably answer the same purpose. It is much used, as every one knows, for curdling milk; a property which it owes to a portion of the gastric secretion, retained and dried in the mucous tissue of the stomach. To the same material it probably owes the property which it possesses of converting glucose into lactic acid; and there is little doubt that it is capable, in greater or less degree, of exercising the solvent property of gastric juice over albuminous and fibrinous food. The first of the properties just referred to suggested to Dr. James Gray, of Glasgow, the use of rennet in diabetes, with the object of promoting the conversion of any

sugar of grapes that might be formed in the stomach into lactic acid, and thus preventing its entrance into the circulation in its unchanged state. He met with considerable success in this use of the remedy; and it has since been employed by others, in the same disease, with supposed advantage. Dr. Gray gave a teaspooniul of the rennet after each meal. To be efficient it must be recently prepared, and of such strength that a teaspoonful will coagulate a pint of milk in five minutes. (*Ed. Monthly Journ. of Med. Sci.*, Jan. 1853, p. 31.) Rennet seems also to have been popularly employed for promoting defective digestion, in the West of England. (*Med. Times and Gaz.*, April, 1857, p. 411.) It is highly probable that the preparation, usually employed to curdle milk, may contribute to the ready digestibility of the curds and whey, so favourite an article of diet among children in this country. Dr. Geo. Ellis gives the following method of preparing *rennet-wine*, from which he has obtained the most satisfactory results, when pepsin from inadequate preparation had failed him. Take the stomach of a calf immediately after death, cut off and reject about three inches of the upper or cardiac portion, slit the stomach longitudinally, wipe it gently with a dry napkin so as to remove as little of the clean mucus as possible, then cut it into small pieces, the smaller the better, put it into a common wine bottle, fill the bottle with good sherry, and let it stand corked for three weeks. The dose is a teaspoonful, in a wineglassful of water, immediately after each meal. It is known to be good if a teaspoonful will coagulate half a pint of milk in two minutes at 100° F. (*Dub. Med. Press*, July 16, 1862.) W.

3. *Pepsin. Pepsina*, Br. Various attempts have been made to concentrate, and bring to a convenient form for administration, the peptic principle of the gastric juice. It must not be supposed that the substances prepared with this object, and sold under the name of pepsin, have any claim to be considered as the pure principle. The one which for a long time was the best in the market, is that prepared by M. Boudault. His process is as follows. The rennet bags of sheep, quite fresh, are opened, turned inside out, and washed by a gentle stream of water; the mucous membrane is then scraped off, bruised in a mortar so as to rupture the cells, and digested for twelve hours in pure water. The infusion thus obtained is precipitated by acetate of lead, and the precipitate, consisting of pepsin and oxide of lead, is mixed with water and decomposed by sulphuretted hydrogen, which throws down the lead, leaving the pepsin in solution. The liquid, having been filtered, is evaporated, at about 100° F., to a syrupy consistence; after which sufficient perfectly dry starch is added to absorb the semi-liquid matter, and bring it to the state of a dry powder. Lactic acid is sometimes added in small proportion to the liquid before evaporation, and no doubt contributes to its efficiency. An attempt to evaporate to dryness might injure the preparation; and at best a matter would be obtained, strongly disposed to absorb moisture, and consequently to undergo putrefaction. Starch is chosen for the solidification of the syrupy mass, on account of its absorbent property, and because it is not affected by the digestive power of the pepsin. If properly prepared, 15 grains of Boudault's pepsin, with the aid of a little lactic or muriatic acid, if the former was not employed in the process, will cause the solution in water of four times its weight of fibrin at the temperature of the human body; and the amount of starch added in the process is proportioned to this result. (*Pharm. Journ.*, xvi. 472.) Much care is requisite to use fresh rennet bags, before they have begun to undergo decomposition, and not to allow the temperature used in evaporation to exceed 100° F. It is asserted, of the pepsin of Boudault, that it has the reactions of the gastric juice above referred to, and is fully capable of replacing that liquid for the purposes of digestion. It may be given either with or without lactic or muriatic acid; the addition being unnecessary when there is already sufficient acid in the stomach. A spurious substance has been sold for it; but may be distinguished by the difference of its reactions, and agency in dissolving fibrin. The genuine pepsin, dissolved in water, is precipitated by acetate of lead, tannic acid, and strong alcohol; and 15 grains of it should, in 12 hours, effect the solution of a drachm and a half of boiled white of egg, or chopped meat, in half a fluidounce of water, at 100° F. (Ballard, *Med. Times and Gaz.*, Feb. 1857, p. 177.) The spurious substance is destitute of these properties. Another test of the activity of pepsin is its power of coagulating milk; and the rapidity with which it produces this effect, and the quantity required to produce a certain degree of effect, are measures of its efficiency. The process of M. Boudault essentially has been adopted in the last edition of the French Codex (1866). W.

It has, however, been departed from in the process recently adopted in the Addendum to the British Pharmacopœia, in favour of a plan which is essentially that devised by Prof. Beale, of London. In this the opened stomach of a recently killed pig, sheep, or calf is laid upon a board with the inner surface upwards, any adhering portions of food, dirt, or other impurity removed, and the exposed surface slightly washed with cold water; the cleansed mucous membrane is then to be scraped with a blunt knife or other suitable instrument, and the viscid pulp thus obtained is to be immediately spread over the surface of glass or of glazed earthenware and quickly dried at a temperature not exceeding 100° F. The dried residue is to be reduced to powder and preserved in a stoppered bottle. This officinal pepsin is a light yellowish-brown powder, having a faint, but not disagreeable odour, and a slightly saline taste, without any indication of putres-

cence. It is very little soluble in water or spirit. "Two grains of it with an ounce of distilled water, to which five minims of hydrochloric acid have been added, form a mixture in which 100 grains of hard boiled eggs, in thin shavings, will dissolve on their being digested together for about 4 hours, at a temperature of 98°." *Br.*

The U. S. Pharmacopœia does not yet recognise pepsin, although it has been for some years very largely used by the American profession. Much of the pepsin thus employed has been obtained from Europe, and has been of very various quality, most of it being heavily loaded with starch and some of it containing little or no pepsin. Several American brands have, however, been put upon the market, which appear to equal in quality Boudault's pepsin. Various processes also have been recommended for making pepsin. If the experiments of Hawley (*Am. Journ. of Pharm.*, 1870, p. 100) and of G. A. Zweck (*Am. Journ. of Pharm.*, 1871, p. 261) are sufficient, one of the best practical methods consists simply in digesting 8 ounces of finely cut up mucous membrane of a pig's stomach in 8 ounces of pure glycerin acidulated with two drachms of muriatic acid, allowing to stand, and filtering out the mucus. Probably the most elaborate investigation of the subject as yet made is that of E. Scheffer (*Am. Journ. of Pharm.*, 1872). He found that various salts, such as the sulphates of sodium and magnesium and the chloride of sodium, precipitate pepsin, and acting upon this discovery devised the following processes. Mucous membrane of the pig's stomach, dissected off and finely chopped, is macerated in water acidulated with muriatic acid for several days, with frequent stirring. The strained liquid, if not clear, is clarified by allowing to stand for 24 hours and decanting. The same bulk of a saturated solution of chloride of sodium is then thoroughly mixed with it. After several hours the floating pepsin is skimmed from the surface and put on a cotton cloth to drain, and finally submitted to strong pressure to get rid of saline solution. This pepsin, when air dried, is very tough, parchment-like or leathery, varying in colour from a dim straw-yellow to a brownish-yellow. To make his *saccharated pepsin*, Mr. Scheffer adds sugar of milk until a powder is obtained, 10 grains of which will dissolve 120 grains of coagulated albumen. *Purified pepsin* he makes by redissolving the pepsin in acidulated water and precipitating as before, immersing the product when perfectly dry in pure water for a short time. A half grain of this dissolved 1500 grains of albumen (*Ibid.*, p. 784). Various elixirs, wines, &c., of pepsin are for sale in the drug stores, and are generally useless. The chemical relations of pepsin are so delicate and widespread that it ought to be given as a simple substance. Alcohol interferes with its activity; in the experiments of Hawley (*Am. Journ. of Pharm.*, 1870, p. 100) and of Dr. Edward H. Hoskin (*Boston Med. and Surg. Journ.*, May 22, 1873), sherry wine entirely destroyed the digestive power of good pepsin. An exception to the rule that pepsin should be exhibited alone is found in infantile diarrhœas, and in some forms of indigestion, in which the best results are obtained by combining it with bismuth. H. C. W.

The idea of employing the gastric juice, or some representative of it, in order to promote digestion, is not new; and it would be difficult to determine to whom the original use of this remedy is to be ascribed. According to Boudault, however, the application of the *principle* pepsin to this purpose was first suggested by Dr. Corvisart, of Paris. (*Journ. de Pharm.*, xxx. 169.) Boudault's preparation has been used by many practitioners with good effects, if we may judge from the reports made in the journals. The particular condition to which it is applicable is that debility of stomach, from whatever cause arising, in which gastric juice is not produced in sufficient quantity, or of sufficient power, to enable the requisite amount of food to be digested. In such cases, the debility of the stomach is kept up by the want of due nutrition of the organ, originating in its own defective function; and it has, therefore, no power of recovering its healthy condition. Artificial digestion supplies the deficient nutriment; and the stomach, being now duly nourished, resumes its proper function. Dyspepsia, the debility of stomach following chronic gastritis, and that attendant upon convalescence, and certain exhausting diseases, such as phthisis, afford suitable occasions for its use. It is thought to have proved useful in the vomiting of pregnancy, and has been highly recommended in the diarrhœa of infancy, which often proceeds from irritation of the bowels from imperfectly digested food. The dose of good pepsin is 15 grains before each meal, to be taken in powder, or suspended in soup or syrup. Boudault recommends especially the syrup of cherries, as well calculated to cover its disagreeable taste. M. Besson prefers the syrup of bitter orange peel, which he has found preferable to other vehicles by its perfume and its tonic properties. He prepares pepsin for administration in the following manner. To the liquid product obtained from fifty rennet bags, of which the evaporation is stopped when 2300 grammes remain, he adds 11 grammes of lactic acid, 100 grammes of tincture of bitter orange peel, and 110 grammes of extract of curaçoa; then filters, adds 450 grammes of sugar, dissolves, and filters. Thirty grammes of this syrup contain 15 grains of acidified pepsin. The syrup will keep a long time without change (*Journ. de Pharm.*, 4e sér., iv. 54.) W.

RESEDA LUTEOLA. *Weld. Dyer's Weed.* An annual European plant, naturalized in the United States. It is inodorous, and has a bitter taste, which is very adhesive. Chevreul obtained from it by sublimation a peculiar yellow colouring matter, which he called *luteolin*. In medicine it has been employed as a diaphoretic and diuretic, but is now

neglected. On the continent of Europe it is much employed for dyeing yellow, and, before the introduction of quercitron into England, was extensively applied to the same purpose in that country. The whole plant is used. W.

RHIGOLENE. This name was given by Dr. H. J. Bigelow, of Boston, to a variety of petroleum naphtha. It is obtained by distilling petroleum, and separating the liquids of the lowest boiling point by redistillation, until a liquid is obtained which boils at about 70°. It is not pretended that this is a peculiar definite principle; on the contrary, it is probably one or more of the liquid products combined with one or more of the gaseous, so as to yield a fluid more volatile than any one previously known, and capable, consequently, of producing a greater degree of cold by its evaporation. In this respect rhigolene probably exceeds all other substances. A degree of cold 15° below zero is, according to Dr. Bigelow, obtained through the evaporation of this liquid by means of the common atomizer or "spray-producer." This is the chief use of the liquid; which may be employed, as a substitute for ether, and with still greater effect, in producing congelation of any part of the body preparatory to a surgical operation, or a great degree of cold for any other purpose. It should, when not in use, be kept in a cool place, in bottles tightly corked; as otherwise it will be rapidly evaporated. In a warm place it might break the bottles through its extreme volatility, unless the stopper should previously be driven out. It has been accused of being liable to explosion; but this has been proved not to be true by Dr. J. D. Jackson, of Danville, Ky. (*Am. Journ. of Pharm.*, July, 1865, p. 349.) If, however, the vapour should be mixed, in certain proportions, with atmospheric air, and then approached by a burning body, there might be explosion, as with other inflammable aeriform substances similarly circumstanced. W.

RHODODENDRUM CRYSANTHUM. *Yellow-flowered Rhododendron.* This is a beautiful evergreen shrub, about a foot high, with spreading branches, and oblong, obtuse. thick leaves, narrowed towards their footstalks, reflexed at the margin, much veined, rugged and deep-green upon their upper surface, ferruginous or glaucous beneath, and surrounding the branches upon strong petioles. The flowers are large, yellow, on long peduncles, and in terminal umbels. The corolla is wheel-shaped, with its border divided into five roundish, spreading segments. The plant is a native of Siberia, delighting in mountainous situations, and flowering in June and July. The leaves are the part used. When fresh, they have a feeble odour, said to resemble that of rhubarb. In the dried state, they are inodorous, but have an austere, astringent, bitterish taste. They yield their virtues to water and alcohol. They are stimulant, narcotic, and diaphoretic, producing, when first taken, increase of heat and arterial action, subsequently a diminished frequency of the pulse, and, in large doses, vomiting, purging, and delirium. They have been long employed in Siberia as a remedy in rheumatism; and their use has extended to various parts of Europe. Their action is said to be accompanied with a sensation of creeping or pricking in the affected part, which subsides in a few hours, leaving the part free from pain. They have been recommended also in gout, lues venerea, and palsy. In Siberia they are prepared by infusing two drachms of the dried leaves in about ten ounces of water, in a close vessel, and keeping the liquid near the boiling point during the night. The strained liquor is taken in the morning; and a repetition of the dose three or four days successively generally effects a cure. The remedy is not used in this country. W.

RIGA BALSAM. *Balsamum Carpaticum. Balsamum Libani.* This is usually stated to be a product of *Pinus Cembra*, a large tree growing in the mountainous regions and northern latitudes of Europe and Asia. The juice exudes from the extremities of the young twigs, and is collected in flasks suspended from them. It is a thin, white fluid, having an odour analogous to that of juniper, and possessing the ordinary terebinthinate properties. In this country it is very rare; but it is occasionally brought from Riga or Cronstadt in bottles. M. Keller, of Darmstadt, affirms that Riga Balsam is nothing but the product of the ordinary *Pinus palustris.* A similar product, called *Hungarian balsam*, is obtained in the same manner from *Pinus Pumilio*, growing on the mountains of Switzerland, Austria, and Hungary. It is scarcely known in the United States. W.

ROBINIA PSEUDO-ACACIA. *Locust-tree.* This well-known indigenous tree, so much valued by the farmers for fence-posts in consequence of the great durability of its wood, and so much a favourite for the beauty of its foliage and the sweetness of its flowers, is also supposed by some to possess remedial properties, and has a place in the Materia Medica of the "eclectics." The bark of the root is the most active part, and is said to be tonic, and in large doses purgative and emetic. Three cases of poisoning in children, who had eaten of the root by mistake, have been recorded. The symptoms were like those produced by an overdose of belladonna; but all the children recovered. One of them, who happened to be labouring under intermittent fever at the time, had no return of the paroxysms afterwards. (*Ann. de Thérap.*, 1860, p. 64.) These facts render caution advisable in the use of the root, yet are also well calculated to stimulate inquiry. W.

ROTTEN STONE. *Terra Cariosa.* An earthy mineral, occurring in light, dull, friable masses, dry to the touch, of a very fine grain, and of an ash-brown colour. It is

obtained from Derbyshire in England, and is used for polishing metals. A particular account of it may be found in the *American Journal of Pharmacy* (Sept. 1860, p. 463). W.

SACCHARATE OF IRON. Under the name of the *Ferrum Oxydatum Saccharatum Solubile* the German Pharmacopœia recognises a preparation which is of some importance, as in the experiments of Dr. H. Köhler (*Brit. and For. Med.-chir. Rev.*, 1870, xlv., p. 558) it was found to be the best antidote to arsenic. To twenty parts of a solution (43·5 per cent.) of the sesquichloride of iron are added 20 parts of simple syrup, and afterwards 40 parts of a solution of soda (30 per cent.). After twenty-four hours 300 parts of hot distilled water are added, and the precipitate washed by decantation and filtration; 90 parts of sugar are added, the whole dried in a water-bath, and enough sugar added to make the whole weigh 100 parts, containing the equivalent of 3 parts of metallic iron. E. Hoffmann has published a formula which he considers superior to the officinal. The reader may find this in the *Am. Journ. of Pharm.*, xlvi. 559. H. C. W.

SACCHARATE OF LEAD. Plumbi Saccharas. *Oxalhydrate of Lead.* A salt composed of saccharic acid and protoxide of lead. Saccharic acid is obtained by the action of nitric acid on sugar. Oxalic acid is generated at the same time, which, having crystallized out of the liquid, leaves the *saccharic* or *oxalhydric* acid, which are synonymes, in solution. The saccharate of lead is made by saturating a solution of saccharic acid in water by freshly precipitated carbonate of lead gradually added. As the acid becomes saturated, the saccharate of lead falls in the form of a white powder, being insoluble in cold water, and but very sparingly soluble in that liquid boiling hot. It was first employed therapeutically by Dr. S. E. Hoskins, who used it as a solvent of urinary calculi. The neutral saccharate of lead has no effect on urinary concretions; and it is only when there is an excess of acid that it become effective. Dr. Hoskins, however, employed the salt in a form which he called *nitro-saccharate of lead*, prepared by dissolving the saccharate in dilute nitric acid, containing only one part of the acid in 20 parts of the mixture, filtering the solution, and gradually evaporating. The nitro-saccharate is deposited in yellow crystals of the form of regular six-sided plates or prisms. By dissolving one grain of this salt, with five drops of pure saccharic acid, in a fluid-ounce of distilled water, a solution was obtained, which, though slightly acid to test-paper, was perfectly bland, and was well tolerated by the conjunctiva, and by the mucous membrane of the urethra. The property, which, in connection with this blandness, gives the salt its remedial value, is that of rapidly dissolving phosphatic calculi out of the body. It was supposed that it might act in the same way in the bladder; and accordingly the solution was injected daily or every other day, in a case of phosphatic sediment, being retained each time fifty minutes, without any inconvenience whatever; and with considerable benefit to the patient. In another instance it was employed in like manner, with similar results; and enough has been ascertained by experience to justify the hope, that it may prove a serviceable remedy, used by injection, in cases of phosphatic deposition in the bladder. For the above facts we are indebted to Pereira's *Mat. Med.* (3d ed., i. 755). W.

SAGAPENUM. Though one of the officinals of the late London Pharmacopœia, Sagapenum has been omitted in the British. It belongs to the category of gum-resins. All that is known in relation to its source is, that it is the concrete juice of a plant, probably umbelliferous, growing in Persia. The plant is conjectured to be a species of Ferula, and Willdenow supposed it to be *F. Persica*, but without sufficient evidence. The drug is brought from Alexandria, Smyrna, and other parts of the Levant. It is in irregular masses, composed of agglutinated fragments, slightly translucent, of a brownish-yellow, olive, or reddish-yellow colour externally, paler internally, brittle, of a consistence somewhat resembling that of wax, and often mixed with impurities, especially with seeds more or less entire. An inferior variety is soft, tough, and of uniform consistence. It has an alliaceous odour less disagreeable than that of assafetida, and a hot, nauseous, bitterish taste. It softens and becomes tenacious by the heat of the hand. The effect of time and exposure is to harden and render it darker. It is inflammable, burning with a white flame and much smoke, and leaving a light spongy charcoal. Pure alcohol and water dissolve it partially, diluted alcohol almost entirely. Distilled with water it affords a small quantity of volatile oil; and the water is strongly impregnated with its flavour. According to Pelletier, it contains 54·26 per cent. of resin, 31·94 of gum, 1·0 of bassorin, 0·60 of a peculiar substance, 0·40 of acidulous malate of calcium, and 11·80 of volatile oil including loss. Brandes found 3·73 per cent. of volatile oil. This is pale-yellow, very fluid, lighter than water, and of a disagreeable alliaceous odour.

Medical Properties and Uses. Sagapenum is a moderate stimulant, resembling assafetida, but much inferior, and usually considered as intermediate between that gum-resin and galbanum. It has been given as an emmenagogue and antispasmodic in amenorrhœa, hysteria, chlorosis, &c., but is now seldom used. It was known to the ancients; and Dioscorides speaks of it as being derived from Media. The dose is from ten to thirty grains, and may be given in pill or emulsion. Sagapenum is also considered discutient, and has been occasionally applied externally, in the form of plaster, to indolent tumours. W.

SALEP. Though not recognised either in the U. S. Pharmacopœia or in the British, this substance deserves a brief notice, as it is frequently mentioned by writers on the materia medica, and is occasionally to be found in the shops. The name is given to the prepared bulbs of *Orchis mascula* and other species of the same genus. The *male orchis* is a native of Europe, the Levant, and Northern Africa. Its bulbs, which are two in number, oval or roundish, internally white and spongy, are prepared by removing their epidermis, plunging them into boiling water, then stringing them together, and drying them in the sun or by the fire. By this process they acquire their peculiar appearance and consistence as found in the shops. Landerer, however, denies that, as prepared in Greece or Macedonia, they are dipped in boiling water, and ascribes their horny character to their being quickly dried in a baking oven. (*Pharm. Journ.*, March, 1850.) They were formerly procured exclusively from Macedonia, Asia Minor, and Persia, but are now said to be prepared in France, and perhaps other parts of Western Europe.

Salep is in small, oval, irregular masses, hard, horny, semi-transparent, of a yellowish colour, a feeble odour, and a mild mucilaginous taste. It is sometimes kept in the state of powder. In composition and relation to water it is closely analogous to tragacanth, consisting of a substance insoluble, but swelling up in cold water (*bassorin*), of another in much smaller proportion, soluble in cold water, and of minute quantities of saline matters. It also occasionally contains a little starch. It is highly nutritive, and may be employed for the same purposes as tapioca, sago, &c. The reputation which it enjoyed among the ancients, and still enjoys in the East, of possessing aphrodisiac properties, is wholly without foundation. On account of its hardness, salep, in its ordinary state, is of difficult pulverization; but the difficulty is removed by macerating it in cold water until it becomes soft, and then rapidly drying it. W.

SALICYLIC ACID. In 1834 *Salycylous acid* was discovered by Pagenstecher in the flowers of Spiræa ulmaria. In 1837 Piria and Ettling found that by oxidizing agents salicylous acid was converted into a new body, salicylic acid, and in 1839 Löwig and Weidmann derived the latter principle directly from the flowers of the Spiræa ulmaria. Shortly afterwards Cahours, in Europe (*Ann. Chim. Phys.*, x. 327), and Prof. Procter, in America (*Am. Journ. of Pharm.*, 1843), almost simultaneously discovered that the acid could be procured from the oil of wintergreen (Gaultheria procumbens). Modern research has shown that the oil of wintergreen is a salicylate of methyl; and when potassa is added a new salt is formed from which the acid is readily obtained by means of muriatic acid. Notwithstanding the discovery of this fact, and also the invention of still another process of manufacture by Ettling in 1845, salicylic acid remained so expensive as to be of no value in the arts until Kolbe and Lautermann discovered that it could be prepared by uniting phenol with carbonic acid through the instrumentality of sodium. The article now began to attact some attention, but remained beyond the reach of general use until Prof. Kolbe, continuing his researches, succeeded, in 1874 (*Journ. für Prakt. Chemie*, July, 1874), in producing it at a moderate cost. In this process the carbolate of sodium is first formed by saturating crystallized phenol with its chemical equivalent of caustic soda in solution. The carbolate of sodium is then heated gradually in an iron retort to 212° F., dry carbonic acid passed in, and the temperature increased to 356° F. When phenol begins to be evolved, the heat is still further increased to 428° F., and subsequently to 482° F. Finally, when the evolution of carbolic acid has ceased, the fire is withdrawn, and on cooling basic salicylate of sodium is left in the retort. The acid is procured from this by treatment of the solution with dilute hydrochloric acid; but as thus obtained it is in more or less brownish crystals. In order to procure it pure Kolbe converts it into ethyl-salicylic acid, decomposes it by means of an alkali, and treats the salts thus formed with hydrochloric acid. Dr. A. Rautert has found that the acid volatilizes with steam of 338° F., and has devised a process of purification based upon this, which yields at very little cost a beautiful product. For details the reader is referred to the *American Journal of Pharmacy*, 1875, p. 303.

Kolbe also obtained salicylic acid from the phenates of barium and calcium, but the yield was less than when the soda salt was employed. The phenate of potassium yielded only a trace of the salicylic acid, but an abundance of *paraoxybenzoic acid.*

Salicylic acid may also be prepared by heating salicin with an excess of potash, but the plan of Kolbe has completely superseded all others.

Salicylic acid, when pure, occurs as a snow-white crystalline powder, free from odour, and also from taste, but leaving a sense of astringency on the tongue and of irritation in the fauces, with an increased flow of saliva. To the mucous membrane of the nose it is irritating, and it will sometimes produce sneezing. It crystallizes out of its hot watery solution on cooling in slender, often very long needles, and on the spontaneous evaporation of its alcoholic solution in large four-sided prisms. It is strongly acid, acting decisively on litmus blue, and forming salts not only with alkalies, but also with metallic oxides. Its melting point has been variously stated as 316⅔° F. (Cahours), 251° F. (Procter), and 257° F. (Ettling). Recent experiments indicate that the latter is the correct figure. At 392° F. it sublimes, without boiling, into slender needles. When heated rapidly it is converted into carbolic and carbonic acids. It is but slightly soluble in cold water, freely so in boiling water, alcohol, and ether. According to Dr. Charles

B. Goldsborough (*Inaugural Thesis*, unpublished), its exact solubilities are as follows: In cold spring water, 1 in 600; in boiling water, 1 in 100, only 1 in 300 remaining on cooling, unless the boiling has been continued for fifteen or twenty minutes, when the acid will be retained in the proportion of 1 in 150 or 200; in alcohol, 1 in 2; ether,1 in 5; hot oil of turpentine, 1 in 5, solidifying on cooling. It is stated that by carefully heating glycerin can be made to dissolve 1 part in 50, and that the solution not only remains clear on cooling, but also may be diluted with water without separating. (*Am. Journ. of Pharm.*, 1875, p. 212.) Dr. Goldsborough also affirms that a mixture of the acid with alcohol, 1 to 10, may be diluted with 150 parts of water without crystallizing. Phosphate of sodium enables cold water to take up much more than its usual proportion of the acid. The crude unbleached salicylic acid is said to be more soluble than the pure.

The most sensitive test for it is a persalt of iron, with which it develops a beautiful violet colour. Goldsborough states that to ensure the delicacy of this reaction it is necessary that the iron salt be perfectly neutral; also that with this precaution he has clearly detected 1 part of the acid in 400,000 parts of water. On the addition of ammonia the violet colour is changed to a reddish-brown, then to an orange, then to a permanent greenish-yellow. Sulphuric and nitric acid change the violet to a light brown (*Goldsborough*). It must be remembered that salicylous acid reacts similarly with ferric salts. Salicylous acid, however, precipitates the potassic or ammonio-nitrate of silver white, the salicylic acid yellow.

By distilling with alcohol and strong sulphuric acid salicylic acid forms methyl, and ethyl salicylic acid.

We owe to Prof. Hermann Kolbe not only the cheap method of manufacturing salicylic acid, but also our first knowledge of the antiseptic action of the drug. Since his investigations very numerous experiments have been made with, on the whole, uniform results. We have not space here to follow them in detail, but the acid is clearly established to be one of the most powerful agents known for the purpose of repressing putrefaction. In the experiments of Prof. Kolbe, it not only inhibited such fermentative processes as are connected with the development of living organisms, but also prevented the formation of hydrocyanic acid from amygdalin and the development of the volatile oil of the black mustard.

Kolbe and Fürbringer (*Zur Wirkung der Salicylsäure*, Jena, 1875) both found that the salts of salicylic acid have little or no influence over putrefaction, and in the experiments of Dr. Goldsborough (*loc. cit.*) this was confirmed. It was also proved that the solution of the acid in water containing the phosphate of sodium is comparatively valueless. The acid itself must always be employed if a reliable agent is desired. It is claimed by various observers that it is more powerful than carbolic acid. As salicylic acid is odourless, far less irritant than carbolic acid, and also much less liable to produce symptoms of poisoning through its absorption, it has rapidly found favour with surgeons, and has, in a great measure, replaced carbolic acid in the antiseptic treatment of wounds. It is used in precisely the same way as the carbolic acid, in the form of spray, solution batting, lint, &c.

Thiersch makes a wadding for hermetically sealing wounds as follows: Two ounces of salicylic acid are dissolved in two pints of alcohol (sp. gr. .83), and this is diluted with 20 pints of water at 158° to 178° F. Six pounds and eight ounces of cotton batting previously entirely freed from oily matters are saturated with the solution. When dry this forms the "three per cent. batting;" by employing a larger proportion of the solution Thiersch makes a "ten per cent. batting," colouring it slightly with cochineal to distinguish it. When there is much suppuration, in order to allow free escape to the pus, it is better to substitute oakum or jute for the cotton batting.

Before the discoveries of Prof. Kolbe, Berlagnini had slightly studied the physiological action of salicylic acid upon the human organism. He took a little over 90 grains in two days, and noted only some ringing in the ears, and also that the acid escaped with the urine partly as salicylic acid, and partly as salicyluric acid, which seems to have about the same relation to its progenitor as hippuric has to benzoic acid. The studies made since the discoveries of Kolbe confirm these observations in regard to the elimination of salicylic acid. In some experiments in the Leipsic Hospital (*Phila. Med. Times*, v. 375), the hypodermic injection of five grains was followed in two hours by the appearance of the acid or its derivative in the urine, where it was still recognisable eighteen hours later.

The physiological action of salicylic acid has not as yet been thoroughly investigated, but it has certainly been shown that, unless in very large doses, it is a harmless agent. Its influence upon the animal heat has been studied to some extent by Dr. Paul Fürbringer. He noted some depression of the temperature produced by it in healthy animals, but failed to obtain any appreciable results from its use in healthy men. (*Zur Wirkung der Salicylsäure*, Jena, 1875.) He also administered the remedy to a number of animals suffering from septic fever, and found that sometimes it lowered the temperature and sometimes failed to do so. Even when it lowered the temperature it did not control the other symptoms of the disease, so that there is no reason for hoping for any specific effect from the remedy in pyæmic affections. Further, Dr. Fürbringer's clinical experiments of the drug with various acute diseases failed to establish its value as an internal

remedy, excepting in cases where its local action was of value, as in fermentative dyspepsia, in diphtheria, and in alkaline cystitis. Dr. E. Buss (*Centralblatt für die Med. Wissen.*, 1875, p. 276) has employed the acid in much larger doses than those exhibited by Dr. Fürbringer, and claims that so given it is a most powerful antipyretic in typhoid fever, rheumatism, erysipelas, &c. He used it in doses of one to two drachms. In a subsequent article, quoted by Fürbringer, Dr. Buss states that the antipyretic dose of the remedy is double that of quinine. He has found, however, that in persons free from fever, such doses produce toxic symptoms, such as bad feelings, congestion of the head, partial deafness and blindness. He himself had frequently taken a drachm without inducing any symptoms of moment. No narcotic manifestations were ever perceptible; and as the great fall of temperature was generally preceded by a profuse perspiration in these cases, it is very probable that the reduction was to a greater or less degree produced by the sweating.

Within the last year numerous practitioners have reported the most favourable results from the use of the remedy in rheumatism. (*Berliner Klin. Wochen.*, Nos. 1 and 2, 1876; *Boston Med. and Surg. Journ.*, Feb. 1876; *London Lancet*, April 8, 1876; *Phila. Med. Times*, vi. 392.) It is asserted that the disease usually yields in from two to three days. Stucker, in Berlin, gives from five to fifteen grammes a day. It would seem that these enormous doses were uncalled for, and perhaps dangerous. From five to ten grains every five or six hours would probably be equally efficacious, and much less apt to induce evil results. Success, though less marked, is also claimed for the use of the drug in diphtheria. There seems to be no doubt as to the value of salicylic acid in cystitis, especially when the disease is accompanied with ammoniacal urine.

Probably the best method of administration is in the form of an aromatized emulsion. A solution in alcohol may be used where the large amount of the active menstruum is not contraindicated. The use of the phosphate of sodium and of other salts to aid in solution should be avoided, as they probably interfere with the action of the remedy. H. C. W.

SAMADERA BARK. This is the inner bark of a tree belonging to the family of Simarubaceæ, growing in Ceylon. It is intensely bitter, and probably contains quassin. For further particulars, see *Pharm. Journ. and Trans.*, Jan. 1872, p. 541. H. C. W.

SANDARACH. *Sandaraca.* This is a resinous substance obtained from *Thuya articulata*, an evergreen tree growing in the North of Africa. It is in small, irregular, roundish-oblong grains or tears, of a pale-yellow colour, sometimes inclining to brown, more or less transparent, dry and brittle, breaking into powder under the teeth, of a faint, agreeable odour increased by warmth, and of a resinous, slightly acrid taste. It melts with heat, diffusing a strong balsamic odour, and easily inflames. It is almost entirely soluble in ordinary alcohol, and entirely so in that liquid when anhydrous, and in ether. Heated oil of turpentine also dissolves the greater part of it, but very slowly. According to Unverdorben, it consists of three resins, varying in their relations to alcohol, ether, and oil of turpentine. The *sandaracin* of Geise, which remains after sandarach has been exposed to the action of ordinary alcohol, is a mixture of two of these resins. Sandarach was formerly given internally, and entered into the composition of various ointments and plasters. At present it is used chiefly as a varnish, and as incense; and its powder is rubbed upon paper to prevent ink from spreading, after letters have been scratched out. W.

SANICULA MARILANDICA. *Sanicle.* An indigenous, umbelliferous, perennial, herbaceous plant, two or three feet in height, growing in woods and thickets, in almost all parts of the United States, as far south as South Carolina. For its botanical character, see *Eaton's Botany*, and *Torrey's and Gray's N. Am. Flora* (vol. i. p. 601). The root is the part used, and is popularly known in some parts of the country by the name of *black snakeroot.* It is fibrous and of an aromatic taste, and has been used as a domestic remedy in intermittent fever. Dr. J. B. Zabriskie has found it highly effectual in chorea. He considers it most efficient in substance, and gives the powder to children eight or ten years old in the dose of half a drachm three times a day. (*Am. Journ. of Med. Sci.*, N. S., xii. 374.) W.

SANTALUM ALBUM ET CITRINUM. *Sandal wood. Saunders.* There are three kinds of wood known by the name of santalum or saunders;—1. *santalum rubrum*, or red saunders, from Pterocarpus santalinus, already described in this work (*page* 803) under the officinal name of *Santalum;* 2. *santalum album*, or *white saunders*, from the *Santalum album* of Linnæus, growing in the East Indies, the S. Pacific Islands, and South America; and 3. *santalum citrinum*, or *yellow saunders*, formerly supposed to be the inner wood of the tree of which the outer constituted white saunders, but now stated to be from a different species, *S. freycinetianum* of M. Gaudichaud, growing in the Sandwich Islands, the Feejee Islands, the Marquesas, on the coast of Malabar, &c. It is this species which supplies the sandal wood so highly valued by the Chinese. Both kinds have a very agreeable aromatic odour. The white is thought by the East India physicians to be refreshing, and useful in remittent fevers, gonorrhœa, and other complaints. It was formerly used in European pharmacy, and still enters into certain compound syrups, confections, &c. The Chinese employ the yellow saunders chiefly as a perfume,

burning it in their temples, sick chambers, &c., and obtain from it a volatile oil by distillation, which they mix with oil of roses. This variety was also formerly used in Europe, and praised as cordial and alexipharmic. The *three saunders* were not unfrequently combined in the same preparation. (*Mérat et De Lens.*) A *volatile oil* is obtained by distillation from a variety of yellow sandal wood, the product of *S. Myrtifolium*, growing in continental India (Lindley, *Flor. Med.*, p. 323), which is stated by Dr. Thos. B. Henlerson, as the result of his own experience, to be a specific in gonorrhœa, equal if not superior in efficacy to copaiba, without its inconveniences. It is pleasant to the taste and grateful to the stomach, and perfectly harmless even in large doses. The odour of the oil is slightly perceptible in the urine. Its effects are observable, in susceptible cases, a few days after beginning with its use. The formula employed by Dr. Henderson is from 20 to 40 minims, diluted with three measures of rectified spirit, and flavoured with oil of cinnamon, and given three times a day. (*Med. Times and Gaz.*, June, 1865, p. 571.) Subsequent experience has justified the observations of Dr. Henderson, and the oil of sandal wood is now very much employed in the treatment of gonorrhœa. W.

SAPINDUS. Various tropical plants belonging to this genus contain saponin, and are largely used for cleansing purposes. Thus in India are employed the pulp of the fruit of the *Sapindus detergens*, the capsules of *S. emarginatus*, the berries of *S. laurifolius*, and in South America the oil and seed-vessels of *S. saponaria*. (*Pharm. Journ. and Trans.*, Jan. 1871, p. 585.) For the properties of Saponin, see *Saponaria officinalis* below. H. C. W.

SAPONARIA OFFICINALIS. *Soapwort.* A perennial herbaceous plant, growing wild in this country in the vicinity of cultivation, but probably introduced from Europe. It is commonly known by the vulgar name of *bouncing bet*. It is one or two feet high, with smooth, lanceolate leaves, and clusters of conspicuous whitish or slightly purplish flowers, which appear in July and August. The root and leaves are employed. They are inodorous, and of a taste at first bitterish and slightly sweetish, afterwards somewhat pungent, continuing long, and leaving a slight sense of numbness on the tongue. They impart to water the property of forming a lather when agitated, like a solution of soap, whence the name of the plant was derived. This property, as well as the medical virtues of the plant, resides in a peculiar proximate principle, obtained from the root by Bucholz, and called by him *saponin*. This principle constitutes, according to Bucholz, 34 per cent. of the dried root, which contains also a considerable quantity of gum and a little bassorin, resin, and altered extractive, besides lignin and water. Saponin is obtained, though not absolutely pure, by treating the watery extract with alcohol and evaporating. It is brown, somewhat translucent, hard and brittle, with a sweetish taste, followed by a sense of acrimony in the fauces. It is soluble in water and officinal alcohol, but is insoluble in anhydrous alcohol, ether, and the volatile oils. Its watery solution froths when agitated. It is a glucoside, and has been found in various plants, as different species of Silene, Dianthus, Lychnis, and Anagallis, in Acacia Concinna, Vaccaria vulgaris, Agrostemma githago. (*Journ. de Pharm.*, 3e sér., x. 339; also *Pharm. Journ. and Trans.*, Jan. 1871, p. 585.) It is said to possess poisonous properties. Soapwort has been used in Germany as a remedy in venereal and scrofulous affections, cutaneous eruptions, and visceral obstructions. It appears to act as an alterative, like sarsaparilla, to which it has been deemed superior in efficacy by some physicians. The plant is given in the form of decoction and extract, which may be freely taken. From two to four pints of the decoction daily are recommended in lues. The inspissated juice, given in the quantity of half an ounce in the course of a day, is said by Andry generally to cure gonorrhœa in about two weeks, without any other remedy. According to Dr. Bonnet and M. Malapert, this and other plants containing saponin are capable of producing poisonous effects. (*Ibid.*) M. Eugene Pélikan, upon experimenting with saponin from various sources upon the lower animals, has found it to possess the extraordinary power, when injected into the cellular tissue, of producing paralysis of the muscles, entirely local in its nature, that is, without the intervention of the general nervous system, and in a normal state of all the functions of sensibility and motility in the parts not submitted to its action. In the parts acted on, sensibility and motility are both suspended, and the paralysis is followed by rigidity. Reflex motion is destroyed, as no irritant applied to the extremity has the least power of provoking contraction. The same phenomena are evinced, though the circulation be suspended by tying the vessels of the limb; and the ligation of the aorta even accelerates the result. This action of saponin has been confirmed by Köhler. (*Berlin. Klin. Wochenschrift*, No. 27, 1874.) It would appear that a substance possessing such extraordinary powers might play an important part in therapeutics. W.

SARCOCOLLA. A peculiar vegetable product, exuding spontaneously from the *Penœa Sarcocolla*, *P. mucronata*, and other species of Penæa, small shrubs growing at the Cape of Good Hope, in Ethiopia, Arabia, &c. It is in the form of small, roundish, irregular grains, sometimes agglutinated in masses, friable, opaque or semi-transparent, of a yellowish or brownish-red colour, inodorous unless heated, when they have an agreeable smell, and of a peculiar, bitter, sweetish, and acrid taste. Sarcocolla, according to Pelletier, consists of 65·3 per cent. of a peculiar substance, considered by Dr. Thomson as

holding an intermediate place between gum and sugar, and called *sarcocollin* or pure sarcocolla, 4·6 of gum, 3·3 of a gelatinous matter having some analogy with bassorin, and 26·8 of lignin, &c. It is said to be purgative, but at the same time to produce serious inconvenience by its acrid properties. The Arabian physicians used it internally; and by the ancients it was employed as an external application to wounds and ulcers, under the idea that it possessed the property of agglutinating the flesh, whence its name was derived. It is out of use. W.

SARRACENIA. *Side-saddle Plant. Fly-trap.* Two Southern species of this curious indigenous genus of plants, *S. flava* and *S. variolaris*, were brought into notice by Dr. E. P. Porcher, in a communication published in the *Charleston Medical Journal and Review.* Dr. Porcher states that the roots (rhizomes) of these plants have long been used as a domestic remedy by the inhabitants of the lower portions of South Carolina. The medicine is believed in that region to possess extraordinary powers in dyspepsia; and he received reports, from persons entirely deserving of confidence, of its efficacy in sick-headache, waterbrash, gastralgia, abdominal distension, &c. In trying the remedy upon himself, he found it to be bitter and astringent to the taste, and, in its effects on the system, stimulant to the stomach, the circulation, and in some degree to the brain, and at the same time to a certain extent diuretic, and disposed to operate mildly on the bowels. From the results stated by Dr. Porcher, we should infer that the medicine is a stimulating tonic, with some tendency to act on the brain; and probably well suited to cases of dyspepsia dependent on debility of stomach. Professor Sheppard submitted the root to chemical examination, and found it to contain lignin, colouring matter, resin, an acid salt of lime, and a salt probably of an organic alkali. The best mode of administration seems not to have been well determined. Invalids chew it as they would chew tobacco; and from Dr. Porcher's statements we should infer that it might be appropriately given in powder, in the dose of half a drachm three or four times a day. (See *Wood's Quarterly Retrospect*, ii. 78.) Much attention has recently been paid to another species of Sarracenia, the *S. purpurea*, in the treatment of smallpox, under the impression that it had the power of very favourably modifying that disease, and, indeed, of materially shortening its course. The claims made in favour of this remedy were so much in opposition to all that we knew, whether of the medicine or the disease, that we had no hesitation in expressing our conviction, that the apparent efficacy of the remedy was simply owing to its employment in those cases of modified smallpox, which, in consequence of a partial protection of the system, either through vaccination or a previous attack of smallpox, generally run a short, and almost always a favourable course; and subsequent experience has fully determined its entire want of any curative influence over the disease. The root was exhibited in infusion or decoction, made in the proportion of half an ounce to a pint of water, and given in the dose of a wineglassful every three hours. The whole herbaceous part of the plant, having been found to possess the same bitter taste was afterwards used in the same manner and dose. For a description of this species of Sarracenia, in all its relations, see a paper by Prof. Bentley, in the *Pharmaceutical Journal* for Jan. 1863 (p. 294). The root of the S. purpurea has been chemically examined by M. Stan. Martin, who found in it, 1. an alkaloid which he proposes to name *sarracenine;* 2. a resin; 3. a yellow colouring principle; 4. extractive; 5. substances which constitute the frame-work of plants. Sarracenine (*sarracenina*) is white, is soluble in alcohol and the ethers, combines with acids to form salts, and with sulphuric acid forms handsome needles, which are bitter, and communicate this taste to its menstrua. (*Ann. de Thérap.*, 1866, p. 73.) E. Schmidt, however, found no alkaloid but discovered *sarracenic acid.* (*Am. Journ. of Pharm.*, 1872, p. 213.)

Under the name of *trumpet-plant*, with various synonymes, as *fly-catcher*, *huntsman's cup*, &c., a yellow-flowered plant of Florida was brought to public notice in the *American Journal of Pharmacy* (July, 1869, p. 292), by Dr. J. Dabney Palmer, who, having experimented with the root therapeutically, at the request of neighbours, ascertained that it possesses extraordinary powers in the cure of diarrhœa. Some of the cases in which it was given were of long standing and very obstinate, others recent; but all yielded to the remedy; and in no case were more than four ounces of the tincture required to effect a cure. A few doses were generally sufficient. The tincture was prepared by macerating, for fourteen days, four ounces of the root with two pints of alcohol, then expressing and filtering. The dose was a teaspoonful after each evacuation. In a subsequent communication to the same journal, Dr. Palmer states that the plant is a Sarracenia, and designates it as the *S. flava*, which is one of the species mentioned above as having been employed by Dr. Porcher. It grows abundantly in Florida, near Monticello. It has a spotted hood, and the flower is greenish-yellow. W.

SASSA GUM. This name has been applied by Guibourt to a gum, occasionally brought into market from the East, and answering so exactly to Bruce's description of the product of a tree which he calls *sassa*, that there is reason to believe in their identity. According to Guibourt's description, it is in mammillary masses, or in convoluted pieces resembling an ammonite, of a reddish colour and somewhat shining surface, and more transparent than tragacanth. Its taste is like that of tragacanth, but slightly acrid.

When introduced into water, it becomes white, softens, and swells to four or five times its original bulk; but it preserves its shape, neither like tragacanth forming a mucilage, nor like Bassora gum separating into distinct flocculi. It is rendered blue by iodine. W.

SASSY BARK. This bark is interesting chiefly from its employment by the natives of Western Africa as an ordeal in their trial for witchcraft or sorcery. Specimens sent to this country from Liberia, were first examined by Mr. C. A. Santos, who published his observations in the *Am. Journ. of Pharm.* (xxi. 97, April, 1849). Other specimens both of the bark and the plant producing it, afterwards came under the notice of Professor Procter, who was thus enabled to determine as well the chemical characters as the botanical source of the product. His papers on the subject are contained in the same journal (xxiii. 301, and xxiv. 195); and in the last is given a botanical description of the tree. To these papers the reader is referred for particular information on the subject. The bark was thought to be the product of a previously undescribed species of *Erythrophleum*, for which Prof. Procter proposed the name of *E. judiciale*. It appears, however, from a note of Prof. Lindley, published in the *Pharmaceutical Journal* for January, 1857 (p. 373), that the tree had been previously described under two specific names, having been noted in Hooker's *Niger Flora* (p. 329) as the *Erythrophleum Guineense* of Don, and the *Fillæa suaveolius* of Guillemin and Perottet's Flora of Senegal; facts, of course, unknown to Prof. Procter when his papers were written. It is a large tree with spreading branches, doubly pinnated leaves, flowers in spike-like racemes, and leguminous fruit. The bark is in pieces more or less curved, with or without epidermis, in the former case somewhat fissured externally, of a dull-red colour diversified by whitish spots, brittle, presenting when cut transversely numerous fawn-coloured spots surrounded by reddish-brown tissue, nearly inodorous, of an astringent taste, and, according to Mr. Santos, of the sp. gr. 1·054. Prof. Procter found it to contain tannic acid, insoluble apotheme analogous to that of rhatany, a red colouring matter formed by a combination of the two preceding constituents, gallic acid, gum, a little resin, fatty matter, various salts, and a peculiar substance precipitable by tannic acid, and soluble in alcohol and chloroform. He did not isolate the active principle. The bark yields its virtues to water. In reference to its effects on the system it has been considered as emetic and cathartic, with some influence over the cerebral functions; but little was certainly known. Professor Procter found three grains of the aqueous extract, given to a cat, to produce prostration, frothing at the mouth, dilatation of the pupils, and total loss of inclination to eat. Largely taken the bark was known often to cause death. The powder snuffed up the nostrils occasions violent sneezing. Some experiments made with it by Drs. S. Weir Mitchell and W. A. Hammond have given us more precise knowledge in regard to its properties. From these it appears to be nauseating and emetic, narcotic and astringent, but without any cathartic power. The same writers give the following, as the result of the observations of Dr. Savage made in Africa, and communicated to them. When the bark is chewed, it causes a feeling of constriction in the fauces, attended with prickling, and followed by numbness. A strong infusion or decoction occasions stricture across the brow, severe pain in the head, coma, and death. Independently of its use by the natives as an ordeal poison, it is sometimes employed by them as a remedy in dysentery, diarrhœa, and colic. Dr. Savage himself has known it to be successful in intermittent fever, dysentery, and diarrhœa. A grain of the watery extract was given for a dose every three hours. (*Charleston Med. Journ.*, Nov. 1859, p. 735.) W.

SATUREJA HORTENSIS. *Summer Savory.* An annual labiate plant, growing spontaneously in the South of Europe, and cultivated in gardens as a culinary herb. It has an aromatic odour and taste, analogous to those of thyme, and was formerly used as a gentle carminative stimulant; but is now employed only to give flavour to food. *S. montana* or *winter savory*, which is also cultivated in gardens, has similar properties. W.

SAURURUS CERNUUS. *Lizard's Tail.* (See *Gray's Manual of Botany*, p. 383.) A perennial, herbaceous plant, growing in low places, on the borders of ponds, in most parts of the United States, but, according to Eaton, especially abundant in New York, west of Cayuga Lake. It received its name from its supposed resemblance to a lizard. The whole plant has a heavy, disagreeable, yet somewhat aromatic odour. Dr. D. L. Phares, of Newtonia, Miss., speaks of it as being much used in some parts of the country, both in regular and domestic practice, as a soothing, discutient cataplasm. He considers it "laxative, antispasmodic, sedative, and slightly astringent," and for many years has employed it largely, and with most satisfactory results, in irritation and inflammation of the kidneys, bladder, prostate, and urinary passages generally. He considers it peculiarly applicable to cases attended with strangury. It is generally acceptable to the stomach. Dr. Phares uses it both externally and internally. He gives it in strong infusion, made with the plant whether fresh or dried, of which from one to four ounces may be given every fifteen or thirty minutes, or three or four times a day, according to the urgency of the symptoms. (*Am. Journ. of Pharm.*, Sept. 1867, p. 468; from *Atlanta Med. and Surg. Journ.*, July, 1867.) W.

SCOLOPENDRIUM OFFICINARUM. Smith. *Asplenium Scolopendrium.* Linn. *Harts-tongue.* A fern indigenous in Europe and America. Its vulgar name was derived from the shape of its leaves, which were the part formerly used in medicine. They have a sweetish, mucilaginous, and slightly astringent taste, and, when rubbed, a disagreeable oily odour. They were used as a deobstruent in visceral affections, as an astringent in hemorrhages and fluxes, and as a demulcent in pectoral complaints; but their properties are feeble, and they have fallen into neglect. W.

SCROPHULARIA NODOSA. *Figwort.* The root of the *knotty-rooted figwort* is perennial, tuberous, and knotty; the stem is herbaceous, erect, quadrangular, smooth, branching, and from two to three feet high; the leaves are opposite, petiolate, ovate-cordate, pointed, sharply toothed, veined, and of a deep-green colour; the flowers are small, dark-purple, slightly drooping, and borne on divided peduncles in erect terminal branches. The plant is a native of Europe, where it grows in shady and moist places, and flowers in July. The leaves, which are the part used, have when fresh a rank fetid odour, and a bitter, somewhat acid taste; but these properties are diminished by drying. Water extracts their virtues, forming a reddish infusion, which is blackened by the sulphate of the sesquioxide of iron. Walz has obtained from them two proximate principles, which he names respectively *scrophularin* and *scrophularosmin.* (Mayer, *Am. Journ. of Pharm.*, July, 1863, p. 295.) Figwort leaves are said to be anodyne and diuretic, and to have repellent properties when externally applied. They were formerly considered tonic, diaphoretic, discutient, anthelmintic, &c., and were thought to be useful in scrofula. They are at present very little employed; but in Europe are sometimes applied. in the form of ointment or fomentation, to piles, painful tumours and ulcers, and cutaneous eruptions. W.

SECALE CEREALE. *Rye.* Syria, Armenia, and the southern provinces of Russia have been severally indicated as the native country of rye. The plant is now cultivated in all temperate latitudes. The *grains* consist, according to Einhof, of 24·2 per cent. of envelope, 65·6 of flour, and 10·2 of water. The *flour*, according to the same chemist, consists of 61·07 per cent. of starch, 9·48 of gluten, 3·28 of albumen, 3·28 of uncrystallizable sugar, 11·09 of gum, 6·38 of vegetable fibre, besides 5·62 of loss, comprising an acid, the nature of which was not determined. Rye flour has been much used, in the dry state, as an external application to erysipelatous inflammation, and other eruptive affections, the burning and unpleasant tingling of which it tends to allay, while it absorbs the irritating secretions. In the form of mush, it is an excellent laxative article of diet, and, mixed with molasses, it may be given with great advantage in hemorrhoids and prolapsus ani, connected with constipation. Rye carbonized by heat, with exclusion of the air, has been highly recommended as a tooth-powder. W.

SEDUM ACRE. *Biting Stone-crop. Small Houseleek.* A small, perennial, succulent European plant, growing on rocks and old walls, with stems about as long as the finger, and numerous very minute leaves. It is inodorous, and has a taste at first cooling and herbaceous, afterwards burning and durably acrid. Taken internally it vomits and purges, and applied to the skin, produces inflammation and vesication. The fresh herb and the expressed juice have been used as an antiscorbutic, emetic, cathartic, and diuretic, and have been applied locally to old ulcers, warts, and other excrescences; but the plant is at present little employed. It has recently been recommended in Germany as a remedy in epilepsy. Other species are less acrid, and are even eaten as salad in some parts of Europe. Such are *Sedum rupestre* and *S. album. S. Telephium* was formerly employed externally to cicatrize wounds, and internally as an astringent in dysentery and hæmoptysis; and is still esteemed by the common people in France as a vulnerary. M. Ernst Mylius found in 100 parts of Sedum Acre 2·2 parts of a soft, not acid resin, 12·80 parts of uncrystallizable sugar, and 12·40 parts of a soft acid resin, besides an alkaloid and inert substance. (*Journ. de Pharm.*, 4e sér., xvii. 81.) W.

SELINUM PALUSTRE. (*Linn.*) *Peucedanum montanum.* (Lindley, *Flor. Med.*) *Marsh Parsley. Persil de marais.* (*Fr.*) This is an umbelliferous herbaceous plant, with a fleshy, lactescent root, from which rises annually a single fistulous stem, about four feet high, furnished with large, soft, smooth, bipinnate or tripinnate leaves, and branching at top, with terminal umbels, each consisting of thirty small white flowers. The plant frequents low wet grounds in the North of Europe. The root is the part used. This, when dried, is of a brown colour externally, of a strong aromatic odour, and an acrid pungent, aromatic taste. The powder is of a light grayish-yellow colour. Analyzed by Peschier, it was found to contain a volatile oil, a fixed oil soluble in ether and alcohol, gum, a yellow colouring substance, a nitrogenous, mucoso-saccharine principle, a peculiar acid which he calls *selinic*, phosphate of calcium, and lignin. The root of Selinum palustre has long been a popular remedy for epilepsy in the Russian Province of Courland; and, having in 1806 attracted the attention of Dr. Trinius, a Russian physician, was by him in 1818 brought before the notice of the profession, and afterwards acquired some reputation in the treatment of that disease. It did not, however, long retain this reputation, and in a few years seems to have been quite forgotten. More recently its use has been revived by Dr. Herpin, who published a memoir upon the subject in 1859, speaking in decidedly

favourable terms of its efficiency. In relation to its physiological effects, it seems to exercise no very obvious influence on the system, sometimes acting as an aperient, in a very few instances causing temporary nausea or gastric uneasiness, but in many cases passing through the alimentary canal without apparent effect, and never, however long continued, producing any derangement of the general health. It seems to act favourably on the menstrual function, restoring its regularity, and relieving the pains often attendant on it. In speaking of its use in epilepsy, Dr. Herpin ranks it as the fourth in value, estimating oxide of zinc, sulphate of copper, and valerian, in the order of their succession, and next Selinum. He has also used it with apparent advantage in hooping-cough, and recommends its trial in other nervous affections. The commencing dose in epilepsy is from 20 to 30 grains three times a day, taken before breakfast and dinner, and at bedtime, and increased by one-half every week, until the original dose is quadrupled; after which it may be continued for six weeks or longer. For children the dose is to be diminished according to the age. (*Journ. de Pharm.*, Juillet, 1859, p. 16.) W.

SEMPERVIVUM TECTORUM. *Common Houseleek.* A perennial, succulent, European plant, growing on rocks, old walls, and the roofs of houses, and remarkable for its tenacity of life. It is occasionally cultivated in this country as an ornament to the walls of houses, or as a domestic medicine. The leaves, which are the part used, are oblong, pointed, from half an inch to two inches in length, thick, fleshy, succulent, flat on one side, somewhat convex on the other, smooth, of a light-green colour, inodorous, and of a cooling, slightly saline, astringent, and sourish taste. They contain a large proportion of supermalate of calcium. They are employed in the recent state and bruised, as a cooling application to burns, stings of bees, hornets, &c., ulcers, and other external affections attended with inflammation. The juice is said to cure warts. W.

SENECIO VULGARIS. *Common Groundsel.* An annual European plant, introduced into this country, and growing in cultivated grounds. The whole herb is used, and should be gathered while in flower. It has, when rubbed, a peculiar rather unpleasant odour, and a disagreeable, herbaceous, bitterish, and saline taste, followed by a sense of acrimony. It is emetic in large doses, and has been given in convulsive affections, liver complaints, spitting of blood, &c., but is now very little used. The bruised herb is sometimes applied externally to painful swellings and ulcers. The plant is employed also as food for birds, which are fond of it. Other species of Senecio have been medicinally used; and an indigenous species, the *S. aureus* or *ragwort*, is said by Schoepf to be a favourite vulnerary with the Indians. The "eclectics" consider it emmenagogue, and use it not only to stimulate the function, but to regulate it when in excess or otherwise deranged. They also believe it to possess diuretic properties, and to be useful in disorders of the urinary organs. They give the name of *senecin* to a preparation made by precipitating the tincture with water; but this name should be reserved for the active principle when discovered. The whole plant is used in decoction or infusion, which may be taken freely. W.

SIENNA. *Terra di Sienna.* An argillaceous mineral, compact, of a fine texture, very light, smooth, and glossy, of a yellowish-brown or coffee-colour, leaving a dull-orange trace when moistened and drawn over paper. By calcination it assumes a reddish-brown colour, and is then called *burnt sienna*. In both the raw and burnt states it is used in painting. The best sienna is brought from Italy, but an inferior kind is found in England. W.

SILENE VIRGINICA. *Catchfly. Wild Pink.* An indigenous perennial plant, growing in Western Virginia, the Carolinas, and in the States beyond the Alleghany mountains. Dr. Barton, in his "Collections," states that a decoction of the roots is said to be efficacious as an anthelmintic. We are told that it is considered poisonous by some of the Indians. *S. Pennsylvanica*, which grows in the Eastern section of the Union, from New York to Virginia, probably possesses similar properties. W.

SILEX, PULVERIZED. Silex Contritus. *Lond. Silicic Acid.* In operations of pharmacy, substances are sometimes employed whose action is exclusively mechanical. Thus, in the U. S. Pharmacopœia, sand was used in preparing oil of amber and the fluid extract of rhubarb, and carbonate of magnesium is now used in forming several of the medicated waters. The use of the same carbonate was also directed in the London Pharmacopœia of 1836, in alternative processes for preparing several of these waters. Mr. R. Warington objected to the use of this carbonate, as being dissolved to an injurious extent, and proposed to substitute porcelain clay, or pulverized silica, glass, or pumice stone. The London College, probably influenced by this objection, abandoned, in its Pharmacopœia of 1851, the use of carbonate of magnesium, and substituted finely pulverized silex, under the name of *Silex Contritus*. This powder may be conveniently obtained from *colourless* quartz or rock-crystal. In order to render the mineral more easily pulverizable, it is advantageous to heat it to redness, and quench it in water. It may then be reduced to fine powder in a porphyry or agate mortar. The London College prepared all the medicated waters, except two, from the volatile oils of the plants, in addition to the method of distillation with water from the plants themselves. When the volatile oils were used, pulverized silex was directed as a mechanical agent. The

oil was rubbed up first with the silex and then with the water, and the whole was filtered. The silex acted by minutely dividing the oil and diffusing it through water, and, by the subsequent filtration, was entirely removed.

Pulverized silex is a harsh, white, tasteless powder, insoluble in water and most other solvents. Its sp. gr. is 2·66. In composition it is a teroxide of silicon, SiO_3. A protoxide (SiO) has been discovered by Wöhler. (*Chem. Gaz.*, May 15, 1857.) *Silicon* is a non-metallic element, which has been obtained in three allotropic states, called amorphous, graphitoidal, and octohedral silicon; the first corresponding to charcoal, the second to graphite, and the third to diamond. The octohedral crystallizes like diamond with curved facets, is hard enough to scratch glass but not topaz, and has the sp. gr. 2·49. B.

SILICATE OF MAGNESIUM, HYDRATED. A mineral used in France for the manufacture of smoking pipes, which, though known by this name to science, is probably a silicate of magnesium and calcium. It has been brought into notice as a medicine by M. Garraud, a distinguished physician of Laval, who, struck with its resemblance to subnitrate of bismuth, being like it white, tasteless, and insoluble, was induced to use it as a substitute for that medicine in obstinate choleraic diarrhœa, and met with so much success as to induce him to make the remedy public. M. Trousseau employed it also with great success in numerous cases of diarrhœa. It is reduced to fine powder, and given in doses of from one to four drachms a day. It no doubt acts mechanically, either as an absorbent or a protective of the intestinal coats, and has the advantage over the subnitrate of being innocent under all circumstances. (*Journ. de Pharm.*, 4e sér., iii. 385.) W.

SILICATE OF SODIUM. *Sodii Silicas. Soluble Glass.* This is the salt employed by MM. Socquet and Bonjean, in conjunction with benzoate of sodium, in the treatment of gout and rheumatism, for the purpose of eliminating uric acid by the urine. (See *page* 1589.) It is made by fusing one part of silica and two of dried carbonate of sodium, mixed in powder, in an earthenware crucible, and pouring out the fused mass on a stone slab to cool. This is pulverized, and treated with boiling water, to dissolve the soluble part. The solution is filtered and concentrated, so as to form crystals on cooling. These are then purified by dissolving them in water heated to 100°, filtering the solution, and concentrating it so that it may recrystallize. Silicate of sodium is supposed to promote the discharge of uric acid by the kidneys; while the benzoate of sodium transforms the same acid into hippuric acid. This action of the latter salt is doubtful; as it is well known that benzoic acid, when taken, is always changed into hippuric acid, the presence of which in the urine is more plausibly attributed to the medicine than to the transformation of uric acid. B.

Silicate of potassium, which may be prepared in the same way as the salt of sodium, and like it is soluble, has been employed for the same purposes by M. Vanden Corput, who prefers it to the silicate of sodium, because it acts more promptly and energetically in bringing about alkalinity of the urine. He published an article upon the therapeutic use of these salts, so early as 1849, and long anticipated MM. Socquet and Bonjean. (*Ann. de Thérap.*, 1865, p. 236.) Another use of soluble silicate of potassium, which, like the salt of sodium, is known in commerce as *soluble glass*, has been proposed by Prof. Shun; as a substitute, namely, for starch, dextrin, and plaster of Paris, in the preparation of immovable dressings in the case of certain fractures of the limbs, and diseased joints. It is applied, of a syrupy consistence, by means of a brush, to the bandages, upon which it rapidly hardens, requiring only five or six hours for this result. The facility of removing it by means of hot water is another advantage which it possesses over the other dressings. (*Journ. de Pharm.*, 4e sér., iv. 52.) W.

SISYMBRIUM OFFICINALE. Scopoli. *Erysimum officinale.* Linn. *Hedge Mustard.* A small annual plant, growing in the United States and Europe, along the roadsides, by walls and hedges, and on heaps of rubbish. It has an herbaceous, somewhat acrid taste, which is strongest in the tops and flower-spikes, and resembles that of mustard, though much weaker. The seeds have considerable pungency. The herb is said to be diuretic and expectorant, and has been recommended in chronic coughs, hoarseness, and ulceration of the mouth and fauces. The juice of the plant may be used mixed with honey or sugar, or the seeds may be taken in substance. *Sisymbrium Sophia*, or the *flix weed*, was formerly officinal. It is of a pungent odour when rubbed, and of an acrid biting taste. The herb has been used externally in indolent ulcers, and the seeds internally in worms, calculous complaints, &c. *Sisymbrium muralis* (*Ditoplaxis muralis*, P. Robert) has been recently used in France in scurvy, scrofula, and other cachectic affections, especially associated, in the form of syrup, with iodide of potassium. (*Ann. de Thérap.*, 1864, p. 126.) W.

SIUM NODIFLORUM. *Water-parsnep.* A perennial, umbelliferous, aquatic European plant, growing also in the southern section of the United States, where it is supposed to have been introduced. It is commonly considered poisonous; but the expressed juice, given by Withering in the dose of three or four ounces every morning, was not found to affect the head, stomach, or bowels. He found it, in this quantity, very advan-

taceous in obstinate cutaneous diseases; and the plant has been usefully employed by others in similar complaints, and in scrofulous swellings of the lymphatic glands. It is considered diuretic. *Sium latifolium*, which grows in Europe and the United States, and is the *common water-parsnep* of this country, is positively asserted to be poisonous; and madness and even death are said to have followed the use of the root. The *S. Sisarum* or *skirret*, a plant of Chinese origin, cultivated in Europe, has a sweetish, somewhat aromatic root, which is employed as food in the form of salad, and is supposed to be a useful diet in complaints of the chest. W.

SMALT. *Azure.* When the impure oxide of cobalt, obtained by roasting the native arseniuret of that metal, is heated with sand and potassa, the mixture melts, and a beautiful blue glass results, which, when reduced to powder, receives the name of smalt or azure. It is used chiefly in painting. W.

SOAP BARK. This is the product of *Quillaya Saponaria*, an evergreen tree, growing in the mountains of Chili, in South America, and known to the inhabitants by the name of *quillay*, said to be derived from the Chilian word *quillean*, which signifies to wash. It is the liber or inner bark that is employed, the outer dead layers being rejected. When bruised and macerated in water, it imparts to that liquid the property of frothing like soap, when agitated. This has been found by MM. Fleury jun. and Boutron Chalard to be owing to the existence of *saponin* in the bark, the same principle as that which gives a similar property to *Saponaria officinalis*. The bark contains neither tannic acid nor any bitter principle. It is much used along the western coast of South America, where it constitutes an article of commerce; and we are informed that it is also imported into this country; being employed for cleansing cloth from grease. According to Mr. Charles Raymond, the people of Chili use it in washing silken and woollen stuffs, when it is desirable not to change their colour, and still more for cleansing the hair, which it is supposed to beautify and preserve. On the same authority, it is stated to be sometimes given as a febrifuge, and as a remedy in colds in the head. For the latter purpose, its powder is snuffed up the nostrils. It causes sneezing and profuse nasal discharge. (*Journ. de Pharm.*, xxxii. 220; also *Am. Journ. of Pharm.*, xxix. 104.) W.

SOLUBLE MERCURY OF HAHNEMANN. This is prepared by adding, drop by drop, a dilute solution of ammonia to an equally dilute solution of nitrate of protoxide of mercury, until the precipitate begins to be paler than at first. It is a black powder, which has usually the composition expressed by the formula $NH_4O,3HgO+NO_5$. It is, therefore, an ammoniated nitrate of protoxide of mercury. When it has a gray colour, the fact shows that too much ammonia has been employed in its precipitation. This preparation is included in the French Codex. It has been used in syphilitic diseases. B.

SOOT. *Fuligo Ligni.* This well-known substance has a peculiar smell, and a bitter, empyreumatic, and disagreeable taste. Its composition is very complex. Reduced to powder, and treated with water, it affords an infusion of a deep-yellow or brown colour, which is deeper if heat is employed. The insoluble portion amounts to about 44 per cent. The soluble part consists chiefly, according to Berzelius, of a pyrogenous resin united with acetic acid (*acid pyretin*), saturated with potassa, lime, and magnesia. It also contains sulphate of calcium, chloride of potassium, acetate of ammonium, and traces of nitric acid. When the solution is evaporated to dryness, it furnishes a black extract. This forms with water a blackish-brown solution, which, when treated with any free acid except the acetate, lets fall the acid pyretin, in the form of a black mass resembling pitch; while the acid employed remains in solution with the bases previously in combination with the pyretin. Braconnot thought he had discovered in pyretin a peculiar principle, which he named *asbolin;* but Berzelius believed he was mistaken. Besides these substances, Braconnot ascertained the existence in soot of an azotized extractive matter to the amount of 20 per cent. This matter, when submitted to dry distillation, afforded a considerable proportion of pyrogenous oil. Soot itself, when subjected to a similar distillation, furnishes one-fifth of its weight of empyreumatic oil. To the above ingredients of soot must be added creasote, to the presence of which it is supposed to owe its medicinal properties.

Soot was formerly officinal with the Edinburgh College, and the Scotch physicians were in the habit of frequently prescribing it as a tonic and antispasmodic in the form of tincture. It went very much out of use in regular practice; but came again into vogue after the discovery of creasote, which is one of its ingredients. At present it is chiefly used as an external remedy in the form of decoction or ointment. In the *Revue Méd.* for June, 1834, M. Blaud details a number of cases of various affections, such as obstinate tetters, porrigo favosa, psora, fistula, cancerous and venereal ulcers, chronic irritations of the lining membrane of the mouth, exudations from the mucous membrane of the nose, herpetic eruptions of the genital organs, and pruritus of the vulva, in which the use of soot effected cures. The *decoction* is made by adding two handfuls of soot to a pint of water, boiling for half an hour, and filtering. It is applied as a lotion to the affected parts, or injected into the fistulas several times a day; and, in the intervals, the part, if accessible, is dressed with an *ointment*, made by rubbing up a drachm of finely powdered soot with an ounce of lard. In cases of porrigo, the crusts must be removed by poultices before the soot is applied. In treating obstinate cases of chronic eczema,

M. Bougard, of Belgium, has been very successful with the use of a mixture of equal parts of soot and glycerin. In scrofulous ophthalmia, M. Caron Duvillards and M. Baudelocque have found a collyrium, made according to the following formula, very useful. Infuse two ounces of soot in boiling water, filter the solution, and evaporate to dryness. Dissolve the dry residue, with the assistance of heat, in strong white wine vinegar, and add extract of roses in the proportion of twenty-four grains to twelve fluid-ounces of the liquid. It is prepared for use by adding a few drops of the liquid to a glass of water. (*Bull. Gén. de Thérapeutique*, Mars, 1834.) This formula is not very satisfactory; as it does not indicate the proportion of vinegar to be employed. In a case of severe and extensive burn, in which, after the separation of the sloughs, the patient began to sink from the profuse discharge, Dr. Ebers, of Bordeaux, found advantage from the application, to the granulating surface, of lint soaked in a decoction of soot. It reduced the discharge in a surprising manner, and promoted cicatrization.

The late Dr. Hewson, of this city, found an infusion of soot an efficacious remedy, employed by injection, in cases of ascarides. In one case of long standing in an adult, in which a number of remedies had been tried unsuccessfully, injections of soot daily, persevered in for two weeks, effected a complete cure. The injection was made by adding a cupful of soot to a pint of boiling water, and straining the solution. An *infusion of hickory ashes and soot* is used in this city as a popular remedy for dyspepsia. It is made by infusing a pint of clean hickory ashes and a gill of soot in half a gallon of boiling water, allowing the liquor to stand for twenty-four hours, and then decanting. Of this a small wineglassful is taken three or four times a day. No doubt this infusion has been useful in acidity of stomach; but its indiscriminate use in the various gastric affections, popularly confounded under the name of dyspepsia, is calculated to do much harm. Soot is decidedly antiseptic. A few shovelfuls of it, thrown into privies or drains, effectually destroy their foul exhalations. B.

Dr. E. A. Wood, of McKeesport, Pa., strongly recommends soot as a remedy in uterine hemorrhage, having been induced first to try it by having witnessed its success in a case of the kind, employed as a domestic remedy. He has himself repeatedly used it with success. He prepares the soot for administration by boiling it for an hour in a muslin bag, and of the decoction thus made gives a wineglassful every half hour until the hemorrhage is arrested. (*Med. and Surg. Reporter*, May 11, 1867, p. 401.) W.

SORBUS AUCUPARIA. *Mountain Ash.* A small European tree, of the family of Rosaceæ, distinguished by its pinnate leaves, somewhat resembling that of the ash, and its beautiful clusters of scarlet fruit about as large as peas, which give it a striking appearance, and have caused it to be cultivated in ornamented grounds. We have an American species, *S. Americana*, which is similarly characterized, and is highly ornamental to our mountain regions in autumn and winter by its bright scarlet fruit. The fruit of the European plant, and the same is probably the case with our own, contains a peculiar kind of sugar called *sorbin*, susceptible of the vinous fermentation; and an alcoholic drink has been prepared from it. It seems to have been used for preparing malic acid; and Dr. Hoffmann has discovered in it two new acids, which he designates as *sorbic* and *parasorbic acids*. (See *Pharm. Journ.*, May, 1859, p. 573.) M. J. Boussingault has found in it a crystalline saccharine principle, *sorbite*, isomeric with mannite, melting, when anhydrous, at 110° to 111°, when hydrated, at 102°. Its formula is $C_6H_{14}O_6$. It does not undergo the vinous fermentation. (*Pharm. Journ. and Trans.*, July, 1872, p. 28.) It has been used in scurvy, and, in infusion, as a remedy in hemorrhoids and strangury. All parts of the tree are astringent, and may be employed in tanning, and dyeing black. W.

SORGHUM SACCHARATUM. *Sorghum. Chinese Sugar-cane.* This valuable plant, indigenous in India, China, and other parts of the East, has within a few years been introduced into Europe and the United States. It was not till 1851 that the seeds were first sent to France from China; and so late as 1855 only a few acres were cultivated. In 1854 some seeds were brought to the United States by Mr. D. Jay Browne, for the Patent Office, from France, and were distributed to different persons through the country. (*H. S. Olcott.*) The sorghum is now very largely cultivated in this country and in France, and there has probably been no instance in which a plant has more rapidly grown into general favour, as an object of agriculture, than this. Barth, in his Travels in Africa (Am. ed., ii. 339), states that it is extensively cultivated in the interior of that continent. It ranks botanically with the *Graminaceæ*, and belongs to Polygamia Monœcia in the Linnæan system. It is an annual plant, with a jointed stem from eight to fifteen feet or more in height, furnished with alternate, sheathing, ensiform leaves, two or three feet long by about two inches or more in breadth, and ending in a panicle of flowers arranged in spikelets, each composed of from three to five flowers, of which one only is fruitful. The glumes which envelop the fruit at maturity, are of a deep-brown colour, which is characteristic of the species. The seeds, which are about as large as millet seeds, are planted in the spring, in rows, like Indian corn, and the plant attains maturity in September or October. It is valued chiefly for the saccharine product of its stems, but other parts are also used. The seeds, though not fitted as food for man, answer well for poultry and domestic animals generally; the leaves, stripped from

the stem and dried, make an excellent winter fodder for cattle; and we have been informed that the stems, when deprived of their juice, are sold to the paper-makers. Prof. Hétet, of the Medical School of Toulon, has found in the glumes of the seeds two colouring principles, one *red*, only slightly soluble in water, but readily dissolved by alcohol, ether, and acid and alkaline solutions, the other *yellow*, very soluble in water and the other menstrua mentioned, both of which may be used in dyeing, and might be substituted for madder. (*Journ. de Pharm.*, Avril, 1859, p. 262.) The stem abounds in juice, which becomes more and more saccharine with the growth of the plant. The proportion of juice is 80 or 90 per cent., and of sugar on the average about 7, though it may reach 10 or 15 per cent. (Hétet, *Ibid.*, p. 258.) According to *M. Leplay*, who has been largely concerned in the manufacture of alcohol and sugar from the sorghum, the period at which the stem yields most sugar is when the seeds are quite ripe yet not hardened, and before the stem has lost its green colour. He also determined by his experiments that, though the juice before this period is less rich in proper sugar of cane or crystallizable sugar, which in solution turns the plane of polarization to the right, yet it contains uncrystallizable sugar capable of conversion into alcohol, and may be profitably employed for this purpose. M. Leplay thinks that the whole of the saccharine matter of the juice, when the seeds are perfectly ripe, is crystallizable, and exists in a proportion often exceeding 15 per cent. Another important fact stated by M. Leplay is, that the sorghum stalks, if carefully dried, lose none of their sugar, and may thus be advantageously carried from various points of production to central manufacturing establishments. (*Ibid.*, 3e sér., xxxiii., p. 342.) If these facts shall be found applicable to the sorghum as cultivated in this country, there is little doubt that the plant will some time be largely employed for the preparation of sugar, should the supply of that from the cane be from any cause insufficient to meet the demand. From experiments by Dr. C. M. Wetherill, the results of which are published in the official U. S. Patent Office Report for 1862 (p. 523), it appears that 17 different specimens of juice, from different parts of the U. States, yielded an average of 4·82 per cent. of crystallizable sugar, 6·46 per cent. of uncrystallizable sugar, and 11·25 per cent. of both kinds. But we are not informed at what period, precisely, in reference to the maturity of the seeds, the juice was expressed; so that there are no grounds of comparison with the results obtained by M. Leplay. At present the sorghum is used almost exclusively in the preparation of molasses, vast quantities of which are made in the United States, sufficient in many instances to meet the wants of the whole neighbourhood. The molasses is prepared by expressing the stems, between rollers, in a machine worked either by the hand, or by horse or steam power, and submitting the juice to ebullition, in order to concentrate it sufficiently, and at the same time coagulate any albuminous matters that may be contained in it. The addition of a little lime to the juice before boiling will prove useful, both by neutralizing acid, which would give a tendency to the saccharine matter to pass into glucose, and by combining with organic principles which interfere with clarification. From what has been above stated, it will be inferred that, when molasses merely is wanted, or when the object is to obtain alcohol or vinegar, it will not be necessary to wait till the seeds are perfectly ripe; and thus a late crop may be made useful, though insufficiently advanced to ripen before frost. For the manufacture of sugar, the stems should not be pressed until the maturity of the fruit.

Another plant, called *imphee* or *African sugar-cane*, has been cultivated to a considerable extent for the same purposes as the sorghum. It is a native of Africa, where it is said to be cultivated by the Kaffirs. Its botanical characters do not seem to be well determined, though it is considered by Mr. Leonard Wray as a Holcus, and specifically designated as *Holcus saccharatus.* (Olcott, *Sorgho and Imphee*, 6th ed., p. 201.) This, however, as defined by Linnæus, is considered by some botanists as a mere synonyme of *Sorghum saccharatum;* and it is highly probable that the two plants are mere varieties of the same species. The seeds of the imphee were brought to this country in 1856 or 1857, and first planted in South Carolina; but we have not learned how far its cultivation has extended, nor what relative proportion it bears to that of the Chinese plant. Still another variety of sorghum has recently been introduced from the islands of the South Pacific, under the name of *Otaheitan sugar-cane*, and cultivated to some extent in the West. It is distinguished by its long heads, from 7 to 12 inches in length, and from 1 to 2 in thickness. This variety, however, has not yet become generally diffused. (*Patent Office Report*, 1862, p. 515.)

Credit is due to Mr. J. S. Lovering, of Philadelphia, for first demonstrating, in this country, that sugar might be advantageously made from the Chinese sugar-cane; and his pamphlet on the subject will be found useful by those who may purpose to engage practically in its manufacture. W.

SPARTIUM JUNCEUM. *Spanish Broom.* A small shrub, indigenous in the South of Europe, and cultivated in our gardens as an ornamental plant. The flowers are large, yellow, and of an agreeable odour. The seeds are in moderate doses diuretic and tonic, in large doses emetic and cathartic, and have been used advantageously in dropsy. The dose is from ten to fifteen grains three times a day. They may also be given in tincture. W.

SPILANTHES OLERACEA. A plant of India, used as a masticatory for the relief of toothache. It contains some acrid principle, and when chewed produces a copious flow of saliva. (*Am. Journ. of Pharm.*, xliv. 323.) H. C. W.

SPONGE. *Spongia. Spongia officinalis.* U. S. 1850. This, being no longer recognised in the Pharmacopœias, is transferred to this place from *Part* I. The sponge is now generally admitted to be an animal. It is characterized as "a flexile, fixed, torpid, polymorphous animal, composed either of reticulate fibres, or masses of small spires interwoven together, and clothed with a gelatinous flesh, full of small mouths on its surface, by which it absorbs and ejects water." More than two hundred and fifty species have been described by naturalists, of which several are probably employed, though *Spongia officinalis* is the only one that has been designated in the Pharmacopœias. Sponges inhabit the bottom of the sea, where they are fixed to rocks or other solid bodies; and are most abundant within the tropics. They are collected chiefly in the Mediterranean and Red Seas, and in those of the East and West Indies. In the Grecian Archipelago many persons derive their support altogether from diving for sponges. When collected they are enveloped in a gelatinous coating, which forms part of the animal, and is separated by first rubbing them with fine sand (*Landerer*), and then washing them with water. Large quantities of the coarser kinds are imported from the Bahamas; but the finest and most esteemed are brought from the Mediterranean, especially from the coasts of Syria.

Sponge, as found in commerce, is in yellowish-brown masses of various shapes and sizes, light, porous, elastic, and composed of fine, flexible, tenacious fibres, interwoven in the form of cells and meshes. It usually contains numerous minute fragments of coral or stone, or small shells, from which it must be freed before it can be used for ordinary purposes. Sponge is prepared by macerating it for several days in cold water, beating it in order to break up the concretions which it contains, and dissolving what cannot thus be separated of the calcareous matter by muriatic acid diluted with thirty parts of water. By this process it is rendered perfectly soft, and fit for surgical use. It may be bleached by steeping it in water impregnated with sulphurous acid, or by exposure in a moist state to the action of chlorine. It is stated that sponges which have been soaked in pus and infectious matters will recover their primitive condition, even to the marine odour, by soaking in a 4 per cent. solution of permanganate of potassium, then in a 25 per cent. solution of sulphurous acid, and finally thorough washing in an abundance of water. (*Am. Journ. of Pharm.*, xliv. 355.) When intended for surgical purposes, the softest, finest, and most elastic sponges should be selected; for forming *burnt sponge*, the coarser will answer equally well. According to Mr. Hatchett, the chemical constituents of sponge are gelatin, coagulated albumen, common salt, and carbonate of calcium. Magnesia, silica, iron, sulphur, and phosphorus have been detected in it; as also have iodine and bromine, combined with sodium and potassium. From the experiments of Mr. Croockewit, it would appear that sponge is closely analogous to, if not identical with the fibroïn of Mulder, differing from it only in containing iodine, sulphur, and phosphorus. (*Annal. der Chem. und Pharm.*, xlviii. 43.) *Fibroïn* is an animal principle, found by Mulder in the interior of the fibres of silk.

Medical Properties and Uses. Sponge, in its unaltered state, is not employed as a medicine; but, in consequence of its softness, porosity, and property of imbibing liquids, it is very useful in surgical operations. From the same qualities it may be advantageously applied over certain ulcers, the irritating sanies from which it removes by absorption. Compressed upon a bleeding vessel, it is sometimes useful for promoting the coagulation of the blood, especially in hemorrhage from the nostrils. In the shape of *sponge tent* it is employed for dilating sinuses. This is prepared by dipping sponge into melted wax, compressing it between two flat surfaces till the wax hardens, and then cutting it into pieces of a proper form and size. By the heat of the body the wax becomes soft, and the sponge, expanding by the imbibition of moisture, gradually dilates the wound or sinus in which it may be placed. When a conical sponge tent of equable calibre is required, as for dilating the uterine cavity, a better plan is to cut the sponge into a conical shape whilst fresh and compress when moist, by winding it carefully with a fine, tightly-drawn cord, removing the cord when perfectly dry, and dipping the tent into melted wax, so as to get a thick coating. For other modes of preparing sponge tent, as well as of saturating the sponge at the same time with substances calculated to made a remedial impression, as carbolic acid, alum, acetate of lead, &c., see a paper by Dr. Geo. Syng Bryant, of Lexington, Ky., in the *Am. Journ. of Pharm.* (Oct. 1868, p. 410); and for a method of preparation by Dr. J. B. Hough, of Ridgeville, Ohio, see the same journal (Sep. 1869, p. 446; from the *Cincin. Lancet and Observer*, July, 1869). After having been partially charred by heat, sponge has long been used as a remedy in goitre. Its efficacy in this complaint, formerly considered doubtful by many physicians, has been generally admitted since the discovery of iodine.

SPONGIA USTA. *U. S.* 1850. *Burnt Sponge.* This was an officinal preparation of the U. S. Pharmacopœia. The following was the formula for its preparation. "Take of sponge *a convenient quantity*. Cut it into pieces, and beat it that any extraneous matter may be separated; then burn it in a close iron vessel until it becomes black and friable; lastly, rub it into very fine powder." *U. S.* The sponge is decomposed, the volatile

matters being driven off by the heat, and a black, friable coal remaining. Preuss found that, of 1000 parts of sponge submitted to calcination, 343·848 were dissipated; and the residue consisted of 327 parts of carbon and insoluble matters, 112·08 of chloride of sodium, 16·43 of sulphate of calcium, 21·422 of iodide of sodium, 7·57 of bromide of magnesium, 103·2 of carbonate of calcium, 35·0 of phosphate of calcium, 4·73 of magnesia, and 28·72 of protoxide of iron. (*Pharm. Cent. Blatt*, 1837, p. 169.) Herberger found in burnt sponge 1 per cent. of iodide of potassium, and 0·5 per cent. of bromide of potassium. (*Annal. der Pharm.*, xx. 204.) As the remediate value of burnt sponge depends chiefly upon the presence of iodine, it cannot be esteemed good unless it affords purple fumes when acted upon by sulphuric acid assisted by heat. It is said that the preparation is most efficient as a remedy, when the sponge is kept on the fire no longer than is necessary to render it friable. The powder is then of a much lighter colour. Guibourt recommends that the sponge selected for burning should be unwashed, of a strong odour, firm, and compact, that it should be put into a roaster like that used for coffee, and heated over a moderate fire till it becomes of a blackish-brown colour, that it should then be removed, powdered, and enclosed in a well-stopped glass bottle. It is best when recently prepared; as the iodine is dissipated by time, and the specimens, at first richest in this principle, contain little of it at the end of a year. (*Journ. de Chim. Méd.*, Dec. 1831.) According to Herberger, the fine and coarse sponges do not materially differ in the proportion of their organic constituents; so that the coarse may be selected for this operation. Burnt sponge has been highly recommended in goitre, glandular swellings of a scrofulous character, and obstinate cutaneous eruptions. It is most conveniently administered mixed with syrup or honey, in the form of an electuary, with the addition of some aromatic, as powdered cinnamon. The dose is from one to three drachms. W.

STAPHISAGRIA. *Stavesacre.* The seeds of *Delphinium Staphisagria.* This officinal of the London and Edinburgh Pharmacopœias has been discarded in the British. For the characters of the genus Delphinium, the reader is referred to *Delphinium Consolida*, in *Part* I. *Delphinium Staphisagria*, or stavesacre, is a handsome annual or biennial plant, one or two feet high, with a simple, erect, downy stem, and palmate, five or seven-lobed leaves, supported on hairy footstalks. The flowers are bluish or purple, in terminal racemes, with pedicels twice as long as the flower, and bracteoles inserted at the base of the pedicel. The nectary is four-leaved and shorter than the petals, which are five in number, the uppermost projected backward so as to form a spur, which encloses two spurs of the upper leaflets of the nectary. The seeds are contained in straight, oblong capsules. The plant is a native of the South of Europe. Stavesacre seeds are about as large as a grain of wheat, irregularly triangular, wrinkled, externally brown, internally whitish and oily. They have a slight but disagreeable odour, and an extremely acrid, bitter, hot, nauseous taste. Their virtues are extracted by water and alcohol. Analyzed by MM. Lassaigne and Feneulle, they yielded a brown and a yellow bitter principle, a volatile oil, a fixed oil, albumen, an azotized substance, a mucilaginous saccharine matter, mineral salts, and a peculiar organic alkali called *delphine* or *delphinia*, which exists in the seeds combined with an excess of malic acid. It is white, pulverulent, inodorous, of a bitter acrid taste, fusible at 150° and becoming hard and brittle upon cooling, volatilizable at 300° (*Guy*), slightly soluble in cold water, very soluble in alcohol and ether, and capable of forming salts with the acids. It is obtained by boiling a decoction of the seeds with magnesia, collecting the precipitate, and treating it with alcohol, which dissolves the *delphinia*, and yields it upon evaporation. According to M. Couerbe, it is impure as thus obtained, consisting of three distinct principles; one of a resinous nature, separated from its solution in diluted sulphuric acid by the addition of nitric acid; another distinguished by its insolubility in ether, and named by M. Couerbe *staphisain;* and the third soluble both in alcohol and ether, and considered as pure delphinia. (*Journ. de Pharm.*, xix. 519.)

Medical Properties and Uses. The seeds were formerly used as an emetic and cathartic, but have been abandoned in consequence of their violence. Powdered and mixed with lard, they are employed in some cutaneous diseases, and to destroy lice in the hair. An infusion in vinegar has been applied to the same purpose. A preparation made by mixing three parts of the seeds in fine powder with five parts of lard, and maintaining the mixture at the temperature of 212° for twenty-four hours, is recommended by Dr. Bourguignon as very efficacious in the itch. (*Journ. de Pharm.*, 3e sér., xviii. 421.) M. Bazin has obtained good effects from the external and internal use of stavesacre in eczema. He gave the extract in the dose of a grain and a half from four to twelve times a day. (*Ann. de Thérap.*, 1851, p. 18.) Mr. B. Squire, believing that prurigo senilis is essentially the result of the presence of the *pediculus corporis*, is in the habit of treating the affection with an ointment made by incorporating a little wax with the oily matter extracted from stavesacre by ether, which amounts to about one-half of the seeds by weight, and contains all their virtues. In the most obstinate cases, this ointment effectually cures the disease, generally in less than a week. (*Pharm. Journ.*, 2d ser., vi. 405.) A strong tincture has been employed as an embrocation in rheumatism. In some countries the seeds are used to intoxicate fish in the same manner as Cocculus Indicus.

Delphinia is highly poisonous, exerting its effects chiefly on the nervous system. Experiments made by Drs. Falck and Rörig on the lower animals show that, introduced into the rectum, the cellular tissue, or the veins, it produces death by asphyxia, preceded by symptoms of local irritation, convulsive movements, and extreme anæsthesia, without apparent disturbance of the cerebral functions until the moment before death. Introduced into the stomach, it caused salivation, vomiting, and diarrhœa, without other signs of absorption. (*Arch. Gén.*, 4e sér., xxx. 482.) Similar results were subsequently obtained by Dr. Van Praag, who found also that the nerves of motion were paralyzed as well as those of sensation. After death, congestion of the cerebral membranes, heart, great veins, and liver was observed. Dr. Turnbull, in his work "*On the Medical Properties of the Ranunculaceæ*," states that pure delphinia may be given to the extent of three or four grains a day, in doses of half a grain each, without exciting vomiting, and without producing much intestinal irritation, though it sometimes purges. In most instances it proves diuretic, and gives rise to sensations of heat and tingling in various parts of the body. Externally, it acts like veratria; but, according to Dr. Turnbull, produces more redness and burning, and less tingling than that substance. He has employed it in neuralgia, rheumatism, and paralysis. It may be applied by friction, in the form of ointment or alcoholic solution, in proportions varying from ten to thirty grains of the alkaloid to an ounce of the vehicle; and the friction should be continued till a pungent sensation is produced. W.

STERCULIA ACUMINATA. *Cola acuminata.* Daniell. This is a large African tree, known as the source of the *kola nuts* of Guinea. In the twelfth edition of the Dispensatory we announced that Dr. Daniell had just discovered in these nuts a crystallizable alkaloid, which he believed to be *thein*, or as it is now generally called *caffein*. He was induced to make the examination by noticing that, after taking a decoction of the seeds, he was affected with long-continued loss of sleep. Since that time, we have had a more particular account of the nuts from Dr. Daniell, and a detailed analysis by Dr. J. Attfield, which fully confirm the conjecture as to the existence of thein in them. They are extensively used and highly valued throughout a large part of Africa, being chewed for their agreeable effects on the system, and the remarkable property of causing wakefulness. The possession of this property is explained by the presence of caffein in the seeds; and thus another is added to the list of vegetable products, which, having been employed by the natives of the country where they grow, as an agreeable stimulant to the nervous system, have been found to contain caffein. (*Pharm. Journ.*, March, 1865, 2d ser., vi. 450.) Dr. Attfield found in 100 parts of the seeds 13·65 of water, 20·00 of cellulose and colouring matter, 41·50 of starch, 1·52 of volatile and fixed oil, 6·33 of an albuminoid substance, 10·67 of gum, sugar, and other organic matter, and 2·13 of thein (caffein); and obtained 2·13 per cent. of ashes. The nuts contain no tannin, and in this respect differ from coffee, which they otherwise resemble. Dr. Attfield separated the caffein by precipitating a decoction with subacetate of lead, removing the excess of lead by sulphuretted hydrogen, and allowing the clear solution to evaporate to dryness. The residue was treated with hot alcohol, and the alcoholic solution evaporated to a small bulk. On cooling, this solidified into a crystalline mass, which was found to have all the properties of caffein. The kola nut is described as roundish, compressed, resembling the European chestnut, and of a bitter taste. Dr. Daniell informs us that it is used by the white inhabitants on the gold coast with apparent benefit in diarrhœa. (*Am. Journ. of Pharm.*, May, 1865, p. 205; from *Chem. News*, Feb. 17, 1865.) W.

STILLINGIA SEBIFERA. *Tallow-tree.* This is a species of the family Euphorbiaceæ, cultivated in the Chinese Provinces of Kiang-se, Kiang-wau, and Chih-kiang for the sake of the fatty matters extracted from the nuts by methods detailed in the *American Journal of Pharm.*, 1872, p. 264. (See also *Pharm. Journal*, June, 1872.) The "tallow" occurs in hard, brittle, opaque, white, tasteless, and odourless masses of about 80 pounds weight. It is said to be nearly pure stearine. The oil is largely used for lighting purposes. The remnants of the nut are used as fuel and as manure. H. C. W.

STROPHANUS HISPIDUS. This is a tree of Gabon, belonging to the Apocyneæ, whose seeds yield a cardiac poison, *Inæa*. (*Lancet*, Dec. 1872, p. 827.) H. C. W.

STRYCHNOS POTATORUM. *Chilbinj. Clearing Nuts.* The nuts of this species of strychnos are very largely used in some parts of India for clearing muddy water, and are stated to have found their way into American commerce. (*Am. Journ. of Pharm.*, 1871.) The fruit is also employed by the native practitioners of Hindostan, under the name of *nirmali*, as an emetic and in dysentery. In clearing water, one of the dried nuts is rubbed hard for a short time around the inside of the earthen water-pot; on settling, the water is left pure and tasteless. The seeds contain a large quantity of an albuminous principle, upon which their virtues probably depend. The tree, which grows to a very large size, produces a shining, black, one-seeded berry (that of the nux vomica being many-seeded). The seeds are described (*Pharm. Journ. and Trans.*, July, 1871, p. 44) as broadly lenticular, about half an inch in diameter and a quarter of an inch in thickness, of a dirty whitish-gray colour, and covered with a thick coating of delicate ap-

pressed hairs. These are so small that the seed to the naked eye looks mealy. Under the microscope the hairs are seen to be agglutinated in bundles of from 3 to 6, and to consist of a single pointed cylindrical cell. H. C. W.

SUCCINIC ACID. *Acidum Succinicum.* This acid is obtained by distilling amber. (See *Succinum.*) The product is an aqueous solution of impure succinic acid, associated with empyreumatic oil. (See *Oleum Succini.*) By filtering the liquor the solution of the impure acid passes through, while the oil is absorbed by the paper. The acid may be purified by boiling the solution with nitric acid, diluted with twice its bulk of water, and then evaporating to crystallize. Should the crystals not be colourless, the treatment with nitric acid must be repeated until they are so. Succinic acid is formed artificially by the action of nitric acid on the fatty acids, and under various other circumstances. M. Desaignes obtained it from malate of calcium, subjected to fermentation excited by casein. The malate was converted into succinate of calcium, which was then decomposed by sulphuric acid, so as to yield succinic acid. For the details of the process for obtaining succinic acid from malate of calcium, see the paper of E. J. Kohl, in the *American Journal of Pharmacy* for July, 1856. Succinic acid, when pure, is a white, transparent solid, crystallizing in prisms, and having a somewhat acrid taste. It dissolves in five times its weight of cold, and twice its weight of boiling water. It is soluble also in alcohol, but very sparingly so in ether. Nitric acid is without action on it. It melts at 365°, and boils without alteration at 473°. It sublimes, however, at a much lower temperature. According to Wackenroder, it is sometimes adulterated with tartaric acid, soaked in oil of amber. Crystallized from its solution in water, its formula is $C_4H_2O_3 + HO$. The sublimed acid has the formula $2C_4H_2O_3 + HO$. Some chemists double the equivalent of this acid, and make its formula $C_8H_4O_6$.

Succinic acid, though formerly officinal, is at present seldom used in medicine. It has been ascertained to be a product of vital action, having been detected by M. Heintz in the colourless liquid found in hydatid cysts of the liver. (See *Journ. de Pharm.*, Sept. 1850.) One of its salts, *succinate of ammonium*, has been used with great alleged success in delirium tremens. This salt is occasionally used as a precipitant of sesquioxide of iron. B.

SULPHATE OF ALUMINIUM AND IRON. This double salt was brought forward by Sir James Murray, of Dublin, as an astringent, styptic, and vermifuge. His method of preparing it is not very clearly expressed; but it may be presumed to be formed by dissolving alumina and carbonate of iron, both recently precipitated, in sulphuric acid, and duly evaporating the solution. Sir James recommends it in chronic dysentery, diarrhœa, fluor albus, and the colliquative sweats and diarrhœa which attend hectic fever and consumption. Externally he found it a powerful styptic, useful as a gargle in relaxation of the tonsils and uvula, and in salivation, as an injection in hemorrhages, and as a wash for foul and flabby ulcers. The dose for internal exhibition is from five to ten grains, dissolved in some aromatic water. This salt probably consists of tersulphate of aluminium, combined with tersulphate of sesquioxide of iron. It is, therefore, not an alum. B.

SULPHATE OF BARIUM. Barytæ Sulphas. *Ed.*, *Dub.* Having been omitted in the British Pharmacopœia, this salt is no longer officinal; but from its former position, requires a brief notice here. The native sulphate of barium is used in pharmacy with the same view as the native carbonate; namely, to obtain chloride of barium. The U. S. Pharmacopœia directs for this purpose the carbonate of barium; but the Ed. and Dub. Colleges gave a separate formula for the use of either the carbonate or sulphate, at the option of the operator. (See *Barii Chloridum.*) Sulphate of barium is a heavy, lamellar, brittle mineral, varying in sp. gr. from 4·4 to 4·6. It is generally translucent, but sometimes transparent or opaque, and its usual colour is white or flesh-red. When crystallized, it is usually in very flat rhombic prisms. Before the blowpipe it strongly decrepitates, and melts into a white enamel, which, in the course of ten or twelve hours, falls to powder. It is thus partially converted into sulphuret of barium, and, if applied to the tongue, will give a taste like that of putrid eggs, from the formation of sulphuretted hydrogen. It consists of one eq. of acid 40, and one of baryta 76·7 = 116·7. This salt, on account of its great insolubility, is not poisonous. It is, however, soluble in a great excess of dilute hydrochloric acid. (*Chem. News*, Aug. 1871, p. 69.) Ground to fine powder it is sometimes mixed with white lead, but impairs the quality of that pigment. The artificial sulphate of barium, under the name of *permanent white* or *blanc-fix*, is much used in the arts as a water-colour. It is made from both the native sulphate and carbonate. It forms a dazzling white colour, unalterable by light, heat, air, or sulphuretted hydrogen. It is used by the manufacturers of paper hangings, and for mixing with other colours, the tone of which it does not impair. B.

SULPHATE OF CALCIUM. Calcii Sulphas. *Gypsum. Plaster of Paris.* We notice this salt simply to state that it has recently been introduced into the practice of surgery as a dressing for fractured limbs, &c. Its origin, general chemical properties, and uses in the arts are too well known to every chemical student to require exposition here. There are, however, one or two properties which demand notice, as it is upon

them that it depends for its adaptation to the surgical use made of it. In the first place, it is so slightly soluble in water, that it may be considered for ordinary purposes insoluble. According to Bucholz, it is soluble in 460 parts of water cold or hot, according to Giese, in 380 parts of cold and 388 of boiling water. Notwithstanding the statement of Bucholz, the fact has been well established, that its solubility varies with the temperature, but, like that of sulphate of sodium, very unequally. Thus, according to M. Poggiale, it is greatest at 35° C. (95° F.), and above or below that temperature, gradually diminishes, so that at 100° C. (212° F.), or the boiling point of water, it is very nearly the same as at 5° (41° F.), not far from the freezing point. (*Journ. de Pharm.*, 4e sér., v. 86.) The other point is that, when deprived of its water by heat, and reduced to the state of a white powder, it rapidly absorbs water added to it, and, from the state of semi-liquid paste into which it is brought with that fluid, quickly hardens without change of bulk. It is this property which fits plaster of Paris so well for all kinds of moulding; and to this also it owes its peculiar adaptability to the purpose of a splint. To prepare it for use, the gypsum must first be deprived of the greater part of its water by exposure to a heat of 212° or from that to 250°. One eq. of gypsum contains naturally 2 eqs. of water. Of these at the above temperature it loses one and a half eqs., and what remains, therefore, contains half an eq., with the formula $CaO,SO_3+\frac{1}{2}HO$. Thus dehydrated, it is reduced to fine powder, and kept in air-tight vessels for use. As thus prepared, if mixed with two parts of water, it forms a semi-liquid cream-like mass, which becomes solid and hard in 15 or 20 minutes; the temperature rising during the process, as in the slaking of lime. According to Mr. T. E. Stark, a medical officer in the British army, flannel is the best material for bandages to be used with gypsum. It should be cut into strips an inch and a half broad and two or three yards long, which should first be spread on a table and rubbed well with the powdered gypsum on both sides and always in the direction of the thread. The bandages should then be rolled up loosely, and kept for use in air-tight cases. Thus applied, the bandages, first thoroughly wetted, should be rolled round the limb, overlapping at the edges, so as to make a uniform covering. After application, it should be left to harden, which generally happens in 15 or 20 minutes. For further particulars on this subject, the reader is referred to a paper by Mr. Stark, in the *Medical Times and Gazette* (March, 1865, p. 222), also *Medical Record* (Nov. 1, 1873). A simpler method of using the gypsum for this purpose is, after the application of the bandages, to paint the whole thoroughly and carefully with the milk of gypsum, which will solidify, and enclose the part in a firm case. W.

SULPHATE OF NICKEL. *Niccoli Sulphas.* This salt is formed by dissolving carbonate of nickel in dilute sulphuric acid, concentrating the solution, and setting it aside to crystallize. The carbonate is procured by dissolving the impure arseniuret of nickel, sold under the name of *speiss*, coarsely powdered and mixed with half its weight of iron filings, in nitromuriatic acid. The solution is evaporated to dryness, and the residue treated with water, which takes up the impure chloride of nickel, and leaves the arsenic in the form of the insoluble arseniate of iron. The liquid is then acidulated with muriatic acid, treated with sulphuretted hydrogen in excess, which precipitates the copper, and, after filtration, boiled with a little nitric acid to sesquioxidize any remaining iron. The cold liquid, largely diluted with water, is next treated with a solution of bicarbonate of sodium, gradually added, which throws down the iron in the state of sesquioxide. Lastly, the filtered solution, containing the chloride of nickel nearly pure, is boiled with carbonate of sodium, which, by double decomposition, throws down a pale-green precipitate of carbonate of nickel. Sulphate of nickel is in the form of emerald green crystals, efflorescent in the air, soluble in three parts of cold water, but insoluble in alcohol and ether. It has a sweet, astringent taste. When crystallized in rhombic prisms, it consists of one eq. of sulphuric acid 40, one of protoxide of nickel 37·5, and seven of water $63=140{\cdot}5$ (NiO,SO_3+7HO).

Prof. Simpson, of Edinburgh, has made some therapeutic trials with this salt, and found it to act as a gentle tonic, like the preparations of iron and quinia, yet somewhat differently. He used it successfully in a case of severe and obstinate periodic headache. The dose is from half a grain to a grain three times a day, given in the form of pill, or of simple solution. In large doses it is liable to produce nausea and vomiting, especially on an empty stomach. (See *Braithwaite's Retrospect*, xxvii. 446.) Dr. J. D. Palmer, of Monticello, Florida, considers sulphate of nickel as a sedative; having employed it in a variety of painful affections, and also simply as a soporific in cases which did not admit the use of opium, and in every instance with the desired result. (*Am. Journ. of Pharm.*, Nov. 1868, p. 516.) B.

SULPHITES, BISULPHITES, HYPOSULPHITES. These salts have, at a comparatively recent date, been introduced into medicine, in reference to their extraordinary hostility, through their acid ingredient, to the lower forms whether of vegetable or animal life. Microscopic plants and animals cannot exist in the presence of sulphurous or hyposulphurous acid; and, as their salts are easily decomposed, with the liberation of the acid, they are capable of exercising the same destructive influence. As it is now generally admitted that a number of our external complaints are caused by these microscopic

organisms, the local use of these remedies is often indicated, and, in fact, has been found by experience to be very efficient. Examples of affections of this kind we have in scabies, porrigo, prurigo senilis, different forms of ringworm, pityriasis versicolor, the sore-mouth or thrush of infants, &c.; and in all these complaints benefit may be expected from the local application of these remedies. In cases of fermentative dyspepsia the sulphites may be of value in checking the changes of the food. But a much more extensive use of them has been suggested by a prevalent opinion, first, that the various fermentations have their origin in these invisible organic beings, and, secondly, that a wide circle of diseases, all those, in fact, to which the term zymotic has been applied, are nothing more than the results of different forms of fermentation going on in the human system; such, for example, as cholera, miasmatic fevers, yellow fever, typhus and typhoid fevers, diphtheria, and all the contagious febrile complaints. In these diseases the salts here considered have been prescribed to a considerable extent, and many favourable reports have been made of their effects; but the theory on which their employment is based is by no means established, and clinical experience has failed to demonstrate their utility.

Of the *sulphites*, those which have been employed are the *sulphites of sodium*, *potassium*, *ammonium*, *magnesium*, and *calcium*. The *sulphites of sodium* and *potassium* are officinal, having been recognised by the U. S. Pharmacopœia, and will be found treated of in the first part of the Dispensatory (*pages* 747 and 864). The *sulphite of ammonium* may be prepared in the same way; that is, by passing sulphurous acid through a solution of the alkaline carbonate. When the carbonate is insoluble, as in the case of magnesia and lime, it is better to have recourse to the method of double decomposition; but the sulphite of calcium may be prepared by using lime-water for the action of the sulphurous acid.

Sulphite of magnesium may be most conveniently prepared by mixing concentrated warm solutions of sulphite of sodium and sulphate of magnesium. The sulphite of magnesium being the least soluble salt that can be formed by an interchange of principles, will be deposited as a crystalline mass, which must be expressed and dried. (J. C. Sticht, *Am. Journ of Pharm.*, Jan. 1868; from *Wittst. Viertelj.* 1867.) Mr. J. P. Remington gives the following method, in which the constituents of the salt are made to act directly on each other. Eight avoirdupois ounces of the best magnesia are thoroughly mixed with a pint of distilled water, and to the mixture the aqueous sulphurous acid of the U. S. Pharmacopœia (sp. gr. 1·035) is added by degrees, with stirring, until the liquid gives a slight acid reaction. The crystals which form are allowed to subside, and, the clear liquid having been decanted, are drained on a muslin strainer, washed with distilled water until free from impurities, and then again drained, and dried on bibulous paper. The product will be about one pound eight ounces of crystals.

In all instances, in the preparation of the sulphites, where evaporation is employed, it should be carefully conducted so as not to drive off the acid, and with as little exposure to the air as possible; as the sulphites in solution are strongly disposed to absorb oxygen, and pass into the state of sulphates. Even in the solid state they slowly undergo the same change, and should therefore be kept, as far as can be conveniently done, excluded from the air.

The sulphites in general have a mild sulphurous taste, and on exposure to heat, or with the addition of an acid, emit the characteristic odour of sulphurous acid. They are distinguishable from the *hyposulphites* by not depositing sulphur on the addition of dilute sulphuric acid to their solution. As the efficiency of the sulphites is ascribable to their acid, they may be used indiscriminately, one being preferred to another according to solubility, or other property affecting the convenience of exhibition. In reference to the individual sulphites it will be necessary to say but little.

Sulphites of sodium and *potassium* have been fully described, and the remarks in reference to their therapeutical application may be considered as applicable to the others. (See *pages* 747 and 864.)

Sulphite of ammonium has an acrid sulphurous taste, at first deliquesces in the air, and afterwards dries, having been converted into the sulphate by the absorption of oxygen. It is soluble in its weight of cold, and in less than its weight of boiling water. It decrepitates with heat, losing a part of its ammonia, and then sublimes as a supersulphite.

Sulphite of calcium is a white powder, and distinguished by its difficult solubility, requiring 800 parts of water for solution. An excess of acid renders it more soluble; and from its hot saturated solution it is deposited, on the cooling of the liquid, in hexagonal needles.

Sulphite of magnesium, as ordinarily prepared, by double decomposition between a soluble sulphite and a soluble salt of magnesia, is in the form of a white powder, of a stale, earthy taste, with a sulphurous after-taste, less disagreeable than the more soluble salts, and, therefore, sometimes preferred in therapeutics. It is but slightly soluble in water; but is more soluble in liquid sulphurous acid, which, on evaporation, yields transparent crystals. These dissolve in 20 parts of cold water, and effloresce on exposure. When strongly heated in a close vessel, the salt gives up its acid; and magnesia only remains.

The influence of these salts on the system in health is feeble. So far as observation

has hitherto gone, they are quite destitute of poisonous properties. Six drachms have been taken in 24 hours, without any injury whatever. When taken internally, they are absorbed, and partly eliminated unchanged with the urine, partly changed by the absorption of oxygen into sulphates, as happens on exposure out of the body. This is proved by an examination of the urine, which will at first be found to contain a sulphite, and after 24 hours a sulphate. From the largest doses of the sulphites only a laxative operation on the bowels, and an increased secretion of urine, are obtained. For their use in medicine they are solely indebted to the destructive influence they exert over all the lower forms of animal and vegetable life. In reference to this influence they are used both internally and externally; the sulphite of magnesium being usually preferred for the former purpose, the sulphite of sodium for the latter. Besides what has been said in this work of their special therapeutic application, the reader is referred, for a full account, to the work of Dr. Geo. B. Wood on Therapeutics and Pharmacology (3d ed., vol. ii. p. 947). Their long-continued use is said to prove injurious, by inducing debility and anæmia. From fifteen grains to a drachm may be given, so repeated as to amount to from two drachms to an ounce in 24 hours. They may be administered in solution, or, in the case of the sulphite of magnesium, suspended in water, to which sugar and an aromatic tincture may be added. As almost all acids decompose the sulphites, they should not be administered with any acid substance, and no acid should be allowed to exist in the stomach at the time. Should the bowels be disturbed, a little of some opiate may be given. For external use, one part of the salt employed may be dissolved in from five to ten parts of water.

Bisulphites. These are quite as efficient as the sulphites, probably more so, in consequence of their greater proportion of acid. They might be and probably are used indiscriminately with the sulphites; as, in the preparation of the latter by the direct union of their constituents, the sulphurous acid may readily be, and often no doubt is used, in excess, and thus gives rise to the formation of the bisulphite. Indeed, Berzelius states that the salt, formed by passing sulphurous acid through a solution of carbonate of sodium until the liquid shall sensibly redden litmus-paper, is really the bisulphite of sodium; and that the sulphite may be prepared by adding to this salt a quantity of soda equal to that already contained in it. The bisulphites generally may be prepared by passing sulphurous acid in excess through the alkaline solution, or through the solution of a sulphite already formed. (See also *Pharm. Journ. and Trans.*, April, 1872, p. 844.) They may be distinguished from the sulphites by being quite neutral to test-paper, while the latter salts have a feeble alkaline reaction. They may be given for the same purposes, and in the same dose and method of administration as the sulphites.

The *bisulphite of calcium* has recently assumed a somewhat distinguished position, in consequence of the claims urged in its favour by Mr. W. Lascelles Scott, as an important pharmaceutical agent. In a communication made by him to the "*British Pharmaceutical Conference*," he states, as the result of his experiments, that bisulphite of calcium is entirely preservative of oleaginous or fatty substances against spontaneous change; several preparations of this kind having been kept absolutely fresh and sweet by the presence of a little of this salt, for a period of six or seven months, while the same preparations, under otherwise precisely the same circumstances, were quite spoiled. For ointments he has found that a fluidrachm of a strong (probably saturated) solution of this salt is sufficient for their preservation, while it is compatible chemically with the great majority of unctuous matters with which it may be thus associated. Beef tea for use in hospitals may be preserved from injurious change by a few drops of the solution added to each pint; and the same may be said of jellies and other liquid food prepared for use in the sick-chamber. Cloths soaked in the solution, and hung up in a chamber, act as a most efficient disinfectant, while they are free from the unpleasant smell of carbolic acid, or the irritating vapours as well as the offensive odours from the chloride of lime. Mr. Scott has also employed the solution successfully for the preservation of anatomical preparations, and others of an organic nature; being preferable to other agents used for the purpose by exercising no injurious influence whatever on the preparation, and by the entire absence of the poisonous properties of some of these agents, as the mercurials and arsenicals. (*Pharm. Journ.*, Oct. 1867, p. 189.)

Hyposulphites. These may be considered as absolutely identical for therapeutic purposes with the sulphites; as, when they undergo decomposition, it is sulphurous acid which is eliminated. The hyposulphites consist of bases and an acid supposed to consist of two eqs. of sulphur and two of oxygen (S_2O_2), and denominated *hyposulphurous acid*, which, however, exists only in composition, being resolved into sulphurous acid (SO_2) and sulphur when separated. They are prepared by boiling a sulphite or bisulphite in solution with sulphur. If a sulphite is used, the sulphurous acid takes an additional eq. of sulphur, becoming S_2O_2; if a bisulphite, one eq. of sulphurous acid escapes, and the other takes an eq. of sulphur; in either case, the resulting acid remaining combined with the base. The chief advantage possessed by the hyposulphites is that they are less disposed than the sulphites to change into sulphates by the absorption of oxygen. They may be recognised by the deposition of sulphur when an acid is added to their solution. They are freely soluble in water, even the hyposulphites of calcium and of magnesium.

They may be used for the same purposes and in the same doses as the sulphites, and administered in the same way. W.

SULPHOCARBOLATES. This is a class of salts just introduced into use, as a convenient means of obtaining the effects of carbolic acid in the treatment of diseases supposed to have a parasitic origin, as cholera and the so-called zymotic diseases generally. The sulphocarbolates may be readily prepared by heating together pure carbolic and sulphuric acids, diluting the mixture with water, and saturating with the base. Upon evaporation, the sulphocarbolate separates in crystals. A single formula will be sufficient as a guide for all that may be wanted.

Sulphocarbolate of sodium is prepared by mixing two measures of pure carbolic acid with one of officinal sulphuric acid in a glass flask; heating the mixture to 280° or 290° F., maintaining the temperature from five to ten minutes; adding, after the liquid has cooled, six or eight measures of water, and carefully neutralizing with carbonate of sodium. The solution is then sufficiently evaporated, and set aside to crystallize. The salt is deposited in rhombic prisms, which, when well drained on white filtering paper, and dried by exposure to the air, are pure and colourless.

Sulphocarbolate of magnesium is obtained precisely in the same way, neutralizing with the carbonate of magnesium. This is deposited in white needle-shaped crystals.

Sulphocarbolate of ammonium, prepared in like manner with the substitution of carbonate of ammonium, crystallizes in scales.

Sulphocarbolate of zinc is also formed in the same way, oxide of zinc, added in excess, being the neutralizing agent. This crystallizes in brilliant right rhombic plates, which, also, are colourless when well drained and dried in the air. (See *Am. Journ. of Pharm.*, 1870, p. 209, 1871, p. 265; also *Pharm. Journ. and Trans.*, April, 1871, p. 845.)

All these salts are soluble in water and alcohol. Their solutions are not precipitated by chloride of barium, showing that the sulphuric acid is in some peculiar mode of combination; but, if boiled for several minutes with concentrated nitric acid, they are decomposed; the carbolic acid being converted into picric acid, and deposited on dilution with two measures of water; and the sulphuric acid then giving the ordinary evidence of its presence on the application of the test. Sulphocarbolic acid may be obtained separate in slender needle-shaped crystals. It is analogous to sulphovinic acid, having the formula $C_{12}H_5+2SO_3HO$.

Mr. John Wood has used the sulphocarbolate of zinc, in King's College Hospital, as a dressing for wounds and ulcers, and an injection in gonorrhœa, and, generally, has found it very serviceable in all cases to which carbolic acid is applicable. The strength of the solution employed by Mr. Wood was from three to six grains of the salt to a fluid-ounce of water. (*Pharm. Journ.*, Jan. 1869, p. 428.) W.

SULPHOCYANIDE OF POTASSIUM. *Potassii Sulphocyanidum.* This salt is prepared by fusing in an iron vessel, at a *low* red heat, a mixture of two parts of dried ferrocyanide of potassium, and one part of flowers of sulphur. The mass, when cold, is dissolved in boiling water; and, to decompose some sulphocyanide of iron, the solution is treated with carbonate of potassium, which throws down the iron as a carbonate, and gives rise to the formation of a fresh portion of sulphocyanide of potassium. The whole is then boiled for a quarter of an hour, filtered to separate the precipitated iron, and evaporated that crystals may form. These are purified from carbonate of potassium by being dissolved in alcohol, which takes up the sulphocyanide and leaves the carbonate. The alcoholic solution is then allowed to crystallize. Sulphocyanide of potassium is in long, striated, anhydrous prisms, deliquescent in a moist atmosphere, very soluble in alcohol, and having a cooling, somewhat biting taste. It has been proposed as a medicine by Sömmering, as a substitute for hydrocyanic acid and cyanide of potassium, on the ground that it possesses the same therapeutic properties, without their inconveniences. B.

SULPHOVINATE OF SODIUM. This salt occurs as a white granular powder or in hexagonal tabular crystals, according to the method of its preparation. Its taste is cooling and rather aromatic, nearly destitute of bitterness. It is very deliquescent, and is soluble in 0·7 parts of water.

When sulphuric acid is added to alcohol the temperature rises at once, and a certain proportion of sulphovinic acid is formed, but as water is at the same time developed, the reaction is soon arrested by the dilution of the mass. The first practical method of overcoming the difficulty was afforded by the process of Limousin. Two pounds 3·5 ounces (avoirdupois) each of pure sulphuric acid, sp. gr. 1·715, and of concentrated alcohol, about 96°, are slowly introduced by means of two funnels (one for the alcohol and the other for the acid) into a third funnel arranged in a flask plunged into a freezing mixture or kept in a current of cold water, the flow of the two liquids into the flask being so regulated as to keep the alcohol in excess. The mixture is kept for four or five days at a temperature of 68° to 77° F., then diluted with 9 to 10 pints of distilled water, and carefully saturated with somewhat less than forty-eight ounces of pure carbonate of barium in solution. When the point of saturation has been attained, the liquid is left to deposit the sulphate of barium, and afterwards filtered. The solution of sulphovinate of barium so obtained is saturated with between 27 and 29 ounces of pure carbonate of sodium dis-

solved in four litres of distilled water. When no more precipitate is formed by the addition of the alkaline solution, and the liquid is neutral to test paper, the transformation of the sulphovinate of barium into sulphovinate of sodium is complete. The liquor, decanted and filtered, is evaporated in a water bath to about sp. gr. 1·33 and left to crystallize. The crystals, after draining, are dried in a stove.

Recently various other processes have been proposed. T. L. Phipson (*Chemical News*, Nov. 1874, p. 221, also *Am. Journ. of Pharm.* xlvii.) mixes small quantities of concentrated sulphuric acid and alcohol; keeps for 8 to 10 hours at a temperature of 100°; cools; adds drop by drop to about 20 times its volume of cold distilled water, cooling at times; adds chalk to this solution until effervescence ceases; filters, heats the filtrate with a little carbonate of calcium for about half an hour; filters while warm, and evaporates at a heat not exceeding 100° till a permanent saline crust forms on the surface, and sets aside to crystallize. The sulphovinate of calcium thus formed is in large brilliant plates, readily converted into a corresponding salt of sodium. M. Dubois modifies (*Journ. de Pharm.*, Janv. 1875, p. 44) the method of Limousin by saturating the first mixture, containing sulphovinic acid, with a concentrated solution of caustic soda in strong alcohol, keeping the mixture constantly cold, and adding the alkaline mixture by small portions. The filtered liquid is evaporated as in the method of Phipson, or preferably, Dubois precipitates the mixture, diluted with strong alcohol, with carbonate of sodium. Limousin's process, as thus modified, appears to be preferable to that of Mr. Chas. Rice, detailed in the *American Journal of Pharmacy*, 1873, p. 60. Sulphovinate of sodium is said to be a mild although active cathartic. According to Dr. Rabuteau, five drachms of it dissolved in three glasses of water will generally produce in the adult four or five liquid stools without pain. The dose for children is from two to three drachms. The pleasantness of its taste and action would render it a favourite purgative were it not for its dearness and the difficulty of preserving it, all of the sulphovinates having a great tendency on exposure to the air to break up into alcohol and a salt of sulphuric acid. H. C. W.

SULPHURET OF CALCIUM. *Calcii Sulphuretum. Hydrosulphate of Lime.* This compound is formed by passing sulphuretted hydrogen, so long as it is absorbed, through water holding lime in suspension. It is in the form of a paste of a greenish-gray colour, and exhaling a strong odour of sulphuretted hydrogen. It is used as a *depilatory*, and is applied in a layer on the part which is to be deprived of hair. At the end of fifteen minutes it is removed with a wet sponge, which at the same time detaches the hairs. On account of this preparation giving out sulphuretted hydrogen, it must not be applied near the mouth or nose. An impure aqueous solution of sulphuret of calcium, necessarily containing hyposulphite of calcium from the manner of its preparation, is used with great success, in Belgium, in itch, the cure of which it effects in a few hours. It is made by boiling together one part of sublimed sulphur, two of lime, and ten of water. The liquid is allowed to cool, and the clear part poured off, and kept in well-stopped bottles. For an explanation of the reaction which takes place, see *Sulphur Præcipitatum*. The patient, after having been well washed with soap and tepid water in a bath, is rubbed over with the liquid, which is allowed to dry on the skin for a quarter of an hour. A second bath is then taken, which completes the cure. The preparation, when it dries, leaves on the skin a thin layer of the sulphur compound, which destroys the itch insect and its eggs. The *sulphides* have been brought forward as a remedy for furuncular eruptions. (*Medical Record*, May, 1874, p. 257.) B.

SWIETENIA FEBRIFUGA. A large tree growing in the East Indies. The bark is the part employed. It is smooth and red internally, rough and gray on the outer surface, of a feeble aromatic odour, and an astringent bitter taste. Water extracts its virtues by infusion or decoction. It is said to have been much used in India as a substitute for Peruvian bark, to which it is somewhat analogous in medical properties. The dose of the powder is from thirty grains to half a drachm. The watery extract has the virtues of the bark.

The *Swietenia Mahagoni*, or *mahogany tree*, which grows in the West Indies and other parts of tropical America, has also a bitter astringent bark, which resembles that of S. febrifuga in virtues as well as in sensible properties. The wood of this tree is the mahogany so much used in ornamental wood-work. The bark of *S. Senegalensis* is used on the coast of Africa in the cure of intermittents; and M. Caventou has extracted an alkaloid from it, which has been suggested as a cheap substitute for quinia. (See *Am. Journ. of Med. Sci.*, N. S., xx. 168.) W.

SYMPHYTUM OFFICINALE. *Comfrey.* A perennial European plant, cultivated in our gardens for medical use. Its root, which is the part used, is spindle-shaped, branched, often more than an inch thick and a foot long, externally smooth and blackish, internally white, fleshy, and juicy. By drying it becomes wrinkled, of a firm horny consistence, and of a dark colour within. It is almost inodorous, and has a mucilaginous, feebly astringent taste. Among its constituents are mucilage in great abundance, and a small quantity of tannin. It was formerly highly esteemed as a vulnerary, but has lost its credit in this respect. Its virtues are chiefly those of a demulcent, and it may be advantageously used for all the purposes to which the marshmallow is applied. It is a very

common ingredient in the domestic cough mixtures, employed in chronic catarrh, consumption, and other pectoral affections. The most convenient form of administration is that of decoction, which may be made either from the fresh or dried root. According to Lewis, comfrey root yields to water a larger proportion of mucilage than the root of Althæa. W.

SYNANTHROSE. This is a new carbohydrate, discovered by O. Popp in *Helianthus tuberosus*. For details, see *Am. Journ. of Pharm.*, 1871, p. 312. H. C. W.

SYRINGA VULGARIS. *Common Lilac.* The leaves and fruit of this common garden plant have a bitter and somewhat acrid taste, and have been used as a tonic and febrifuge. In some parts of France they are said to be employed habitually by the country people in the cure of intermittent fever; and they were recommended by Cruveilhier in the treatment of that complaint. The fruit was examined by MM. Petroz and Robinet, who found a sweet and bitter principle. The latter was afterwards obtained pure by M. Meillet, who gave it the name of *lilacin*. The green capsules, which yield it in largest proportion, are boiled in water, the decoction is concentrated, subacetate of lead is added, the liquor is evaporated to the consistence of syrup, magnesia is added in excess, and the whole is evaporated to dryness. The residuum is powdered, digested in water at 90° or 100°, and then treated with boiling alcohol and animal charcoal. The alcoholic solution, being filtered and concentrated, yields lilacin upon cooling. This principle, though not alkaline, is thought by M. Meillet to exist in the fruit combined with malic acid. It is crystallizable, bitter, and insoluble in water. (*Am. Journ. of Pharm.*, xiv. 139; from *Journ. de Pharm.*) W.

TACAMAHAC. *Tacamahaca.* The resinous substance, commonly known by this name, is supposed to be derived from the *Fagara octandra* of Linn. (*Elaphrium tomentosum*, Jacq., *Amyris tomentosa*, Spreng.), a tree of considerable size, growing in the island of Curaçoa, and in Venezuela. The juice exudes spontaneously, and hardens on exposure. As brought into the market, it is in irregularly shaped pieces of various sizes, some not larger than a mustard seed, others as much as an inch or two inches in diameter. The colour is usually light-yellowish or reddish-brown; but in the larger masses is more or less diversified. The pieces are in general translucent, though frequently covered with powder upon their surface, so as to render them apparently opaque. They are heavier than water, brittle, and pulverizable, yielding a pale-yellow powder. Their odour is resinous and agreeable, their taste bitter, balsamic, and somewhat acrid. Exposed to heat they melt and exhale a stronger odour. Tacamahac is partially soluble in alcohol, and completely so in ether and the fixed oils. It consists of resin with a little volatile oil.

Another variety is obtained from the East Indies, and called *tacamahaca orientale*, or *tacamahaca in testis*. It is supposed to be derived from the *Calophyllum Inophyllum*, and comes into the market in gourd-shells covered with rush leaves. It is of a pale-yellow colour inclining to green, slightly translucent, soft, and adhesive, of an agreeable odour, and an aromatic bitterish taste. It is at present very rare in commerce. The tree which yields this resin produces a drupe, about as large as a plum, from the seeds of which 50 per cent. of a greenish-yellow fixed oil is obtained by expression, used in India for lamps, and as a local application in the itch. (*Journ. de Pharm.*, Juillet, 1861, p. 23.)

Guibourt describes several other varieties of tacamahac, which, however, are little known. Among them is a soft, adhesive, dark-green resin, said to be procured from the *Calophyllum Tacamahaca*, growing in the islands of Bourbon and Madagascar.

Tacamahac was formerly highly esteemed as an internal remedy, but is now employed medicinally only in the composition of ointments and plasters, and little even for this purpose. Its properties are analogous to those of the turpentines. It is sometimes used as incense. W.

TANNATE OF ALUMINA. *Aluminæ Tannas.* Mr. Rogers Harrison, of London, has employed an aqueous solution of a substance which he calls by this name, as an injection in gonorrhœa, after the acute symptoms have passed. He makes it of such a strength as to produce smarting. The substance is described to be in crystals, about the size of those of coarse sugar, of a dirty-yellowish colour, and readily soluble in hot water. (*Lond. Med. Gaz.*, xiii. 853.) It is not easy to conjecture what is the substance employed by Mr. Harrison. Tannate of aluminium is nearly insoluble in water. Prof. Procter tried to make a soluble tannate of this earth, but without success; and, from the description of the substance used by Mr. Harrison, he is inclined to think that it was a mixture of tannic acid and alum. (*Am. Journ. of Pharm.*, Jan. 1853, p. 25.) B.

TANNATE OF IRON. *Ferri Tannas.* This salt is prepared by dissolving 44 parts of precipitated subcarbonate of iron, moderately dried, in a boiling solution of 9 parts of pure tannic acid, evaporating the solution at the temperature of 176°, in a porcelain vessel, until it becomes thick, pouring it out on a glass or porcelain plate, and drying it with a gentle heat. As thus obtained, tannate of iron is in flat pieces, of a crimson colour, without taste, and insoluble in water. It acts as an astringent and tonic, and may be given in chlorosis, in the dose of from eight to thirty grains, in the course of the day, made into pills. *Ink* is an aqueous solution of the tanno-gallate of iron, and probably possesses similar medical properties. It is a popular application to ringworm. B

TANNATE OF LEAD. *Plumbi Tannas.* This is obtained by precipitating a concentrated infusion of oak bark with acetate of lead, added drop by drop. It has been used as an external application with success by Dr. Fantonetti in two cases of white swelling of the knee-joint. He employed it at first mixed with a third of its weight of lard, and afterwards pure, the fresh precipitate admitting of application as an ointment. Autenrieth recommends it as a dressing to gangrenous ulcers; and it is probably peculiarly efficacious in bed-sores. With this intention, the precipitate, either uncombined or mixed in its dry state with simple ointment in the proportion of two drachms to the ounce, may be spread on linen, and applied to the sore. Van den Corput uses it in excoriations, applying it freshly precipitated, and rubbed up with glycerin. (*Ann. de Thérap.*, 1865, p. 266.) It is especially commended in sore nipples. (*Med. Record*, Aug. 1875, p. 575.) The preparation here described is a bitannate. Other tannates of lead exist. B.

TARTRATE OF SODIUM. *Sodii Tartras.* This salt, in crystals, has been recommended by M. Delioux as an agreeable purgative, almost without taste, and acting with power equal to that of the sulphate of magnesium, in the dose of ten drachms. The *soda powders*, so much used in the United States, form an extemporaneous tartrate of sodium, somewhat aërated with carbonic acid. B.

TAXUS BACCATA. *Common European Yew Tree.* The fruit of this handsome and well-known evergreen appears to be a deadly poison. A child was found in a field, where, as proved by the contents of the stomach, he had been eating the berries of the yew, semi-comatose, with convulsions, a cold and clammy skin, difficult respirations, dilated pupils, and attempts at vomiting. He died before anything else could be done than to administer an emetic, which acted promptly. Other children had eaten the same fruit without serious consequences; but they had swallowed the pulp only, rejecting the stones; while these, in a masticated state, were found in the stomach of the deceased child; so that the poisonous property would seem to reside in the stone of the fruit; as in the peach and bitter almond. A horse, having eaten some of the fruit, died in an hour. In the child, death did not take place under four hours. (Dr. James Thompson, *Lancet*, Oct. 17, 1868, p. 530.) A second fatal case occurring in an adult is recorded. (*Med. Times and Gaz.*, 1870, ii. 446.) The leaves also have produced death. (*Lancet*, Oct. 1870, p. 471.) W.

TAYUYA. This is a remedy used in Brazil in syphilis. It has been chemically examined by M. Stanislas Martin, who found in it a green resin, a bitter aromatic extractive matter, and tannic acid. (*Philad. Med. Times*, v., p. 725.) H. C. W.

TEA. The plant which furnishes tea—*Thea Chinensis*—is an evergreen shrub belonging to the class and order Monadelphia Polyandria of the sexual system (Polyandria Monogynia, *Linn.*), and to the natural order Ternstromiaceæ. It is usually from four to eight feet high, though capable, in a favourable situation, of attaining the height of thirty feet. It has numerous alternate branches, furnished with elliptical-oblong or lanceolate, pointed leaves, which are serrate except at the base, smooth on both sides, green, shining, marked with one rib and many transverse veins, and supported alternately upon short footstalks. They are two or three inches long, and from half an inch to an inch in breadth. The flowers are either solitary, or supported, two or three together, at the axils of the leaves. They are of considerable size, not unlike those of the myrtle in appearance, consisting of a short green calyx with five or six lobes, of a corolla with from four to nine large unequal snow-white petals, of numerous stamens with yellow anthers and connected at their base, and of a pistil with a three-parted style. The fruit is a three-celled and three-seeded capsule. It has not been certainly determined whether more than one species of the tea-plant exists. Linnæus admitted two species—*T. Bohea* and *T. viridis*—differing in the number of their petals; but this ground of distinction is untenable, as the petals are known to vary very much in the same plant. Hayne makes three species—*T. stricta*, *T. Bohea*, and *T. viridis*—which are distinguished severally by the shape of their leaves and fruit, and the direction of the footstalk. De Candolle admits but one species, with two varieties—the *viridis* or green tea, with "lanceolate flat leaves, three times as long as they are broad," and the *Bohea*, with "elliptical-oblong, subrugose leaves, twice as long as broad." Lindley recognises the two Linnæan species, distinguishing them by the leaves, which in *T. viridis* are acuminate, and emarginate at the apex, and in *T. Bohea* are smaller, flatter, darker green, with small serratures, and terminate gradually in a point, but are not at all acuminate or emarginate. (*Flora Medica*, 120.)

The tea-plant is a native of China and Japan, and is cultivated in both countries, but most abundantly in the former. In Japan it forms hedgerows around the rice and cornfields; in China, whence immense quantities of tea are exported, whole fields are devoted to its culture. It is propagated from the seeds, which are planted in holes at certain distances, six or eight seeds being placed in each hole, in order to ensure the growth of one. In three years the plant yields leaves for collection, and in six attains the height of a man. When from seven to ten years old it is cut down, in order that the numerous shoots which issue from the stump may afford a larger product of leaves. These are picked

separately by the hand. Three harvests, according to Kœmpfer, are usually made during the year; the first at the end of February, the second at the beginning of April, and the third in June. As the youngest leaves are the best, the product of the first collection is most valuable, while that of the third, consisting of the oldest leaves, is comparatively little esteemed. Sometimes only one or two harvests are made; but care is always taken to assort the leaves according to their age; and thus originate numerous commercial varieties of tea. The character of the plant, dependent upon the soil, situation, climate, and culture, has also a great influence upon the value of the leaves. It is said that the best tea is procured from the shrubs which grow upon the sides of steep hills with a southern exposure. Though the plant grows both about Pekin in the north and Canton in the south of China, it is said to attain greater perfection in the intermediate country, in the neighbourhood of Nankin, for instance, where the climate is neither so cold as in the first-mentioned vicinity, nor so hot as in the second. Some of the commercial varieties have their origin in this cause; and it is highly probable, though the fact has not been certainly proved, that difference in species may be another source of diversity. After having been gathered, the leaves are dried by artificial heat in shallow iron pans, from which they are removed while still hot, and rolled with the fingers, or in the palm of the hand, so as to be brought into the form in which they are found in commerce. For further particulars as to the cultivation of tea, see *Pharm. Journ. and Trans.*, Sept. 1871, p. 386. The odour of the tea leaves themselves is very slight; and it is customary to mix with them the flowers of certain aromatic plants, as those of the orange, different species of jasmine, the rose, *Olea fragrans*, and *Camellia Sasanqua*, in order to render them pleasant to the smell. The flowers are afterwards separated by sifting or otherwise. (See *Pharm. Journ.*, xv. 112.) The cultivation of tea has been successfully introduced into Brazil, and into the British possessions in India. In 1861, about 20,000 acres of land were under cultivation in Assam, and are said to have yielded 1,705,130 pounds of tea in that year. (*Galignani's Messenger*, Jan. 20, 1862; from the *London Times.*) Samples of Himalaya tea, chemically examined by T. Zoeller, were found to be equal to the best Chinese product, containing at least five per cent. of thein, 5·38 per cent. of nitrogen. (*Pharm. Journ. and Trans.*, Aug. 1871, p. 162.) Mrs. Ida Pfeiffer states, in her "*Second Journey round the World*" (Am. ed., 1857, p. 127), that tea cultivated in Java is occasionally sent to Europe. Attempts have been made, under the auspices of the Government, to introduce the tea culture into the U. States. Large numbers of the seeds were, through arrangements made by the Patent Office, imported from China, and, having been planted in the propagating garden in Washington, germinated satisfactorily. No general result has been reached, but it is stated that a Captain James Campbell produces yearly in Tennessee the tea required for his family. (*Am. Journ. of Pharm.*, 1870, p. 468.)

Tea is brought to this country from Canton and other ports of China. Numerous varieties exist in commerce, differing in the shape communicated by rolling, in colour, in flavour, or in strength; but they may all be arranged in the two divisions of *green* and *black teas*, which, at least in their extremes, differ so much in properties, that it is difficult to conceive that they are derived from the same species.

Properties. Green tea is characterized by a dark-green colour, sometimes inclining more or less to blue or brown. It has a peculiar, refreshing, somewhat aromatic odour, and an astringent, slightly pungent, and agreeably bitterish taste. Its infusion has a pale greenish-yellow colour, with the odour and taste of the leaves. According to Mr. Warington, who examined numerous varieties of tea carefully both by the microscope and chemical tests, many of the green teas imported into Great Britain owe their colour to a powdery coating, consisting of sulphate of calcium and Prussian blue; others to a mixture of these with a yellowish vegetable substance; and others, again, to sulphate of calcium alone. (*Pharm. Journ.*, iv. 37.) *Black tea* is distinguished by a dark-brown colour. It is usually less firmly rolled, and lighter than the green, and contains the petioles of the plant mingled with the leaves. Its odour is fainter, and of a somewhat different character, though still fragrant. Its taste, like that of green tea, is astringent and bitterish; but is less pungent, and to many persons less agreeable. To hot water it imparts a brown colour, with its sensible properties of taste and smell. These vary exceedingly in degree in the different varieties; and some black teas are almost wholly destitute of aromatic or agreeable flavour. According to Mr. Warington, the difference between green and black tea, in reference to their chemical and physical condition, arises from a kind of fermentation which the latter is made to undergo, before being roasted. (*Ibid.*, x. 618.) A sophisticated tea is largely exported from China, consisting of powdered tea mixed with sand and other earth, and agglutinated with gum; that which is to pass for black being coloured with plumbago, and the green with the coating above referred to. On analysis, these teas were found to afford from 35 to 45 per cent. of ashes, while the genuine yields only 5 per cent. They may be detected by not unfolding when steeped in boiling water. (*Ibid.*) Willow leaves are also sometimes used to adulterate tea. (*Pharm. Journ. and Trans.*, Sept. 1871, p. 208.) For methods of detecting the various adulterations of tea, see *Ibid.*, Oct. 1873, p. 331.

Analyzed by G. J. Mulder, 100 parts of green Chinese tea afforded 0·79 of volatile oil,

2·22 of chlorophyll, 0·28 of wax, 2·22 of resin, 8·56 of gum, 17·80 of tannic acid of the variety contained in galls, 0·43 of thein (caffein), 22·80 of extractive, traces of apotheme, 23·60 of muriatic extract, 3·00 of albumen, 17·68 of lignin, and 5·56 of salts. The muriatic extract was the matter taken up by diluted muriatic acid from tea, previously exhausted successively by ether, alcohol, and water, and consisted of artificial tannin. The same chemist obtained from 100 parts of black Chinese tea 0·60 of volatile oil, 1·84 of chlorophyll, 3·64 of resin, 7·28 of gum, 12·88 of tannic acid, 0·46 of thein (caffein), 19·88 of extractive, 1·48 of apotheme, 19·12 of muriatic extract, 2·80 of albumen, 28·32 of lignin, and 5·24 of salts. (*Annal. der Pharm.*, xxviii. 317.) Dr. Rochleder has found also a peculiar acid, which he calls *boheic acid.* According to Stenhouse, the tannin of tea, though always accompanied with a little gallic acid, differs essentially from that of galls; not being like it a glucoside, but yielding, under the influence of sulphuric acid, a dark-brown substance, almost insoluble in water. (See *Am. Journ. of Pharm.*, May, 1862, p. 254.) M. Eug. Peligot obtained a much larger proportion of thein or caffein than was found by Mulder, the lowest quantity from green tea being 2·4 per cent. and the highest 4·1 per cent.; but even this quantity is too small to represent all the nitrogen contained in tea. (*Journ. de Pharm.*, 3e sér., iv. 224.) Stenhouse has found from 2 to 2·1 per cent. of thein in tea.* M. Pucetti found about twice as much in black as in green tea. (*Am. Journ. of Pharm.*, xxviii. 234.) The volatile oil is probably one of the principles upon which depend the effects of tea upon the nervous system. Hence old teas are less energetic than the recently imported; and it is said that the fresh leaves have often produced dangerous effects in China. Nevertheless, the tannic acid is not without influence upon the system; and it is not improbable that both the extractive and thein contribute to the peculiar influence of this valuable product. Of these active ingredients, the volatile oil, tannic acid, and extractive are found most largely, according to the analysis of Mulder, in the green tea. *Thein* is a crystallizable principle discovered by Oudry. It was afterwards proved by Jobst to have the same composition as caffein, and is now generally considered as in all respects identical with that principle. It exists also in the leaves of the Ilex Paraguaiensis or Paraguay tea, in the seeds of Paullinia sorbilis, and in the kola nut or fruit of Cola acuminata. (See *Coffee*, *Ilex*, *Paullinia*, and *Sterculia acuminata.*) According to Mulder, thein exists in tea combined with tannic acid. Peligot obtained it by adding to a hot infusion of tea, first subacetate of lead, and then ammonia, filtering the liquid, passing sulphuretted hydrogen through it, again filtering, and evaporating with a moderate heat. On cooling, the liquid deposited thein abundantly, and yielded an additional quantity by a careful evaporation. (*Journ. de Pharm.*, 3e sér., iv. 224.) It may be cheaply prepared by putting some old spoiled tea in an iron pot covered with filtering paper, enclosing the whole in a cylindrical paper cap, and cautiously applying heat. Thein rises in vapour, and condenses on the paper. (See *Chem. Gaz.*, No. 178, p. 119.) Thein has a feebly bitter taste; is, in the state of crystals, dissolved by 93 parts of water, 158 of alcohol, and 298 of ether; melts at about 350° F., and at 723° sublimes in white vapours, which condense in minute needles. From its watery solution few reagents precipitate it. Infusion of galls causes a deposit of tannate of thein, which is again, however, dissolved by heating the water.

Medical Properties and Uses. Tea is astringent and gently excitant, and in its finer varieties exerts a decided influence over the nervous system, evinced by the feelings of comfort and even exhilaration which it produces, and the unnatural wakefulness to which it gives rise, when taken in unusual quantities, or by those unaccustomed to its use. Its properties, however, are not of so decided a character as to render it capable of very extensive application as a medicine; and its almost exclusive use is as a grateful beverage at the evening and morning meals. Taken moderately, and by healthy individuals, it may be considered as perfectly harmless; but long continued, in excessive quantity it is capable of inducing unpleasant nervous and dyspeptic symptoms, the necessary consequences of over-excitement of the brain and stomach. Green tea is decidedly more injurious in these respects than black, and should be avoided by dyspeptic individuals, and by those whose nervous systems are peculiarly excitable. As a medicine, tea may sometimes be given advantageously in diarrhœa; and a strong infusion will often be found to relieve nervous headache. The mode of preparing it for use is too well known to require description. An extract is made from it in China, which is said to be useful in fevers. Though the effects of tea and coffee upon the system are probably in part owing to the thein or caffein they contain, there must be some other active ingredient; as the effects produced by different varieties are not proportionate to the amount of that principle contained in them. Thus coffee, which exerts a more powerful influence on the system than tea, in any of its varieties, contains less caffein.

Thein is a powerful nervous stimulant, very analogous to tea in its mode of action. Prof. H. J. Pratt, of Harvard College, tried it on himself and others, administering it both by subcutaneous injection and by the mouth. He also tried its effects on toads. From quantities less than five grains no very marked effects were obtained, except a slight diminution in the frequency of the pulse and subsequent wakefulness. In a man to whom he gave six grains subcutaneously, the pulse in fifteen minutes fell from 84 to

* For methods of estimating percentage of thein in a sample of tea, see *Journ. de Pharm.*, 4e sér., xviii. 436.

68 in the minute, and continued at about the same rate at the end of fourteen hours. The rate of 84 was probably the result of the temporary excitement from the operation; and, so far as this experiment goes, little can be inferred as to the effect on the circulation. Increased frequency of micturition was also noticed. From twelve grains taken by himself by the mouth, he experienced at the end of about two hours great physical restlessness with mental uneasiness, and soon afterwards marked tremulousness of the hands and arms. This continued for about two hours, after which there were no other phenomena except wakefulness, with the "mind in a state of most active and persistent thinking." Similar results took place in other cases; and in one there was what was described "as increased brain power, enabling the patient to read, with great ease and perfect understanding, books before considered abstruse;" a strong evidence of power in thein to stimulate the nervous system. In relation to the pulse, it was reduced in one instance from 66 to 56, and in another from 76 to 67. The discharge of urine was increased in frequency and amount. In his experiments on toads performed in connection with Mr. Fred. Ware, the subcutaneous injection of thein produced convulsions, which were ascribed to increased reflex action of the spinal cord. (*Bost. Med. and Surg. Journ.*, Sept. 10, 1868, p. 81.) M. Leven, who experimented comparatively on caffein and thein, found that, though admitted by chemists to be identical, they differed somewhat in their physiological action. Both increase the frequency of the pulse and of respiration; both stimulate the brain and spinal cord, and, through their action on the cord, induced tetanic convulsions when largely given to the lower animals; and both agree in not abolishing the muscular function, and in not causing the heart to cease contracting immediately after death. But thein is much less powerful as a poison than caffein, requiring to be given in twice the quantity to produce the same effect; and thein produces convulsions of the limbs, which Dr. Leven had not noticed as an effect of caffein. (*Am. Journ. of Med. Sci.*, April, 1868, p. 525, and Oct. 1868, p. 260; from *Arch. de Physiol. Norm. et Pathol.*) For the therapeutical use of thein considered as identical with caffein, see *Part* I. p. 189. For an elaborate discussion of the physiological action of caffein, see H. C. Wood's Treatise on Therapeutics, 2d ed., p. 202. W.

TELLURIUM. Several of the combinations of this metal have been tried on the living organism by M. Hansen. Five grains of the *tellurite of potassium*, given to dogs, produced stupefaction and vomiting, and the garlic-like odour of tellurium in the breath. The same salt, tried upon himself for seven successive days, in a dose daily of half a grain, afterwards increased to a grain, caused drowsiness at first, followed, after the seventh day, by a sense of oppression in the cardiac region, nausea, an increased flow of saliva, and loss of appetite. The breath had a garlic-like odour throughout the experiment. (*Chem. Gaz.*, March 1, 1854, p. 90.) Prof. Simpson, of Edinburgh, relates the case of a student, who inadvertently took a dose of tellurium, and exhaled so persistent an odour that he had to sit apart from his fellow students. (See *Am. Journ. of Med. Sci.*, April, 1855, p. 496.) This disagreeable effect of tellurium precludes its employment in medicine. B.

TEPHROSIA VIRGINIANA. *Turkey Pea. Goat's Rue.* Several species of Tephrosia are employed in different parts of the world, though unknown in general commerce. They are leguminous plants, shrubby or herbaceous, with leaves unequally pinnate, and flowers in axillary or terminal racemes. They are generally possessed of cathartic properties; their leaves or roots being employed. *Tephrosia Virginiana* grows in most parts of the United States. It is a foot or two high, with pubescent stems and leaves and handsome terminal flowers. (See Griffith's *Med. Bot.*, p. 237.) The roots, which are slender, long, and matted, are tonic and aperient, and are said to have been used by the Indians as a vermifuge, given in the form of decoction. Dr. B. O. Jones, of Atlanta, Geo., has used the plant with advantage, as a mild stimulating tonic and laxative, having a tendency to increase most of the secretions, and has found it specially useful in typhoid fever. He prepares it by boiling eight ounces of the plant with two ounces of *Rumex acutus* in four quarts of water to a quart, and straining; adding, when the preparation is to be kept, an equal bulk of diluted alcohol or brandy, and half its weight of sugar, and macerating for several days. The dose is one or two tablespoonfuls. (*Am. Journ. of Pharm.*, xxviii. 218.) W.

TEREBENA. This is a substance which is produced by the action of sulphuric acid upon oil of turpentine. For an elaborate account of the method of preparation and of its properties, by M. Ribau, see *Journ. de Pharm.*, 4e sér., xviii. 186, 374; xix. 443. H. C. W.

TEUCRIUM CHAMÆDRYS. *Germander. Chamædrys.* A small, didynamous, labiate, perennial European plant, the leaves and tops of which have an agreeable aromatic odour, diminished by drying, and a bitter, somewhat astringent, aromatic, durable taste. They have been employed as a mild corroborant, in uterine, rheumatic, gouty, and scrofulous affections, and intermittent fevers; but are at present little used, and never in this country. Germander was an ingredient in the *Portland powder*, noted as a remedy in gout. This powder, according to the original prescription, consisted of equal parts of the roots of *Aristolochia rotunda* and *Gentiana lutea*, of the tops and leaves of *Teucrium*

Chamædrys and *Erythræa Centaurium*, and of the leaves of *Ajuga Chamæpytis*, or *ground pine*. The dose was a drachm every morning before breakfast, for three months, then two scruples for three months, afterwards half a drachm for six months, and finally half a drachm every other day for a year. (*Parr.*) Two other species of Teucrium have been used in medicine;—*T. Marum, cat thyme*, or *Syrian herb mastich*, indigenous in the South of Europe, and *T. scordium*, or *water germander*, growing in the higher latitudes of the same continent. The former is a warm, stimulating, aromatic bitter, and has been recommended in hysteria, amenorrhœa, and nervous debility; the latter has the odour of garlic, and a bitter, somewhat pungent taste, and was formerly highly esteemed as a corroborant in low forms of disease; but neither of them is now much employed. *T. Marum*, however, has been revived somewhat of late; having been given successfully, by Dr. Lucanus, in pertussis and other cases of spasmodic cough, in the forms of syrup and confection. (*Revue Pharmaceut.*, 1858, p. 32.) This species also acts as an errhine, and was formerly an ingredient of the *Pulvis Asari Compositus*. The dose of either of the three species is about half a drachm. A plant said to have been used advantageously in cholera in the Levant, a specimen of which was sent to Paris, proved to be *Teucrium Polium*. (*Journ. de Pharm.*, xv. 352.) W.

THALLIUM. This is one of the metals recently discovered by means of the spectrum analysis, and has been found to prevail widely in nature, and to yield itself readily to chemical agencies. The point about it principally interesting to the physician at present is, that it has been ascertained to act energetically as a poison. M. Lamy, having experienced, while making chemical investigations in reference to thallium, extreme general lassitude, with pains in the lower extremities, was disposed to consider these symptoms as the result of a poisonous influence of the metal. To determine the point, he dissolved 75 grains of sulphate of thallium in some milk, intending to try its effects on a couple of puppies, which, however, after tasting it, refused to swallow more. Accidentally it was placed where other animals had access to it; and the consequences were that the milk disappeared, and a middle-sized dog, a hen, and six ducks died from having drank it. There was no vomiting or purging, but violent intestinal pains, and spasm of the posterior limbs, followed by paralysis; and this last seemed to be the most characteristic effect of the poison. Death took place in two or three days; and, what is of much importance, the two puppies which had only tasted of the milk, were seized with similar symptoms, and died at the end of four days. The poison, therefore, must be very energetic; and a circumstance worthy of remark in relation to it is, that, even in a fatal dose, it may produce no sensible effect for a considerable time. M. Lamy afterwards gave about a grain and a half to a puppy, which died in forty hours. There seems to be a remarkable coincidence between the poisonous effects of thallium and those of lead. Connected with its deleterious action, it is an interesting circumstance that thallium is not unfrequently associated with metals used in medicine, as with copper and bismuth for example. Spectrum analysis affords an easy method of detecting the poison. M. Lamy readily recognised it in the tissues of animals which perished with it, by subjecting small pieces to examination in the spectroscope. A sharply defined green line in the spectrum gave undoubted evidence of the presence of the poison. (*Journ. de Pharm.*, Oct. 1863, p. 285.) The effects of thallium on the system have recently been carefully investigated by Dr. Wm. Marmé, by experiments on different orders of animals, with the following results. Small doses of the different preparations are tolerated for a short time, but the effects are cumulative; and perseverance with their use gives rise to very serious consequences; as the system does not become accustomed to the poison. After continued administration of the preparations of thallium, the appetite is impaired, pain is felt in the bowels, and vomiting occurs with diarrhœa, hemorrhage, salivation, and emaciation. General debility, embarrassed respiration, weakness of the circulation, disordered muscular action, as tremors and want of co-ordination, are added to the other symptoms; and, when the poisoning becomes general, conjunctivitis, with free secretion of mucus, is a frequent symptom. After death, small effusions of blood and infiltration of the lungs are observed, as are also intense congestion of the bowels, copious pericardial effusion, and ecchymoses on the heart's surface. The poison is absorbed, and is eliminated by all the secretions. (See also *Journ. de Pharm.*, 4e sér., x. 263.) It seems to disorganize the blood. There is no known antidote. (*B. and F. Medico-chir. Rev.*, Jan. 1868, p. 254.) According to M. Rabuteau, after death from thallium the muscles are found to have lost their irritability. (*Ed. Med. Journ.*, Sept. 1874, p. 272.) W.

THAPSIA GARGANICA. An umbelliferous plant, growing in Southeastern Europe, and well known to the ancients, who named it from the isle of *Thapsos*, where it was obtained. Theophrastus speaks of its root as emetic and purgative. After long neglect, it has again come into notice in France, where a resinous substance derived from it has of late been in much esteem as a local irritant and revulsive, under the name of *resin of thapsia*. (*Ann. de Thérap.*, 1868, p. 210.) The bark of the root and the resin are both objects of commerce. The bark is described by M. Stanis. Martin, as almost always doubly quilled, unless where altogether in small fragments, exteriorly rugose with the

epidermis here and there detached in patches larger or smaller, and of a deep-brown colour, interiorly smooth and whitish, and of a fibrous fracture. The size of the pieces varies extremely; the largest not exceeding 24 inches in length and about an inch in circumference. At the point where the root begins there is often adherent a ligneous fibre about an inch long; and over their whole surface there are found but few radicles. It is said that great care is necessary, in removing the root from the bales, not to be injured by the powder which escapes, and which causes itchings and swellings of the face and hands. An extract of the *root*, which is sold as a *resin*, has really little claim to be so named; as, of 15 parts of it, 6 are dissolved by cold water, and the 9 parts of resinous matter which remain are of a deep-brown colour, while the resin extracted by sulphuret of carbon is of a fine yellow. (*Ibid.* 1869, p. 221; from *Bulletin Thérapeutique.*) By submitting thapsia to the successive action of alcohol and ether M. Pressoir obtained two resins. Sulphuric acid coloured that soluble in alcohol scarlet, that soluble in ether blue. (*Journ. de Pharm.*, 4e sér., xi. 328.) M. Cazenave objects to the plaster prepared from the resin, and kept in masses; as it deteriorates by time. He proposes the following method of preparing a plaster extemporaneously when wanted. Dissolve the resin in alcohol, and with the aid of a brush spread it on a suitable recipient, which may be ordinary plaster, waxed taffetas, or simply gummed paper. A single layer is sufficient for the purpose of an active revulsion; but the effect may be increased at pleasure, by increasing the number of layers. (*Journ. de Pharm.*, Juillet, 1868, p. 29.) W.

THLAPSUS BURSA PASTORIS. *Shepherd's Purse.* Thlapsus is a genus of Cruciferous plants, of which several species grow in this country. In Europe, the *T. bursa pastoris* is a very common plant, growing everywhere upon walls, by the roadsides, in gardens, &c., and flowering nearly all the year. Like others of the same natural family, it yields by contact with water a volatile oil, which may be obtained by distillation. The plant is bitter and pungent, and is supposed to possess astringent properties; being employed with asserted advantage in hæmaturia and other hemorrhages. It is also thought to be specially antiscorbutic, and has been used in cases demanding expectorants and diuretics, as in humoral asthma, dropsy, &c. The expressed juice is used in the dose of from two to four fluidounces. A tincture, extract, syrup, &c. have also been prepared, for which formulas may be found in the *Annuaire de Thérapeutique* for 1854 (p. 216). The fresh herb, bruised, is employed as a topical remedy in rheumatism. W.

THUYA OCCIDENTALIS. *Thuja Occidentalis. Arbor Vitæ.* An indigenous evergreen tree, growing wild from Canada to the Carolinas, and cultivated for ornament in gardens. The leaves, or small twigs invested with the leaves, are the parts used. They have an agreeable balsamic odour, especially when rubbed, and a strong, balsamic, camphorous, bitter taste. They were analyzed by A. Kawalier, of Vienna, and found to contain volatile oil, a bitter principle called *pinipicrin*, found also in Pinus sylvestris, sugar, gelatinous matter, a variety of wax, resin, and tannic acid. (See *Chem. Gaz.*, Feb. 1, 1855, p. 45.) In a more recent analysis, Kawalier discovered in the leaves a peculiar crystallizable colouring principle, which he names *thujine*. It is of a citron-yellow colour and astringent taste, soluble in alcohol, inflammable, and separable, through the agency of sulphuric acid, into glucose, and another yellow substance, which he calls *thujetin*. A third substance, *thujegenine*, was also obtained, apparently a result of some change in thujine. The formula of thujine is $C_{40}H_{22}O_{24}$. The same chemist determined that the tannic acid of this plant is identical with that which he had previously obtained from the leaves of *Pinus sylvestris*, and to which he had given the name of *pinitannic acid*. (See, for the mode of preparing these principles, and a full account of their properties, the *Chemical Gazette*, Nos. 392 and 393, pp. 61 and 88, A. D. 1859.) In the form of decoction the leaves have been used in intermittent fever, and, according to Schoepf, in coughs, fevers, scurvy, and rheumatism. Dr. J. R. Leaming, of New York, has employed a tincture of the leaves internally, with supposed advantage, in affections believed to be cancerous; and the same remedy has been used locally with prompt effect in venereal excrescences. (*N. Y. Journ. of Med.*, &c., N. S., xiv. 406.) Dr. Benedict has found a saturated tincture useful as an emmenagogue, given in the dose of a teaspoonful three times a day. (*Ibid.*, Nov. 1856, p. 395.) Made into an ointment with lard or other animal fat, the leaves are said to form a useful local application in rheumatic complaints. The distilled water is praised by Boerhaave as a remedy in dropsy. (*Schoepf.*) A yellowish-green volatile oil, which may be obtained from the leaves by distillation, has been used with success in worms. W.

TIN. *Stannum.* This was recognised in the late Ed. and Dub. Pharmacopœias, and in the U. S. of 1850; but is no longer officinal. It has, however, too long ranked among recognised remedies to be passed without notice. Tin is one of the metals which have been known from the earliest ages. It exists generally as an oxide (*tin stone* and *wood tin*), rarely as a sulphuret (*tin pyrites*), and is by no means generally diffused. It is found in England, Spain, Germany, Bohemia, and Hungary, in Europe; in the island of Banca and the Peninsula of Malacca in Asia; in Chili; and at Durango in Mexico Recently it has been asserted in the daily journals, that tin has been discovered within the territory of the United States, especially in Madison Co., Missouri, where it is even

asserted that the largest deposit exists yet known in the world. (*Phila. N. Am. & U. S. Gaz.*, July 25, 1867.) A valuable tin ore has also been discovered in the United States, at Jackson, New Hampshire. Tin mines are particularly abundant and rich in the Tenasserim provinces of British India. (*Dr. Royle.*) The Cornwall mines are the most productive, but those of Asia furnish the purest tin. The metal is extracted from the native oxide. When this occurs in its purest state, in detached roundish grains, called *stream tin*, the reduction is effected by heating with charcoal. When the common oxide, called *mine tin*, is melted, it requires to be freed, by pounding and washing, from the adhering gangue; after which it is roasted to drive off sulphur, arsenic, and antimony, and finally reduced in furnaces by means of stone coal. The metal, as thus obtained, is called *block tin*, and is not pure. The purest kind of tin, known in commerce, is called *grain tin.*

Properties. Tin is a malleable, rather soft metal, of a silver-white colour. It may be beaten out into thin leaves, called *tin foil.* It undergoes a superficial tarnish in the air. Its taste is slight, and when rubbed it exhales a peculiar smell. Its ductility and tenacity are small; when bent to and fro, it emits a crackling noise, which is characteristic. Its sp. gr. is 7·29, melting point 442° (melting point 228·5° C., volatilizing point 420° C., *Chem. News*, July 16, 1869), equivalent number 59, and symbol Sn. It forms three oxides, a protoxide, sesquioxide, and deutoxide. The *protoxide* is of a grayish-black colour. When perfectly pure it has, according to Dr. Roth, a red colour. The *sesquioxide* is gray. The *deutoxide* acts as an acid, and exists in two isomeric states, called *stannic* and *metastannic acid.* Stannic acid may be prepared by decomposing bichloride of tin with water. The metastannic acid is formed by acting on tin with nitric acid, which converts it into a white powder. The native crystallized oxide is metastannic acid. These acids, though having the same composition, SnO_2, are perfectly distinct in chemical properties. The stannic acid is soluble, the metastannic insoluble in nitric acid and dilute sulphuric acid. One eq. of potassa requires for saturation one eq. of stannic acid, but five of metastannic acid. Hence the latter is sometimes represented by Sn_5O_{10}.

The tin of commerce is often impure, being contaminated with other metals, introduced by fraud, or present in consequence of the mode of extraction from the ore. A high specific gravity is an indication of impurity. When its colour has a bluish or grayish cast, the presence of copper, lead, iron, or antimony, may be suspected. Arsenic renders it whiter, but at the same time harder; and lead, copper, and iron cause it to become brittle. Pure tin is converted by nitric acid into a white powder (*metastannic acid*), without being dissolved. Boiled with muriatic acid, it forms a solution which gives a white precipitate with ferrocyanide of potassium. A blue precipitate with this test indicates iron, a brown one copper, and a violet-blue one both iron and copper. If lead be present, a precipitate will be produced by sulphate of magnesium. The Malacca and Banca tin, and the English grain tin are the purest kinds found in commerce. Banca tin, from recent analyses by Mulder, appears to be particularly pure, containing only one twenty-fifth of 1 per cent. of foreign metals. Block tin and the metal obtained from Germany are always of inferior quality.

Uses. Tin enters into the composition of bronze, bell-metal, pewter, and plumber's solder. It is used also in making tin-plate, which is sheet-iron coated with tin, in silvering looking-glasses, and in forming the solution of bichloride of tin, a combination essential to the perfection of the scarlet dye. It is employed in fabricating various vessels and instruments, useful in domestic economy and the arts. Being unaffected by weak acids, it forms a good material for vessels intended for boiling operations in pharmacy. We are told that a *false tin foil* is considerably used at present, made by coating lead with tin, and then rolling it out into thin sheets. As tin foil is employed for enclosing medicinal powders, and in other ways is brought into contact with medicinal substances, care should be taken not to use this substituted preparation, lest the patient might be exposed to the poisonous action of lead. According to Ernest Baudrimont, lemons, cacao butter, and other perishable articles may be preserved for a long time by carefully wrapping them in tin foil. (*Pharm. Journ.*, July, 1870.)

Stanni Pulvis. *U. S.* 1850. *Powder of Tin.* The following directions were given for preparing powder of tin in the U. S. Pharmacopœia of 1850. "Take of Tin *a convenient quantity.* Melt it in an iron vessel over the fire, and, while it is cooling, stir it until it is reduced to a powder, which is to be passed through a sieve." *U. S.* Tin, being very fusible, is easily granulated by fusion, and subsequent agitation while solidifying. On a small scale, the granulation is most conveniently performed in a wooden box, the inside of which has been well rubbed with chalk. This should be afterwards washed away with water; and, as the granulated powder is of unequal fineness, the coarser particles must be separated by a sieve.

Medical Properties and Uses. Powder of tin is used exclusively as an anthelmintic, and is supposed to act by its mechanical properties. It is considered particularly adapted to the expulsion of *Ascaris lumbricoides*, and is also employed to expel the tapeworm. For internal exhibition it should be free from oxidation. The dose is half an ounce, mixed with molasses, given for several successive mornings, and then followed by a brisk

cathartic. Dr. Alston was in the habit of administering larger doses for the expulsion of the tapeworm. He began by giving an ounce on an empty stomach, which was followed, for two successive days, by half an ounce each day, and finally by a brisk purge. In the *Journ. de Pharm.*, 4e sér., xix. 78, is reported a case in which death was believed to have been caused by tin. B.

TONKA BEAN. The seed of *Dipterix odorata* of Willd., the *Coumarouna odorata* of Aublet, a large tree growing in Guiana. The fruit is an oblong-ovate pod, enclosing a single seed, from an inch to an inch and a half long, from two to four lines broad, usually somewhat compressed, with a dark-brown, wrinkled, shining, thin, and brittle skin, and a light-brown oily kernel. The bean has a strong, agreeable, aromatic odour, and a bitterish, aromatic taste. Its active constituent is a crystallizable, odorous substance, analogous to the volatile oils and camphor, and called *coumarin* by Guibourt. It is capable of sublimation; but, to obtain it in crystals in this way, a low temperature is necessary. (Waddington, *Pharm. Journ.*, March, 1868, p. 410.) This substance is sometimes found in a crystalline state, between the two lobes of the kernel. It has been shown by M. Bleibtreu to be identical with the odorous principle of *Asperula odorata*, *Trifolium melilotus*, and *Anthoxanthum odoratum*. (See *Chem. Gaz.*, Feb. 16, 1852, p. 61.) Mr. W. H. Lippitt, of Wilmington, N. C., having noticed a crystalline exudation upon the leaves of *Liatris odoratissima*, in that neighbourhood, sent a specimen to Prof. Procter, of Philadelphia, who ascertained that it was *coumarin*. According to Mr. Lippitt, this product of the Liatris was collected for the purpose of protecting woollens against moths. (*Am. Journ. of Pharm.*, Nov. 1859, p. 556.) Dr. Gössmann obtains coumarin in the following manner. The beans, cut finely, are heated for a long time with an equal bulk of alcohol of 0·863, nearly to boiling; and, the tincture being decanted, the residue is treated in the same manner. The tinctures are mixed, the alcohol distilled off until turbidness appears, when four times the bulk of water is added, which precipitates coumarin and fatty matter. The precipitate is then heated to boiling, and the liquid passed through a moistened filter. The fatty matter remains on the filter, and the hot solution which passes deposits the coumarin on cooling. More may be obtained by concentrating the liquid, and may be purified by animal charcoal. One pound of the beans yielded 108 grains of coumarin. (*Ibid.*, June, 1856, p. 211.) Coumarin has been prepared by Mr. Perkins, of England, synthetically. (*Am. Journ. of Pharm.*, 1869, p. 205.) The tonka bean is used to flavour snuff, being either mixed with it in the state of powder, or put entire into the snuff-box. Dr. John Cooper, of Philadelphia, has used it with advantage in hooping-cough, in which it relieves the paroxysms, and enables the patient to sleep. He gave from five to eight grains of a fluid extract to children five years old. (*Am. Journ. of Pharm.*, Jan. 1869, p. 27; from *Med. and Surg. Reporter.*) W.

TRIGONELLA FŒNUMGRÆCUM. *Fenugreek.* An annual plant growing spontaneously in different parts of the South of Europe, and cultivated in France and Germany for the sake of its seeds. These are oblong-cylindrical, somewhat compressed, obliquely truncated at each extremity, one or two lines in length, brownish-yellow externally, yellow internally, and marked with an oblique furrow running half their length. They have a strong peculiar odour, and an oily, bitterish, farinaceous taste, and contain fixed and volatile oil, mucilage, bitter extractive, and a yellow colouring substance. An ounce of the seeds, boiled in a pint of water, renders it thick and slimy. They yield the whole of their odour and taste to alcohol. Their virtues depend chiefly upon their oil and mucilage. On the continent of Europe they are employed in the preparation of emollient cataplasms and enemata, and enter into some officinal ointments and plasters. They are never used internally. W.

TRILLIUM. This is an indigenous genus of pretty, little, herbaceous plants, growing generally in woods and shady places. The roots are reputed to possess valuable remedial properties. They were employed by the aborigines, have been long used in domestic practice in some parts of the country, and were noticed as medicinal in Henry's Herbal, published in 1812. Dr. S. W. Williams published a paper upon them in the *New England Journ. of Med. and Surg.*, in the year 1820, and afterwards another in the *N. Y. Journ. of Med.* (viii. 94). The roots have a somewhat balsamic odour and taste, and produce, when chewed, a sense of heat and irritation, with an increased flow of saliva. A root received by Mr. E. S. Wayne, of Cincinnati, is described by him as an "oblong rhizome, with numerous rootlets attached to it, and of a yellowish-brown colour." Upon the removal of the epidermis, it is white and starchy, and gives a deep blue with tincture of iodine. Mr. Wayne found in the root an acrid principle, analogous to senegin and saponin in the property of frothing with water; half a grain in two ounces of water being sufficient to show this property. He obtained it by treating the powdered root with alcohol by percolation, distilling off the alcohol and adding water as the alcohol escaped, separating an oleoresin which floated on the surface of the remaining watery liquid, treating the latter with acetate and subacetate of lead so long as a precipitate was produced, filtering, separating the excess of lead by sulphuric acid, again filtering, and setting the clear liquid aside. In the following day a gelatinous precipitate had formed, which, being collected on a filter, washed, and dried, was redissolved in dilute

alcohol, and recovered by spontaneous evaporation of the menstruum. A white, amorphous powder was thus obtained, of an acrid taste, soluble in alcohol, and, as above stated, giving in a high degree the frothing property to water. (*Proceed. of Am. Pharm. Assoc.* for 1856, p. 36, also *Am. Journ. of Pharm.*, xxviii. 512.) Besides this acrid principle, the Trillia roots are said to contain volatile oil, gum, starch, extractive, resin, and tannic acid. They are astringent; and tonic, expectorant, and alterative properties have been ascribed to them. They have been used by the vulgar to hasten parturition. The complaints in which they are said to have proved most advantageous are the hemorrhages; but they have been used also in cutaneous affections, and externally in obstinate ulcers. Dr. Williams gave a drachm of the powdered root three times a day. Of the different species *T. erectum* is generally esteemed most active. *T. pendulum* is referred to, in the *Peninsular and Independent Med. Journ.* (Jan. 1859, p. 187), as among the most valued indigenous plant of Michigan; being used especially in menorrhagia. W.

TRIPOLI. *Terra Tripolitana.* An earthy mineral, of a whitish, yellowish, or pale-straw colour, sometimes inclining to red or brown, usually friable, often adhesive to the tongue, and presenting the aspect of argillaceous earth, though differing from clay by the roughness and hardness of its particles, and by not forming a paste with water. The *Venice tripoli* is said to come from Corfu. Tripoli is sometimes artifically prepared by calcining certain argillites. It is used for cleaning and polishing metals. W.

TRITICUM REPENS. *Couch-grass. Dog-grass. Quickens. Chiendent*, Fr. A perennial European plant, very common in gardens and cultivated grounds, where it is considered a troublesome weed. The root, which is the part medically used, is horizontal, creeping, jointed, about as thick as a straw or thicker, inodorous, and of an agreeable, sweetish, slightly pungent taste. H. Müller found in it a peculiar substance *triticin*, allied to inulin. (*Am. Journ. of Pharm.*, 1873, p. 396.) It is used in some parts of Europe, in the form of decoction, as a slightly aperient and nutritive drink; and has been strongly recommended of late in irritable bladder. Great quantities of it are said to be consumed in the hospitals of Paris. The infusion or decoction, in consequence of the sugar which it contains, is susceptible of the vinous fermentation, and alcohol has been obtained from it by distillation. W.

TROMPATILA. This is the stem and branches of *Bouvardia triphylla*, a Mexican plant used by the natives for hydrophobia. (*Am. Journ. of Pharm.*, Feb. 1874, p. 51.) H. C. W.

TURPETHUM. *Turpeth. Resin of Turpeth. Résine de Turbith*, Fr. This product, at one time considerably used, but of late better known from having given its name to the *turpeth mineral* or *yellow sulphate of mercury*, than for any valuable property of its own, is really possessed of merits which would seem to render it worthy of a better reputation. It is obtained from the *Ipomæa Turpethum* (*Convolvulus Turpethum*, Linn.), an Indian plant, said to have first been made known in Europe by Dacosta, who brought it to France from Hindostan, and caused a figure of it to be drawn. The root is the only part used. By Mérat and De Lens it is described as "long, of the size of the little finger or larger, covered by a rather thick bark, grayish without, white within, porous, liable to decay, very resinous when fresh, and in this state yielding a juice, capable of coagulating, and constituting, when coagulated, a gum-resin similar to scammony." In choosing the roots, those should be selected in which the bark is perfect, as most of the activity of the root resides in this part. It is without odour, and has little taste. Examined by M. Boutron-Charlard, it was found to contain resin, a fatty substance, volatile oil, albumen, starch, a yellow colouring matter, lignin, salts, and oxide of iron. (*Journ. de Pharm.*, viii. 121.) The root contains 10 per cent. of resin. (M. Andouard, *Ann. de Thérap.*, 1866, p. 118.)

According to M. Spirgatis, this resin is a glucoside, like that of other Convolvulaceæ, insoluble in ether, but soluble in alcohol, to which it imparts a brown colour not removable by animal charcoal. To obtain it pure, the alcoholic solution is concentrated; the resin precipitated by water, boiled with this vehicle, then dried, reduced to powder, digested with ether, and finally redissolved by absolute alcohol, and thrown down by ether. After being treated several times in this way, it is obtained in the state of a brownish resin, yielding on pvlverization a gray powder, which strongly irritates the mucous membrane of the nostrils and mouth, and fusible at 360° F. It is inflammable, burning with a smoky flame, and emitting irritant vapours. With strong bases it acts like jalapin, fixes water, and is transformed into a soluble acid. The resin is called *turpethine* by M. Spirgatis. (*Journ. de Pharm.*, 4e sér., i. 236; from *Zeitschr. Chem. Pharm.*, vii. 442.)

Turpeth root is purgative, somewhat less powerful than jalap, and rather slow in its action, in this respect resembling jalap. From one to three drachms may be given in decoction, and from fifteen grains to a drachm in powder. (*Mérat et De Lens.*) But the resin is probably the more expedient form for administration. It has recently been the subject of special examination by M. Andouard, who states, as the result of clinical experiment, that it purges perfectly well, though perhaps somewhat less active than jalap or scammony. Trials have been made with it by others, with the general conclusion,

that it might very properly take a place with other efficient cathartics, as aloes, gamboge, resin of jalap, &c. A strong inducement for its general introduction into practice is offered by the abundance in which it may be obtained, while the sources of jalap are scarcely sufficient to meet the demand, and scammony is so liable to adulteration. Turpeth, on the contrary, has no great commercial value, may be cultivated to any desirable extent, and is rarely adulterated. About seven or eight grains of the resin is the dose for an adult. It may be given in sweetened milk or in emulsion. (*Ann. de Thérap.*, 1866, p. 119.) W.

TUSSILAGO FARFARA. *Coltsfoot.* Coltsfoot is a perennial herb, with a creeping root, which early in the spring sends up several leafless, erect, simple, unifloral scapes or flower-stems, five or six inches high, and bearing appressed scale-like bractes of a brownish-pink colour. The flower, which stands singly at the end of the scape, is large, yellow, compound, with hermaphrodite florets in the disk, and female florets in the ray. The latter are numerous, linear, and twice the length of the former. The leaves do not make their appearance until after the flowers have blown. They are radical, petiolate, large, cordate, angular, toothed at the margin, bright-green upon their upper surface, white and downy beneath. The plant grows spontaneously both in Europe and North America. In this country it is found upon the banks of streams in the Middle and Northern States, and flowers in April. The whole of it is employed, but the leaves most so. They should be gathered after their full expansion, but before they have attained their greatest magnitude. The flowers have an agreeable odour, which they retain after desiccation. The dried root and leaves are inodorous, but have a rough, bitterish, mucilaginous taste. Boiling water extracts their virtues. Coltsfoot exercises little sensible influence upon the human system. It is, however, demulcent, and is sometimes used in chronic coughs, consumption, and other affections of the lungs. The expectorant properties which it was formerly thought to possess are not obvious. The leaves were smoked by the ancients in pulmonary complaints; and in some parts of Germany they are at the present time said to be substituted for tobacco. Cullen states that he found the expressed juice of the fresh leaves, taken to the extent of some ounces every day, beneficial in several cases of scrofulous sores; and a decoction of the dried leaves, as recommended by Fuller, answered a similar purpose, though it often failed to effect a cure. The usual form of administration is that of decoction. An ounce or two of the plant may be boiled in two pints of water to a pint, of which a teacupful may be given several times a day. W.

TUTTY. *Tutia. Impure Oxide of Zinc.* This oxide is formed during the smelting of lead ores containing zinc. It is deposited in the chimneys of the furnaces, in the form of incrustations, moderately hard and heavy, and studded over with small protuberances of a brownish colour on the outside, and yellowish within. As it occurs in commerce, the pieces occasionally present a bluish cast, from the presence of small particles of metallic zinc. Sometimes a spurious substance is sold for tutty, consisting of a mixture of blue clay and copper filings, made into a paste with water, and dried on an iron rod. It is distinguished from the genuine tutty by its diffusing in water and exhaling an earthy smell, and by its greater friability. Tutty is used as an external application only, being employed as a desiccant in excoriations. To fit it for medicinal use it must be reduced to fine powder, which is dusted over the affected part, or applied in the form of ointment. It has been superseded by the pure oxide. B.

ULTRAMARINE. This fine blue pigment was formerly obtained from *lapis lazuli*, or *lazulite*, a mineral of Siberia. It is now prepared artificially by mixing equal parts of sulphur, carbonate of sodium, and silica, adding enough solution of soda to dissolve the silica, and rapidly igniting the mixture. A bluish-green mass results, which becomes blue by ignition in contact with air. It is thought to be a compound of the silicates of aluminium and sodium with sulphuret of sodium. (*Pharm. Journ.*, xi. 230.) For a chemical discussion of its nature, see *Chem. News*, Jan. 1873, xxxix. 51. It is very largely manufactured at Nuremberg, in Germany. (*Am. Journ. of Pharm.*, xxviii. 416.) In reference to this manufacture, see a paper by Dr. Ernst Röhrig in the *Chemical News* (Oct. 11 and 25, 1867, pp. 188 and 212). W.

UMBER. *Terra Umbria.* A mineral of a fine compact texture, light, dry to the touch, shining when rubbed by the nail, and of a fine pale-brown colour, which changes to a peculiar beautiful deep-brown by heat. According to Klaproth, it contains 13 parts of silica, 5 of alumina, 48 of oxide of iron, 20 of manganese, and 14 of water in 100. *Burnt umber*, as well as the mineral in its unaltered state, is used in painting. The umber of commerce is said to be brought chiefly from the island of Cyprus. W.

UPAS ANTIAR AND UPAS TIEUTE. Under these names, two poisons have long been used by the natives of Java and other East India islands for poisoning their arrowheads; and very exaggerated notions have prevailed among the people of the Western World in relation to the tremendously destructive power over animal life of the upas-tree in Java, from which it was supposed that the poison was derived. The tale was told that birds and animals perished when within the influence of its exhalations, and that man came into its near vicinity at the peril of life. All such accounts have proved

to be fabulous; but there is no doubt as to the exceedingly poisonous character of the arrow-poison to which reference has been made. It seems now to be pretty well determined that the active ingredient of the *upas antiar* is a gum-resinous exudation proceeding from incisions in the trunk of the *Antiaris toxicaria*, a large tree belonging to the *Urticaceæ*, growing in Java, Celebes, and the neighbouring islands, and described in *Lindley's Flora Medica* (p. 301). Like certain species of Rhus, this plant exhales an aeriform matter, which very unpleasantly affects many of those who approach it, causing eruptions upon the skin and exterior swelling, while others seem altogether insensible to its influence. The juice is mixed with various substances which probably have little other effect than to give a due consistence to the poison. This, whether taken internally or introduced into the system through a wound, acts with extreme violence, producing vomiting, with great prostration, a feeble irregular pulse, involuntary evacuations, and convulsive movements, which are soon followed by death. Brodie, who made experiments with the poison on animals, could observe no sign of special action on the brain, and believed that death was produced by its action upon the heart, which ceased to beat before respiration ceased, and after death was found full of blood, differing in both these respects from its condition under ordinary narcotic poisoning. In other words, the poison seems to rank with tobacco and aconite, rather than with opium, belladonna, &c. From a chemical examination by Pelletier and Caventou, it appears that the antiar owes its activity to a peculiar principle which they named *antiarin*, crystallizable, soluble in water and alcohol, but scarcely so in ether, and consisting of carbon, hydrogen, and oxygen, with the formula $C_{14}H_{10}O_5$. (See *Am. Journ. of Pharm.*, Sept. 1863, p. 474.) Recent investigations are said to show that antiarin acts directly as a paralyzant on the cardiac muscle, diminishes the irritability of the peripheral vagus, and stimulates the vaso-motor centres. (*New Remedies*, Oct. 1875, p. 308.)

The *upas tieute* is even more poisonous than the *antiar*. This is said to be obtained from a climbing woody plant, growing exclusively in Java, and belonging to the genus Strychnos, specially designated by Leschenault as *Strychnos Tieute*. It is from the bark of the root, according to this author, that the poison is prepared. A decoction of the bark is concentrated to the consistence of syrup, then mixed with onions, garlic, pepper, &c., and allowed to stand till it becomes clear. Leschenault, having dipped the point of an arrow in the poison and allowed it to dry, pricked a chicken with it, which died in a minute or two in violent convulsions. MM. Delille and Magendie found that the poison had not lost its strength in four years. (Hammond, *Am. Journ. of Med. Sci.*, Oct. 1860, p. 366.) A gentleman of Berlin took 3 grains of the poison, apparently for the relief of headache. This disappeared, but a feeling of oppression of the stomach came on, with stiffness along the spine, in half an hour, succeeded by a feeling as of a violent shock through the system, spasmodic contraction and rigidity of the muscles, loss of speech, difficulty of deglutition; in short, with all the symptoms of a poisonous dose of nux vomica. He recovered under the use of emetics followed by opiates. (*Chemist and Druggist*, May 15, 1863.) In fact the poison has upon analysis been found to contain strychnia, as might have been suspected from its origin.

Dr. Wm. A. Hammond made some experiments with a poisonous substance brought by Dr. Ruschenberger from Singapore, which proved to have the combined effects of the two poisons above mentioned, both diminishing directly the power of the heart, and causing tetanic spasms of the muscles; suggesting the idea that it might be a mixture of the antiar and tieute; but Dr. Hammond seems, from other considerations, to have been led to the opinion that it had a different origin from either. (*Am. Journ. of Med. Sci.*, Oct. 1860, p. 371.) W.

URATE OF AMMONIUM. *Ammonii Uras.* ($NH_4O,HO + N_4C_{10}H_2O_4$.) This is an acid salt, and may be formed by digesting uric acid in solution of ammonia. Uric acid is generally obtained from the dried and powdered excrement of the boa serpent, and of other large snakes, by dissolving it in a weak solution of potassa with the aid of heat, and precipitating the uric acid from the filtered solution by muriatic acid, added in excess. Urate of ammonium is a white, amorphous, very sparingly soluble salt. It is a constituent of some varieties of guano; and the medicinal properties of that substance are attributed by some to its presence. This salt has been used with good effects by Dr. Bauer, of Germany, as an external application, in the form of ointment, in chronic cutaneous eruptions, and in tuberculous diseases of the lungs. The ointment is made with a scruple of the salt to an ounce of lard, and is applied to the eruptions night and morning, and, in the pectoral disease, by friction, night and morning, alternately to the back and front of the chest. (*Medico-chirurg. Review*, July, 1852, p. 207; from *Buchner's Repert.*) The urates should be given with caution internally, for fear of producing oxalic acid in the urine. When uric acid was given to rabbits in the dose of from thirty to forty-five grains in their daily food, Dr. Neubauer found that the urea in the urine was considerably increased, showing that the acid was transformed into urea in the economy. When, however, a large quantity of uric acid was given, the urine, in addition to an increased amount of urea, contained some uric acid, and traces of oxalic acid. (*Ranking's Abstract*, July to Dec. 1857, p. 298.) B

UREA. ($C_2H_4N_2O_2$.) This substance, the characteristic organic constituent of urine, was shown by Wöhler to be identical with the hydrated cyanate of ammonium (NH_3, $NC_2O + HO$), which furnishes the first example of a complex organic product artificially formed. When obtained from urine, the most convenient process is that proposed by Dr. Gregory, which consists in saturating concentrated urine with oxalic acid, dissolving in water the oxalate of urea formed, decolorizing the solution with animal charcoal, digesting it with carbonate of calcium, separating the precipitated oxalate of calcium by filtration, and concentrating the filtrate that crystals may form. For the mode of obtaining artificial urea, the reader is referred to chemical treatises. For a new method, which claims to have better results than that previously pursued, the reader is referred to a paper by Mr. John Williams, contained in the *American Journal of Pharmacy* (May, 1868, p. 260); from the *Chemist and Druggist* for March, 1868. Mr. Williams makes cyanate of lead the basis of his operations, which he prepares by heating together cyanide of potassium and red lead, exhausting the product with cold water, precipitating with nitrate of barium, and treating the mother-liquid with nitrate of lead. From the cyanate of lead thus obtained he prepares urea by digesting together equivalent quantities of that salt and sulphate of ammonium, filtering and evaporating.

Urea is in the form of four-sided prismatic crystals, colourless and free from odour when pure, somewhat resembling nitre in appearance, and having a similar saline, cooling taste. It is soluble in its weight of cold water, and in every proportion in hot water. Though without acid or alkaline reaction, it is capable of uniting with several acids, forming crystallizable compounds, having all the characters of salts. Its action on the inferior animals has recently been investigated by M. Gallois. Given to rabbits in the dose of five drachms, it acted as a poison, producing accelerated respiration, weakness of the limbs, tremblings, convulsions, tetanus, and death. Administered in the daily dose of 75 grains for three days, it passed unaltered into the urine, appearing in the secretion in 30 or 40 minutes. (*Chem. Gaz.*, July 1, 1857.)

Urea was proposed many years ago by the French physicians as a diuretic; and its use in this way has been revived by Dr. T. H. Tanner, of London. In the few cases in which Dr. Tanner tried the remedy, it acted as a powerful diuretic without giving rise to any unpleasant symptom whatever. Prof. Mauthner, of Vienna, also bears testimony to its diuretic properties, having found it, in two cases occurring in children, promptly to remove the anasarca following scarlet fever. The dose for an adult to begin with is ten grains every six hours, dissolved in water, flavoured with syrup; the action of the medicine being aided by the free administration of diluents, and by keeping the skin moderately cool. (See *Braithwaite's Retrospect*, xxv. 161.) B.

URTICA DIOICA. *Common nettle.* A well-known perennial herbaceous plant, growing both in Europe and the United States, by the roadsides, in hedges, and gardens. The leaves, seeds, and roots were formerly officinal. They were deemed diuretic and astringent, and were employed in nephritic complaints, hemorrhages, consumption, jaundice, worms, &c. Dr. Benavente has obtained extraordinary success, in the treatment of uterine hemorrhage, both passive and symptomatic, from a decoction of the nettle, made with thirty parts of the plant to five hundred parts of water (℥i to Oj) given in cupful doses, several times a day. (*Ann. de Thérap.*, 1867, p. 92; from *Siglo Medico.*) The young shoots are boiled and eaten by the common people as a remedy in scurvy; and the fresh plant is sometimes used to excite external irritation in cases of torpor and local palsy, the part being beaten with it till the requisite degree of action is produced. The irritant effect of the nettle, applied to the skin, is said to be owing to the presence of free formic acid in the sharp hairs. (*Am. Journ. of Pharm.*, xxii. 181.) The root of the Urtica dioica was examined by Mr. Benj. Shoemaker, with the view of discovering the principle to which it owes its diuretic properties. This he thinks he has found in a volatile oil. (*Ibid.*, Nov. 1866, p. 492.) *U. urens*, or *dwarf nettle*, which is an annual plant, and smaller than the former species, has similar properties, and is used for the same purposes. This species also grows wild both in America and Europe. The two plants were formerly distinguished by the names of *urtica major* applied to *U. dioica*, and of *urtica minor* to *U. urens*. Dr. U. B. Johnson, of Marion, Alabama, has found U. urens very efficacious in uterine hemorrhage. (*N. Orleans Med. and Surg. Journ.*, vi. 452.) *Urtica gigas* of Australia is said to attain a height of 30 feet, and to produce a sting whose impression lasts for many months. It is also asserted that horses are not rarely killed by it. (*New Rem.*, Oct. 1875, p. 352.) W.

VALERIANATE OF BISMUTH. *Bismuthi Valerianas.* This salt is formed by double decomposition between solutions of ternitrate of bismuth and valerianate of sodium. Valerianate of bismuth precipitates as a white powder, which is washed with water, and dried with a gentle heat. It has been recommended by Righini in neuralgia, and in painful affections of the stomach. The dose is from half a grain to two grains, repeated several times a day, and given in the form of pill. B.

VALERIANATE OF IRON. Ferri Valerianas. *Dub.* This officinal of the late Dublin Pharmacopœia has not been retained in the British. The following was the Dublin process. "Take of Valerianate of Soda *five ounces and* 164 *grains* [avoirdupois];

Sulphate of Iron *four ounces* [avoird.]; Distilled Water *one pint* [Imperial measure]. Let the Sulphate of Iron be converted into a persulphate, as directed in the formula for *Ferri Peroxydum Hydratum*, and, by the addition of distilled water, let the solution of the persulphate be augmented to the bulk of eight [fluid]ounces [Imp. meas.]. Dissolve the Valerianate of Soda in ten [fluid]ounces of the Water, then mix the two solutions cold, and, having placed the precipitate which forms upon a filter, and washed it with the remainder of the Water, let it be dried by placing it for some days rolled up in bibulous paper on a porous brick. This preparation should be kept in a well-stopped bottle." The first step in this process is to convert the sulphate of protoxide of iron into the tersulphate of sesquioxide. Then by a double decomposition between this salt and valerianate of sodium, sulphate of sodium is formed in solution, and tervalerianate of sesquioxide of iron is precipitated. The proper proportion of the reacting salts is three equivalents of valerianate of sodium, and one of tersulphate of sesquioxide of iron; and the resulting salts are three eqs. of sulphate of sodium, and one of tervalerianate of sesquioxide of iron.

Properties, &c. This salt is in the form of a dark tile-red, loose, amorphous powder, having a faint odour and taste of valerianic acid. It is insoluble in cold water, and decomposed by boiling water, which extracts all its acid, and leaves the sesquioxide of iron behind. It is soluble in alcohol. Citrate and tartrate of iron, impregnated with oil of valerian, have been fraudulently sold for valerianate of iron. The genuine salt may be distinguished from these substitutions by being insoluble in water and soluble in alcohol, and by the action of a little dilute muriatic acid, which sets free the valerianic acid, readily recognised by its disagreeable odour, which is quite distinct from that of the oil of valerian. In relation to the modes of distinguishing the true from the spurious valerianates, see *Pharm. Journ.* (viii. 577). See also, on the composition, properties, and preparations of this salt, a paper by Mr. Francis Sutton, of Norwich, England, in the same journal (2d ser., viii. 131). Valerianate of iron has been given in hysterical affections, complicated with chlorosis. The dose is about a grain, repeated several times a day. B.

VALONIA. This is the great cups of the acorns of the *Quercus ægilops*, a native of Bosnia. They contain a very large percentage of tannic acid, and are extensively exported for dyeing and tanning. They have also been employed as an astringent in diarrhœa. H. C. W.

VANDELLIA DIFFUSA. This is an herb of Paraguay, said to be used by the natives as an emetic. (*Pharm. Journ. and Trans.*, April, 1872, p. 849.) H. C. W.

VENETIAN RED. *Bolus Veneta.* A dull-red ochrey substance used in painting.

VERBASCUM THAPSUS. *Mullein.* This is a biennial plant, with an erect, round, rigid, hairy stem, which rises from three to six feet in height, and is irregularly beset with large sessile, oblong or oval, somewhat pointed leaves, indented at the margin, woolly on both sides, and decurrent at the base. The flowers are yellow, and disposed in a long, close, cylindrical, terminal spike. The mullein is common throughout the United States, growing along the roadsides and in neglected fields, and springing up abundantly in newly cleared places, at the most remote distance from cultivation. It is, however, generally considered as a naturalized plant, introduced originally from Europe, where it is also abundant. It flowers from June to August. The leaves and flowers have been employed. Both have a slight, somewhat narcotic smell, which in the dried flowers becomes agreeable. Their taste is mucilaginous, herbaceous, and bitterish, but very feeble. They impart their virtues to water by infusion. Mullein leaves are demulcent and emollient, and are thought to possess anodyne properties, which render them useful in pectoral complaints. On the continent of Europe, an infusion of the flowers, strained in order to separate the rough hairs, is considerably used in mild catarrhs. Dr. Home found a decoction of the leaves useful in diarrhœa. The infusion or decoction may be prepared in the proportion of an ounce of the leaves to a pint of water, and given in the quantity of four fluidounces. Dr. N. R. Newkirk, of Bridgeton, N. J., informed the author that he had found the smoking of dried mullein leaves useful in aphonia from irritation of the larynx. The leaves are also employed externally, steeped in hot water, as a feebly anodyne emollient. An ointment is prepared from them in the recent state, and used for the same purposes. It may be made in the same manner as ointment of stramonium, by boiling the leaves in lard. It will be found advantageous to moisten them with water previously to the boiling. W.

VERBENA OFFICINALIS. *Vervain.* This is a common European weed, growing on the roadsides, in the vicinity of towns and villages. Its sensible properties do not indicate the possession of medical virtues; as it is nearly inodorous, and has only a slightly astringent, bitterish taste. By the ancients it was highly esteemed both as a medicine, and as a sacred plant employed in certain religious rites. In modern times, superstitious notions in relation to its virtues are still entertained; and the suspension of the root around the neck by a white riband, has been gravely recommended for the cure of scrofula. The leaves, bruised and made into a cataplasm, are used by the vulgar as a remedy in severe headache, and other local pains. The plant, however, is probably inert. An American

species, *V. hastata*, is more bitter than the European, and is said to be emetic. It is not, however, employed in regular practice. Schoepf states that the root of *V. urticifolia*, another indigenous species, has been advantageously used in poisoning from the Rhus Toxicodendron. It is prepared by boiling it in milk and water along with the inner bark of the white oak. *V. bracteosa* of the West is said to be exhibited as an alterative in scrofula. (*Am. Journ. of Pharm.*, 1870, p. 104.) W.

VERDITER. Two preparations of copper, employed as pigments, are known by this name in commerce, and are distinguished by the epithets of blue and green. *Blue verditer* is prepared in London from the solution of nitrate of copper obtained in precipitating silver by copper. According to Gray, this solution is poured hot upon whiting (carbonate of calcium), and the mixture stirred every day till the liquor loses its colour, when it is decanted, and fresh portions added till the proper colour is obtained. By a process for procuring this pigment, invented by Pelletier, the solution of nitrate of copper is decomposed by quicklime, and the precipitate, after being washed, is incorporated intimately with another portion of quicklime. By the former process, a carbonate of copper is obtained; by the latter, a mixture of the hydrated oxide of copper and hydrate of lime. *Green verditer* is prepared by precipitating a solution of nitrate of copper by chalk or a white marl, and consists of carbonate of copper mixed with an excess of the calcareous carbonate. W.

VERONICA OFFICINALIS. *Speedwell.* Several species of Veronica, common to Europe and this country, have been medicinally employed. Of these V. officinalis, and *V. Beccabunga* or *brooklime*, are the most conspicuous. *V. officinalis* has a bitterish, warm, and somewhat astringent taste. Examined by Enz, it was found to contain, in the fresh juice and an extract from the herb, a bitter principle soluble in water and alcohol, but scarcely so in ether, and precipitated by the salts of lead but not by tannic acid; an acrid principle; red colouring matter; a variety of tannic acid producing a green colour with the salts of iron; a crystallizable fatty acid, with malic, tartaric, citric, acetic, and lactic acids; a soft, dark-green bitter resin; and mannite. Prof. Mayer, of N. York, in an examination of the herb, found evidences of the existence of an alkaloid, and a small quantity of a saponaceous principle. (*Am. Journ. of Pharm.*, July, 1863, p. 209.) The plant has been considered diaphoretic, diuretic, expectorant, tonic, &c.; and was formerly employed in pectoral and nephritic complaints, hemorrhages, and diseases of the skin, and in the treatment of wounds. The *beccabunga*, which is very succulent, was employed in the fresh state with the view of purifying the blood, and as a remedy in scurvy. Both plants, however, are at present out of use. W.

VIBERNUM PRUNIFOLIUM. *Black Haw.* (See *Gray's Manual*, p. 167.) This is a tree-like shrub, growing southward from New York and Ohio, and remarkable for the beauty of its foliage and flowers. Attention was first called to the medical virtues of this plant by Dr. D. L. Phares, of Newtonia, Miss., who considers it as "nervine, antispasmodic, astringent, diuretic, and tonic," and recommends it in the nervous disorders of pregnancy, and as peculiarly efficacious in preventing miscarriage, whether habitual, or threatened as the result of accident, or of criminal design. In this latter application of the remedy, his report is confirmed by the experience of a writer in the *Atlanta Medical and Surgical Journal*, who used it with complete success in two cases. The bark is given in infusion or decoction, of which, when the symptoms are urgent, an ounce or two may be given every two or three hours. (*Boston Med. and Surg. Journ.*, Oct. 10, 1867, p. 212.) W.

VINCA MAJOR. *Greater Periwinkle.* VINCA MINOR. *Lesser Periwinkle.* These English plants are said to be very useful in arresting menorrhagic and other hemorrhages. (*Pharm. Journ. and Trans.*, April, 1871, p. 961; *Ibid.*, May, 1873, p. 963; also *Am. Journ. of Pharm.*, 1872, p. 209.) H. C. W.

VISCUM ALBUM. *Mistletoe.* A European evergreen parasitic shrub, growing on various trees, particularly the apple and other fruit trees, and forming a pendent bush from two to five feet in diameter. The plant is famous in the history of druidical superstition. In the religious rites of the Druids, the mistletoe of the oak was employed, and hence was afterwards preferred when the plant came to be used as a remedy; but it is in fact identical in all respects with those which grow upon other trees. The fresh bark and leaves have a peculiar disagreeable odour, and a nauseous, sweetish, slightly acrid and bitterish taste. The berries, which are white, and of about the size of a pea, abound in a peculiar viscid principle, and are sometimes used in the preparation of bird-lime, of which this principle is the basis. Mistletoe is said to be capable of vomiting and purging when largely taken. A case has been recorded by M. Gampert, in France, in which a child three years old was poisoned by eating the berries. Vomiting and prostration were produced, and on the arrival of the physician the patient was found insensible, with a fixed and somewhat contracted pupil, coldness of the skin, and convulsive movements of the extremities. An emetic brought away a considerable quantity of the berries, and the child recovered. (*Ann. de Thérap.*, 1859, p. 36.) A fatal case is recorded in the *Medical Times and Gazette* (Jan. 1867, p. 26), in which a child a year old died comatose from the effects of these berries, which had been given by a young sister, though the stomach was

evacuated, and a large number of the berries discharged. The plant was formerly looked upon as powerfully antispasmodic, and was highly esteemed as a remedy in epilepsy, palsy, and other nervous diseases; but it is now out of use. The leaves and wood were given in the dose of a drachm in substance, and of an ounce in decoction. One or more species of Viscum grow in the United States, but are little used. Dr. Henry Dye, of Texas, records several cases of children poisoned by eating the berries of a species growing on the elm, probably *Viscum flavescens* of Pursh, *Phoradendron flavescens* of Nuttall. (See *Gray's Manual*, p. 382.) The prominent symptoms were vomiting and great thirst, followed by frequent discharges of bloody mucus from the bowels, with tenesmus. One of the children was found in a collapsed state, in which death took place. Dr. Dye states also that, in other instances, as he had been informed, children had eaten the berries without any ill effect. (*Memphis Med. Recorder*, iv. 344.) W.

VULCANITE. For cases of poisoning by *artificial gum*, made of vulcanite coloured with vermilion, see *Med. Press and Circular*, Dec. 1874. H. C. W.

WHITE CEDAR, OIL OF. Dr. F. K. Bailey reports the case of a girl, aged fifteen, who took 16 drops of the oil of white cedar, and directly afterwards fell unconscious. He found her shortly afterwards in clonic spasms, and, forcing open her jaws, poured in some castor oil, which vomited her. The clonic spasms then yielded to epileptiform convulsions lasting at intervals for several hours. Long-continued irritation of the stomach resulted, and it was a year before health was fully recovered. (*New Remedies*, 1872.) H. C. W.

WHITING. This is essentially the same as prepared chalk, being made by the pulverization and elutriation of crude chalk. It is used as a coarse paint, and for various purposes in the arts, for which carbonate of calcium is requisite. *Paris white* is a variety of the same material. W.

WINE, AROMATIC. *Aromatic Wine.* The following formula for an aromatic wine, handed to us by Prof. Procter, merits notice, if only for its extensive use. "Take of Sage, Thyme, Hyssop, Spearmint, Wormwood, Origanum, each, in coarse powder, *half a troyounce;* Alcohol *a fluidounce;* Claret Wine *two pints.* Mix the Alcohol and Wine, and, having moistened the powders with a portion of the mixture, pack the mass in a percolator, and pour upon it the remainder of the menstruum. When the liquid has disappeared, add Alcohol diluted with three times its bulk of water, until a pint of filtered liquid has passed." The alcohol is added to the claret wine to give it greater stability. Though not officinal, we are informed that this wine, the formula for which was introduced from France, is much employed in this neighbourhood, and to some extent elsewhere in the U. States. It no doubt possesses strong tonic and aromatic properties, and may be used in cases of enfeebled digestion, especially when accompanied with gastric pains and flatulence; but its chief employment is externally by way of fomentation, and as a stimulant to feeble and unhealthy ulcers. It possesses the advantage over the aromatic and tonic tinctures that it is less stimulating. The dose may be from one to four fluidrachms. W.

WINTER'S BARK. WINTERA. *U. S.* 1850. *The Bark of Drimys Winteri.* The genus *Drimys* belongs to Polyandria Tetragynia in the Linnæan system, and to the natural order Magnoliaceæ (*Juss.*), Winteraceæ (*Lindley*). The following is the generic character. "*Calyx* with two or three deep divisions. *Corolla* with two or three petals, sometimes more numerous. *Stamens* with the filaments thickened at the summit, and anthers having two separate cells. *Ovaries* from four to eight, changing into the same number of small, many-seeded berries." (*A. Richard.*) This plant, which is figured in *Carson's Illustrations of Medical Botany* (i. 11, pl. 5), is an evergreen tree, varying very much in size, sometimes rising forty or fifty feet in height, sometimes not more than six or eight feet. The bark of the trunk is gray, that of the branches green and smooth. Its leaves are alternate, petiolate, oblong, obtuse, somewhat coriaceous, entirely smooth, green on their upper surface, of a pale-bluish colour beneath, with two caducous stipules at their base. The flowers are small, sometimes solitary, but more frequently in clusters of three or four, upon the summit of a common peduncle about an inch in length, simple, or divided into as many pedicels as there are flowers. The tree is a native of the southern parts of South America, growing along the Straits of Magellan, and extending as far north as Chili. According to Martius, it is found also in Brazil. The bark of the tree was brought to England, in the latter part of the sixteenth century, by Captain Winter, who attended Drake in his voyage round the world, and while in the Straits had learned its aromatic and medicinal properties. Since that period, a bark has been occasionally employed in medicine under the name of Winter's bark; but it is now believed not to have been derived from Drimys Winteri; as it does not correspond with the specimens of the bark obtained from that tree, still preserved in the cabinets of Europe. The origin of the commercial Winter's bark is unknown. The following is the description of a specimen which came into our possession many years since. It corresponds closely with Guibourt's description of commercial Winter's bark. It is in quilled pieces, usually a foot in length, and an inch or more in diameter, appearing as if scraped or rubbed on the outside, where the colour is pale-yellowish or reddish-gray, with red

elliptical spots. On the inside the colour is that of cinnamon, though sometimes blackish. The pieces are sometimes flat and very large. The bark is two or three lines in thickness, hard and compact, and when broken exhibits on the exterior part of the fracture a grayish colour, which insensibly passes into reddish or yellowish towards the interior. The powder resembles in colour that of Peruvian bark. The odour is aromatic, the taste spicy, pungent, and even burning. Winter's bark was found by M. Henry to contain resin, volatile oil, colouring matter, tannic acid, several salts of potassa, malate of calcium, and oxidized iron. The presence of tannic acid and oxide of iron serves to distinguish it from *canella alba*, with which it has often been confounded. The bark above described as commercial Winter's bark is destitute both of tannic acid and oxide of iron, and cannot, therefore, be the bark examined by M. Henry.*

Medical Properties and Uses. Winter's bark is a stimulant aromatic tonic, and was employed by Winter as a remedy for scurvy. It may be used for similar purposes with cinnamon or canella alba, but is scarcely known in the medical practice of this country. The dose of the powder is about half a drachm. Another species, the *Drimys Chilensis* of De Candolle, growing in Chili, yields a bark having similar properties. (Carson, *Am. Journ. of Pharm.*, xix. 81.) W.

WOORARI. *Woorara. Woorali. Urari. Curare.* This is a powerful poison prepared by the aborigines in the interior of British Guiana, and used for arming the points of their weapons. It has the aspect of a black extract, brittle, and of a resinoid appearance. But the specimens, as brought into Europe and this country, vary much in character, at least in their energy of action on the cerebral system. M. C. Bernard has experimented with ten or twelve specimens brought to him from S. America, some of which appeared nearly identical, while others differed in the relation of one to six. (*Journ. de Pharm.*, 4e sér., ii. 166.) Various opinions have been advanced in relation to its source and preparation; but the most probable account is that of Dr. Hancock, who states, from information derived from the natives, that it is a watery extract from the bark of a gourd-like plant. It has been stated that the plant producing it is a Strychnos, and Sir R. H. Schomburgk, who claims to have seen the plant, proposes to name it *Strychnos toxifera*. But the facts that the poison acts in a mode directly opposite to that of strychnia in destroying life, and that chemists have been unable to detect that alkaloid in it, are, we think, sufficient proof that Schomburgk must have been mistaken on this point. (See *Pharm. Journ.*, xvi. 502.) The probability is that it is derived from different plants, and Schomburgk gives the native names of eight which he says enter into its constitution. (*B. and F. Medico-chir. Rev.*, Oct. 1865, p. 526.) Nor is it always identical, for very different effects have been obtained on the system from different substances, brought from S. America. It has been conjectured that the poison from the fangs of serpents is mingled with, if it does not constitute the active ingredient of the woorari. But this is contradicted by those who have had the best opportunities of ascertaining its mode of preparation; and is also opposed by the fact, that, unlike the venom of snakes, this poison does not occasion local inflammation when inserted into a wound, but appears to act exclusively on the nervous system, through the medium of the blood. In order that it may act, it must find entrance into the circulation; and hence, when swallowed, it does not in general prove poisonous, either because it cannot penetrate the mucous membrane, or because it is altered in the stomach. It would not, however, be altogether safe to rely on its innoxiousness when swallowed; for, in an empty condition of the stomach, and taken in large doses, it has been found by Dr. John W. Green and others to cause death in some animals. (*Am. Med. Gaz.*, vi. 299.) It appears also, from the experiments of MM. Pelouze and Bernard, to be absorbed as quickly from the air-passages as when inserted into the cellular tissue, and, when thrown into the rectum, produces its peculiar effects, though very slowly. (*Journ. de Pharm.*, Août, 1856, p. 150.) M. C. Bernard thinks that its apparent want of effect, when applied to the mucous membranes, is owing to the fact that it passes through that tissue into the circulation so slowly that it is eliminated by the different secretions as fast as it enters. (*B. and F. Med.-chir. Rev.*, Oct. 1865, p. 527.)

When this article was originally written, the following is a summary of what was known of the effects of this poison. When it is inserted in a wound, the animal speedily falls into stupor, and dies in a few minutes, the heart continuing to act for some time after respiration has ceased. If artificial respiration is resorted to before the heart

* M. Guibourt, in the third edition of his "Drogues Simples," published in 1850, gives the following description of a specimen of the true Winter's bark, presented to him by Robert Brown, and labelled "*Port Famine, Captain P. King, Drimys Winteri.*" The bark is 3 millimetres (1·18 of an inch) thick, and covered with a grayish-white, very thin, and rather smooth epidermis. It is of a deep reddish-brown colour internally, and has a spongy appearance, especially in the part in contact with the wood, where it appears to be formed of longitudinal, radiating ligneous layers, isolated one from the other. It has a strong odour, somewhat analogous to that of canella and slightly camphorous, and a taste in like manner very aromatic, with considerable acrimony. Another specimen brought from the Straits of Magellan, in 1840, bears a close resemblance to the above, being in quills as large as the little finger, with a thickness of 2 millimetres, and an epidermis thin, smooth, and of a whiteness strongly contrasting with the reddish-brown colour of the interior. Beneath the epidermis there is a certain number of very compact concentric layers; but most of the thickness of the bark is formed of radiating and distinct ligneous layers, altogether like those of the preceding specimen. Guibourt also describes the barks of two other species of Drimys, those of *D. Mexicana* and *D. Granatensis*, growing respectively in Mexico and New Granada, both of which have considerable resemblance to the preceding.—(Tom. iii. pp. 681, 682.)

has ceased to act, and is sustained, the animal recovers. From numerous experiments, performed by different persons, there is reason to believe that woorari acts by paralyzing the nervous centres of respiration and motion, without producing essentially any discoverable alteration in the blood or solid tissues. Its action is therefore directly opposite to that of strychnia; and it is said to serve as an antidote to that poison by producing relaxation of the contracted muscles. Its peculiar mode of action has even suggested its remedial use in tetanus. A horse suffering under tetanus was inoculated by Mr. Sewell with woorari. In ten minutes apparent death was produced, when the animal was revived by artificial respiration; and the symptoms of tetanus did not return, though death occurred next day, as was supposed, from overeating. (*Pharm. Journ.*, xvi. 506.) In several cases of tetanus in which it was tried by M. L. Vella, in an hospital at Turin, it appeared to afford relief in all, and in one instance recovery took place. (*Arch. Gén.*, Oct. 1850, p. 1.) But as we have other medicines at least equally effectual, and of which the precise strength is better known, it would not be advisable to trust a case to this remedy. It is said that chlorine and bromine neutralize entirely the effects of the poison (*Ibid.*, p. 504); and, from the experiments of Drs. Brainard and Green, there can be little doubt that iodine has the same effect. It was ascertained by them that woorari, mixed with solution of iodine and iodide of potassium, had no effect when introduced into a wound; and that, if introduced alone, its effects were quite neutralized by subsequent injection of the solution; a cupping-glass being applied so as to prevent the absorption of the poison before the iodine could be brought into contact with it. (*Am. Med. Gaz.*, vii. 305.)

The attempts first made to isolate the poisonous principle of woorari were without satisfactory results. Dr. Heintz succeeded in obtaining the poison in an exceedingly concentrated form, but not entirely separated from other principles. (*Ibid.*, vii. 6.) In 1828, MM. Boussingault and Roulin separated a substance which they regarded as an alkaloid, but which neither they nor other chemists obtained in a crystalline state. At length, however, M. W. Preyer, at the urgent request of M. Bernard, who desired to find some physical test of the identity of the different substances which bore the common name of curare, undertook a laborious investigation into the subject, and succeeded in isolating a crystallizable alkaloid, which is undoubtedly the active principle of woorari, and which has received the appropriate name of *curarine* (*curaria*). From the different specimens examined by him he extracted the same alkaloid; and it is no doubt common to all the varieties of this poison which produce its characteristic effects on the system. The following is the process employed by him. It was first necessary to separate substances added by the Indians to give consistence to the poison, and aid in its preservation. Such are the resin, gum, and perhaps the lime of the woorari. For this purpose he treats the poison successively with alcohol and water, both of which dissolve the alkaloid, though the former less than the latter. Having added a few drops of a saturated solution of carbonate of sodium to the powdered woorari, he treats this with absolute alcohol boiling hot, then distils off the alcohol, and adds distilled water to the residue in the retort. Having filtered the watery solution, he adds solution of bichloride of mercury in excess, which precipitates the whole of the curaria. The precipitate is suspended in water, and treated with a current of sulphuretted hydrogen, which throws down sulphuret of mercury, leaving muriate of curaria in solution. To obtain this pure, however, it is necessary to repeat the treatment with the bichloride several times. A colourless, or nearly colourless solution is thus obtained, from which the muriate of curaria crystallizes under the receiver of an air-pump. Another proceeding is given by M. Preyer, in which phosphomolybdic acid is employed as the precipitant. The alkaloid may be obtained from the muriate in the ordinary mode. Besides the muriate, he has obtained the nitrate, sulphate, and acetate, all soluble and crystallizable. Curaria differs from all the other crystallizable alkaloids, with one exception, in containing no oxygen. It consists of carbon, hydrogen, and nitrogen, and M. Preyer presents as a provisional formula $C_{10}H_{15}N$. Curaria is extremely deliquescent, of an extreme and persistent bitterness, crystallizing in quadrilateral prisms, which are colourless, soluble in water and alcohol in all proportions, little soluble in chloroform or amylic alcohol, insoluble in anhydrous ether, benzole, oil of turpentine, or sulphuret of carbon. It very feebly changes litmus blue, and its soluble salts do not redden it. Pure concentrated sulphuric acid gives it a very durable magnificent blue colour, which is not the case with strychnia. With bichromate of potassium the same acid develops the same violet colour as with strychnia, but much more persistent. Concentrated nitric acid renders it purple. By these tests curare may be readily detected in the fluids of animals poisoned with it. (*Journ. de Pharm.*, 4e sér., ii. 296.)

In reference to the effects of curaria on the system, M. Bernard has proved that it is identical in the character of its operation with woorari, but vastly more powerful, according to M. Bernard at least twenty times more powerful than the substance from which it was extracted. There can be no doubt, therefore, that it is the active principle of woorari, and that anything which may be offered under this name, has no claims to it unless it is capable of furnishing more or less curaria. The identity of effect is so complete, that the same difficulty of absorption by the intestinal canal which characterizes woorari, belongs also to the alkaloid. (*Journ. de Pharm.*, 4e sér., ii. 167.)

After the publication of the eleventh edition of the Dispensatory, elaborate and highly interesting experiments were made by Drs. Wm. A. Hammond and S. Weir Mitchell on the woorari poison, of which we give a brief abstract, referring for a full account of them to a communication by those gentlemen to the *American Journal of the Medical Sciences* (July, 1859, p. 13). The specimens operated on were of two kinds, named respectively *carroval* and *vao*, and were brought by Drs. Ruschenberger and Caldwell of the U. S. Navy, from New Granada, S. America. 1. *Woorari*, variety *Corroval.* This was in dark-brown lumps, having the appearance of a vegetable extract, and of an intensely bitter and persistent taste. Under the microscope it presented the appearance of vegetable remains, but nothing animal. It yielded its active properties to water and alcohol, and was found to contain a peculiar alkaloid, which they propose to call *corrovalia*, and which they ascertained to produce on the system the same effects as corroval itself. These were to some extent similar to those obtained from woorari by preceding experimenters, yet with so much difference as to lead to the conclusion, that the poison was derived from a different source. In a few minutes after the introduction of the poison through a wound, paralytic phenomena became obvious, and the animal soon died, without preliminary spasm or convulsions. But the heart, instead of continuing to act after apparent death, had entirely ceased to beat, and had quite lost its irritability, so that it could not be excited by galvanism. They inferred that the action of the poison is directly and primarily on the heart, possibly through the ganglia contained in its tissue. The capillary circulation was always arrested a minute or two before the heart's actions, which the authors ascribe to paralysis of the sympathetic. There was no evidence whatever, whether chemical or physiological, of the presence of strychnia in the poison. 2. *Woorari*, variety *Vao* or *Bao.* This, like the preceding, had the characters of a vegetable extract, with a large proportion of vegetable but none of animal remains. It contained the same alkaloid as the corroval, but in smaller proportion; and its effects on the system, though much feebler than those of the other variety, were of the same general character. They inferred from their observations that it was the same poison, but in a diluted state.

Experiments have recently been made in France by MM. Voisin and Liouville, followed by others by M. Du Cazal, which may be considered as determining the physiological action, and to a considerable extent the therapeutical applicability of woorari. We have not space for these in detail, and must content ourselves with giving the general results obtained. The poison was introduced into the system hypodermically. A filtered aqueous solution was employed by M. Du Cazal; as it was found to exercise the whole effect of the poison on the system, with only temporary local irritation if any, while the poison injected unaltered, or in unfiltered solution, in consequence of the insolubility of some of its ingredients, caused persistent inflammation, often ending in suppuration, and lasting for months. It was found, as on former occasions, that the poison introduced into the stomach produced comparatively little effect. It was also found, as stated by Bernard, that its action could be to a considerable extent controlled by applying a ligature around the limb above the point of insertion, so as to arrest the return of blood. The experiments were first performed on the lower animals, and afterwards, when a safe dose had been determined, were cautiously extended to the human subject. The effects on the lower animals were always characteristic; and in no instance were symptoms produced such as are caused by other poisons, as strychnia, &c. The nerves of voluntary motion were always disordered, often completely paralyzed, but they retained their irritability, as shown by their contraction under electric excitement, and cutaneous sensibility was unimpaired. In fatal cases a remarkable increase of the temperature of the rectum was observed, amounting to from 5° to 7° F., while little if any change was noticed on the surface. The circulation, at first excited, gradually became depressed, ending in asphyxia. Moderate doses usually dilated the pupils; while, after large doses, though at first widely dilated, they rather suddenly contracted; and subsequently there was an alternation between the two conditions. Double exophthalmia was also observed after fatal doses. As regards the effects on the human subject, MM. Voisin and Liouville divide the effects into two classes, according to their severity. The milder symptoms are chiefly exhibited in the circulatory system. The pulse is increased in force and frequency, the respiration is rendered somewhat more frequent, the temperature is slightly elevated, perspirations sometimes occur, and the urine is augmented in quantity, is remarkably light coloured, and contains glucose. From larger quantities of the poison violent febrile phenomena occur, commencing with the characteristic symptoms of a severe chill. There are shivering, chattering of the teeth, sensations of severe cold, cutis anserina, startings, and general trembling, with small and rapid pulse, anxiety, sighing, &c. The power of the lower extremities rapidly diminishes or quite ceases, co-ordination of motion is disturbed, and sometimes the patient is unable to move the legs. Thirst, headache, insomnia, and sometimes diuresis, are added to the other symptoms. The first coldness is followed by a hot skin, frequent and full pulse, redness of the surface, injected conjunctiva, and a profuse sweat. The paralysis of the lower extremities continues generally for a few minutes, at most for an hour; but care was taken to arrest the action of the poison by compressing the vessels above the

point of insertion. The fever continues longer; sometimes, when the dose is large, for five or six days, gradually diminishing. The elimination of the poison by the kidneys appears to cease in about 24 hours. In cases of poisoning from the injection of woorari, a ligature round the limb between the place of injection and the heart, the free exhibition of diluents and evacuants, and artificial respiration when required are the measures recommended; and, as a last resource, in cases of asphyxia, tracheotomy. (*Ed. Med. Journ.*, Jan. 1867, p. 667.) Contrary to the experiments just detailed, Dr. F. Riegel (*Lancet*, 1871, p. 516) finds that there is a steady fall of temperature in animals under the influence of woorari.

Great care was taken by M. Du Cazal in determining the proper dose of woorari, and the following are the results obtained by him; though, with the exceeding diversity in the strength of the poison, no numbers can be considered otherwise than as the mean. Fortunately, should woorari ever come into use as a medicine, the discovery of its active principle, curaria, will enable us to give entire precision to our prescriptions. According to M. Du Cazal, from 5 to 10 milligrammes (·077 to ·154 gr.) daily were borne by a dog without inconvenience; at the dose of 10 milligrammes the characteristic phenomena began to show themselves, but disappeared in a few hours; with 14 milligrammes the animal perished. For man the doses administered by subcutaneous injection were from 1 to 5 centigrammes (·1543 to ·7715 gr.), and exceptionally from 6 to 7. From these quantities, the appearance of glucose in the urine proved the presence of the poison in the system; and some slight characteristic symptoms, as dazzling, headache, vertigo, general lassitude, have appeared, but without any serious disturbance of the locomotor apparatus. M. Du Cazal also experimented with the poison therapeutically; but his trials with it were confined to chronic cases. His conclusion was that it will never become a remedy in common use. Great objections to it are its high price, and its occasional entire disappearance from the market; but were it possessed of any great therapeutic value, this difficulty could be overcome by the discovery of the locality of the plant producing it. The fact, however, as stated by M. Du Cazal, is, that it in no way modified the pathological condition in epilepsy, the only disease in which it was given, and which presents the very derangement of the nervous system, for the correction of which it would seem from its ordinary action to be peculiarly calculated. The state of the patient was in no way modified; the paroxysms recurring neither more nor less frequently than before. (*Arch. Gén.*, Sept. 1869, p. 328.) It has been prescribed in the same complaint and in chorea by M. Beigel, but without any satisfactory result. (*Ann. de Thérap.*, 1869, p. 48.) The pathological condition in which its use would seem to be especially indicated is that of acute spasmodic affections, of a very severe character, as tetanus, the poison of strychnia, and hydrophobia. Administered in tetanus, it is said by MM. Jousset and Bellesme to cause the rigidity of the muscles to cease; and this is an important result, but we are yet without evidence to prove its curative powers in that complaint. The method of exhibition is to prepare an infusion in the proportion of one part of the medicine to ten parts of boiling water, and, after filtration, to inject subcutaneously, at short intervals, a quantity of the infusion equivalent to half a centigramme (about one-thirteenth of a grain), to be increased or diminished according to its effects. (*Ann. de Thérap.*, 1866, p. 37.) Could curaria be obtained, it should be exhibited in the same way, in doses not exceeding, at first, the twentieth of that of the drug. (*Ibid.*, p. 44.) W.

WRIGHTIA ANTIDYSENTERICA. (R. Brown.) *Nerium antidysentericum.* (Linn.) An East India tree, belonging to the Apocynaceæ, the bark of which was, about a century since, in some repute in Europe as a remedy in dysentery, diarrhœa, and febrile diseases. Though no longer used in Europe, it still retains its reputation in India, among the native practitioners. Dr. Stenhouse has recently examined the seeds of this plant, and obtained from them, besides a fixed oil which they contain in large quantity, a peculiar principle called by him *wrightine*, which though uncrystallizable, and forming uncrystallizable compounds with the acids, has claims to be ranked with the alkaloids. Both wrightine and its salts have an extremely persistent bitterness. For further particulars in reference to it, the reader is referred to the *Pharmaceutical Journal* (April, 1864, p. 493). W.

XANTHORRHŒA RESINS. Two resinous substances, the products of different species of Xanthorrhœa, have been introduced into England from New Holland. They are obtained by spontaneous exudation from the stems of the plants, which are usually shrubs. One of the resins is yellow and the other red. The *yellow variety* is in tears, in flattish pieces having on one side the mark of the stem, or in masses of various size and irregular shape. It has a reddish-yellow colour, resembling gamboge when broken, and when heated emits a fragrant odour like that of Tolu balsam. It contains resin, cinnamic and benzoic acids, and a trace of volatile oil, and may therefore be ranked among the balsams. When heated with nitric acid, it yields a large product of carbazotic acid. In medical properties it is said to bear a close resemblance to storax and the balsam of Tolu. A tincture, made in the proportion of two ounces to a pint of alcohol, may be given in the dose of one or two fluidrachms. The *red variety* resembles dragon's

blood in colour, and appears to be analogous to the other variety in properties. The above account has been abridged from that of Dr. Pereira in the third edition of his Materia Medica. W.

XYLOL. This is a hydrocarbon, first extracted from naphtha by Dr. Hugo Müller, which was brought forward by Dr. Zuelzer as a specific in smallpox, but which has failed to make good the claims made for it. (*Pharm. Journ. and Trans.*, Feb. 1872, p. 623; *Am. Journ. of Pharm.*, 1872, p. 392.) H. C. W.

ZEA MAYS. *Indian Corn. Maize.* The common Indian corn of this country, analyzed by Mr. Archibald Polson, of Paisley, Scotland, yielded as the average result from three varieties, 12·16 per cent. of water, 1·67 of ashes, 8·83 of gluten, 54·37 of starch, 15·77 of husk and vegetable fibre, 4·50 of fat, and 2·70 of gum and sugar. (*Chem. Gaz.*, June 1, 1855, p. 211.) The late Dr. Gorham, of Boston, found 1·50 per cent. of sulphate and phosphate of calcium. The meal, in the form of mush, makes an excellent emollient poultice, much used in hospitals; and a gruel may be prepared from it, which is sometimes more grateful to the sick than that made from oatmeal. A fungous product sometimes attends the growth of Indian corn, commonly known as the smut, which was submitted to examination by Mr. C. H. Cressler, and found to contain the alkaloid discovered by Winckler in ergot, and named by him secalin, now considered as a mere synonyme of propylamia. Besides the alkaloid, there were obtained a thick, viscid, fixed oil, a resin soluble in ether, but not in alcohol, pectin, gluten, and a species of sugar. The morbid product may, therefore, be considered as the *ergot of maize.* (*Am. Journ. of Pharm.*, July, 1861, p. 306.) The fungus has received the title of *Ustilago maidis.* It is said to produce abortion in cows, when the diseased grain is eaten by them; and six drachms of this ergot produced the same effect on two pregnant bitches to which it was given to test its abortefacient property. (*Ibid.*, Sept. 1861, p. 413; from *Annal. Med. Vet. Belge.*) W.

ZEDOARY. *Radix Zedoariæ.* There are two kinds of zedoary, the long and the round, distinguished by the old officinal titles of *radix zedoariæ longæ*, and *radix zedoariæ rotundæ;* the former produced by the *Curcuma Zedoaria* of Roxburgh, the latter, as some suppose, by the *Kæmpferia rotunda* of Linn., but, according to others, by the *Curcuma Zerumbet* of Roxburgh. Both kinds come from the East Indies. The *long zedoary* is in slices, from an inch and a half to three inches in length, and from half an inch to an inch thick, obtuse at the extremities, and exhibiting the remains of the radical fibres. The *round* is also usually in slices, which are the sections of a roundish root, ending in a point beneath, and divided longitudinally into two parts, each of which is flat on one side, convex on the other, and heart-shaped in its outline. Sometimes the root of the latter variety is entire, and sometimes in quarters instead of halves. It is marked with circular rings on the convex surface, and, like the former, with small projecting points which are the remains of radical fibres. Both are grayish-white on the outside, yellowish-brown within, hard, compact, of an agreeable aromatic odour, and a bitterish, pungent, camphorous taste. The round, however, is less spicy than the long. They yield a volatile oil, when distilled with water. Zedoary is a warm, stimulating aromatic, useful in flatulent colic and debility of the digestive organs. It is not now employed, as it produces no effects which cannot be as well or better obtained from ginger. The dose is from ten grains to half a drachm. W.

ZERUMBET. *Cassumuniar.* Under these names an East India root was formerly used, having some analogy in sensible and medical properties to ginger, and ascribed to the *Zingiber Zerumbet* of Roscoe. Some consider the cassumuniar as a distinct root, and refer it to the *Zingiber Cassumuniar* of Roxburgh. The difference of opinion is of little importance, as neither of the roots, supposing them not to be the same, is at present to be found in the markets. By some authors the zerumbet has been erroneously confounded with the round zedoary. Geiger describes it as in pieces of the size of a fig or larger, externally grayish-brown and wrinkled, internally yellowish, hard and tough, of a biting, aromatic taste, and a spicy odour. W.

ZIZYPHUS VULGARIS. Lamarck. *Rhamnus Zizyphus.* Linn. A shrub, or small tree, growing on the shores of the Mediterranean, and cultivated in Italy, Spain, and the South of France. The fruit is the part used. This consists of oval drupes, of the size of a large olive, with a thin, coriaceous, red or reddish-brown skin, a yellowish, sweet, acidulous pulp, and an oblong, pointed stone in the centre. These have the officinal name of *jujubæ.* By drying, their pulp becomes softer and sweeter, and acquires a vinous taste, evincing the commencement of fermentation. They are nutritive and demulcent, and are used in the form of decoction in pectoral complaints. *Jujube paste* consists properly of gum arabic and sugar, dissolved in a decoction of this fruit, and evaporated to the proper consistence. As a demulcent, it is in no respect superior to a paste made with gum arabic and sugar alone; and the preparation commonly sold in this country under the name, contains in fact none of the fruit.

The fruits of two other species of Zizyphus, *Z. Lotus*, growing in the North of Africa and *Z. Jujuba*, a native of the East Indies, possess properties similar to those of the first-mentioned species, and are used as food by the inhabitants of the countries where they grow. W.

APPENDIX.

I. ART OF PRESCRIBING MEDICINES.

The physician should be acquainted not only with the properties of medicines, and the diseases to which they are respectively applicable, but also with the art of prescribing them, so that they may be adapted to the peculiarities of individual patients, and, by the mode in which they are administered, may produce the greatest curative effect with the least possible inconvenience. In relation to these points, a few general rules will be useful for the guidance of the young practitioner, although much must be left to his own judgment and discretion. We shall compress the remarks which we have to offer, under the two heads of the quantity or dose in which medicines may be given, and the mode of their exhibition.

1. Dose of Medicines.—In the body of the work, the quantity has been stated in which each medicine must ordinarily be given to produce its peculiar effects in the adult patient. But there are various circumstances which modify the dose, and demand attention on the part of the practitioner.

The *age* of the patient is the most important of these circumstances. The young require a smaller dose than those of maturity, to produce an equal effect; and the old, though their systems are, perhaps, less susceptible to the action of medicines than those of the middle-aged, cannot bear an equally forcible impression. The following table of Gaubius, exhibiting the doses proportioned to the age, is frequently referred to.

The dose for a person of middle age being		1 or 1 drachm,
That of a person from 14 to 21 years will be		$\frac{2}{3}$ or 2 scruples,
7 to 14	" "	$\frac{1}{2}$ or $\frac{1}{2}$ a drachm,
4 to 7	" "	$\frac{1}{3}$ or 1 scruple,
of 4 years	"	$\frac{1}{4}$ or 15 grains,
3 "	"	$\frac{1}{6}$ or 10 grains,
2 "	"	$\frac{1}{8}$ or 8 grains,
1 year	"	$\frac{1}{12}$ or 5 grains.

We prefer the following simple scheme of Dr. Young, extracted from Paris's Pharmacologia.

"For children under twelve years, the doses of most medicines must be diminished in the proportion of the age to the age increased by twelve; thus, at two years to $\frac{1}{7}$; viz., $\frac{2}{2+12}=\frac{1}{7}$. At twenty-one the full dose may be given."

To the above rule some exceptions are offered in particular medicines, which require to be given to children in much larger proportional doses than those above stated. Such are castor oil and calomel, a certain quantity of which will in general not produce a greater effect in a child two or three years old than will double the quantity in an adult.

Sex, *temperament*, and *idiosyncrasy* have also an influence upon the dose, and should be kept in view in prescribing. Females usually require somewhat smaller doses than males, and persons of sanguine temperament than the phlegmatic. Constitutional peculiarities, called idiosyncrasies, often exist in individuals, rendering them more than usually susceptible or insusceptible to the action of certain remedies, the dose of which must be modified accordingly. Thus, in some persons a grain or two of calomel will excite salivation, while in others scarcely any quantity which can be safely administered will produce this effect. Sometimes, moreover, a medicine operates on an individual in a manner wholly different from its ordinary mode.

In all such cases experience is the only sure guide; but the occasional existence of these peculiarities indicates the propriety of making particular inquiries in relation to the idiosyncrasies of those patients, for whom we may be called for the first time to prescribe.

Habit is another important circumstance which modifies the dose of medicines. Generally speaking, the susceptibility to the action of medicines is diminished by their frequent and continued use; and, in order to maintain a given impression, the quantity must be regularly increased. This is especially true in regard to the narcotics, which are sometimes borne in enormous doses by those habituated to their use. It is a good practical rule in prescribing, when circumstances demand the continuance, for a considerable length of time, of some particular effect, to vary the medicine, and employ successively several with the same general powers, so as not too rapidly to exhaust the susceptibility to the action of any individual remedy. Another important practical rule connected with the influence of habit is, when any medicine, which from its nature is of variable strength, has been employed for some time in increasing doses, to reduce the dose upon resorting to a new parcel, until its relative strength has been ascertained. A neglect of this precaution, in cases where the last parcel happened to be more powerful than that previously employed, has sometimes been followed by very serious consequences.

2. Mode of Administering Medicines.—This has reference both to the combination of medicines with one another, and the form in which they are exhibited.

Simplicity in prescription is always desirable, when no object is to be gained by deviating from it. Remedies should never be mixed together without a definite purpose, nor with the vague hope that, out of the number prescribed, some one may perchance produce a salutary impression. Those exceedingly complex prescriptions, formerly so much in vogue, of which the ingredients were so numerous as to render altogether impossible a reasonable estimate of their bearing on each other, or their effects on disease, have been generally abandoned by modern practitioners. The only ground upon which any of them can be justifiably retained is that, by very frequent trials, through a long course of years, and in various states of disease, their influence on the system may have been fully ascertained, so that they may be considered rather in the light of a single remedy than a compound of many. Upon this ground, however, no prudent physician would attempt to originate such combinations. In mixing medicines, we ought to proceed no further than we may be justified in doing by a clear knowledge of the properties and mutual relations of the several ingredients, and their fitness to answer some particular indication in the treatment of disease. There are certain principles upon which medicines may be advantageously combined, and which it may not be amiss to mention for the benefit of the young practitioner.

Remedies of the same general character may be given in connection, in order to increase their energy, or to render their action more certain. It has been well ascertained that substances thus combined will often act vigorously, when, severally, they would produce comparatively little effect; and it sometimes happens that, while their activity is augmented, they are at the same time rendered less irritating, as in the case of the drastic cathartics. (See *Pilulæ Catharticæ Compositæ.*)

Different medicines are very often mixed together, in order to meet different and coexisting indications, without any reference to the influence which they may reciprocally exert on each other. Thus in the same patient we not unfrequently meet with debility of stomach and constipation of the bowels, connected with derangement of the hepatic function. To answer the indications presented by these morbid conditions, we may properly combine, in the same dose, a tonic, cathartic, and mercurial alterative. For similar reasons we often unite tonics, purgatives, and emmenagogues, anodynes and diaphoretics, emetics and cathartics, antacids, astringents, and tonics; and scarcely two medicines can be mentioned, not absolutely incompatible with each other, which may not occasionally be combined with advantage to counteract coexisting morbid conditions.

Another very important object of combination, is the modification which is thereby effected in the actions of medicines differing from each other in properties. In this

way new powers are sometimes developed, and those previously existing are greatly increased. Examples of such a result are afforded in the officinal powder of ipecacuanha and opium, and in the combination of squill and calomel; the former operating as a diaphoretic, the latter as a diuretic, beyond the capabilities of either of their constituents. The effects of one medicine are, in numerous instances, increased by the influence of another in augmenting the natural susceptibility of the system to its action. Thus, bitters enable cathartics to operate in smaller doses; purgatives awaken the dormant susceptibility to the action of mercury; and stimulants excite the torpid stomach, so that it will receive impressions from various medicines before inoperative. In some instances, the action of one medicine is promoted by that of another apparently of a nature wholly opposite. Thus, when calomel and opium are given in colic, the purgative operation of the former is facilitated by the relaxation of intestinal spasm produced by the latter. Medicines, in addition to the effects for which they are administered, very frequently produce disagreeable symptoms, which may be moderated or altogether prevented by combination with other medicines; and this object may usually be accomplished, without in the least degree interfering with the remediate influence desired. Thus, the griping produced by cathartics, and the nausea by these and various other medicines, may often be corrected by the simultaneous use of aromatics. To cover the disagreeable taste or odour of certain medicines, and to afford a convenient vehicle for their administration, are also important objects of combination; as upon these circumstances often depend the acceptability of the medicine to the stomach, and even the possibility of inducing the patient to swallow it. Substances should be preferred as vehicles which are calculated to render the medicine acceptable to the palate and stomach, and in other ways to correct its disagreeable effects; as syrups for powders, the aromatic waters for medicines given in the form of mixture, and carbonic acid water for the neutral salts.

But, in the mixing of medicines, care should be taken that they are neither chemically nor physiologically incompatible; in other words, that they are not such as will react on each other so as to produce new and unexpected combinations, nor such as will exert contrary and opposite effects upon the system. Thus, when the operation of an acid is desired, an alkali should not be given at the same time, as they unite to form a third substance entirely different from either; nor should a soluble salt of lime, baryta, or lead be given with sulphuric acid or a soluble sulphate, as decomposition would ensue, with the production of an inert compound. So, also, in relation to physiological incompatibility, diaphoretics and diuretics should not, as a general rule, be united with a view to their respective effects; as these are to a certain extent incompatible, one being diminished by whatever has a tendency to increase the other. There are cases, however, in which we may advantageously combine medicines with a view to their chemical reaction, as in the instance of the effervescing draught; and circumstances sometimes call for the union of remedies apparently opposite, as in the case of colic before alluded to, in which opium may be advantageously combined with purgatives. Still, such combinations should never be formed, unless with a full understanding of their effects, and a special reference to them.

The *form in which medicines are exhibited* is often an object of considerable importance. By variation in this respect, according to the nature of the medicine, the taste of the patient, or the condition of the stomach, we are frequently enabled to secure the favourable operation of remedies. which, without such attention, might prove useless or injurious. Medicines may be given in the solid state, as in the form of powder, pill, troche, or electuary; in the state of mixture, in which a solid is suspended in a liquid, or one liquid is mechanically mixed with another in which it is insoluble; or in the state of solution, under which may be included the various forms of infusion, decoction, tincture, wine, vinegar, syrup, honey, and oxymel. Of these different forms we have already treated sufficiently at large, under their respective heads, in the second part of this work.

In writing extemporaneous prescriptions, neatness, order, and precision should always be observed; as, independently of the pleasing moral effect inseparable from these principles in all things, a positive practical advantage results in the greater accuracy which the habit of attending to them gives to the prescriber, and the com-

parative certainty which they afford that his directions will be strictly complied with. As a general rule, when medicines are combined in prescription, that should come first in order which is considered as the most prominent and important, next the adjuvant or corrigent, and lastly the vehicle. Sometimes, however, it is important to indicate to the apothecary the succession in which the substances should be combined, in reference to the perfection of the mixture; and this may render convenient a deviation from the order above mentioned. The physician should always be careful either to write out the full name of the medicine, or to employ such abbreviations as are not likely, by the misunderstanding of an ill-formed letter, to lead into error. Very serious and even fatal mistakes have been occasioned by a neglect of this precaution. The formulas of the several Pharmacopœias which are detailed in this work, will serve as good examples for the guidance of the young practitioner. The following table explains the signs and abbreviations habitually used in prescriptions. The formulas afterwards given will serve to illustrate the ordinary mode of prescribing, while they exhibit combinations of medicines frequently employed in practice. W.

Table of Signs and Abbreviations.

℞	Recipe.	Take.	Collyr.	Collyrium.	An eye-water.
āā	Ana.	Of each.	Cong.	Congius vel congii.	A gallon or gallons.
lb	Libra vel libræ.	A pound or pounds.	Decoct.	Decoctum.	A decoction.
℥	Uncia vel unciæ.	An ounce or ounces.	Ft.	Fiat.	Make.
			Garg.	Gargarysma.	A gargle.
ʒ	Drachma vel drachmæ.	A drachm or drachms.	Gr.	Granum vel grana.	A grain or grains.
℈	Scrupulus vel scrupuli.	A scruple or scruples.	Gtt.	Gutta vel guttæ.	A drop or drops.
			Haust.	Haustus.	A draught.
O	Octarius vel octarii.	A pint or pints.	Infus.	Infusum.	An infusion.
			M.	Misce.	Mix.
f℥	Fluiduncia vel fluidunciæ.	A fluidounce or fluidounces.	Mass.	Massa.	A mass.
			Mist.	Mistura.	A mixture.
fʒ	Fluidrachma vel fluidrachmæ.	A fluidrachm or fluidrachms.	Pil.	Pilula vel pilulæ.	A pill or pills.
♏	Minimum vel minima.	A minim or minims.	Pulv.	Pulvis vel pulveres.	A powder or powders.
Chart.	Chartula vel chartulæ.	A small paper or papers.	Q. S.	Quantum sufficit.	A sufficient quantity.
Coch.	Cochlear vel cochlearia.	A spoonful or spoonfuls.	S.	Signa.	Write.
			Ss.	Semis.	A half.

Examples of Common Extemporaneous Prescriptions.

POWDERS.

℞ Antimonii et Potassii Tartratis gr. i.
Pulveris Ipecacuanhæ ℈i.
Fiat pulvis.
S. To be taken in a wineglassful of sweetened water.
An active emetic.

℞ Hydrargyri Chloridi Mitis,
Pulveris Jalapæ, āā, gr. x.
Misce.
S. To be taken in syrup or molasses.
An excellent cathartic in the commencement of bilious fevers, and in hepatic congestion.

℞ Pulveris Jalapæ gr. x.
Potassii Bitartratis ʒii.
Misce.
S. To be taken in syrup or molasses.
A hydragogue cathartic, used in dropsy, and in scrofulous inflammation of the joints.

℞ Sulphuris ʒi.
Potassii Bitartratis ʒii.
Misce.
S. To be taken in syrup or molasses.
A laxative used in piles and cutaneous diseases.

℞ Pulveris Rhei gr. x.
Magnesiæ ʒss.
Fiat pulvis.
S. To be taken in syrup or molasses.
A laxative and antacid, used in diarrhœa, dyspepsia, &c.

℞ Pulveris Scillæ gr. xii.
Potassii Nitratis ʒi.
Fiat pulvis, in chartulas sex dividendus.

S. One to be taken twice or three times a day in syrup or molasses.

A diuretic employed in dropsy.

℞ Potassii Nitratis ʒi.
Antimonii et Potassii Tartratis gr. i.
Hydrargyri Chloridi Mitis gr. vi.
Fiat pulvis, in chartulas sex dividendus.

S. One to be taken every two hours in syrup or molasses.

A refrigerant, diaphoretic, and alterative, used in bilious fevers; usually called *nitrous powders*.

℞ Pulveris Guaiaci Resinæ,
Potassii Nitratis, āā, ʒi.
Pulveris Ipecacuanhæ gr. iii.
Opii gr. ii.
Fiat pulvis, in chartulas sex dividendus

S. One to be taken every three hours in syrup or molasses.

A stimulant diaphoretic, used in rheumatism and gout after sufficient depletion.

℞ Ferri Subcarbonatis,
Pulveris Colombæ,
Pulveris Zingiberis, āā, ʒi.
Fiat pulvis, in chartulas sex dividendus.

S. One to be taken three times a day in syrup or molasses.

A tonic, used in dyspepsia and general debility.

Pills.

℞ Pulveris Aloës,
Pulveris Rhei, āā, ʒss.
Saponis ℈i.
Misce, et cum aquâ fiat massa in pilulas viginti dividenda.

S. Two or three to be taken daily, at bedtime, or before a meal.

An excellent laxative in habitual constipation.

℞ Massæ Pilularum Hydrargyri,
Pulveris Aloës,
Pulveris Rhei, āā, ℈i.
Misce, et cum aquâ fiat massa in pilulas viginti dividenda.

S. Three to be taken at bedtime.

An alterative and laxative, useful in constipation with deranged or deficient hepatic secretion.

℞ Pulveris Aloës,
Extracti Quassiæ, āā, ʒi.
Olei Anisi ♏x.
Syrupi q. s.
Misce, et fiat massa in pilulas triginta dividenda.

S. Two to be taken once, twice, or three times a day.

A laxative, tonic, and carminative, useful in dyspepsia.

℞ Pulveris Scillæ ℈i.
Hydrargyri Chloridi Mitis gr. x.
Pulveris Acaciæ,
Syrupi, āā, q. s.
Misce, et fiat massa in pilulas decem dividenda.

S. One to be taken twice or three times a day.

A diuretic and alterative, much used in dropsy, especially when complicated with organic visceral disease.

℞ Pulveris Opii gr. iv.
Pulveris Ipecacuanhæ gr. xviii.
Pulveris Acaciæ,
Syrupi, āā, q. s.
Misce, et fiat massa in pilulas duodecim dividenda.

S. One to be taken after each stool.

An anodyne diaphoretic, useful in dysentery and diarrhœa after the use of laxatives.

℞ Pulveris Opii,
Pulveris Ipecacuanhæ, āā, gr. iii.
Hydrargyri Chloridi Mitis gr. vi.
Pulveris Acaciæ,
Syrupi, āā, q. s.
Misce, et fiat massa in pilulas tres dividenda.

S. One or more to be taken at bedtime, or according to circumstances.

An anodyne, diaphoretic, and alterative, very useful in diarrhœa, dysentery, typhoid pneumonia, and various other diseases.

℞ Plumbi Acetatis, in pulv. triti, gr. xii.
Pulveris Opii gr. i.
Pulv. Acaciæ,
Syrupi, āā, q. s. ut fiat massa in pilulas sex dividenda.

S. One every two, three, or four hours.

An astringent much employed in hæmoptysis and uterine hemorrhage.

Mixtures.

℞ Magnesiæ ʒi.
Syrupi fʒi.
Tere simul, et affunde
Aquæ Acidi Carbonici fʒiv.
Fiat haustus.

S. To be taken at a draught, the mixture being well shaken.

An agreeable mode of administering magnesia.

℞ Mannæ ʒi.
Fœniculi contusi ʒi.
Aquæ bullientis fʒiv.
Fiat infusum et cola; dein adjice
Magnesii Carbonatis ʒii.
Ft. mist.

S. One-third to be taken every three or four hours till it operates, the mixture being shaken.

An excellent carminative and mild laxative in flatulence and pain in the bowels.

℞ Olei Ricini f℥i.
Pulveris Acaciæ,
Sacchari, āā, ℥ii.
Aquæ Menthæ Piperitæ f℥iii.
Acaciam et saccharum cum fluiduncîâ dimidiâ aquæ menthæ tere; dein oleum adjice, et contere; denique aquam reliquam paulatim infunde, et omnia misce.
S. To be taken at a draught, the mixture being well shaken.

℞ Olei Ricini f℥i.
Vitellum ovi unius.
Tere simul, et adde
Syrupi f℥ss.
Aquæ Menthæ Piperitæ f℥ii.
Ft. haust.
S. To be taken at a draught, the mixture being well shaken.
This and the preceding formula afford convenient modes of administering castor oil, when the stomach is irritable. Any other fixed oil may be given in the same way. Half the quantity will often answer.

℞ Olei Ricini f℥iss.
Tincturæ Opii ♏xxx.
Pulv. Acaciæ,
Sacchari, āā, ℥ii.
Aquæ Menthæ Viridis f℥iv.
Acaciam et saccharum cum paululo aquæ menthæ tere; dein oleum adjice, et iterum tere; denique aquam reliquam paulatim infunde, et omnia misce.
S. A tablespoonful to be taken every hour or two hours till it operates, the mixture being each time well shaken.
Used as a gentle laxative in dysentery and diarrhœa. It is usually known by the name of *oleaginous mixture.*

℞ Elaterii gr. i.
Spiritus Ætheris Nitrosi f℥ii.
Tincturæ Scillæ,
Vini Colchici Rad., āā, f℥ss.
Syrupi f℥i.
Ft. mist.
S. A tablespoonful to be taken three or four times a day in a little water.
Diuretic, used by Ferriar in dropsy.

℞ Copaibæ,
Spiritûs Lavandulæ Comp., āā, f℥ii.
Mucilaginis Acaciæ f℥ss.
Syrupi f℥iii.
Simul tere; dein paulatim affunde
Aquæ f℥iv.
Misce.
S. A tablespoonful to be taken four times a day, or more frequently.
Given in chronic catarrh, and chronic nephritic affections. The dose must be larger in gonorrhœa.

Neutral Mixture.

℞ Acidi Citrici ℥ii.
Olei Limonis ♏i.
Simul tere, et adde
Aquæ f℥iv.
Liqua, et adde
Potassii Carbonatis q. s. ad saturandum.
Misce, et per linteum cola.

Or,

℞ Succi Limonis recentis f℥iv.
Potassii Carbonatis q. s. ad saturandum.
Misce et cola.
S. A tablespoonful to be given, with an equal quantity of water, every hour or two hours.
An excellent diaphoretic in fever.

Effervescing Draught.

℞ Potassii Carbonatis ℥ii.
Aquæ f℥iv.
Liqua.

Or,

℞ Potassii Bicarbonatis ℥iii.
Aquæ f℥iv.
Liqua.
S. Add a tablespoonful of the solution to the same quantity of lemon or lime juice, previously mixed with a tablespoonful of water; and give the mixture in the state of effervescence, every hour or two hours.
An excellent diaphoretic and anti-emetic in fever with nausea or vomiting.

Brown Mixture.

℞ Pulv. Extract. Glycyrrhizæ,
Pulv. Acaciæ, āā, ℥ii.
Aquæ ferventis f℥iv.
Liqua, et adde
Vini Antimonii f℥ii.
Tincturæ Opii ♏xx.
Ft. mist.
S. A tablespoonful to be taken occasionally.
Expectorant, demulcent, and anodyne useful in catarrhal affections.

℞ Antimonii et Potassii Tartratis gr. i.
Syrupi Scillæ,
Liquoris Morphiæ Sulphatis, āā, f℥ss.
Pulveris Acaciæ ℥ii.
Syrupi f℥ss.
Aquæ f℥iv.
Ft. mist.
S. A tablespoonful to be taken occasionally.
An expectorant and anodyne cough mixture.

℞ Camphoræ ℥i.
Myrrhæ ℥ss.
Pulv. Acaciæ,
Sacchari, āā, ℥ii.
Aquæ f℥vi.
Camphoram cum alcoholis paululo in pulverem tere; dein cum myrrhâ, acaciâ, et saccharo contere; denique cum aquâ paulatim installatâ misce.

S. A tablespoonful to be taken for a dose, the mixture being well shaken.

A convenient form for administering camphor.

℞ Pulveris Kino ʒii.
Aquæ bullientis fʒvi.
Fiat infusum et cola; dein secundum artem admisce,
Cretæ Præparatæ ʒiii.
Tincturæ Opii fʒss.
Spiritûs Lavandulæ Compositi fʒss.
Pulveris Acaciæ,
Sacchari, āā, ʒii.

S. A tablespoonful to be taken for a dose, the mixture being well shaken.

Astringent and antacid, useful in diarrhœa.

℞ Acidi Nitrosi fʒi.
Tincturæ Opii gtt. xl.
Aquæ Camphoræ fʒviii.
Misce.

S. One-fourth to be taken every three or four hours.

Hope's mixture, used in dysentery, diarrhœa, and cholera.

℞ Cretæ Præparatæ ℈iv.
Massæ Pil. Hydrarg. gr. viii.
Tincturæ Opii gtt. viii.
Pulveris Acaciæ,
Sacchari, āā, ʒi.
Aquæ Cinnamomi,
Aquæ, āā, fʒi.

Solida simul tere, dein liquida paulatim inter terendum adjice, et omnia misce.

S. A teaspoonful to be taken for a dose, the mixture being well shaken.

An antacid and alterative mixture, well adapted to infantile diarrhœa, with white stools. The dose mentioned is for a child a year or two old, and may be repeated four or six times in twenty-four hours.

Solutions.

℞ Magnesii Sulphatis ʒi.
Syrupi Limonis fʒi.
Aquæ Acidi Carbonici fʒvi.
Misce.

S. To be taken at a draught.

An agreeable mode of administering sulphate of magnesium.

℞ Quiniæ Sulphatis gr. xii.
Acidi Sulphurici Aromatici gtt. xxiv.
Syrupi fʒss.
Aquæ Menthæ Piperitæ fʒi.
Misce.

S. A teaspoonful to be taken every hour or two hours.

A good mode of administering sulphate of quinia in solution.

℞ Magnesii Sulphatis ʒi.
Antimonii et Potassii Tartratis gr. i.
Succi Limonis recentis fʒi.
Aquæ fʒiii.
Misce.

S. A tablespoonful to be taken every two hours till it operates upon the bowels.

Useful in fevers.

℞ Potassii Nitratis ʒi.
Antimonii et Potassii Tartratis gr. i.
Aquæ fʒiv.
Liqua.

S. A tablespoonful to be taken every two hours.

A refrigerant diaphoretic, used in fevers.

Infusions.

℞ Sennæ ʒiii.
Magnesii Sulphatis,
Mannæ, āā, ʒss.
Fœniculi ʒi.
Aquæ bullientis Oss.
Macera per horam in vase leviter clauso, et cola.

S. A teacupful to be taken every four or five hours till it operates.

An excellent purgative in febrile complaints.

℞ Colombæ contusæ,
Zingiberis contusi, āā, ʒss.
Sennæ ʒii.
Aquæ bullientis Oi.
Macera per horam in vase leviter clauso, et cola.

S. A wineglassful to be taken morning, noon, and evening, or less frequently if it operate too much.

An excellent remedy in dyspepsia with constipation and flatulence.

℞ Spigeliæ ʒss.
Sennæ ʒii.
Mannæ ʒi.
Fœniculi ʒii.
Aquæ bullientis Oi.
Macera per horam in vase leviter clauso, et cola.

S. A wineglassful to be given to a child from two to four years old, three or four times a day.

A powerful anthelmintic.

℞ Pulveris Cinchonæ Rubræ ʒi.
Acidi Sulphurici Aromatici fʒi.
Aquæ Oi.
Macera per horas duodecim, subinde agitans.

S. A wineglassful of the clear liquid to be taken for a dose.

A good method of administering Peruvian bark in cold infusion.

II. TABLES OF WEIGHTS AND MEASURES.

APOTHECARIES' WEIGHT. *U.S.*

Pound.		Troyounces.		Drachms.		Scruples.		Troy Grains.
℔ 1	=	12	=	96	=	288	=	5760
		℥ 1	=	8	=	24	=	480
				ʒ 1	=	3	=	60
						℈ 1	=	gr. 20

The Imperial Standard Troy weight, at present recognised by the British laws, corresponds with the Apothecaries' weight in pounds, ounces, and grains, but differs from it in the division of the ounce, which, according to the former scale, contains twenty pennyweights, each weighing twenty-four grains.

AVOIRDUPOIS WEIGHT. *Br.*

Pound.		Ounces.		Drachms.		Troy Grains.
℔ 1	=	16	=	256	=	7000
		oz. 1	=	16	=	437·5
				dr. 1	=	gr. 27·34375

Relative Value of Troy and Avoirdupois Weights.

Pound.		Pounds.		Pound.	Ounces.	Grains.
1 Troy	=	0·822857	Avoirdupois =	0	13	72·5
1 Avoirdupois	=	1·215277	Troy =	1	2	280

APOTHECARIES' OR WINE MEASURE. *U.S.*

Gallon.		Pints.		Fluidounces.		Fluidrachms.		Minims.		Cubic Inches.
Cong. 1	=	8	=	128	=	1024	=	61440	=	231
		O 1	=	16	=	128	=	7680	=	28·875
				f℥ 1	=	8	=	480	=	1·8047
						f℥ 1	=	♏ 60	=	·2256

IMPERIAL MEASURE.

Adopted by the British Pharmacopœia.

Gallon.		Pints.		Fluidounces.		Fluidrachms.		Minims.
1	=	8	=	160	=	1280	=	76800
		1	=	20	=	160	=	9600
				1	=	8	=	480
						1	=	60

Relative Value of Apothecaries' and Imperial Measure.

APOTHECARIES' MEASURE.

		IMPERIAL MEASURE. Pints.	Fluidounces.	Fluidrachms.	Minims.
1 gallon	=	6	13	2	23
1 pint	=		16	5	18
1 fluidounce	=		1	0	20
1 fluidrachm	=			1	2·5
1 minim	=				1·04

IMPERIAL MEASURE.

		APOTHECARIES' MEASURE. Gallon.	Pints.	Fluidoz.	Fluidr.	Minims.
1 gallon	=	1	1	9	5	8
1 pint	=		1	3	1	38
1 fluidounce	=				7	41
1 fluidrachm	=					58
1 minim	=					0·96

Relative Value of Weights and Measures in Distilled Water at 60° Fahrenheit.

1. Value of Apothecaries' Weight in Apothecaries' Measure.

			Pints.	Fluidoz.	Fluidr.	Minims.
1 pound	= 0·7900031 pints	=	0	12	5	7·2238
1 ounce	= 1·0533376 fluidounces	=	0	1	0	25·6020
1 drachm	= 1·0533376 fluidrachms	=	0	0	1	3·2002
1 scruple	=		0	0	0	21·0667
1 grain	=		0	0	0	1·0533

2. Value of Apothecaries' Measure in Apothecaries' Weight.

			℔	℥	ʒ	℈	Gr.	Grains.
1 gallon	= 10·12654270 pounds	=	10	1	4	0	8·88	= 58328·886
1 pint	= 1·26581783 pounds	=	1	3	1	1	11·11	= 7291·1107
1 fluidounce	= 0·94936332 ounces	=	0	0	7	1	15·69	= 455·6944*
1 fluidrachm	= 0·94936332 drachms	=	0	0	0	2	16·96	= 56·9618
1 minim	= 0·94936332 grains	=						·9493

3. Value of Avoirdupois Weight in Apothecaries' Measure.

		Pints.	Fluidounces.	Fluidrachms.	Minims.
1 pound	= 0·9600732 pints	= 0	15	2	53·3622
1 ounce	= 0·9600732 fluidounces	= 0	0	7	40·8351

4. Value of Apothecaries' Measure in Avoirdupois Weight.

1 gallon	=	8·33269800 pounds.
1 pint	=	1·04158725 pounds.
1 fluidounce	=	1·04158725 ounces.

5. Value of Imperial Measure in Apothecaries' and Avoirdupois Weights.

Imperial Measure.		Apothecaries' Weight.		Avoirdupois Weight.		Grains.		Cubic Inches.
1 gallon	=	12 ℔ 1 ℥ 6 ʒ 2 ℈ 0 gr.	=	10 ℔ 0 oz.	=	70,000	=	277·27384
1 pint	=	1 6 1 2 10	=	1 4	=	8,750	=	34·65923
1 fluidounce	=	7 0 17·5	=	1	=	437·5	=	1·73296
1 fluidrachm	=	2 14·69	=			54·69	=	0·21662
1 minim	=					·91	=	0·00361

In converting the weights of liquids heavier or lighter than water into measures, or conversely, a correction must be made for specific gravity. In converting weights into measures, the calculator may proceed as if the liquid was water, and the obtained measure will be to the true measure *inversely* as the specific gravity. In the converse operation, of turning measures into weights, the same assumption may be made, and the obtained weight will be to the true weight *directly* as the specific gravity.

FORMER FRENCH WEIGHTS.

Pound.	Marc.	Onces.	Gros.	Deniers.	Grains.	Troy Grains.	Grammes
1 Poids de Marc	= 2 =	16 =	128 =	384 =	9216 =	7561	= 489·5058
1 Apothecary	= 1·5 =	12 =	96 =	288 =	6912 =	5670·5	= 367·1294
	1 =	8 =	64 =	192 =	4608 =	3780·5	= 244·7529
		1 =	8 =	24 =	576 =	472·5	= 30·5941
			1 =	3 =	72 =	59·1	= 3·8242
				1 =	24 =	19·7	= 1·2747
					1 =	0·8	= ·0530

* Dr. W. H. Pile, in a communication to the *American Journal of Pharmacy*, gives the following weights of the fluidounce of water, on different authorities, at 60° F.: United States standard 455·6216 grains; Sir G. Shuckburg (U.S.D.) 455·6944; British standard 455·6910; average weight 455·6690.

Relative Value of Old French and English Weights.

Poids de Marc.		Troy Weight.		Avoirdupois.		Troy Grains.
1 pound	=	1·312680 ℔	=	1·080143 ℔	=	7561
1 once (ounce)	=	·984504 ℥	=	1·080143 oz.	=	472·5625
1 gros (drachm)	=	·954504 ℥	=			59·0703125
1 grain	=					·820421

Troy.		Poids de Marc.		French Grains.
1 pound	=	0·76180 ℔	=	7561
1 ounce	=	1·01574 onces	=	585·083
1 drachm	=	1·01574 gros	=	73·135
1 grain	=		=	1·219

Avoirdupois.		Poids de Marc.		French Grains.
1 pound	=	0·925803 ℔	=	8532·3
1 ounce	=	0·925803 once	=	533·27

To convert French grains into Troy grains, divide by } 1·2189.
————Troy grains into French grains, multiply by }
————French ounces into Troy ounces, divide by } 1·015734.
————Troy ounces into French ounces, multiply by }
————French pounds (poids de marc) into Troy pounds, multiply by } 1·31268.
————Troy pounds into French pounds, divide by }

FRENCH DECIMAL WEIGHTS AND MEASURES.

The French *metrical* system is based upon the idea of employing, as the unit of all measures, whether of length, capacity, or weight, a uniform unchangeable standard, adopted from nature, the multiples and subdivisions of which should follow in decimal progression. To obtain such a standard, the length of one-fourth part of the terrestrial meridian, extending from the equator to the pole, was ascertained. The ten-millionth part of this arc was chosen as the unit of measures of length, and was denominated *metre*. The cube of the tenth part of the metre was taken as the unit of measures of capacity, and denominated *litre*. The weight of distilled water, at its greatest density, which this cube is capable of containing, was called *kilogramme*, of which the thousandth part was adopted as the unit of weight, under the name of *gramme*. The multiples of these measures, proceeding in the decimal progression, are distinguished by employing the prefixes, *deca*, *hecto*, *kilo*, and *myria*, taken from the Greek numerals; and the subdivisions, following the same order, by *deci*, *centi*, *milli*, from the Latin numerals.

The *metre*, or unity of length, at 32°,	= 39·371	English inches at 62°.
The *litre*, or unity of capacity,	= 61·028	English cubic inches.
The *gramme*, or unity of weight,	= 15·434	Troy grains.

Upon this basis the following tables, taken with some slight alterations from the Edinburgh New Dispensatory, have been constructed. It was ascertained by accurate examination at the London Mint, that the gramme is only 15·434 Troy grains, though sometimes stated at 15·444 grains.

MEASURES OF LENGTH.

The metre being at 32°, and the foot at 62°.

		English Inches.		Miles.	Fur.	Yards.	Feet.	Inches.
Millimetre	=	·03937						
Centimetre	=	·39371						
Decimetre	=	3·93710						
Metre	=	39·37100	=	0	0	1	0	3·371
Decametre	=	393·71000	=	0	0	10	2	9·710
Hectometre	=	3937·10000	=	0	0	109	1	1·100
Kilometre	=	39371·00000	=	0	4	213	1	11·000
Myriametre	=	393710·00000	=	6	1	156	1	2·000

MEASURES OF CAPACITY.

		English Cubic Inches.		Apothecaries' Measure.
Millilitre	=	·061028	=	16·2318 minims.
Centilitre	=	·610280	=	2·7053 fluidrachms.
Decilitre	=	6·102800	=	3·3816 fluidounces.
Litre	=	61·028000	=	2·1135 pints.
Decalitre	=	610·280000	=	2·6419 gallons.
Hectolitre	=	6102·800000		
Kilolitre	=	61028·000000		
Myrialitre	=	610280·000000		

MEASURES OF WEIGHT.

		Troy grains.		lb	℥	ʒ	Gr.
Milligramme	=	·0154					
Centigramme	=	·1543					
Decigramme	=	1·5434					
Gramme	=	15·4340					
Decagramme	=	154·3402	=	0	0	2	34·3
Hectogramme	=	1543·4023	=	0	3	1	43·4
Kilogramme	=	15434·0234	=	2	8	1	14
Myriagramme	=	154340·2344	=	26	9	4	20

Though the decimal system of weights and measures was established by law in France, it was found impossible to procure its general adoption by the people, who obstinately adhered to the old *poids de marc* and its divisions; or, if they adopted the new weights, gave them the names of the old weights to which they most nearly approached. Thus, the *kilogramme*, which is equal to $18{,}827\frac{15}{100}$ French grains, or 2 pounds 5 gros $35\frac{15}{100}$ grains *poids de marc*, was divided into two parts, and the half of it called a pound. One reason for this adherence to the old weights was the convenience of division into halves, quarters, &c., of which the new were not susceptible. To obviate this difficulty the Imperial government legalized the employment of the half kilogramme as the unit of weight, under the name of pound, and allowed this to be divided into half pounds, quarters, eighths, ounces, &c., as in the old *poids de marc*. The new pound is distinguished by the name of *metrical pound*, and has been adopted to a considerable extent; while the old weights are retained by some, particularly by the apothecaries and goldsmiths; so that three systems are now more or less in use in France—the original *poids de marc*, the decimal system, and the metrical pound with its divisions. The following table represents the relative value of these different weights.

Decimal System.		Poids de Marc. lb.	oz.	dr.	gr.		Metrical Pound. lb.	oz.	dr.	gr.
1 centigramme	=	0	0	0	0·19	=	0	0	0	0·18
1 decigramme	=	0	0	0	1·88	=	0	0	0	1·84
1 gramme	=	0	0	0	18·83	=	0	0	0	18·43
1 decagramme	=	0	0	2	44·27	=	0	0	2	40·32
1 hectogramme	=	0	3	2	10·71	=	0	3	1	43·2
1 kilogramme	=	2	0	5	35·15	=	2	0	0	0

Poids de Marc.		Grammes.	Metrical Pound.		Grammes.
1 grain	=	0·0531	1 grain	=	0·054
24 grains or ℈i	=	1·2747	24 grains or ℈i	=	1·302
72 grains or ʒi	=	3·8242	72 grains or ʒi	=	3·906
1 ounce	=	30·5941	1 ounce	=	31·25
1 pound	=	489·5508	1 pound	=	500

Value of Avoirdupois Weights, and Imperial Measures, in Metrical Weights and Measures, as stated in the British Pharmacopœia.

Avoirdupois Weights.		Metrical Weights.	Imperial Measures.		Metrical Measures.
1 pound	=	453·5925 grammes.	1 gallon	=	4·543487 litres.
1 ounce	=	28·3495 "	1 pint	=	0·567936 "
1 grain	=	0·0648 "	1 fluidounce	=	0·028396 "
			1 fluidrachm	=	0·003599 "
			1 minim	=	0·000059 "

The following table is taken from Christison's Dispensatory, and was calculated chiefly from data contained in Soubeiran's Traité de Pharmacie.

Table of certain foreign Apothecaries' Weights, exhibiting the Value of their different Denominations in Troy Grains.

	Pound.	Ounce.	Drachm.	Scruple.	Grain.
French (old)	5670·5	472·50	59·10	19·70	0·820
Spanish	5320·4	443·49	55·44	18·47	0·769
Tuscan	5240·3	436·67	54·58	18·19	0·758
Roman	5235·0	436·25	54·53	18·17	0·757
Austrian	6495·1	541·25	67·65	22·55	1·127
Germany or Nuremberg or Russian	5524·8	460·40	57·55	19·18	0·960
Prussian	5415·1	451·26	56·40	18·80	0·940
Dutch or Belgian	5695·8	474·64	59·33	19·78	0·988
Swedish	5500·2	458·34	57·29	19·09	0·954
Piedmontese	4744·7	395·39	49·45	16·48	0·824
Venetian	4661·4	388·45	48·55	16·18	0·809

Of these weights, all except the French, Spanish, Tuscan, and Roman (first named in the table), are divided into parts corresponding with those of the English Apothecaries' weight. In these four, the drachm contains 72 instead of 60 grains, and the scruple 24 instead of 20 grains; but, as in the English, there are 3 scruples in the drachm, 8 drachms in the ounce, and 12 ounces in the pound.

APPROXIMATE MEASUREMENT.

For the sake of convenience, in the absence of proper instruments, we often make use of means of measurement, which, though not precise nor uniform, afford results sufficiently accurate for ordinary purposes. Of this kind are certain household implements, of a capacity approaching to uniformity, and corresponding to a certain extent with the regular standard measures. Custom has attached a fixed value to these implements, with which it is proper that the practitioner should be familiar; although their capacity, as they are now made, with the exception of the wineglass, generally somewhat exceeds that at which they were originally and still continue to be estimated.

A *tea-cup* is estimated to contain about four fluidounces, or a gill.
A *wineglass* - - - - - two fluidounces.
A *tablespoon* (cochlear magnum) - half a fluidounce.
A *teaspoon* (cochlear parvum) - - a fluidrachm.

In reading French medical works, if unacquainted with their customary expressions of measure, we are often left in great uncertainty as to the precise quantity indicated by the names. The following table, translated from the French Codex of 1866, will obviate this difficulty.

	Grammes.
A coffeespoon (*cuillerée à café*, Fr., *teaspoon*) - - - - -	5
A common spoon (*cuillerée*, Fr., *tablespoon*), 4 coffeespoons, or - -	20
A glass (*verre*, Fr.), 8 common spoons - - - - - -	160
A handful (*poignée*, Fr.) of barleyseed - - - - - -	80
" " " flaxseed - - - - - -	50
" " " flaxseed-meal - - - - -	150
" " " dried mallow leaves - - - -	40
" " " " chicory, " - - - -	30
A pinch (*pincée*, Fr.) of chamomile flowers - - - - -	2
" " " arnica " - - - - -	1
" " " marshmallow " - - - - -	2
" " " mallows " - - - - -	1
" " " linden " - - - - -	2
" " " fruits of anise - - - - - -	2
" " " " fennel - - - - - -	2
A hen's egg, newly weighed, has the mean weight of - - - -	64
" the white alone - - - - - - - -	40
" the yellow alone - - - - - - - -	20
Blanched almonds have the mean weight, each, of - - - -	1

Small quantities of liquid medicines are often estimated by *drops*, each of which is usually considered equivalent to a minim, or the sixtieth part of a fluidrachm. The drop of water and of watery fluids is, on an average, about that size; but the same is by no means the case with all medicinal liquids, and the drop even of the same liquid varies much in bulk, according to the circumstances under which it is formed. This is, therefore, an uncertain mode of estimating the quantity of liquids, and should be superseded where minim measures can be had. Certain general rules, however, influence the formation of drops, which will enable us to form some notion of their probable relative number, in the same amount of liquid, when possessed of the requisite data. Thus, the heavier the liquid the smaller, other things being equal, is the size of the drops, and the greater their number in a given measure. The drop of chloroform, for example, which is a very heavy liquid, is very small, much smaller than that of alcohol or ether. The greater or less viscidity, and greater or less mobility of the liquid have much influence, the former in increasing, the latter in diminishing the size of the drops. The adhesiveness of liquids, which opposes their disposition to leave the surface from which they fall, requires a greater mass to overcome it, and consequently augments the size of the drop. The rapidity of the

movement acts in a contrary direction, and the drop from a full bottle should be less than from one more or less emptied. The broader the surface from which they fall, the greater is their size. The drops from a thick-lipped bottle are larger than from one with thin lips.

The results stated in the following table were obtained by Mr. E. Durand, of Philadelphia. (See *Journ. of the Philadelphia College of Pharmacy*, i. 169.) They may be relied on as accurate, but should be considered as indicating only the relative number of drops afforded by the several liquids mentioned; for, under other circumstances than those of Mr. Durand's experiments, entirely different results might be obtained as relates to each liquid. The preparations experimented with were those of the first edition of the U. S. Pharmacopœia.

Table, exhibiting the Number of Drops of different Liquids, equivalent to a Fluid-drachm.

	Drops.		Drops.
Acid, acetic (crystallizable)	120	Tincture of assafetida, of foxglove,	
Acid, hydrocyanic (medicinal)	45	of guaiac, of opium	120
Acid, muriatic	54	Tincture of chloride of iron	132
Acid, nitric	84	Vinegar, distilled	78
Acid, nitric, diluted (1 to 7)	51	Vinegar of colchicum	78
Acid, sulphuric	90	Vinegar of opium (black drop)	78
Acid, sulphuric, aromatic	120	Vinegar of squill	78
Acid, sulphuric, diluted (1 to 7)	51	Water, distilled	45
Alcohol (rectified spirit)	138	Water of ammonium (strong)	54
Alcohol, diluted (proof spirit)	120	Water of ammonium (weak)	45
Arsenite of potassium, solution of	57	Wine (Teneriffe)	78
Ether, sulphuric	150	Wine, antimonial	72
Oil of aniseed, of cinnamon, of		Wine of colchicum	75
cloves, of peppermint, of sweet		Wine of opium	78
almonds, of olives	120*		

* See *page* 1344 for the results obtained by Professor Procter with the volatile oils, which give a considerably smaller number of drops to the fluidrachm than here stated, showing how different may be the results under different circumstances.

III. ALPHABETICAL TABLE OF PHARMACEUTICAL EQUIVALENTS.*

Name.	*Symbol or Formula.†*	*Equivalent.*
Acid, acetic	$C_4H_3O_3$	51
crystallized	$C_4H_3O_3+HO$	60
amylic. See Acid, valerianic.		
antimonic	SbO_5	162
antimonious	SbO_4	154
arsenic	AsO_5	115
arsenious	AsO_3	99
benzoic	$C_{14}H_5O_3$	113
crystallized	$C_{14}H_5O_3+HO$	122
boracic	BO_3	34·9
crystallized	BO_3+3HO	61·9
camphoric (hydrated)	$C_{20}H_{14}O_6+2HO$	200
carbolic	$C_{12}H_6O_2$	94
carbonic	CO_2	22
chloric	ClO_5	75·5
chlorous	ClO_4	67·5
chromic	CrO_3	50·3
cinnamic	$C_{18}H_7O_3+HO$	148
citric	$C_{12}H_5O_{11}$	165
crystallized	$C_{12}H_5O_{11}+4HO$	201
cyanic	CyO	34
gallic (dried at 212°)	$C_7H_3O_5$	85
hydriodic	HI	127·3
hydrocyanic (prussic acid)	HCy	27
hydrosulphuric (sulphuretted hydrogen)	HS	17
hypochlorous	ClO	43·5
hyponitric (formerly nitrous)	NO_4	46
hypophosphorous	PO	40
hyposulphuric	S_2O_5	72
hyposulphurous	S_2O_2	48
iodic	IO_5	166·3
kinic (crystallized)	$C_7H_6O_6$	96
lactic (monohydrated)	$C_6H_5O_5+HO$	90
margaric	$HO,C_{34}H_{33}O_3$	270
meconic (dried under 212°)	$C_{14}HO_{11}+3HO$	200
metaphosphoric (glacial)	HO,PO_5	81
muriatic (hydrochloric acid)	HCl	36·5
nitric	NO_5	54

* This table includes all the elements, although several of them are not used in medicine. It also embraces a few compounds which are not used in pharmacy, but which are inserted on account of their general importance. Excluding aridium and donarium, which have not maintained their claim to be considered as distinct metals, the present number of the elements is 66; three new metals having been discovered since the eleventh edition of the Dispensatory was published.

† By modern chemists the elements are designated by letters, called *symbols*. The initial letter of the name is the symbol, whenever it is distinctive; but, when several elements have names beginning with the same letter, the plan adopted is to represent one of them by the initial letter, and the rest by the initial letter with some other associated with it. Thus C stands for carbon, Ca for calcium, Cd for cadmium, Ce for cerium, Cl for chlorine, Co for cobalt, Cr for chromium, Cu for copper, &c. The use of these symbols saves time and space in designating the composition of compounds. Where a single equivalent is intended to be designated, the symbol of the element is simply given; but where several equivalents are to be represented, the symbol is preceded by a figure indicating the number. Thus C means one equivalent of carbon, 2C two equivalents, and so on. The number of equivalents is now generally denoted by a small depressed figure following the symbol; and this plan has been adopted in the above table. The group of letters and figures, thus used to denote the composition of any compound, is called the *formula* of such compound. The symbols given are those of Berzelius, and should not be varied from, for fear of destroying their usefulness by creating confusion.

Name.	*Symbol or Formula.*	*Equivalent.*
Acid, nitric, monohydrated (nitrate of water)	HO,NO_5	63
quadrihydrated (sp. gr. 1·42)	HO,NO_5+3HO	90
nitrous (formerly hyponitrous)	NO_3	38
oleic	$C_{36}H_{33}O_3$	273
oxalic	C_2O_3	36
crystallized	C_2O_3+3HO	63
sublimed	C_2O_3+HO	45
permanganic	M_2O_7	111·4
phosphoric	PO_5	72
phosphoric (tribasic)	$3HO,PO_5$	99
monohydrated (glacial acid)	HO,PO_5	81
phosphorous	PO_3	56
prussic. See Acid, hydrocyanic.		
pyrophosphoric	$2HO,PO_5$	90
stearic	$HO,C_{36}H_{35}O_3$	284
succinic	$C_4H_2O_3+HO$	59
sulphuric	SO_3	40
monohydrated (sulphate of water)	HO,SO_3	49
(Nordhausen acid)	$HO,2SO_3$	89
sulphurous	SO_2	32
tannic (tannin from galls)	$C_{54}H_{19}O_{31}+3HO$	618
tartaric	$C_4H_2O_5$	66
crystallized	$C_4H_2O_5+HO$	75
uric (lithic acid)	$N_4C_{10}H_2O_4$	150
hydrated	$N_4C_{10}H_2O_4+2HO$	168
valerianic (amylic acid)	$C_{10}H_9O_3$	93
hydrated	$C_{10}H_9O_3+HO$	102
Aconitia	$C_{60}H_{47}NO_{14}$	533
Alcohol	C_4H_5O+HO	46
amylic	$C_{10}H_{11}O+HO$	88
cetylic	$C_{32}H_{33}O+HO$	242
methylic	C_2H_3O+HO	32
Aldehyd	$C_4H_4O_2$	44
Alum, potassa- (common alum)	$Al_2O_3,3SO_3+KO,SO_3+24HO$	474·6
ammonia-	$Al_2O_3,3SO_3+NH_4O,SO_3+24HO$	453·4
ammonio-ferric	$Fe_2O_3,3SO_3+NH_4O,SO_3+24HO$	482
potassio-ferric	$Fe_2O_3,3SO_3+KO,SO_3+24HO$	503·2
Alumina	Al_2O_3	51·4
tersulphate (salt in alum)	$Al_2O_3,3SO_3$	171·4
ALUMINIUM	Al	13·7
Amidogen (amide)	NH_2	16
Ammonia	NH_3	17
acetate	$NH_4O,C_4H_3O_3$	77
crystallized	$NH_4O,C_4H_3O_3+6HO$	131
benzoate	$NH_4O,C_{14}H_5O_3+HO$	148
bicarbonate	$NH_4O,2CO_2$	70
bihydrosulphate	$NH_3,2HS$	51
bromide	NH_4Br	96·4
carbonate	NH_4O,CO_2	48
hydrosulphate (hydrosulphuret)	NH_3,HS	34
iodide	NH_4I	144·3
chloride (sal ammoniac)	NH_4Cl	53·5
nitrate	NH_4O,NO_5	80
phosphate (alkaline)	$3NH_4O,PO_5+5HO$	195
(neutral)	$2NH_4O,HO,PO_5+4HO$	169
sesquicarbonate (medicinal carbonate)	$2NH_4O,3CO_2$	118
sulphate	NH_4O,SO_3	66

Name.	*Symbol or Formula.*	*Equivalent.*
Ammonia, urate	$NH_4O,HO + N_4C_{10}H_2O_4$	185
valerianate	$NH_4O,C_{10}H_9O_3$	119
Amyl	$C_{10}H_{11}$	71
acetate of oxide (acetate of amylic ether)	$C_{10}H_{11}O,C_4H_3O_3$	130
oxide (amylic ether)	$C_{10}H_{11}O$	79
Antimony (Stibium)	Sb	122
oxychloride (powder of Algaroth)	$2SbO_3,SbCl_3 + HO$	529·5
oxysulphuret, U. S. (kermes mineral)	$SbO_3 + 2SbS_3 + 6HO$	540
tartrate of teroxide	$SbO_3,C_4H_2O_5$	212
terchloride (butter of antimony)	$SbCl_3$	228·5
teroxide (medicinal oxide)	SbO_3	146
tersulphuret (medicinal sulphuret)	SbS_3	170
Arabin (pure gum)	$C_{12}H_{11}O_{11}$	171
Arsenic	As	75
bisulphuret (realgar)	AsS_2	107
terchloride	$AsCl_3$	181·5
teriodide	AsI_3	453·9
tersulphuret (orpiment)	AsS_3	123
Atropia	$C_{34}H_{23}NO_6$	289
sulphate	$C_{34}H_{23}NO_6,SO_3$	329
Barium	Ba	68·7
carbonate	BaO,CO_2	98·7
chloride	BaCl	104·2
crystallized	$BaCl + 2HO$	122·2
hydrate	BaO,HO	85·7
nitrate	BaO,NO_5	130·7
sulphate	BaO,SO_3	116·7
Baryta	BaO	76·7
Benzole	$C_{12}H_6$	78
Benzyl	$C_{14}H_5O_2$	105
Bismuth	Bi	210
carbonate of teroxide	BiO_3,CO_2	256
nitrate of teroxide	BiO_3,NO_5	288
ternitrate of teroxide	$BiO_3,3NO_5$	396
teroxide	BiO_3	234
Black oxide of manganese. See Manganese, deutoxide.		
Blue Vitriol. See Copper, sulphate of protoxide.		
Borax. See Sodium, biborate.		
Boron	B	10·9
Bromine	Br	78·4
Brucia	$C_{46}H_{26}N_2O_8$	394
Cadmium	Cd	55·8
carbonate	$CdCO_2$	85·8
iodide	CdI	182·1
protoxide	CdO	63·8
sulphate of protoxide	CdO,SO_3	103·8
Cæsium	Cæ	133
Caffein (theïn and guaranin)	$C_{16}H_{10}N_4O_4$	194
Calcium	Ca	20
acetate	$CaO,C_4H_3O_3$	79
bone-phosphate	$3CaO,PO_5$	156
carbonate (chalk)	CaO,CO_2	50
chloride	CaCl	55·5
crystallized	$CaCl + 6HO$	109·5
chlorinated	CaO,Cl	63·5
hydrate (slaked lime)	CaO,HO	37
oxalate	CaO,C_2O_3	64

Name.	*Symbol or Formula.*	*Equivalent.*
CALCIUM, sulphate	CaO,SO_3	68
crystallized	$CaO,SO_3 + 2HO$	86
tartrate	$CaO,C_4H_2O_5$	94
Calomel. See Mercury, protochloride.		
Camphene	$C_{20}H_{16}$	136
Camphor	$C_{20}H_{16}O_2$	152
CARBON	C	6
bisulphuret	CS_2	38
Caustic potassa. See Potassa, hydrate.		
Caustic soda. See Soda, hydrate.		
CERIUM	Ce	46
oxalate	$2CeO,C_4O_6 + 6HO$	234
Ceruse. See Lead, carbonate of protoxide.		
Cetin	$C_{32}H_{33}O$	233
Chalk. See Calcium, carbonate.		
Chloral	$C_4HO_2Cl_2$	116
CHLORINE	Cl	35·5
Chloroform	C_2HCl_3	119·5
CHROMIUM	Cr	26·3
sesquioxide	Cr_2O_3	76·6
hydrated	$Cr_2O_3 + 10HO$	166·6
Cinchonia	$C_{40}H_{24}N_2O_2$	308
bisulphate	$C_{40}H_{24}N_2O_2,2SO_3$	388
sulphate	$C_{40}H_{24}N_2O_2,SO_3$	348
crystallized	$C_{40}H_{24}N_2O_2,SO_3 + 2HO$	366
Cinchonidia (isomeric with cinchonia)	$C_{40}H_{24}N_2O_2$	308
Cinnabar. See Mercury, bisulphuret.		
COBALT	Co	29·5
Codeia	$C_{36}H_{21}NO_6$	299
COLUMBIUM (TANTALUM)*	Ta	185
Common salt. See Sodium, chloride.		
Conia	$C_{16}H_{15}N$	126
COPPER (CUPRUM)	Cu	31·7
acetate of protoxide	$CuO,C_4H_3O_3$	90·7
ammonio-sulphate	$CuO,SO_3 + 2NH_3,HO$	122·7
black or protoxide	CuO	39·7
diacetate of protoxide (verdigris)	$2CuO,C_4H_3O_3$	130·4
nitrate of protoxide	CuO,NO_5	93·7
crystallized	$CuO,NO_5 + 3HO$	120·7
red or dioxide	Cu_2O	71·4
sulphate of protoxide (blue vitriol)	CuO,SO_3	79·7
crystallized	$CuO,SO_3 + 5HO$	124·7
Corrosive sublimate. See Mercury, bichloride.		
Cream of tartar. See Potassium, bitartrate.		
Creasote	$C_{14}H_8O_2$	108
Cyanogen	NC_2 or Cy	26
DIDYMIUM	Di	47·5
Emetia	$C_{37}H_{27}O_{10}$	329
Epsom Salt. See Magnesium, sulphate.		
ERBIUM	E	56·3
Ethal. See Alcohol, cetylic.		
Ether	C_4H_5O	37
acetic	$C_4H_5O,C_4H_3O_3$	88
hydriodic	C_4H_5I	155·3
hyponitrous	C_4H_5O,NO_2	75

* According to M. H. Rose, the columbium of Hatchett, and the tantalum of Ekeberg are distinct metals.

Name.	*Symbol or Formula.*	*Equivalent.*
Ether, muriatic	C_4H_5Cl	64·5
Ether, sulphuric. See Ether.		
Ethereal oil. See Sulphate of ether and ethylen.		
Ethyl	C_4H_5	29
Ethylen (etherine)	C_4H_4	28
Ferridcyanogen	$2FeCy_3$ or Cfdy	212
Ferrocyanogen	$FeCy_3$ or Cfy	106
Flowers of zinc. See Zinc, protoxide.		
FLUORINE	F	18·7
Formyl	C_2H	13
Fusel oil. See Alcohol, amylic.		
Glauber's salt. See Sodium, sulphate.		
Glucina	G_2O_3	38
GLUCINIUM	G	7
Glucose (grape sugar)	$C_{12}H_{14}O_{14}$	198
Glycerin	$C_6H_7O_5+HO$	92
Glyceryl	C_6H_7	43
GOLD (AURUM)	Au	199
Goulard's extract of lead. See Lead, diacetate of protoxide.		
Grape sugar. See Glucose.		
Green vitriol. See Iron, sulphate of protoxide.		
Heavy oil of wine. See Sulphate of ether and ethylen.		
HYDROGEN	H	1
protoxide (water)	HO	9
ILMENIUM	Il	60·2
INDIUM	In	74
IODINE	I	126·3
Iodoform	C_2HI_3	391·9
IRIDIUM	Ir	98·8
IRON (FERRUM)	Fe	28
arseniate of protoxide	$3FeO,AsO_5$	223
bitartrate of sesquioxide	$Fe_2O_3,2C_4H_2O_5$	212
bromide	FeBr	106·4
carbonate of protoxide	FeO,CO_2	58
citrate of sesquioxide	$Fe_2O_3,C_{12}H_5O_{11}$	245
ferrocyanide (pure Prussian blue)	Fe_4Cfy_3	430
iodide	FeI	154·3
crystallized	$FeI+5HO$	199·3
lactate of protoxide	$FeO,C_6H_5O_5+3HO$	144
medicinal black oxide	$2FeO+Fe_2O_3$	152
native black oxide	$FeO+Fe_2O_3$	116
oxalate	FeO,C_2O_3	72
phosphate of protoxide (tribasic)	$3FeO,PO_5$	180
phosphate of protoxide (neutral)	$2FeO,HO,PO_5$	153
protocyanide	FeCy	54
protosulphuret	FeS	44
protoxide	FeO	36
pyrophosphate of sesquioxide	$2Fe_2O_3,3PO_5$	376
red or sesquioxide	Fe_2O_3	80
hydrated	Fe_2O_3+2HO	98
sesquichloride	Fe_2Cl_3	162·5
subarseniate of protoxide	$4FeO,AsO_5$	259
sulphate of protoxide (green vitriol)	FeO,SO_3	76
crystallized	FeO,SO_3+7HO	139
tartrate of protoxide	$FeO,C_4H_2O_5$	102
tartrate of sesquioxide	$Fe_2O_3,C_4H_2O_5$	146
teracetate of sesquioxide	$Fe_2O_3,3C_4H_3O_3$	233

Name.	*Symbol or Formula.*	*Equivalent.*
IRON, ternitrate of sesquioxide	$Fe_2O_3,3NO_5$	242
tersulphate of sesquioxide	$Fe_2O_3,3SO_3$	200
tervalerianate of sesquioxide	$Fe_2O_3,3C_{10}H_9O_3$	359
LANTANIUM	La	44·3
LEAD (PLUMBUM)	Pb	103·6
acetate of protoxide (sugar of lead)	$PbO,C_4H_3O_3$	162·6
crystallized	$PbO,C_4H_3O_3+3HO$	189·6
carbonate of protoxide (white lead)	$2(PbO,CO_2)+PbO,HO$	387·8
LEAD, chloride	PbCl	139·1
deutoxide (puce oxide)	PbO_2	119·6
diacetate of protoxide (Goulard's extract)	$2PbO,C_4H_3O_3$	274·2
iodide	PbI	229·9
nitrate of protoxide	PbO,NO_5	165·6
protoxide (massicot)	PbO	111·6
red oxide (red lead or minium)	Pb_3O_4 or $2PbO,PbO_2$	342·8
Lime	CaO	28
Lithia	LO	15
LITHIUM	L	7
carbonate	LO,CO_2	37
citrate	$3LO,C_{12}H_5O_{11}$	210
Magnesia	MgO	20
MAGNESIUM	Mg	12
ammonio-sulphate	MgO,SO_3+NH_4O,SO_3+HO	135
carbonate (magnesia alba)	$3(MgO,CO_2+HO)+MgO,HO$	182
citrate	$3MgO,C_{12}H_5O_{11}$	225
hydrated chloride	$MgCl,6HO$	101·5
sulphate (Epsom salt)	MgO,SO	60
crystallized	MgO,SO_3+7HO	123
MANGANESE	Mn	27·7
carbonate of protoxide	MnO,CO_2	57·7
deutoxide (black oxide)	MnO_2	43·7
sulphate of protoxide	MnO,SO_3+4HO	111·7
Mannite	$C_{12}H_{14}O_{12}$	182
Massicot. See Lead, protoxide.		
MERCURY (HYDRARGYRUM)	Hg	200
acetate of protoxide	$HgO,C_4H_3O_3$	259
ammoniated (white precipitate)	$HgCl_2+HgAd_2$	503
bichloride (corrosive sublimate)	$HgCl_2$	271
bicyanide (prussiate)	$HgCy_2$	252
biniodide (red iodide)	HgI_2	452·6
binitrate of deutoxide	$HgO_2,2NO_5$	324
bisulphate of deutoxide	$HgO_2,2SO_3$	296
bisulphuret (cinnabar)	HgS_2	232
deutoxide (red precipitate)	HgO_2	216
nitrate of protoxide	HgO,NO	262
protiodide (green iodide)	HgI	326·3
protochloride (calomel)	HgCl	235·5
protosulphuret	HgS	216
protoxide (black oxide)	HgO	208
sesquiodide	Hg_2I_3	778·9
subsulphate of deutoxide (turpeth mineral)	$3HgO_2,2SO_3$	728
sulphate of protoxide	HgO,SO_3	248
Methyl	C_2H_3	15
Methylen (olefiant gas)	C_2H_2	14
Minium. See Lead, red oxide.		
MOLYBDENUM	Mo	48
Morphia	$C_{34}H_{19}NO_6$	285

Name.	*Symbol or Formula.*	*Equivalent.*
Morphia, acetate	$C_{34}H_{19}NO_6,C_4H_3O_3$	336
muriate	$C_{34}H_{19}NO_6,HCl$	321·5
sulphate	$C_{34}H_{19}NO_6,SO_3$	325
Narcein	$C_{46}H_{29}NO_{18}$	463
Narcotina	$C_{44}H_{23}NO_{14}$	413
NICKEL	Ni	29·5
protoxide	NiO	37·5
sulphate of protoxide	NiO,SO_3	77·5
crystallized	NiO,SO_3+7HO	140·5
NIOBIUM*	Nb	94
Nitre. See Potassium, nitrate.		
NITROGEN (Azote)	N	14
Olefiant gas. See Methylen.		
Orpiment. See Arsenic, tersulphuret.		
OSMIUM	Os	99·7
OXYGEN	O	8
PALLADIUM	Pd	53·3
Paramorphia	$C_{38}H_{21}NO_6$	311
PHOSPHORUS	P	32
PLATINUM	Pt	98·9
bichloride	$PtCl_2$	169·9
Potassa	KO	47·2
POTASSIUM (KALIUM)	K	39·2
acetate	$KO,C_4H_3O_3$	98·2
crystallized	$KO,C_4H_3O_3+2HO$	116·2
arsenite	KO,AsO_3	146·2
bicarbonate	$KO,2CO_2$	91·2
crystallized	$KO,2CO_2+HO$	100·2
bichromate	$KO,2CrO_3$	147·8
binoxalate (salt of sorrel)	$KO,2C_2O_3$	119·2
crystallized	$KO,2C_2O_3+3HO$	146·2
bisulphate	$KO,2SO_3$	127·2
crystallized	$KO,2SO_3+2HO$	145·2
bitartrate (cream of tartar)	$KO,2C_4H_2O_5$	179·2
crystallized	$KO,2C_4H_2O_5+HO$	188·2
bromide	KBr	117·6
carbonate (salt of tartar)	KO,CO_2	69·2
chlorate	KO,ClO_5	122·7
chloride	KCl	74·7
chromate	KO,CrO_3	97·5
citrate	$3KO,C_{12}H_5O_{11}$	306·6
cyanate	KO,CyO	81·2
cyanide	KCy	65·2
ferridcyanide	K_3Cfdy	329·6
ferrocyanate. See Potassium, ferrocyanide.		
ferrocyanide	K_2Cfy	184·4
crystallized	$K_2Cfy+3HO$	211·4
hydrate (caustic potassa)	KO,HO	56·2
hydriodate. See Potassium, iodide.		
iodate	KO,IO_5	213·5
iodide	KI	165·5
iodohydrargyrate	$2KI,HgI_2$	783·6

* Niobium and pelopium were alleged to exist in the Bavarian and North American columbites. Recently, however, M. H. Rose has announced that they are the same, and proposes to retain the name niobium. It is not contended that the peculiar metal of the columbites is different from that discovered in 1801 by Hatchett; and, therefore, as justly remarked by Prof. A. Connell, of St. Andrews, it should be called columbium, the name given to it by its discoverer, and the name niobium should be abandoned. (*Philos. Mag.*, June, 1854, p. 461.)

Name.	*Symbol or Formula.*	*Equivalent.*
POTASSIUM, nitrate (nitre or saltpetre)	KO,NO_5	101·2
oxalate	KO,C_2O_3	83·2
permanganate	KO,Mn_2O_7	158·6
sesquicarbonate	$2KO,3CO_2$	160·4
sulphate (vitriolated tartar)	KO,SO_3	87·2
tartrate (soluble tartar)	$KO,C_4H_2O_5$	113·2
teroxide	KO_3	63·2
tersulphuret	KS_3	87·2
tribasic phosphate (neutral)	$2KO,HO,PO_5$	175·4
Prussian blue. See Iron, ferrocyanide.		
Prussiate of mercury. See Mercury, bicyanide.		
Prussic acid. See Acid, hydrocyanic.		
Puce oxide of lead. See Lead, deutoxide.		
Pyroxylic spirit. See Alcohol, methylic.		
Quinia	$C_{40}H_{24}N_2O_4$	324
bimuriate	$C_{40}H_{24}N_2O_4,2HCl$	397
bisulphate	$C_{40}H_{24}N_2O_4,2SO_3$	404
bivalerianate	$C_{40}H_{24}N_2O_4,2C_{10}H_9O_3$	510
sulphate (medicinal sulphate)	$C_{40}H_{24}N_2O_4,SO_3$	364
crystallized	$C_{40}H_{24}N_2O_4,SO_3+8HO$	436
Quinidia (isomeric with quinia)	$C_{40}H_{24}N_2O_4$	324
Realgar. See Arsenic, bisulphuret.		
Red lead. See Lead, red oxide.		
precipitate. See Mercury, deutoxide.		
RHODIUM	R	52·2
Rochelle salt. See Tartrate of potassium and sodium.		
RUBIDIUM	Rb	85·4
RUTHENIUM	Ru	52·2
Sal ammoniac. See Ammonium, chloride.		
Salicin	$C_{26}H_{18}O_{14}$	286
Salt of sorrel. See Potassium, binoxalate.		
of tartar. See Potassium, carbonate.		
Saltpetre. See Potassium, nitrate.		
SELENIUM	Se	40
Silica	SiO_3	45·3
SILICON	Si	21·3
SILVER (ARGENTUM)	Ag	108
ammonio-nitrate	$AgO,NO_5,2NH_3$	204
chloride	AgCl	143·5
cyanide	AgCy	134
nitrate of protoxide	AgO,NO_5	170
protoxide	AgO	116
Slaked lime. See Lime, hydrate.		
Soda	NaO	31·3
hydrate (caustic soda)	NaO,HO	40·3
SODIUM (NATRIUM)	Na	23·3
acetate	$NaO,C_4H_3O_3$	82·3
crystallized	$NaO,C_4H_3O_3+6HO$	136·3
arseniate	$2NaO,HO,AsO_5$	186·6
crystallized	$2NaO,HO,AsO_5+14HO$	312·3
biborate (borax)	$NaO,2BO_3$	101·1
octohedral	$NaO,2BO_3+5HO$	146·1
prismatic	$NaO,2BO_3+10HO$	191·1
bicarbonate	$NaO,2CO_2$	75·3
crystallized	$NaO,2CO_2+HO$	84·3
carbonate	NaO,CO_2	53·3
crystallized	NaO,CO_2+10HO	143·3

Name.	*Symbol or Formula.*	*Equivalent.*
SODIUM, chloride (common salt)	$NaCl$	58·8
hyposulphite	$NaO\,S_2O_2 + 7HO$	142·3
iodide	NaI	149·6
muriate. See Sodium, chloride.		
nitrate	NaO,NO_5	85·3
phosphate (bibasic), pyrophosphate	$2NaO,PO_5$	134·6
crystallized	$2NaO,PO_5 + 10HO$	224·6
sesquicarbonate	$2NaO,3CO_2$	128·6
hydrated	$2NaO,3CO_2 + 4HO$	164·6
sulphate (Glauber's salt)	NaO,SO_3	71·3
crystallized	$NaO,SO_3 + 10HO$	161·3
sulphite	NaO,SO_2	63·3
crystallized	$NaO,SO_2 + 8HO$	135·3
tartrate	$NaO,C_4H_2O_5$	97·3
crystallized	$NaO,C_4H_2O_5 + 2HO$	115·3
teroxide	NaO_3	47·3
tribasic phosphate (medicinal phosphate)	$2NaO,HO,PO_5$	143·6
crystallized	$2NaO,HO,PO_5 + 24HO$	359·6
valerianate	$NaO,C_{10}H_9O_3$	124·3
Soluble tartar. See Potassium, tartrate.		
Starch	$C_{12}H_{10}O_{10}$	162
Strontia	SrO	51·8
STRONTIUM	Sr	43·8
Strychnia	$C_{44}H_{23}N_2O_4$	347
Strychnia (Br.)	$C_{42}H_{22}N_2O_4$	334
muriate	$C_{44}H_{23}N_2O_4,HCl$	383·5
sulphate	$C_{44}H_{23}N_2O_4,SO_3 + 7HO$	450
Sugar, cane	$C_{12}H_{11}O_{11}$	171
of lead. See Lead, acetate of protoxide.		
of milk (isomeric with cane sugar)	$C_{12}H_{11}O_{11}$	171
crystallized	$C_{12}H_{11}O_{11} + HO$	180
Sulphate of aluminium and potassium. See Alum, potassa-.		
of ether and ethylen	$C_4H_5O,SO_3 + C_4H_4,SO_3$	145
SULPHUR	S	16
iodide (bisulphuret of iodine)	IS_2	158·3
Sulphuretted hydrogen. See Acid, hydrosulphuric.		
Tartar emetic. See Tartrate of antimony and potassium.		
Tartrate of antimony and potassium	$SbO_3,C_4H_2O_5 + KO,C_4H_2O_5$	332·2
of iron and potassium	$Fe_2O_3,C_4H_2O_5 + KO,C_4H_2O_5$	259·2
of potassium and sodium	$KO,C_4H_2O_5 + NaO,C_4H_2O_5$	210·5
TELLURIUM	Te	64
TERBIUM	Tb	112·6
THALLIUM	Tl	204
Thorina	ThO	67·6
THORIUM	Th	59·6
TIN (STANNUM)	Sn	59
protochloride	$SnCl$	94·5
TITANIUM	Ti	25
TUNGSTEN (WOLFRAMIUM)	W	92
Turpeth mineral. See Mercury, subsulphate of deutoxide.		
URANIUM	U	60
Urea	$C_2H_4N_2O_2$	60
VANADIUM	V	51·2
Veratria	$C_{64}H_{52}N_2O_{16}$	592
Verdigris. See Copper, diacetate of protoxide.		
Vitriolated tartar. See Potassium, sulphate.		
Water. See Hydrogen, protoxide.		

Name.	*Symbol or Formula.*	*Equivalent.*
White precipitate. See Mercury, ammoniated.		
vitriol. See Zinc, sulphate of protoxide.		
Yttria - - - - - -	YO	38·85
YTTRIUM - - - - - -	Y	30·85
ZINC - - - - - - -	Zn	32·3
acetate of protoxide - - -	$ZnO,C_4H_3O_3$	91·3
crystallized - - - -	$ZnO,C_4H_3O_3+7HO$	154·3
carbonate of protoxide (precipitated carbonate) - - - -	$8ZnO,3CO_2+6HO$	442·4
chloride - - - - -	ZnCl	67·8
cyanuret - - - - -	ZnCy	58·3
iodide - - - - - -	ZnI	158·6
protoxide (flowers of zinc) - -	ZnO	40·3
sulphate of protoxide (white vitriol)	ZnO,SO_3	80·3
crystallized - - - -	ZnO,SO_3+7HO	143·3
sulphuret (blende) - - -	ZnS	48·3
valerianate of protoxide - -	$ZnO,C_{10}H_9O_3$	133·3
Zirconia - - - - - -	Zr_2O_3	91·2
*ZIRCONIUM - - - - -	Zr	33·6

B.

* Several of the numbers in this table have been slightly altered to correspond with those most recently admitted; and a few have been given originally, either with new substances introduced into the table, as carbolic and cinnamic acids, or for bodies of which the eq. has been but recently satisfactorily ascertained, as erbium and niobium.

IV. TABLES

SHOWING THE SPECIFIC GRAVITY CORRESPONDING WITH THE SEVERAL DEGREES OF HYDROMETERS IN USE.

Baumé's hydrometer is usually employed. In this instrument, the sp. gr. of distilled water is assumed as the zero of the descending scale, in relation to fluids heavier than itself, and as 10 on the ascending scale in relation to lighter fluids. In the following tables, the specific gravity of liquids is given, corresponding with the several degrees of this hydrometer. The first column of specific gravities is taken from the French Codex, and is, therefore, of high authority. The second is the one given in previous editions of this work, taken from Duncan's Edinburgh Dispensatory (A. D. 1830), and based on the calculations of Huss. The third column was calculated by Mr. Henry Pemberton, of Philadelphia, in 1851, and is recognised by the Philadelphia College of Pharmacy. The figures in this column correspond with the degrees of the hydrometers prepared by Dr. W. H. Pile, of this city, which may be relied on for their accuracy.

For Liquids lighter than Water.

Degree of hydrometer.	Specific Gravity. By Baumé.			Degree of hydrometer.	Specific Gravity. By Baumé.		
10	1·000	1·0000	1·0000	44	0·809	0·8047	0·8045
11	0·993	0·9930	0·9929	45	0·804	0·8001	0·8000
12	0·986	0·9861	0·9859	46	0·800	0·7956	0·7954
13	0·979	0·9792	0·9790	47	0·795	0·7911	0·7909
14	0·973	0·9724	0·9722	48	0·791	0·7866	0·7865
15	0·966	0·9657	0·9655	49	0·787	0·7821	0·7821
16	0·960	0·9591	0·9589	50	0·783	0·7777	0·7777
17	0·953	0·9526	0·9523	51	0·778	0·7733	0·7734
18	0·947	0·9462	0·9459	52	0·774	0·7689	0·7692
19	0·941	0·9399	0·9395	53	0·770	0·7646	0·7650
20	0·935	0·9336	0·9333	54	0·766	0·7603	0·7608
21	0·929	0·9274	0·9271	55	0·762	0·7560	0·7567
22	0·923	0·9212	0·9210	56	0·758	0·7518	0·7526
23	0·917	0·9151	0·9150	57	0·754	0·7476	0·7486
24	0·911	0·9091	0·9090	58	0·750	0·7435	0·7446
25	0·905	0·9032	0·9032	59	0·746	0·7394	0·7407
26	0·900	0·8974	0·8974	60	0·742	0·7354	0·7368
27	0·894	0·8917	0·8917	61	0·738	0·7314	0·7329
28	0·889	0·8860	0·8860	62	0·735	0·7275	0·7290
29	0·883	0·8804	0·8805	63	0·731	...	0·7253
30	0·878	0·8748	0·8750	64	0·727	...	0·7216
31	0·872	0·8693	0·8695	65	0·724	...	0·7179
32	0·867	0·8638	0·8641	66	0·720	...	0·7142
33	0·862	0·8584	0·8588	67	0·716	...	0·7106
34	0·857	0·8531	0·8536	68	0·713	...	0·7070
35	0·852	0·8479	0·8484	69	0·709	...	0·7035
36	0·847	0·8428	0·8433	70	0·706	...	0·7000
37	0·842	0·8378	0·8383	71	0·702	...	0·6965
38	0·837	0·8329	0·8333	72	0·699	...	0·6930
39	0·832	0·8281	0·8284	73	0·696	...	0·6896
40	0·827	0·8233	0·8235	74	0·692	...	0·6863
41	0·823	0·8186	0·8187	75	0·689	...	0·6829
42	0·818	0·8139	0·8139	76	0·686	...	0·6796
43	0·813	0·8093	0·8092	77	0·682	...	0·6763

For Liquids heavier than Water.

Degree of hydrometer.	Specific Gravity. By Baumé.			Degree of hydrometer.	Specific Gravity. By Baumé.		
0	1000	1·0000	1·0000	38	1359	1·3559	1·3551
1	1007	1·0070	1·0069	39	1372	1·3686	1·3679
2	1014	1·0141	1·0139	40	1384	1·3815	1·3809
3	1022	1·0213	1·0211	41	1398	1·3947	1·3942
4	1029	1·0286	1·0283	42	1412	1·4082	1·4077
5	1036	1·0360	1·0357	43	1426	1·4219	1·4215
6	1044	1·0435	1·0431	44	1440	1·4359	1·4356
7	1052	1·0511	1·0507	45	1454	1·4501	1·4500
8	1060	1·0588	1·0583	46	1470	1·4645	1·4646
9	1067	1·0666	1·0661	47	1485	1·4792	1·4795
10	1075	1·0745	1·0740	48	1501	1·4942	1·4949
11	1083	1·0825	1·0820	49	1516	1·5096	1·5104
12	1091	1·0906	1·0902	50	1532	1·5253	1·5263
13	1100	1·0988	1·0984	51	1549	1·5413	1·5425
14	1108	1·1071	1·1068	52	1566	1·5576	1·5591
15	1116	1·1155	1·1153	53	1583	1·5742	1·5760
16	1125	1·1240	1·1240	54	1601	1·5912	1·5934
17	1134	1·1326	1·1328	55	1618	1·6086	1·6111
18	1143	1·1414	1·1417	56	1637	1·6264	1·6292
19	1152	1·1504	1·1507	57	1656	1·6446	1·6477
20	1161	1·1596	1·1600	58	1676	1·6632	1·6666
21	1171	1·1690	1·1693	59	1695	1·6823	1·6860
22	1180	1·1785	1·1788	60	1715	1·7019	1·7058
23	1190	1·1882	1·1885	61	1736	1·7220	1·7261
24	1199	1·1981	1·1983	62	1758	1·7427	1·7469
25	1210	1·2082	1·2083	63	1779	1·7640	1·7682
26	1221	1·2184	1·2184	64	1801	1·7858	1·7901
27	1231	1·2288	1·2288	65	1823	1·8082	1·8125
28	1242	1·2394	1·2393	66	1847	1·8312	1·8354
29	1252	1·2502	1·2500	67	1872	1·8548	1·8589
30	1261	1·2612	1·2608	68	1897	1·8790	1·8831
31	1275	1·2724	1·2719	69	1921	1·9038	1·9079
32	1286	1·2838	1·2831	70	1946	1·9291	1·9333
33	1298	1·2954	1·2946	71	1974	1·9548	1·9595
34	1309	1·3072	1·3063	72	2002	1·9809	1·9863
35	1321	1·3190	1·3181	73	2031	2·0073	2·0139
36	1334	1·3311	1·3302	74	2059	2·0340	2·0422
37	1346	1·3434	1·3425	75	2087	2·0610	2·0714

The following formulas, furnished by Dr. Pile, may prove useful by enabling any one to calculate the sp. gr. corresponding with the several degrees of Baumé's hydrometer, and, conversely, the degree of Baumé's corresponding with the sp. gr.

1. *For Liquids lighter than Water.* The following formulas give the sp. gr. as represented in the first column in the foregoing table; or, the specific gravity being known, gives the correspondent degree of Baumé.

$$\frac{144}{B^\circ+134} = \text{sp. gr.}; \text{ and } \frac{144}{\text{sp. gr.}} - 134 = B^\circ.$$

The following formulas apply to the third column of specific gravities.

$$\frac{140}{B^\circ+130} = \text{sp. gr.}; \text{ and } \frac{140}{\text{sp. gr.}} - 130 = B^\circ.$$

2. *For Liquids heavier than Water.* For the first column, $\frac{144}{144-B^\circ} = \text{sp. gr.}$, and $144 - \frac{144}{\text{sp. gr.}} = B^\circ$; for the third, $\frac{145}{145-B^\circ} = \text{sp. gr.}$, and $145 - \frac{145}{\text{sp. gr.}} = B^\circ$.

Gay-Lussac's centesimal alcoholmeter is applicable only to alcohol. The scale of this instrument is divided into 100 unequal degrees, the zero corresponding to pure water, and 100° to absolute alcohol; and every intermediate degree expresses the percentage of pure alcohol, by measure, contained in the liquors examined. Thus, when the instrument stands at 40° in any alcoholic liquid, it indicates that 100 measures of the liquid contain 40 of pure alcohol and 60 of water. But, as it was graduated for the temperature of 59° of Fahrenheit, the liquors to be tested should be brought to that temperature. *Tralles' centesimal alcoholmeter* is the one used by the U.S. Government in gauging the strength of spirit; and is generally employed in this country by distillers and wholesale dealers in the purchase and sale of alcoholic liquors. The scale of this instrument is like Gay-Lussac's divided into 100 unequal parts, each corresponding to the percentage by volume of pure alcohol contained in the liquors examined. As the sp. gr. of water is considered as unity at its temperature of greatest density 39·8° F., and the degrees of this scale are calculated for 60° F., the zero, corresponding to the density of water, will represent a sp. gr. of ·9991.

The following table of Tralles gives the percentage of alcohol *by measure* corresponding with the specific gravity. Under alcohol in the first part of this work a table of the percentage by weight corresponding with the sp. gr. is given. By means of these tables, in connection with the alcoholmeter, every problem that can arise in reference to the strength of spirituous liquors can be solved; and by the appended table, giving the value of Baumé's degrees in those of Tralles, the facility is still further extended.

Alcoholmetrical Table of Tralles.

Alcohol in 100 measures of spirit.	Specific gravity at 60° Fahr.	Alcohol in 100 measures of spirit.	Specific gravity at 60° Fahr.	Alcohol in 100 measures of spirit.	Specific gravity at 60° Fahr.	Alcohol in 100 measures of spirit.	Specific gravity at 60° Fahr.
0	9991	26	9689	51	9315	76	8739
1	9976	27	9679	52	9295	77	8712
2	9961	28	9668	53	9275	78	8685
3	9947	29	9657	54	9254	79	8658
4	9933	30	9646	55	9234	80	8631
5	9919	31	9634	56	9213	81	8603
6	9906	32	9622	57	9192	82	8575
7	9893	33	9609	58	9170	83	8547
8	9881	34	9596	59	9148	84	8518
9	9869	35	9583	60	9126	85	8488
10	9857	36	9570	61	9104	86	8458
11	9845	37	9556	62	9082	87	8428
12	9834	38	9541	63	9059	88	8397
13	9823	39	9526	64	9036	89	8365
14	9812	40	9510	65	9013	90	8332
15	9802	41	9494	66	8989	91	8299
16	9791	42	9478	67	8965	92	8265
17	9781	43	9461	68	8941	93	8230
18	9771	44	9444	69	8917	94	8194
19	9761	45	9427	70	8892	95	8157
20	9751	46	9409	71	8867	96	8118
21	9741	47	9391	72	8842	97	8077
22	9731	48	9373	73	8817	98	8034
23	9720	49	9354	74	8791	99	7988
24	9710	50	9335	75	8765	100	7939
25	9700						

Table showing the Value of the Degrees of Baumé's Hydrometer in those of Tralles' Alcoholmeter.

Baumé.	Tralles.	Baumé.	Tralles.	Baumé.	Tralles.	Baumé.	Tralles.
10·12	·0	20	50·1	30	75·6	40	92·9
11	4·3	21	53·2	31	77·6	41	94·2
12	9·8	22	56·1	32	79·6	42	95·5
13	16·1	23	58·9	33	81·5	43	96·7
14	22·9	24	61·6	34	83·4	44	97·8
15	29·2	25	64·2	35	85·1	45	98·8
16	34·5	26	66·6	36	86·8	46	99·7
17	39·2	27	69·0	37	88·4	46·37	100·0
18	43·1	28	71·3	38	90·0		
19	46·8	29	73·5	39	91·4		

V. CORRESPONDENCE BETWEEN DIFFERENT THERMOMETERS.

In *Fahrenheit's* thermometer, which is universally employed in this country and Great Britain, the freezing point of water is placed at 32°, and the boiling point at 212°, and the number of intervening degrees is 180.

The *centigrade* thermometer, which has long been used in Sweden, under the name of Celsius's thermometer, and is now most generally employed on the continent of Europe, marks the freezing point *zero*, and the boiling point 100°.

In *Reaumur's* thermometer, used in France before the revolution, the freezing point is at *zero*, and the boiling point at 80°.

In *De Lisle's* thermometer, used in Russia, the graduation begins at the boiling point, which is marked *zero*, while the freezing point is placed at 150°.

From the above statement, it is evident that 180 degrees of Fahrenheit are equal to 100° of the centigrade, 80° of Reaumur, and 150° of De Lisle; or 1 degree of the first is equal to $\frac{5}{9}$ of a degree of the second, $\frac{4}{9}$ of a degree of the third, and $\frac{5}{6}$ of a degree of the last. It is easy, therefore, to convert the degrees of one into the equivalent number of degrees of the other; but in ascertaining the corresponding points upon the different scales, it is necessary to take into consideration their different modes of graduation. Thus, as the zero of Fahrenheit is 32° below the point at which that of the centigrade and of Reaumur is placed, this number must be taken into account in the calculation. The following propositions will embrace all the cases which can arise in relation to the three last-mentioned thermometers. That of De Lisle is seldom or never referred to in works which are read in this country.

1. If any degree on the *centigrade* scale, either above or below zero, be multiplied by 9 and divided by 5, or if any degree of *Reaumur* above or below zero be multiplied by 9 and divided by 4, the quotient will, in either case, be the number of degrees above or below 32°, or the freezing point of *Fahrenheit.*

2. The number of degrees between any point of *Fahrenheit's* scale and 32°, if multiplied by 5 and divided by 9, will give the corresponding point on the *centigrade;* if multiplied by 4 and divided by 9, will give the corresponding point on the scale of *Reaumur.*

3. Any degree of the *centigrade* multiplied by 4 and divided by 5, will give the corresponding degree of *Reaumur;* and, conversely, any degree of *Reaumur* multiplied by 5 and divided by 4, will give the corresponding degree of the *centigrade.*

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